DEMOGRAPHY AND THE EVOLUTION OF EDUCATIONAL INEQUALITY*

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INTRODUCTION

An often controversial feature of human societies is that not all groups reproduce at the same rate. Differences in fertility rates across social strata arouse concern because they portend changes in patterns of dominance, inequality, or average well-being. For example, a recent, widely publicized book on inequality in the United States expresses apprehension about the presumed "dysgenic" effects of the relatively high rates of fertility among persons with low education and intelligence (Herrnstein and Murray 1994). That fertility rates for low ability and low education women are relatively high, the authors argue, is likely to diminish the country's average intellectual ability and to polarize a small "cognitive elite" and a growing number of persons who have limited intellectual and economic capacity. Ironically, others have looked at the same demographic phenomena and drawn diametrically opposite conclusions. For example, in his classic statement about the connections between demography and social stratification, Sibley (1942) warned of the dire effects of reduced immigration and lowered fertility differentials. A large, steady influx of persons with low socioeconomic origins, he maintained, is essential to maintain high rates of upward social mobility and to offset the class conflict that occurs in a demographically static society. In this paper I appraise some of these concerns by examining the effects of variation in demographic rates on trends in the distribution of formal schooling. More specifically, I examine the combined effects of differential fertility, differential mortality, and intergenerational educational mobility on the distribution of educational attainment in the United States for women during the past half century.

Although this paper is stimulated by contemporary public discussion of social inequality, it is motivated by conceptual and technical issues in the analysis of social stratification as well.

To understand how a social hierarchy, such as the distribution of formal schooling, is maintained or modified over time one must examine the process by which a socioeconomically differentiated population reproduces itself. The dominant approach to such problems in the literature on social stratification and mobility has been to focus on the intergenerational transmission of socioeconomic status. The paradigm of intergenerational mobility research, pioneered by Duncan and Hodge (1963) and Blau and Duncan (1967) and sustained by three decades of subsequent work, has been well suited to describing the associations between the socioeconomic positions of parents and offspring and to elucidating the mechanisms that underpin these associations. Yet although these studies show superficially how socioeconomic distributions in one generation give rise to distributions in a subsequent generation, they do not reveal how intergenerational mobility is implicated in changing those distributions from one period to the next. Indeed, Duncan (1966) showed that the measurements of family background used in typical surveys of stratification do not represent any specific cohort or period and thus standard social mobility tables are not the appropriate transition matrices required for transforming a population over time. Unfortunately, Duncan's argument has, for the most part, not served as a challenge to solve this problem. Rather, most researchers have simply lived with this limitation of their models.[1]

As a result of this limitation, stratification research has been ill-equipped to handle such aggregate, dynamic questions as: How is the socioeconomic (for example, occupational or educational) distribution for persons or families in one period transformed into the distribution

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[1] These remarks apply equally to the analysis of social mobility tables and to structural equation models for interval measures of socioeconomic status. The argument also applies equally to approaches to stratification that emphasize psychological, institutional, or economic mechanisms in attempting to account for the intergenerational and intragenerational association of education, occupation, income, or other measures of socioeconomic standing.

at a later period? How does intergenerational and intragenerational mobility contribute to that transformation? What are the contributions of status transmission, differentials in levels and timing of fertility, and exogenous change in socioeconomic opportunity to the transformation of socioeconomic hierarchies? How have demographic constraints on opportunity structures affected stratification processes? How have these effects changed over time? These central questions of stratification research require different models from those that are in widespread use and a change in orientation away from exclusive focus on microlevel statistical relationships.

To address these sorts of questions requires that one acknowledge that social mobility occurs within a demographic milieu and that the evolution and transformation of social hierarchies is the joint outcome of demographic metabolism, intergenerational transmission, and opportunity structure. It is important to distinguish between the intergenerational *transmission* of socioeconomic status -- that is, the individual- or family-level processes by which parents affect the life chances of their offspring --, and the *reproduction* of socioeconomic hierarchies -- that is, the population-level processes by which distributions of social statuses and positions persist or evolve. An account of how a socioeconomically diverse population is transformed requires that one take account of not only social mobility but also age structure, differential fertility, assortative mating, family structure, differential mortality, and immigration.[2]

In this paper I employ a simple model for the reproduction of educational hierarchies that takes differential fertility, age structure, differential mortality, and social mobility into account.

[2] In fact Blau and Duncan (1967) recognized the role of demographic processes by including detailed analyses of most of these processes in their monograph. Although these analyses were not as influential as the chapters on social mobility and the process of social stratification, they too have inspired much subsequent work. Unfortunately, each of these topics has spawned its own, largely independent literature. There has been relatively little effort to synthesize these topics into a common analytic framework.

This is but the first stage in a larger research agenda, which attempts to take fuller account of the interdependence of the intergenerational transmission of inequality and the demographic milieu within which it occurs. The balance of this paper is as follows. First, I link the present effort to past literature that has presented models and analyses of social mobility, fertility, and socioeconomic reproduction. Second, I present the specific empirical questions that guide this investigation. Third, I review trends in educational attainment and education differences in fertility during the past five decades. This provides the historical and demographic context for this research. Fourth, I describe the analytic approach taken in this paper, including a projection model that takes account of population heterogeneity in both age and socioeconomic standing and the data sources used in the analysis. Fifth, I present the empirical results. Finally, after summarizing the conclusions of the analysis, I present an agenda for further work on the reproduction of socioeconomic hierarchies.

LINKS TO PREVIOUS LITERATURE

Although most sociological research has neglected the interplay between demographic processes and the levels and distributions of socioeconomic traits, several sociologists and demographers have examined the relationship between fertility and intergenerational mobility.[3] Matras (1961, 1967) presented a projection model for a one-sex population differentiated by both age and occupation. Preston (1974) analyzed the implications of differential fertility for

[3] This brief review omits the works in the economics literature which describe behavioral models of social mobility and inequality [for example, Conlisk (1974), Goldberger (1986), and Becker (1992)]. These models have not been formulated in a way that allows direct investigation of the impact of fertility differentials on socioeconomic distributions, although it may be possible to modify them for this purpose. The review also omits population-genetic models, which do bear close kinship to the models considered here (for example, Cavalli-Sforza and Feldman 1981).

differences in occupation distributions and occupational mobility opportunities for black and white men. Preston's approach is an important point of departure for the analyses reported in this paper. Johnson (1980) sketched a two-sex population model of assortative mating, differential fertility, and the intergenerational transmission of religious affiliation. Lam (1986) examined the effects of differential fertility and intergenerational mobility on the time path of income inequality in Brazil. Preston and Campbell (1993) developed a two-sex model for the intergenerational transmission of intelligence (I.Q.). They showed that, under broad conditions, fixed rates of fertility and assortative mating by level of I.Q. lead to a stable distribution of I.Q. rather than, as intuition might suggest, to a distribution that is increasingly concentrated at the level of I.Q. where fertility is highest.

The present investigation is similar in spirit to these prior studies, but also differs in several important respects. First, it focusses on formal educational attainment, rather than I.Q., occupation, or income. The distribution of formal schooling is clearly of interest for the reasons suggested above. It may, moreover, be especially well suited to an investigation of the effects of differential fertility on distributional outcomes relative to occupation or income. Whereas educational attainment is heavily affected by the resources and preferences of individuals and their families, occupational and income attainment are more strongly constrained by opportunity structures. The arguments investigated and the models that are used in this paper assume that social mobility and fertility are separable at the aggregate level. They do not allow for the possibility that patterns of fertility may interact with the structure of available socioeconomic outcomes to force changes in patterns of social mobility (Preston 1974). The latter type of effect occurs when socioeconomic distributions are determined by a relatively fixed distribution of socioeconomic opportunities which are, in turn, established by the demand for labor of various types. It is widely believed that occupational and income mobility are largely determined by demand rather than the supply of individuals with varying characteristics (e.g., Baron 1994). In the 20th Century United States, however, it is likely that educational opportunities have not been seriously constrained by a relatively fixed number of educational "slots." Insofar as personal and family resources and preferences have been the principal forces behind educational change, it is sensible to analyze the combined effects of differential fertility and mobility on educational outcomes.

