# HOW MUCH DOES SORTING INCREASE INEQUALITY?*

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Some commentators argue that increased sorting into internally homogeneous neighborhoods, schools, and marriages is radically polarizing society. Calibration of a formal model, however, suggests that the steady-state standard deviation of education would increase only 1.7 percent if the correlation between neighbors' education doubled, and would fall only 1.6 percent if educational sorting by neighborhood disappeared. The steady-state standard deviation of education would grow 1 percent if the correlation between spouses' education increased from 0.6 to 0.8. In fact, marital and neighborhood sorting have been stable, or even decreasing historically. Sorting has somewhat more significant effects on intergenerational mobility than on inequality.

Several influential social commentators have argued that Americans are increasingly sorting into internally homogeneous neighborhoods, schools, workplaces, and marriages, and that this sorting has led to increasing inequality. Wilson [1987] argues that black middle-class flight from urban centers leaves inner-city blacks without role models; Reich [1991] contends that a "fortunate fifth" has seceded from close contact with the rest of society; and Herrnstein and Murray [1994] assert that people are sorting more by intelligence, with a "cognitive elite" increasingly living in the same neighborhoods, attending the same schools, working in the same firms, and marrying each other. To the extent that peer influence matters [Borjas 1995; Crane 1991; Corcoran et al. 1989; Cutler and Glaeser 1995; Case and Katz 1991], this suggests that America may be caught in a vicious cycle of increasing sorting and inequality [Bénabou 1993, 1996; Durlauf 1992, 1994; Fernandez and Rogerson 1992].

When I started this project, I shared these concerns. I now believe that they are based largely on misleading intuition from models in which children's outcomes are very strongly influenced by their parents and neighbors. Sorting improves economic prospects for descendants of rich families while worsening them for descendants of poor families. The extent to which this process

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increases long-run inequality depends on how likely currently poor dynasties are to be poor in the future. Calibration of a simple model suggests that changes in sorting will have only a small impact on steady-state inequality of characteristics that are only moderately heritable, such as education and income.

To see the intuition, it is useful to consider a hypothetical case in which spouses sort perfectly and then to examine the effect of variations in sorting by neighborhood. Data from the Panel Survey of Income Dynamics (PSID) indicate that a child's educational attainment can be expressed as 0.39 times the average educational attainment of the child's parents, plus 0.15 times the average educational attainment in the census tract in which the child grew up, plus an intercept, plus an error term with a standard deviation of 1.79 years. For the sake of argument, suppose that we accept this relationship as causal, although the coefficient on neighbors' education may merely reflect omitted parental characteristics or measurement error in parental education.

If all children had identical neighborhood education, dynastic education would follow an AR(1) process with a persistence parameter of 0.39, implying that the steady-state standard deviation of education would be $1.79/(1 - 0.39^2)^{1/2} = 1.95$ years. On the other hand, if neighborhoods were completely segregated by education, neighborhood education would be equal to parental education, so that dynastic education would follow an AR(1) process with a persistence parameter of $0.39 + 0.15 = 0.54$. The resulting steady-state standard deviation of education would be $1.79/(1 - 0.54^2)^{1/2} = 2.13$ years. Thus, moving from no educational segregation in neighborhoods to complete educational segregation would increase the steady-state standard deviation of education by approximately 9 percent. (This paper will generally use the standard deviation of education as a measure of inequality. Since much evidence suggests log earnings are approximately linear in years of schooling, the standard deviation of education is likely to be a reasonable proxy for the standard deviation in log permanent earnings.)

More realistic changes in sorting would cause much smaller increases in inequality, especially since the actual correlation between spouses' education is less than one. Section II shows that the steady-state standard deviation of educational attainment would increase by 1.7 percent—approximately six days—if the correlation between neighbors' education doubled from its current level of 0.2 to 0.4. Similarly, the standard deviation of educational attainment would fall by 1.6 percent if sorting by education in neighborhoods were eliminated. To the extent that measured neighborhood effects reflect omitted parental variables, the effect of neighborhood sorting will be even smaller. The steady-state standard deviation of education would increase by 1 percent if the correlation between spouses' education increased from 0.6 to 0.8. Although I focus on education, changes in sorting are also unlikely to affect income inequality significantly, given the intergenerational correlation of income of approximately 0.4 estimated by Solon [1992] and Zimmerman [1992]. Note that sorting by neighborhood would have a much bigger impact on inequality if the parental effect were greater—as in many theoretical models that may shape intuition on these issues.

Not only is inequality fairly insensitive to sorting, but sorting itself has been stable or declining. The correlation of education among people in the same census tract fell from 0.180 to 0.178 from 1960 to 1990. (As explained below, the correlation of education is equivalent to the $R^2$ that would be obtained by a regression of individuals' education on a set of dummy variables for their census tracts.) The correlation between spouses' education fell from 0.649 in 1940 to 0.620 in 1990.