Second, the present study examines the effects of differentials in demographic rates in somewhat more detail than most prior studies. Unlike the previous studies that have examined the effects of fertility differentials, the present study considers the separate effects of both the *level* and the *timing* of fertility. To accomplish this, I follow Matras and develop a projection model that incorporates the effects of the age pattern of fertility. In addition, I investigate the effects of differential mortality as well as fertility.

Finally, the emphasis in this analysis is on the effects of the observed historical sequence of fertility rates on educational growth during the past 50 years, rather than on the theoretical issue of deriving the equilibrium distributions of socioeconomic outcomes. Whereas these equilibria are useful for illustrating the long run implications of a given regime of vital rates, they are less well suited to providing an assessment of the quantitative historical importance of demographic rates for changes in socioeconomic distributions.

RESEARCH QUESTIONS AND CONJECTURES

Within the framework described thus far, this paper will investigate the following questions:

1. Fertility levels during the past several decades have usually varied inversely with the educational attainment of women. This does suggest that more poorly educated women reproduce themselves at a higher rate than women with higher levels of schooling and that, *ceteris paribus*, fertility differentials may have reduced average levels of educational attainment below what they would have been in the absence of such differentials. As shown below, however, the strength of these differentials has varied over time, suggesting that the effect might not be uniformly strong. It remains, therefore, an empirical issue whether the differential fertility of persons of diverse socioeconomic origins affected the trend in average educational attainment and the inequality of schooling during the past 50 years, how large this effect is, and how the current educational distribution would be different if all groups had had the same level of fertility during the past 50 years.

2. Insofar as fertility does affect the level and distribution of schooling, are there separate effects of variation in both the *level* and the *timing* of fertility among socioeconomic groups? Given that more highly educated women bear their children, on average, at a later age, that pattern too should reduce average educational attainment in the population. (That is, absent historical patterns of fertility timing, education would have been higher.) It remains, however, an open question how large this effect has been. As discussed more fully below, differentials in the timing of fertility have varied over the past half-century. The timing of fertility, moreover, has a secondary effect on population growth compared to fertility levels (for example, Keyfitz 1968), suggesting that timing effects may be smaller than those of the level of fertility.

3. Whatever the historical effect of differential fertility, what are the implications of the large *recent* patterns of differential fertility? How would the trend in the distribution of schooling have been different if recent fertility differentials had been in effect throughout the past

several decades?

4. Does differential mortality have an important effect on the level and distribution of schooling? Mortality differentials should favor higher attainment because women who have more poorly educated children are less likely to survive to their childbearing years and to survive to adulthood generally. Because mortality rates are low for all groups during this period, however, this effect may not be large.

5. The degree to which fertility affects socioeconomic distributions is conditional on the openness of socioeconomic groups. That is, differential fertility has a stronger effect when socioeconomic groups are more closed to intergenerational mobility and a weaker effect when mobility is greater. How big is this interaction between differential fertility and the rate of intergenerational mobility? If mobility chances were to change, would the effects of demographic rates become more or less important than they are now?

TRENDS IN EDUCATIONAL ATTAINMENT, 1940-1990

During the past 50 years in the United States average educational attainment has grown tremendously. As shown in Table 1 and Figure 1, which report the educational attainment of women in each decade, formal attainment grew primarily through a decline in the proportion of persons who fail to complete high school and a corresponding growth in those who complete at least some post-secondary schooling. From 1940 to 1990 for 20-49 year old women, average years of school completed increased by about 3.5 years, the percentage who completed more than high school almost quadrupled, and the percentage who failed to complete high school was cut by about four fifths. Despite substantial educational growth, women who have completed exactly 12 years of schooling remain the modal educational group in 1990.

Table 1 also reports Theil's (1972) entropy measure (H) for the distribution of educational attainment in each period. H measures the degree of dispersion of a discrete distribution, in this case the five categories of educational attainment used in Figure 1. For a five-category distribution H varies from 0 (all persons are in the same category) to approximately 1.6 (a uniform distribution).[4] By this measure, the inequality of the education distribution for 20-49 year old women increased between 1940 and 1960 and decreased thereafter. This reflects the change in concentration of the education distribution from the lowest levels of attainment, to a greater degree of uniformity across all categories, and finally to the highest levels of attainment. This curvilinear pattern of change in H holds for all ages but inequality tends to peak in earlier decades for the youngest women and in later decades for the oldest. This is not surprising inasmuch as the growth of schooling occurs primarily as a process of cohort replacement.

Although these trends are well known (see, for example, Mare 1995), one should keep them in mind in considering the impact of trends in fertility and mortality on the evolution of educational distributions. Whatever the harmful impact of fertility differentials on average educational attainment, it has not been enough to offset the large surge in attainment during the past 50 years. The size of the estimated effects of demographic rates should, moreover, be appraised in light of the scale of the total observed change in educational attainment over this period.

TRENDS IN FERTILITY

Both levels and socioeconomic differences in fertility in the United States have fluctuated

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[4] H is calculated as $\Sigma_i p_i \log(1/p_i)$, where p_i denotes the proportion of persons in the ith education category. When the distribution is uniform, H = 5[.2log(1/.2)] ≅ 1.6.

considerably over the past 50 years. Table 2 summarizes the trends in age-specific fertility from 1945 to 1990.[5] (The sources for these fertility estimates are discussed below.) Over this period, women at each level of education experience a common trend in fertility, which rises sharply from immediately after World War II to 1960, which constitutes the peak of the Baby Boom, and falls precipitously thereafter (e.g., Rindfuss and Sweet 1977). Within most periods women with more schooling tend to bear children at a lower rate than their more poorly educated counterparts, but there are important exceptions to this trend. In 1970 and 1980, women with a high school degree but no further school exhibit the highest fertility rates. Strikingly, it is in the most recent year shown in the table that the negative correlation between mother's schooling and fertility is the largest. These large recent differentials are one source of the concern raised in some recent commentary about the implications of differential fertility (Herrnstein and Murray 1994, pp. 348-51).

Education groups vary in the timing as well as the level of their childbearing. For the most part, women with relatively small amounts of schooling tend to bear their children earlier than women who leave school later. Here again, however, 1970 and 1980 are exceptions inasmuch as women who are high school graduates tend to have the lowest mean age of childbearing. Table 2 also shows that more highly educated women tend to compress their childbearing into a narrower time interval. In every year the least educated women have a

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[5] The age-specific rates in Table 2 indicate the annual number of female children born to 1000 women of the given age group. The gross reproduction rate denotes the number of female children born to a hypothetical cohort of women, all of whom survived until the end of their childbearing years, who experienced the age-specific fertility rates of that year. It is estimated as the sum of the age-specific rates for the given year multiplied by 5/1000. The means and standard deviations of the fertility schedule presented in Table 2 are the means and standard deviations respectively of the ages represented in the table weighted by the age-specific fertility rates.

standard deviation of age at childbearing that is about one and a half years greater than women with a college degree. This pattern reflects that women who leave school later have a shorter period during which they are exposed to the risk of childbearing without the competing activity of school attendance.

The fertility trends shown in Table 2 do indicate that women with lower amounts of schooling have higher levels of fertility, earlier fertility, and more broadly spaced fertility than more highly educated women. Taken together, these patterns suggest that the more poorly educated part of the population is growing more rapidly than the better educated part. That there are exceptions to the general pattern of fertility differentials, however, makes it hard to know how important educational fertility differentials have been for educational growth during the past five decades.

A PROJECTION MODEL FOR DEMOGRAPHIC AND EDUCATIONAL CHANGE

To examine the effects of fertility, mortality, and mobility regimes on trends in educational distributions, I develop a projection model for a population differentiated by socioeconomic categories (in this case, educational attainment). This is a one-sex model and, in the present analysis, is applied only to women. Data on fertility rates for educational attainment groups are much more readily available and of higher quality for women than for men. Despite some differences in educational trends between the sexes, the general pattern of educational growth and distribution during the 20th Century has been similar for men and women.[6] As discussed at the in the conclusion, it is desirable to elaborate the analysis to

[6] Educational inequality has historically been somewhat greater for men than women. That is, men have tended to have disproportionate numbers who drop out of school very early or who attain the highest possible levels of schooling. These sex differences, however, have

incorporate box sexes simultaneously, but this is the subject of future work. Rates of fertility, mortality, and mobility are variables in the projection model. Thus, my strategy is to predict the trend in the distribution of schooling given an initial education distribution and alternative assumptions about demographic rates.

A model for intergenerational educational mobility can be developed through an analogy to well-established models for interregional mobility and population growth. The general discrete-time multiregional projection matrix for a single sex is discussed in detail by Feeney (1970), LeBras (1971), and Rogers (1975). [(Broader classes of related models are described by Land and Rogers (1982) and Schoen (1988)]. The model for educational mobility used in this paper is a special case of the general model. Suppose that a population is divided into *A* 5-year age groups and *R* groups, which are regions in the context of geographic mobility or socioeconomic categories in the context of social mobility. Let $\mathbf{P_t}$ denote an $RA \times 1$ vector of population totals at time *t*, with typical entry P_{rat}, which is the population in the r*th* region and the a*th* age group in the t*th* year ($r = 1,..., R$; a = 0-4, 5-9, ..., *A*-A+4); $t = 1,...,T$). The age-region specific populations five years later are linked to the totals at time *t* by a multiregional projection matrix, that is,

$$\mathbf{M_t P_t} = \mathbf{P_{t+5}}. \qquad (1)$$

M is an $RA \times RA$ matrix of transition probabilities with the following structure:

declined in recent decades (Mare 1995).

$$
\mathbf{M_t} = \begin{matrix}
\mathbf{0} & \mathbf{0} & \mathbf{B_{10t}} & \mathbf{B_{15t}} & \mathbf{B_{20t}} & \mathbf{B_{25t}} & \mathbf{B_{30t}} & \mathbf{B_{35t}} & \mathbf{B_{40t}} & \mathbf{B_{45t}} \\
\mathbf{S_{0t}} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{S_{5t}} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{S_{10t}} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{S_{15t}} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{S_{20t}} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{S_{25t}} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{S_{30t}} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{S_{35t}} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{S_{40t}} & \mathbf{0}
\end{matrix} \qquad (2)
$$

where the $\mathbf{S_{0t}}$, $\mathbf{S_{5t}}$, ..., $\mathbf{S_{40t}}$ are $R \times R$ submatrices of 5-year age-specific survival and migration probabilities and the $\mathbf{B_{10t}}$, $\mathbf{B_{15t}}$, ..., $\mathbf{B_{45t}}$ are $R \times R$ submatrices of 5-year age-specific birth and migration probabilities, adjusted for maternal and childhood mortality. The typical element of submatrix $\mathbf{S_{at}}$, $S_{ijat,}$ is the probability that a woman aged a to $a + 5$ and living in region i at time t is living five years later in region j ($i = 1, ..., R$; $j = 1, ..., R$). The S_{ijat} reflect the joint processes of region-specific adult mortality and interregional migration. The typical element of submatrix $\mathbf{B_{at}}$, B_{ijat}, is the probability that a woman aged a to $a + 5$ and living in region i has a child who survives and is living five years later in region j. The B_{ijat} reflect the joint processes of region-specific fertility, adult mortality, child mortality, and interregional migration.

When the multiregional projection model is applied to educational mobility, it is possible to simplify $\mathbf{M_t}$. Inasmuch as one cannot "migrate" from a higher to a lower level of educational attainment (that is, all *intra*generational educational mobility is upward), $S_{ijat} = 0$ whenever $i > j$. Thus, all of the $\mathbf{S_{at}}$ are upper triangular submatrices. Such a simplification does not apply to the $\mathbf{B_{at}}$ because both upward and downward *inter*generational educational mobility are possible. One can further simplify the $\mathbf{S_{at}}$ if one assumes that all educational attainment is completed by a given age, say c. In this case, the $\mathbf{S}_{at}$ are diagonal submatrices whenever $a > c$.

In practice I further simplify $\mathbf{M_t}$ because of data limitations and my intention to focus the analysis on intergenerational rather than intragenerational mobility. In particular, I assume that ultimate educational attainment is determined at birth; that is, that there is no intragenerational educational mobility.[7] This detracts somewhat from the realism of the model, but it is of no important consequence for the analysis of the effects of demographic rates and intergenerational mobility on education distributions. Furthermore, I focus on the educational distributions of women of childbearing ages, rather than all adults, although this restriction could easily be relaxed. Finally, I assume that fertility rates for women below age 15 or above age 45 are zero. Given these simplifications, the $\mathbf{S_{at}}$ are all diagonal submatrices in which the S_{ijat} equal the age-education specific 5-year survival rates if $i = j$ and equal zero if $i \neq j$. Specifically, when $i = j$, $S_{ijat} = {}_5L_{i,a+5,t}/{}_5L_{iat}$, where ${}_5L_{iat}$ is the life table population between ages a and $a + 5$ for education group i in year t.

A typical element of the $\mathbf{B_{at}}$ submatrices, B_{ijat}, incorporates information on the fertility of women aged a to $a + 5$, the survival of women during that age interval, the mortality of children during the first five years of life, and the probabilities that mothers in education group i have daughters who attain education group j. That is,

$$B_{ijat} = {}_5L_{i0t}(F_{iat} + S_{iat}F_{i,a+5,t})M_{ijt}, \tag{3}$$

where ${}_5L_{i0t}$ denotes the life table population between ages 0 and 5 for the offspring of mothers in education group i in year t, F_{iat} denotes the rate of female births to women aged a to $a + 5$ in education group i in year t, S_{iat} denotes the age-education specific 5-year survival rate for women aged a to $a + 5$ in education group i in year t, and M_{ijt} denotes the proportion of mothers in year

[7] In addition, in projecting the survival of the population, I assume that children follow the mortality schedule of their ultimate educational attainment group, rather than the mortality schedule of their mother's education group.

t in education group *i* whose daughters attain education group *j*.[8]

The basic ingredients of the projection model are the age-education-specific female fertility rates (F_{iat}) and survival rates (S_{iat}) and the educational mobility rates (M_{ijt}). By making alternative assumptions about how these quantities vary across education groups and over time, I explore the effects of demographic and mobility regimes on education distributions. Given the model; an assumed pattern of fertility, mortality, and mobility rates; and an initial population distribution, one can derive the subsequent sequence of population distributions. To simulate the impact of fertility patterns on recent educational distributions, it is necessary to use an initial distribution that is sufficiently far in the past that subsequent fertility rates completely determine the current distribution. For example, women aged 20 to 49 years old in 1990 were born between 1940 and 1970. Thus, to assess the effects of past fertility on this group of women, one must use an initial distribution for 1940 or earlier. For the simulations reported in this paper, I use the age-education distribution of women aged 20-49 years in 1940 as the initial distribution. Using the 1950 population, a parallel set of projections yields very similar results to those reported here.

DATA

Fertility. Data for estimating the projection model are taken from a variety of published and unpublished sources. For the age-education-specific fertility rates for the years 1945, 1950, 1955, 1960, and 1965 I use Rindfuss and Sweet's estimates derived by the "own children in the household" method from the 1960 and 1970 Public Use Microdata Samples of the Census

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[8] A further elaboration of this projection matrix would be to allow the mobility rates m_{ijt} to depend on ages of mother. Although mother's age at the birth of her child affects the child's educational attainment (Mare and Tzeng 1989; Leng 1990), it is beyond the scope of this paper to include this refinement of the projection model.