The finding that increased sorting has only a minor impact on inequality does not seem to be an artifact of the assumption that children's characteristics are a first-order linear function of parents' and neighbors' characteristics. Estimation of a general Markovian model for intergenerational transmission of education yields similar results. Moreover, there is only limited evidence that the moderate observed heritability of education masks a highly inherited latent variable. Even under strong assumptions about the heritability of such a latent variable, the correlation between spouses' education will still have relatively small effects on the steady-state standard deviation of education.

Sorting has a somewhat greater effect on the persistence of status across generations than on inequality. A doubling of the correlation among neighbors' education would increase the correlation between parents' and children's education by 8.6 percent, from 0.346 to 0.375. An increase in the correlation between spouses' education from 0.6 to 0.8 would increase the correlation between parents' and children's education by 11 percent, from 0.346 to 0.385. Either of these changes in sorting would produce approximately a 3.5 percent increase in the steady-state standard deviation of a measure of long-run educational inequality among family dynasties. However, educational sorting will not strongly influence persistence of status among ethnic groups if people draw spouses and neighbors largely from within their own ethnic group.

This paper follows Galton [1889], Pearson [1896], Blinder [1973, 1976], Atkinson [1975], Becker [1981], and Becker and Tomes [1979], in assuming that children's characteristics can be written as a linear function of parents' characteristics. Following Goldberger [1979], Cavalli-Sforza and Feldman [1981], and Borjas [1992, 1995], I assume that children's characteristics also are a linear function of the characteristics of other adults in the environment. This paper differs from earlier work both in its focus on the transmission of education rather than the inheritance of financial assets, and in its use of the model to examine contemporary concerns about increased sorting in American society.[1]

The remainder of the paper is organized as follows. Section I models sorting's effect on inequality using a modified version of the Galton-Pearson model of inheritance. Section II calibrates the model, arguing that sorting into homogeneous neighborhoods and marriages is likely to have only minor effects on steady-state inequality of education. Section III examines the effect of sorting on the persistence of educational status among families and ethnic groups. Section IV argues that the results are unlikely to change significantly under more general models.

This paper evaluates claims that sorting will increase inequality on their own terms rather than appealing to incentive responses, which are difficult to quantify. However, I argue in the conclusion that endogenous behavioral responses are likely to further counteract tendencies for sorting to increase inequality. I also discuss policy implications.

## I. The Model

Suppose that the educational attainment of a member of the $i$th dynasty in generation $t + 1$ is

$$z_{i,t+1} = k_{t+1} + \alpha\left(\frac{z_{i,t} + z_{i',t}}{2}\right) + \beta\frac{\sum_{j=1}^{n} z_{j,t}}{n} + \varepsilon_{i,t+1}, 0 \leq \alpha + \beta \leq 1, \tag{1}$$

where $\alpha$ represents the additional years of education a child will attain given an increase of one year of average parental educa-

1. Blinder [1973, 1976] shows that changes in inheritance rules, or in marital sorting, can have only a slight effect on income distribution through inheritance of physical capital, since inherited wealth accounts for only a small part of inequality.

tion, $i'$ is the spouse of agent $i$, $\beta$ represents the additional years of education a child will attain given an increase in average education of one year in the neighborhood, $n$ is the number of neighbors, $z_{j,t}$ is the education of neighbor $j$ at time $t$, and $\varepsilon_{i,t+1}$ is an i.i.d. random shock to educational attainment. Note that $k_{t+1}$ is constant across dynasties, but could vary with time if there is an exogenous time trend in education. This linear, first-order, genderless model should be seen as an illustrative approximation.[2] In general, $z_{j,t}$ could represent any asset, but for specificity, I will generally use $z_{j,t}$ to refer to human capital, as measured by years of formal schooling. In order to focus on the implications of sorting, I assume that fertility and the transmission of human capital by neighbors and parents are fixed. All households are assumed to have two children, one boy and one girl.[3]

Squaring both sides of equation (1) and taking expectations shows that the variance of education at time $t + 1$ will be an increasing function of $\sigma_t^2$, the variance of education at time $t$; $\rho_m$, the correlation between spouses' education; and $\rho_n$, the correlation between neighbors' education.[4] Assuming that $n$ is large, so that a child's parents can be treated as an insignificant part of the neighborhood,

$$\sigma_{t+1}^2 = [\alpha^2(1 + \rho_m)/2 + \beta^2\rho_n + 2\alpha\beta\rho_n]\, \sigma_t^2 + \sigma_\epsilon^2. \tag{2}$$

Solving for the steady state standard deviation,

2. The approximation clearly breaks down for the tails of the distribution, since education is bounded.

3. Although tendencies for poor households to have more children will clearly affect the steady-state distribution of education, this effect is also likely to be minor [Mare 1996]. In any case, it is not clear that differential fertility will interact with changes in the assortativeness of marriage. I therefore abstract from differential fertility in calibrating the effect of changes in marriage patterns on steady-state inequality.