(Rindfuss 1976; Rindfuss and Sweet 1977).[9] A weakness of these estimates is that they have not been adjusted for maternal and child mortality, for children away from parents, and for undercount. Whereas the effect of not adjusting for child mortality and children who have left their parents' homes is to undercount the rate at which children born to less educated women, the effect of not adjusting for maternal mortality is likely to overestimate this rate. The effect of not adjusting for undercount on fertility differentials is unclear. On balance, the net effects of these problems on estimated fertility differences are likely to be small. By this method, the numerators of age-specific fertility rates for women aged *a* at a time *t* years prior to the census are the numbers of children present in the household who are *t* years of age at the census. The denominators are the numbers of women of a given education level at the census date who were aged *a* when the children were born *t* years before. One advantage of such measures is that the rates for women aged 15-19 are based on the reports (and thus the educational statuses) of women who are older than 15-19 and who thus have completed their schooling. Compared to contemporaneous fertility measures, the own children estimates for 15-19 year olds are more consistent with the assumption in the projection model of no intragenerational educational mobility

For 1970, 1975, 1980, 1985, and 1990 I use published vital statistics data on the annual numbers of births to women by educational attainment (National Center for Health Statistics 1975, 1978, 1984, 1988, 1993). To form age-education-specific fertility rates I use population denominators from published tables from the 1975, 1985, and 1990 Current Population Surveys (U.S. Bureau of the Census 1976, 1987, 1992) and the 1970 and 1980 Decennial Censuses (U.S.

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[9] I used the 1960 Census estimates for 1945 and 1950 and the 1970 Census estimates for 1955, 1960, and 1965.

Bureau of the Census 1973, 1984). The denominators have been adjusted for changes in the number of states for which information about educational attainment is obtained on the birth certificate. Unlike the fertility estimates based on own children in the household, the vital statistics data do not depend on the adequacy of coverage of children residing with their mothers. These data do, however, have the shortcoming that they are classified by the educationa attainment of mothers at the time they they give birth, rather than by their ultimate educational attainment.[10]

Mortality. Mortality data for this study come from two sources. For adult women, I use the age-education-specific death probabilities from the 1960 Matched Records Study as reported by Kitagawa and Hauser (1973, Table 2.8). For infants, I use infant mortality rates computed from the 1964-66 National Sample Surveys of Natality and Mortality (National Center for Health Statistics 1970) and reported by Kitagawa and Hauser (1973, Table 2.9). Mortality estimates specific to education groups are not available prior to 1960. Although estimates are available for the 1980s (Preston and Elo 1994; Elo and Preston 1995), I have elected to rely exclusively on the data for the early 1960s. They capture mortality experience during the middle of the 1940-1990 period and thus represent the conditions experienced by young adults and middle aged persons in 1990. Using the 1960 and 1964-66 rates and Model West Regional Model Life Tables, I derive a life table for each educational group (Coale, Demeny, and Vaughn 1983). Figure 2, which presents the survival functions for each educational attainment group, is a summary of the life table estimates. These data indicate that persons who have not completed high school experience substantially higher mortality than high school graduates. Among

[10] The Rindfuss-Sweet estimates and some of the vital statistics estimates assume no fertility below age 15 and above 44. I assume that age-specific fertility rates are zero outside of the 15-44 age interval for all years.

persons who have at least a high school degree, educational mortality differences are small and difficult to distinguish from variation attributable to measurement error.

Educational Mobility. Data on intergenerational mobility are taken from the 1987-88 National Survey of Families and Households (NSFH) (Sweet, Bumpass, and Call 1988). This survey includes 7753 women aged 18 and over. To reduce the number of respondents who were still in school at the time of the survey or who were born well before the period to which this analysis applies, I included only women aged 20-69, which reduced the sample to 6725. In the mobility table used in the analysis, NSFH respondents are the daughters and their mothers' data are obtained by the respondents' retrospective reports. This arrangement of the data, however, gives disproportionate weight to mothers who had large numbers of children. Thus, I weighted each daughter inversely proportional to her reported number of full sisters.[11] I calculated the mobility table for the 5198 respondents who provided data on their own educational attainment, the eduation of their mothers, and their number of full sisters.[12]

Educational Attainment Distributions. The data summarized in Table 1 and Figure 1 on age-specific distributions of schooling for each decade, which are also used to form initial distributions for the projection models are drawn from published tables from the Decennial Censuses of 1940-1980 and the March 1990 Current Population Survey (U.S. Bureau of the Census 1945, 1953, 1963, 1973, 1984, 1992). Current Population Survey Data are used for 1990 because they use a measure of educational attainment that is similar to the one used in the

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[11] In addition I weighted the data by the sampling weights to take account of the diproportionate stratification of the NSFH sample (Sweet, Bumpass, and Call 1988).

[12] Women as young as 20 were included to maximize the sample size. As a result, some of the included respondents had not completed their schooling as of the survey data. This may create a small downward bias in respondents' educational attainments. Such respondents, however, are such a small fraction of the sample that this bias can have only a small impact on the analysis.

preceding Censuses, whereas the 1990 Census measure of attainment is not comparable with previous Censuses (Mare 1995).

FERTILITY AND MORTALITY EFFECTS GIVEN OBSERVED MOBILITY RATES

Table 3 summarizes the results of a number of simulations which reveal the ways that differential fertility and mortality may affect the evolution of educational distributions. Each row of the table corresponds to a distinct simulation and the second through sixth columns indicate the values of the variables that are modified across simulations. "Mobility Structure" denotes the assumed pattern of association between mother's and daughter's schooling in the mobility table. The "NSFH" mobility structure denotes the associations observed for women aged 18 and over in the 1987-88 NSFH data. The other possible values for mobility structure are described below. "Daughter's Distribution" denotes the assumed marginal distribution of daughter's schooling in the mobility table. "Mortality," "Fertility Level," and "Fertility Timing" denote the assumed vital rates. For these variables "O" denotes the observed level and pattern of differentials of fertility and mortality, "HSG" indicates that all educational groups have the fertility or mortality of persons with exactly 12 years of schooling (that is, an absence of education differentials), and "1990" indicates that the fertility levels and education differentials for 1990 are in effect throughout the 1940-1990 period. The final four columns of the table present summary statistics for the projected 1990 distribution of educational attainment for 20-49 year old women.

The most important result of this investigation is that the effects of differential fertility and mortality and their interaction with alternative mobility regimes on changes in educational distributions are *very small*. Although one can detect demographic effects that are consistent with common beliefs about the effects of demographic differentials on socioeconomic distributions, these effects are small relative to historical variations in levels of educational attainment.

Fertility Differentials. Simulation 1 in Table 3 projects the 1990 schooling distribution under the assumption that the population experiences the observed levels and differentials of fertility and mortality from 1940 to 1990.[13] This simulation yields a projected average number of years of school completed of 12.98. In simulation 2, I assume that in each period from 1940 to 1990 there were no fertility differentials. That is, all women had the same age-specific rates as women with exactly 12 years of schooling. Comparing these two simulations shows that the effects of differential fertility are very small indeed, a difference of only .14 years of schooling over the entire 50 year period. If one focusses on percentages with more or less than 12 years of schooling, one sees similarly small differences. Had there been no fertility differentials, educational attainment would have been higher, but only to a trivial degree.[14]

Level *vs.* Timing Effects. In conjunction with simulations 1 and 2, simulations 3 and 4 reveal the relative importance of fertility levels and fertility timing in the effect of differential fertility on the 1990 education distribution. When the fertility levels of all education groups are

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[13] I assume that fertility rates for 1940 are the same as for 1945 because education-specific fertility rates are not available for 1940. This is an unrealistic assumption inasmuch as 1940 was the end of the Great Depression and fertility in 1945 is a result of the mixed effects of World War II and the beginning of the Post-War period. Nonetheless, an alternative analysis in which I use 1950 as the initial distribution and rely only on 1950-1990 fertility rates, yields very similar results to those presented here.

[14] The projected education distribution for 1990 in simulation 1 differs slightly from the observed 1990 distribution (see Table 1). This discrepancy is the result of several factors, including errors in fertility and mortality rates, immigration, and the fact that the age range of persons included in the mobility matrix is broader than for the observed 1990 distribution. For the purposes of this analysis, however, these discrepancies are unimportant. The effects of demographic rates can be assessed by comparing among alternative simulated distributions, all of which are discrepant from the observed distribution for the same reasons.

set equal to those of high school graduates but the age pattern of fertility varies across education groups (simulation 3), the projected 1990 distribution is virtually identical to the projected distribution when both the level and the timing of fertility are held constant across education groups (simulation 2). In contrast, when fertility levels vary across education groups but the age pattern of fertility is fixed (simulation 4), the projected distribution is virtually identical to the projected distribution when both the level and the timing of fertility vary across education groups (simulation 1). This shows clearly that the small effect of differential fertility is entirely the result of differences in the *level* of fertility and not differences in the *timing* of fertility.[15]

Recent Fertility Differentials. One reason for the small effects of fertility on the distribution of schooling is that fertility differentials vary in strength and direction between 1940 and 1990 (see Table 2). It is, therefore, of considerable interest to analyze the implications of the fertility differentials in 1990, which are the largest over the five decades considered here. If the 1990 pattern of educational fertility differences groups had been in effect every year from 1940 to 1990, average educational attainment would have been lower (simulation 5). Compared to the distribution implied by observed fertility differentials (simulation 1), average attainment would have been .13 of a year lower. Compared to the distribution implied by no fertility differentials over this period (simulation 2), average attainment would have been .27 of a year lower. We would, after 50 years, have 5.5 percentage points fewer women with some college and 2.2 percentage points more high school dropouts than if there had been no fertility

[15] In simulation 3 the age-specific fertility rates were calculated by multiplying the age specific rate for each education group by the ratio of the gross reproduction rate (GRR) for high school graduates to its own GRR. In simulation 4 fertility rates were calculated by assigning all education groups the age-specific rates of high school graduates and then multiplying the assigned rate for each education group by the ratio of its own GRR to the GRR of high school graduates.

differentials by education. Thus current patterns of differential fertility will have a small negative effect on educational attainment if they persist into the future.

Differential Mortality. The effects of differential mortality on educational distributions are also small. In the absence of mortality differentials from 1940 to 1990 (simulation 6), the average attainment in 1990 would have been .01 years lower than the level implied by observed mortality differentials. Although the direction of this discrepancy is in keeping with the notion that the superior survival chances of more educated persons raise average educational attainment, the size of this effect is trivial.

THE EFFECTS OF ALTERNATIVE MOBILITY REGIMES

The effects of fertility differentials depend on the degree of intergenerational mobility experienced by a population. When groups are relatively closed to social mobility, the differences in reproductivity across groups results in greater size differences in these groups in later years than when groups are relatively open to mobility. It is instructive to examine the size of this interaction between differential fertility and social mobility. In addition, it is particularly interesting to know how much stronger the effects of differential fertility would be in a world with lower rates of mobility than those enjoyed by persons in the United States during the past half century. Simulations 11-21 examine the effects of differential fertility and mortality under four alternative mobility regimes: (1) independence of mother's and daughter's educational attainment (perfect mobility) (simulations 7-10), (2) no mobility at all -- that is a regime in which daughters have identical educational attainment to their mothers -- (simulations 11-16), and (3) the association between mother's and daughter's schooling that is observed in the NSFH data but a distribution of daughter's schooling that implies no increases in average educational attainment between mothers and daughters (simulations 17-21).

Independence. If mother's and daughter's educational attainments are statistically independent, differential fertility has no effect at all on the distribution of educational attainment (simulations 7-9). This is true by construction because no matter how many children poorly educated women bear and how few highly educated women bear, these children have equal chances of educational success. This represents one extreme on the range of mobility regimes and indicates that the more a population approximates equality of opportunity, the lower the importance of fertility differentials. In contrast, under perfect mobility, the effect of differential mortality on education distributions is not logically required to be nil. Nonetheless, given the size of prevailing mortality differences, the effect is at least as small as under the observed mobility pattern (simulation 10).

No Mobility. To examine the other extreme on the range of mobility -- that is, a regime in which daughters achieve exactly the same status as their mothers -- it is necessary to modify not only the associations between mother's and daughter's schooling in the observed mobility table but also the marginal distribution of schooling. Much of the intergenerational mobility experienced by the NSFH sample is simply a result of a large secular shifts in average levels of schooling between the mothers' and daughters' generations. Thus, it is impossible to retain the same mothers' and daughters' education distributions in a table that represents no mobility as are observed in the NSFH data. Instead, I assume a mobility table that is simply the identity matrix, yielding an expected daughter's education distribution that is approximately the same as the 1940 initial distribution. This preserves complete "inheritance" of mother's educational attainment and allows for no "structural mobility" between mothers and daughters. Simulations under this assumption yield, by construction, much lower predicted levels of educational attainment than those based on the observed mobility table (1-6) or on independence of mother's and daughter's schooling subject to the observed marginal distribution of daughter's schooling (7-10). From the standpoint of the present investigation, however, the important issue is how predicted education distributions vary *within* sets of simulations that make a common mobility assumption.

The effects of differential fertility and mortality in the absence of mobility are larger than for the observed mobility regime, but are still small relative to historical variation in average educational attainment. In the absence of mobility, the observed sequence of fertility and mortality rates imply a 1990 education distribution that averages 9.74 years, 11.1 percent of women with at least some college, and 61.2 percent of women who did not graduate from high school (simulation 11). In the absence of fertility differentials -- that is, when all women have the fertility rates of high school graduates in every period -- the predicted average 1990 educational attainment is 10.1 years, an increment of .36 of a year, indicating that differential fertility does depresses average levels of schooling (simulation 12). The effect of differential fertility is larger in the absence of mobility than for the observed NSFH mobility regime for which the differential fertility effect is only .14 of a year of schooling. As under the observed mobility regime, the depressing effect of differential fertility in the absence of mobility is exclusively the result of differences in level of fertility rather than its timing (simulations 13 and 14). Indeed, when fertility levels are held constant and fertility timing varies across education groups, average attainment is slightly higher than when both level and timing are fixed, suggesting that, in the absence of mobility, the sequences of differences in timing have a slightly positive effect on educational attainment.

As in the case of the observed mobility table, it is possible to explore the effects of the large 1990 differentials in fertility in the absence of mobility by assuming that the 1990 differentials were in place throughout the 1940-1990 period. Under this assumption, the implied 1990 average level of education is 9.49 years, a fourth of a year lower than implied by the observed sequence of fertility rates and .61 of a year lower than implied by the absence of fertility differentials. (Compare simulation 15 to simulations 11 and 12.) These effects are about twice as large as one observes for the observed NSFH mobility table and illustrate clearly that differential reproductivity has a much bigger effect on relative group size when groups are closed to mobility. These effects, however, remain small relative to the growth in years of schooling between 1940 and 1990.

Observed Mother-Daughter Associations and No Educational Upgrading. An alternative mobility regime, which may better approximate future mobility chances in the United States than any of the regimes considered thus far, is one in which the association between mother's and daughter's schooling is the same as for NSFH respondents, but average levels of educational attainment are stable from generation to generation. To approximate this condition, I adjust the marginal distributions of mother's and daughter's schooling in the NSFH mobility table to agree with the 1940 education distribution (simulations 17-21).[16] Under these conditions, the pattern of effects under alternative simulations is similar to the ones for the observed mobility table (1-5) and for no mobility (14-18), but the sizes of the effects are closer to those for the observed mobility regime. Average 1990 attainment in the absence of fertility differences (simulation 18) is .2 of a year greater than the level implied by the observed sequence of fertility rates (simulation 17). This compares to the effect of .14 of a year for the observed mobility table

[16] Alternative approaches would be to adjust the table to the 1990 education distribution or the distribution for NSFH respondents. These adjustments would yield expected 1990 education distributions more similar to those from simulations 1-10, but would lead to a pattern of *differences* among simulations that is similar to simulations 17-21.

and .36 of a year for the model of complete inheritance. Had 1990 fertility patterns been in effect for the entire period under this mobility pattern, average attainment would have been .32 of a year lower than if there had been no fertility differentials. This compares to the effect of .27 of a year for the observed table and .61 of a year for complete inheritance. If relative mobility chances remain unchanged but general educational upgrading is reduced, the impact of differential fertility will continue to be small.

DEMOGRAPHIC RATES AND EDUCATIONAL INEQUALITY

It is also interesting to examine the effects of alternative fertility regimes on the dispersion as well as the average level of attainment. These effects, which are indicated by the variation in H displayed in the final column of Table 3, depend on where a group of women lies on the trajectory of educational growth. For the observed mobility regime (simulations 1-6) the variations in the pattern of demographic rates induce only slight changes in the H statistic across simulations.