4. The correlation between neighbors' education is defined as

$$\rho_n = \frac{\Sigma_{j=1}^{J}\Sigma_{i\in N_j}(z_i - \bar{z})\Sigma_{k\in N_j}(z_k - \bar{z})/n_j}{\Sigma_{j=1}^{J}\Sigma_{k\in N_j}(z_k - \bar{z})^2},$$

where there are $J$ neighborhoods indexed by $j$, $N_j$ denotes the set of people in neighborhood $j$, $n_j$ is the number of people in neighborhood $j$, and $\bar{z}$ denotes average education in the economy. Kremer and Maskin [1996] discuss this index of segregation in more detail, and show that it is equivalent to the $R^2$ from a regression of individuals' education on a set of dummies for all census tracts. Note that this measure of segregation is invariant to affine transformations of variables, which would produce a general increase or decrease in inequality.

(3) $$\sigma_\infty = \frac{\sigma_\epsilon}{(1 - [\alpha^2(1 + \rho_m)/2 + (\beta^2 + 2\alpha\beta)\rho_n])^{1/2}}.$$

Under the linear model considered in this section, changes in sorting affect the standard deviation of education, but not the mean level of education. Since the steady-state distribution of education is normal under the model, the entire distribution can be summarized by its standard deviation.

It is useful to consider first the effects of sorting in marriage in the special case with no neighborhood effects. This case illustrates principles that carry over to the more general case with both parental and neighborhood effects. If $\beta = 0$ or $\rho_n = 0$, the steady-state standard deviation simplifies to

(4) $$\sigma_\infty = \frac{\sigma_\epsilon}{(1 - \alpha^2(1 + \rho_m)/2)^{1/2}}.$$

The effect of sorting on steady-state inequality depends critically on $\alpha$. It is useful first to consider the effect of sorting under savings models in which shocks to dynastic wealth are fully transmitted to children; i.e., $\alpha$ equals one. Let $z$ represent physical, rather than human capital, and suppose that savings rates and returns are independent of wealth, and that shocks cannot be fully insured. If there is perfect correlation between spouses' wealth, $z_{i,t+1}$ will equal $z_{i,t} + \varepsilon_{i,t+1}$, entailing the well-known counterfactual implication that the variance of assets among dynasties will grow indefinitely.[5]

On the other hand, inequality will be bounded if the correlation between spouses' assets is bounded away from one, since rich people will tend to marry less wealthy spouses (because most people will be poorer than they are). Therefore, rich people will have children who are on average poorer than they themselves are, implying that the steady-state standard deviation of assets will be finite.

If marriages take place only within countries, the model predicts that there will be a steady-state variance of assets within a country, but the variance of assets among countries will grow indefinitely. The data are consistent with this prediction: inequality has not grown monotonically within the United States, but the variance of log income (and presumably wealth) among countries has grown over time [Pritchett 1995].

5. If there are decreasing returns to accumulable factors, inequality will be bounded, but only because it will be impossible for the very rich to continue accumulating because of economywide diminishing returns.

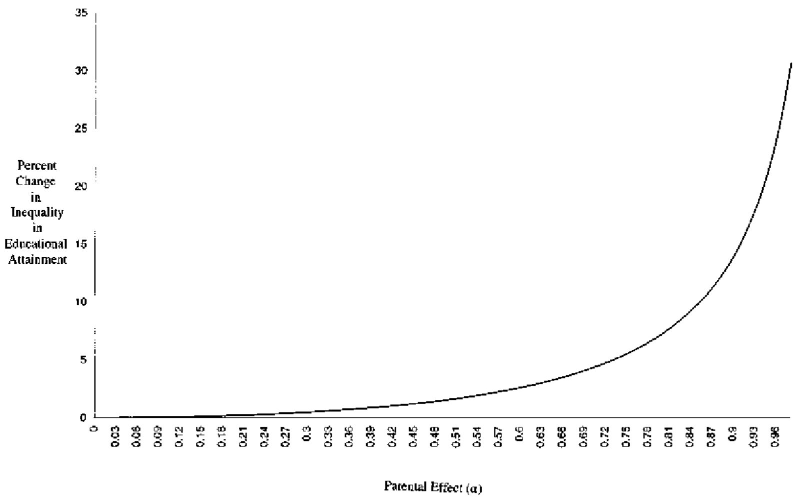


FIGURE I
Percent Increase in Steady-State Standard Deviation of Educational Attainment due to Increase in Correlation between Spouses' Education from 0.6 to 0.8

Changes in sorting will have a dramatic effect on steady-state inequality if $\alpha$, the parental effect, is close to 1, but only a tiny effect if $\alpha$ is moderate. This fact is illustrated in Figure I, which shows the percentage increase in steady-state standard deviation of the characteristic that would be caused by an increase in $\rho_m$ from 0.6 to 0.8 for various values of $\alpha$, assuming that $\beta = 0$. The figure also can be interpreted as illustrating the effect of an increase in $\rho_m$ for various values of $\alpha + \beta$ for the special case in which $\rho_n = 1$. To see the intuition for why the effect is so sensitive to $\alpha$, note that if $\alpha$ is high, the denominator of equation (4) will be close to zero.