Under complete inheritance (no mobility) the effects of demographic rates on H are larger and generally in the opposite direction from those for the observed mobility table. Configurations of rates that lower average attainment tend to lower the dispersion of the schooling distribution (compare simulations 18 and 15, for example). The *magnitude* of the changes in H are, like the variations in the mean of the distribution, a reflection of the greater sensitivity of schooling distributions to demographic differentials when mobility is low than when it is high. The direction of the effects, however, is largely a result of the pattern of educational growth. As indicated in Table 1, the dispersion of the schooling distribution reaches its maximum during the middle phase of educational growth and then, at high average levels of attainment, shrinks toward its previous size. Thus, patterns of fertility or mortality rates that lower average attainment tend to lower the dispersion when an education distribution is similar to the one observed in 1940 (simulations 11-21) and raise the dispersion when a distribution is similar to the one observed in 1990. The effect of differential fertility and mortality on educational inequality, therefore, is heavily dependent on their effects on the mean attainment and on the era in which these effects are observed.

DEMOGRAPHIC RATES AND INTERGENERATIONAL MOBILITY

Differential fertility is likely to affect not only socioeconomic distributions but also rates of upward and downward mobility. When a large proportion of a population is born to mothers of low socioeconomic standing there is greater potential for upward mobility than when a small proportion have low socioeconomic origins. Thus differential fertility has an effect on the proportion of persons who are upwardly mobile that is the opposite of its effect on average levels of socioeconomic standing (Preston 1974). Table 4 shows how alternative patterns of differential fertility affect expected rates of upward and downward educational mobility for cohorts of women born in 1950, 1970, and 1990. These calculations use the 1940 education distribution as the initial distribution and the observed NSFH educational mobility table.[17] Under all simulations, rates of upward mobility decline and rate of downward mobility increase over cohorts born between 1950 and 1990. This is a natural result of secular educational growth. As more persons reach the top of the distribution, fewer have the potential for upward mobility and

[17] As shown above, under independence, differential fertility has no effect on education distributions and thus has no effect on mobility rates. Under perfect inheritance upward and downward mobility percentages are, by definition, zero irrespective of the pattern of fertility.

more have the potential to move down. Across alternative fertility regimes, mobility rates do vary but the variations are very small. Compared to the mobility rates predicted by the observed sequence of fertility rates (simulation 1), the percentage of women who would be upwardly mobile would be about two points lower in the absence of fertility differentials (simulation 2). If the 1990 fertility pattern were in effect throughout the 1940-1990 period, rates of upward mobility would increase slightly. On balance, the effects of differential fertility on mobility rates are slight.

CONCLUSIONS

The analyses reported in this paper lead to clear answers to the five questions posed at the outset of the paper.

1. Differential fertility by educational attainment of mother has retarded the growth of average educational attainment over the past 50 years, but this effect is small. Had there been no fertility differentials between 1940 and 1990, average educational attainment for prime age women would have been less than a fifth of a year lower than the actual 1990 attainment level. When one considers that the average educational attainment of women increased by about 3.5 years over this period, this effect as negligible.

2. Whereas the differential *level* of fertility by women's educational attainment depresses average attainment slightly, the differential *timing* of fertility has essentially no effect. This appears to be because education differentials in fertility timing are highly variable. In some periods the expected positive correlation between average age of childbearing and educational attainment is nonexistent.

3. Although 1990 fertility differentials by education are stronger than at any other period

since 1945, even these differentials do not have much effect on the distribution of schooling. Had 1990 fertility patterns been in effect for the past 50 years, the average level of educational attainment in the population today would be only slightly lower than it is.

4. Differential mortality raises the average level of educational attainment because less educated persons die earlier than their more educated counterparts. This effect, however, is even smaller than the effect of fertility differentials.

5. In a world of perfect mobility (that is, independence of social origins and destinations), differential fertility has no effect on education distributions. The greater the degree of resemblance between mother and daughter on educational attainment (that is, the lower the rate of intergenerational mobility), the greater the effect of differential fertility. In the extreme case in which each daughter has the same educational attainment as her mother, the effects of differential fertility are considerably larger than under the actual regime of intergenerational mobility observed during the past several decades. It is this extreme (and unrealistic) condition that is sometimes mistakenly assumed in discussions of the presumed harmful effect of differential fertility (Preston and Campbell 1993; Lam 1993). Even in this case, however, the impact of differential fertility over a 50 year period is small relative to the overall change in average attainment observed during this period. Moreover, even if we further assume that the large fertility differentials observed in 1990 held for 50 years under this extreme regime of immobility, educational attainment would be only about three fourths of a year less than the level implied by no differential fertility. This effect is still less than one fourth of the observed increase in attainment during the past 50 years.

Even under a relatively pessimistic forecast for the prospects for future upward mobility in the United States, it is extremely unlikely that the future will approximate the extreme condition of complete educational immobility. A more realistic scenario is that average attainment levels will converge to a somewhat higher level than they are now, subsequent generations will average similar levels of attainment to those of their parents, and the *association* between parents and offspring will not change much from its historical pattern. This last expectation is in line with the stable patterns of parental effects on offsprings' educational attainment throughout this century (Mare 1981; Hout, Raftery, and Bell 1993). Under these conditions, the effects of differential fertility on educational distributions will be very modest.

RESEARCH AGENDA

The strength of the approach described in this paper is that it enables one to answer aggregate, dynamic questions about the reproduction and evolution of social hierarchies. Such questions cannot be divorced from the demographic mechanisms required to sustain a population, even when, as in the case of the specific illustration presented in this paper, demographic effects on socioeconomic distributions are relatively weak. Nonetheless, the analyses reported in this paper are based on a very rudimentary model of socioeconomic reproduction. Obvious extensions of this work are to take account of intercohort changes in social mobility, to use indirect estimation procedures to extend the analysis to periods prior to 1940, and to investigate trends in the distribution of socioeconomic attributes other than educational attainment (such as occupation and income). Of greater importance, however, is the exploration of several key demographic and social complexities that are ignored here.

Two-Sex *vs.* One-Sex Models. The most serious limitation of the model is that it is confined to one sex. The model does not take account of the ways that marriage markets constrain fertility and how this may vary across persons with varying levels of educational attainment.[18] Taking account of both sexes *simultaneously* enables one to answer additional questions about how demographic processes affect levels and distributions of socioeconomic characteristics. The degree to which fathers and mothers resemble each other on educational attainment or other socioeconomic attributes affects the degree of inequality experienced by their offspring. When the correlation of spouses' attainments is only moderate the advantage experienced by a child because of the high attainment of one parent is offset by the lower status of the other parent. When the correlation of spouses' attainments is high, however, the benefit or deficit experienced by a child because of the status of one parent is more often reinforced by the similar status level of the other parent. As the degree of parental resemblance shifts, so may change in the inequality of subsequent generations. The next order of business for the line of investigation proposed here is to develop a two-sex model of fertility and educational mobility. Prototypes for such models already exist (e.g., Preston and Campbell 1993), and the good data available on educational assortative mating (Mare 1991) make these models feasible to estimate.

Changing Household Structure. Once the effects of assortative mating are recognized, it is also necessary to explore the consequences of changing rates of marriage, marital disruption, and non-marital childbearing, as well as levels of marital homogamy, on socioeconomic distributions in subsequent generations (McLanahan and Sandefur 1994). A large and growing proportion of children raised by single parents may offset or reinforce the effect of the changing covariance of mothers' and fathers' socioeconomic attributes on the intergenerational reproduction of inequality. Thus, in simulating the sequence of socioeconomic distributions, one should take account of the evolving mixture of two-parent and single-parent households in the

[18] Of course, it would also be desirable to examine educational trends for the entire population, rather than just the female half of it. This shortcoming, however, can be remedied simply by carrying out a replication of the present analysis on men.

population.

Parental Age Effects. Whereas the present analysis assumes an invariant mobility matrix across ages of mother, parents' ages when children are born affect children's socioeconomic achievement (Mare and Tzeng 1989, Leng 1990). Children born to older parents fare substantially better than those born to younger parents. As the mean and variance of ages of childbearing have changed over time, this may have contributed to the level and dispersion of socioeconomic outcomes in subsequent generations. Incorporation of parental age effects is a straightforward extension of the projection model.[19]

Three-Generation Effects. Population projection models, as well as most conventional models of social stratification processes, typically assume that the effects of social standing in one generation on the social standing of subsequent generations can be represented fully by social mobility between successive generations. That is, it is assumed that individuals are not affected by their grandparents or great-grandparents once the effects of their parents are taken into account. Yet whether such "Non-Markovian" effects are present is an empirical question that has not been extensively studied. As social mobility data on three generations become available, it will be useful to incorporate multi-generational influences into both individually oriented models of the stratification process and aggregate population models of the sort presented here (Mare and Hauser 1993, Warren 1995).

Implications for Racial Inequality. The results in this paper average over the diverse behaviors of racial and ethnic groups. It is worthwhile to revisit, in light of several decades of

[19] Alternatively, one might investigate the closely related issue of the aggregate implications of changing parity (birth order) distributions. At the individual level, however, parental age effects appear to be stronger and more robust than those of birth order (Mare and Tzeng 1989).

social change, Preston's (1974) question of whether differences in socioeconomic achievement between African Americans and whites are partly attributable to racial differences in fertility patterns. Perhaps of greater import is the way that fertility patterns have affected black socioeconomic progress in recent decades. This period has witnessed exceptional growth in the number of blacks who have attained college degrees and even higher educational credentials (for example, Mare 1995). The overwhelming majority of these college graduates have experienced substantial upward intergenerational mobility. These accomplishments benefit not only the persons who achieve them but also, given the intergenerational correlation of educational success, their offspring. On the one hand, therefore, one can hope for an intergenerational "multiplier" effect on black socioeconomic progress. On the other hand, however, patterns of differential fertility may offset this effect. If fertility levels of highly educated African Americans are low, relatively few children are available to benefit form their parents' high level of socioeconomic attainment.[20] Under these conditions, most blacks will continue to face the burden of achieving success through the hard route of upward mobility rather than the easier route of maintaining their parents' level of success. One can investigate the degree to which this occurs with the model presented in this paper.[21]

Immigration. In addition to differential fertility and mortality and intergenerational mobility, socioeconomic distributions are also affected by levels and patterns of immigration. Immigration of persons of low socioeconomic origins initially lowers average levels of achievement, but is subsequently a source of intra- and intergenerational social mobility (Sibley 1942). A full demographic understanding of the evolution of socioeconomic distributions

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[20] I am indebted to Samuel Preston for discussions of this point.

[21] This effect of differential fertility is separate from and may indeed be compounded by blacks' chances for downward mobility.

requires that the model presented in this paper be elaborated to take account of differences in immigration rates among socioeconomic groups.

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TABLE 1

TRENDS IN WOMEN'S EDUCATIONAL ATTAINMENT IN THE UNITED STATES, 1940-1990

AGE		1940	1950	1960	1970	1980	1990
	Ave. Yrs. Completed	10.28	10.87	11.44	12.28	12.58	12.83
20-24	H (entropy)	0.607	0.617	0.606	0.598	0.579	0.590
	% < 12 Yrs.	51.93	43.16	34.81	21.01	16.38	14.50
	% > 12 Yrs.	12.48	16.54	21.31	34.45	40.65	47.03
	Ave. Yrs. Completed	9.96	10.73	11.26	12.08	12.91	13.08
25-29	H (entropy)	0.615	0.619	0.623	0.617	0.611	0.600
	% < 12 Yrs.	58.69	45.23	38.46	26.49	15.31	12.99
	% > 12 Yrs.	13.23	15.03	18.92	27.74	43.33	45.34
	Ave. Yrs. Completed	9.70	10.38	11.04	11.70	12.79	13.15
30-34	H (entropy)	0.610	0.624	0.628	0.618	0.617	0.600
	% < 12 Yrs.	63.22	51.44	42.06	31.53	16.75	12.29
	% > 12 Yrs.	14.39	14.35	17.77	22.95	41.17	46.83
	Ave. Yrs. Completed	9.28	9.99	10.85	11.44	12.41	13.21
35-39	H (entropy)	0.577	0.621	0.623	0.622	0.623	0.596
	% < 12 Yrs.	68.84	58.31	43.44	35.35	21.45	11.40
	% > 12 Yrs.	13.08	14.43	16.39	20.53	34.45	48.02
	Ave. Yrs. Completed	8.99	9.75	10.48	11.23	12.03	13.05
40-44	H (entropy)	0.546	0.614	0.630	0.630	0.626	0.601
	% < 12 Yrs.	72.02	62.29	50.22	39.31	26.35	12.88
	% > 12 Yrs.	11.46	15.60	15.43	19.34	28.79	44.71
	Ave. Yrs. Completed	8.35	9.32	10.04	11.00	11.80	12.66
45-49	H (entropy)	0.462	0.579	0.626	0.627	0.628	0.617
	% < 12 Yrs.	79.49	67.70	57.83	41.87	29.77	17.97
	% > 12 Yrs.	8.54	13.86	15.14	17.56	25.69	38.11
	Ave. Yrs. Completed	9.52	10.23	10.85	11.67	12.51	13.02
20-49	H (entropy)	0.591	0.626	0.632	0.628	0.620	0.605
	% < 12 Yrs.	64.33	53.78	44.48	31.84	19.77	13.42
	% > 12 Yrs.	12.34	15.01	17.44	24.46	37.17	45.38

TABLE 2
TRENDS IN FERTILITY, 1945-90

AGE	EDUCATION	1945	1950	1960	1970	1980	1990
		AGE-SPECIFIC FEMALE FERTILITY RATES					
	0-8	0.0	64.3	71.5	9.3	14.4	24.6
	9-11	0.0	58.7	85.6	28.8	23.5	28.9
15-19	12	0.0	19.5	30.5	61.4	39.8	42.9
	13-15	0.0	7.9	12.0	26.1	13.3	17.6
	16+	0.0	1.9	3.7	0.0	0.0	0.0
	0-8	0.0	96.1	105.9	70.6	49.2	100.3
	9-11	22.2	95.0	123.7	108.1	85.5	117.6
20-24	12	23.6	83.2	119.9	99.2	70.8	76.4
	13-15	23.5	75.6	104.5	55.1	31.8	33.2
	16+	22.2	34.2	54.1	50.4	24.4	7.4
	0-8	20.8	73.5	90.0	48.6	32.8	75.7
	9-11	22.1	67.2	85.0	58.7	44.9	63.9
25-29	12	0.0	74.3	93.2	70.1	56.8	56.3
	13-15	23.5	85.0	99.8	77.0	57.3	65.9
	16+	23.5	79.6	95.8	83.1	57.5	38.4
	0-8	23.5	50.1	56.8	30.0	18.7	45.9
	9-11	23.6	42.0	49.7	30.0	19.7	30.0
30-34	12	0.0	48.6	55.1	33.3	24.7	30.3
	13-15	5.5	56.5	58.6	37.5	29.8	41.5
	16+	6.7	54.2	63.9	46.3	46.9	41.9
	0-8	7.1	27.8	30.9	16.9	9.4	24.4
	9-11	5.2	23.0	24.9	14.1	7.7	11.9
35-39	12	4.7	24.9	26.2	14.4	7.7	10.1
	13-15	5.4	26.4	26.1	14.2	8.9	14.9
	16+	0.0	30.6	28.3	16.4	14.8	20.2
	0-8	7.5	10.0	12.0	5.8	2.7	6.3
	9-11	8.4	6.6	8.1	3.7	2.0	2.3
40-44	12	8.6	7.4	7.7	4.0	1.6	1.7
	13-15	7.4	9.1	8.9	3.9	1.6	2.6
	16+	7.0	6.4	8.5	3.6	2.3	3.8
		GROSS REPRODUCTION RATE					
	0-8	0.29	1.61	1.84	0.91	0.64	1.39
	9-11	0.41	1.46	1.88	1.22	0.92	1.27
15-44	12	0.18	1.29	1.66	1.41	1.01	1.09
	13-15	0.33	1.30	1.55	1.07	0.71	0.88
	16+	0.30	1.03	1.27	1.00	0.73	0.56
		MEAN AGE OF FERTILITY SCHEDULE					
	0-8	32.6	26.1	26.2	27.3	26.2	26.9
	9-11	29.8	25.7	25.2	25.5	25.0	25.2
15-44	12	29.1	27.5	26.7	24.9	24.9	25.0
	13-15	28.6	28.4	27.6	26.8	27.3	27.8
	16+	28.0	29.8	29.2	28.5	29.5	31.4
		STANDARD DEVIATION OF AGE OF FERTILITY SCHEDULE					
	0-8	4.96	6.71	6.69	5.95	5.94	5.96
	9-11	6.21	6.44	6.36	5.60	5.25	5.24
15-44	12	8.87	6.03	5.90	5.91	5.52	5.69
	13-15	6.59	5.74	5.65	5.77	5.37	5.69
	16+	6.20	5.28	5.38	4.84	4.67	4.68

Sources: Rindfuss (1976), Vital Statistics of the U.S., 1970 and 1980 Censuses, and March 1990 Current Population Survey.

TABLE 3

PROJECTED EDUCATION DISTRIBUTIONS UNDER ALTERNATIVE SIMULATIONS OF FERTILITY, MORTALITY, AND MOBILITY

Simulation	Mobility Structure	Daughter's Distribution	Mortality	Fertility Level	Fertility Timing	Projected 1990 Schooling Distribution			
						Ave. Yrs.	% > 12	% < 12	H
1.	NSFH	NSFH	O	O	O	12.98	44.3	12.8	0.595
2.	NSFH	NSFH	O	HSG	HSG	13.12	47.2	11.7	0.594
3.	NSFH	NSFH	O	HSG	O	13.11	46.9	11.6	0.592
4.	NSFH	NSFH	O	O	HSG	12.98	44.5	12.9	0.596
5.	NSFH	NSFH	O	1990	1990	12.85	41.7	13.9	0.595
6.	NSFH	NSFH	HSG	O	O	12.97	44.2	13.0	0.596
7.	Indep.	NSFH	O	O	O	13.12	47.1	11.6	0.594
8.	Indep.	NSFH	O	HSG	HSG	13.12	47.1	11.6	0.594
9.	Indep.	NSFH	O	1990	1990	13.12	47.1	11.6	0.594
10.	Indep.	NSFH	HSG	O	O	13.11	47.1	11.8	0.594
11.	No Mobility	1940	O	O	O	9.74	11.1	61.2	0.595
12.	No Mobility	1940	O	HSG	HSG	10.10	13.3	55.7	0.615
13.	No Mobility	1940	O	HSG	O	10.21	14.1	53.7	0.620
14.	No Mobility	1940	O	O	HSG	9.62	10.3	63.1	0.588
15.	No Mobility	1940	O	1990	1990	9.49	9.4	64.6	0.577
16.	No Mobility	1940	HSG	O	O	9.67	10.8	62.2	0.613
17.	NSFH	1940	O	O	O	9.94	15.1	58.6	0.621
18.	NSFH	1940	O	HSG	HSG	10.14	16.9	55.9	0.634
19.	NSFH	1940	O	HSG	O	10.18	17.2	53.3	0.636
20.	NSFH	1940	O	O	HSG	9.90	14.8	59.2	0.618
21.	NSFH	1940	O	1990	1990	9.82	14.0	60.3	0.612

O: Observed   NSFH: Women aged 20 and over in 1987-88 National Survey of Families and Households   HSG: High School Graduates

TABLE 4

PROJECTED MOBILITY RATES UNDER ALTERNATIVE SIMULATIONS OF FERTILITY AND MORTALITY*

Simulation	Mortality	Fertility Level	Fertility Timing	Mobility Rates by Year of Birth					
				Upward			Downward		
				1950	1970	1990	1950	1970	1990
1.	O	O	O	42.8	35.2	33.4	17.5	22.5	23.8
2.	O	HSG	HSG	42.5	33.0	30.2	17.7	24.3	26.5
3.	O	HSG	O	41.5	33.6	31.7	18.4	23.8	25.3
4.	O	O	HSG	43.8	34.7	32.2	16.8	23.0	24.9
5.	O	1990	1990	43.7	36.8	34.3	17.0	21.2	23.2

* Assumes observed mobility matrix for women aged 20 and over in 1987-88 NSFH.

O: Observed

HSG: High School Graduates

FIGURE 1
TRENDS IN THE DISTRIBUTION OF SCHOOLING, 1940-19
WOMEN AGED 20-49

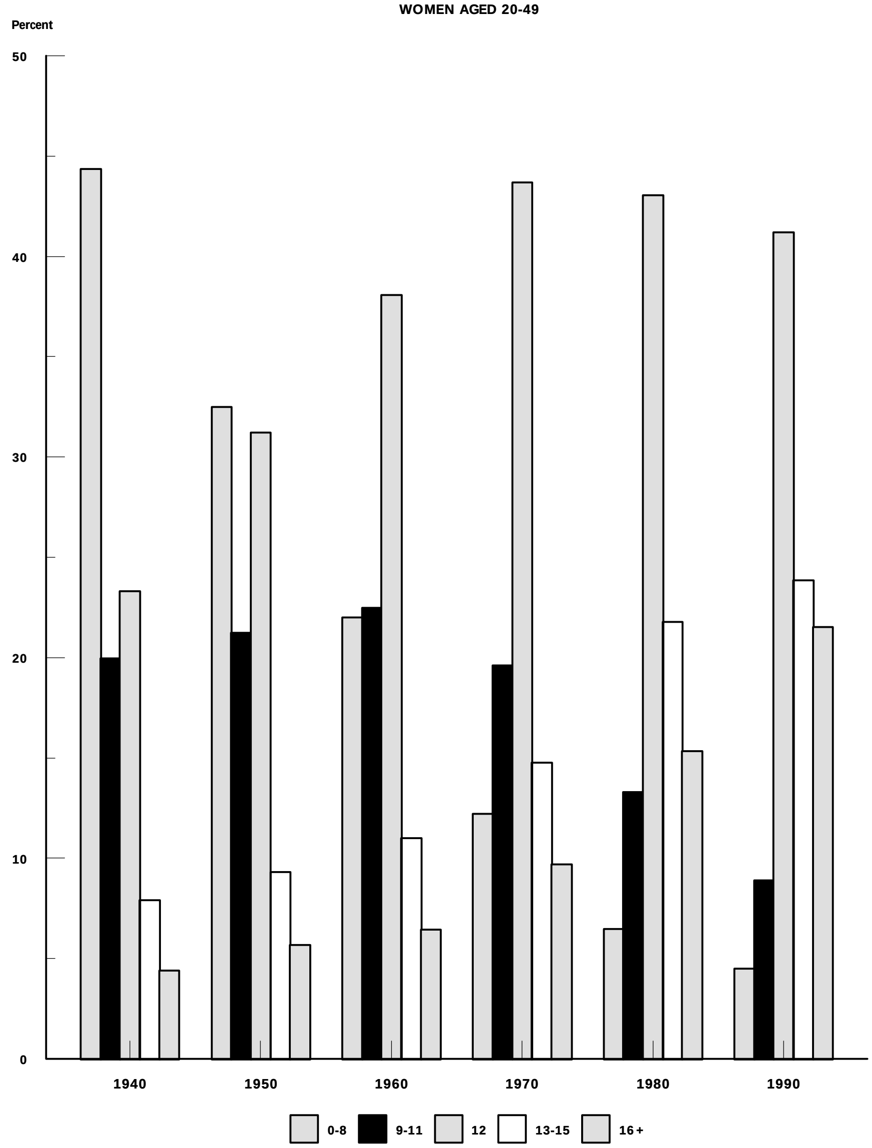

FIGURE 2
ESTIMATED PROBABILITIES OF SURVIVAL [l(x)]
BY EDUCATIONAL ATTAINMENT