It is straightforward to calculate how big $\alpha$ would need to be for a specified increase in $\rho_m$ to cause a specified increase in $\sigma_\infty$.[6] For example, if an increase in $\rho_m$ from 0.6 to 0.8 were to cause a 10 percent increase in the standard deviation of education, then by (4),

$$\frac{\sigma_\epsilon}{\sqrt{1 - \frac{(1+0.8)}{2}\alpha^2}} = 1.1 \frac{\sigma_\epsilon}{\sqrt{1 - \frac{(1+0.6)}{2}\alpha^2}}. \tag{5}$$

6. I am grateful to an anonymous referee for the derivation below.

Solving this equation implies that $\alpha$ would have to equal 0.84. As discussed in Section II, empirical estimates suggest that in the contemporary United States, $\alpha$ is approximately 0.4 for education and income.

The relationship between sorting and the steady-state standard deviation of human capital is qualitatively similar if $\beta$ is greater than zero, so children's education is affected by average education in the neighborhood. Increases in sorting will always increase steady-state inequality, but this effect will be strong only if $\alpha + \beta$ is close to 1 and $\rho_m$ and $\rho_n$ are large, so that the denominator of (3) is close to 0. Even if $\alpha + \beta$ is close to 1, steady-state inequality is only moderately sensitive to the correlation between spouses' assets if $\rho_m$ and $\rho_n$ are small.

Equation (3) indicates that the effects of simultaneous increases in sorting in marriage and neighborhoods are greater than the sum of the effects of separate increases. However, as discussed below, this complementarity between sorting in marriage and neighborhoods is relatively minor for realistic values of $\alpha$ and $\beta$.

## II. Calibration

This section calibrates the model to the distribution of human capital in the United States. Using data from the PSID and the Matching Census Extract Data Sets, I find that the parental effect $\alpha$ is approximately 0.39, and that an upper bound on the neighborhood effect $\beta$ is 0.15. This implies that changes in sorting will have a minor effect on inequality.

I focus on education, rather than on income, because an individual's income is often significantly influenced by the income of his or her spouse, and sorting is well-defined only for variables that are exogenous to marriages and neighborhoods. Education is not completely exogenous to marriage, since people with rich spouses may be able to obtain more education instead of working, but spousal characteristics are likely to be a more important determinant of income than education. Moreover, for some purposes, education may in fact be a better indicator of socioeconomic status than income.

Table I reports summary statistics on children's and parents' education from the first 21 waves of the PSID (up through the 1988 interview year). In order to avoid including children who had not yet completed their education, the sample was restricted

TABLE I
SUMMARY STATISTICS

The top entry in each cell is the full sample; the bottom entry is the sample with neighborhood data. Education is measured in years of schooling. Education of neighbors refers to those over age 25 in the Census tract in which the individual resided in 1968.

| Variable | N | Mean | Std. dev. |
|---|---|---|---|
| Education at 28 | 1550 | 13.08 | 2.109 |
| years of age | 880 | 13.184 | 2.027 |
| Average education | 1550 | 11.327 | 2.777 |
| of parents | 880 | 11.997 | 2.486 |
| Mother's | 1550 | 11.509 | 2.599 |
| education | 880 | 12.025 | 2.310 |
| Father's | 1550 | 11.144 | 3.496 |
| education | 880 | 11.969 | 3.197 |
| Average education of neighbors | 880 | 11.222 | 1.307 |

to children over 28 years old in 1988. People with any postgraduate education were classified as having 17 years of schooling.[7] In order to use self-reported data from both parents and children, I used split-offs from the original PSID sample. Thus, the sample is not a random sample of the population, because it does not include the replenishment to the PSID to replace respondents lost to attrition. Moreover, the PSID oversamples the poor. Following Hill [1992], all observations were therefore weighted using the most recent set of PSID weights for each individual.[8]

There are two criteria for inclusion in the data set: (1) a subject must be interviewed at least once after he has turned 28 years old, and (2) both of the subject's parents must have been interviewed at least once for the PSID. Similar results were obtained for a larger sample, including all those for whom child-reported measures of parental education were available. Children are included even if they do not live with a parent.

Data on neighborhood education were based on the average education of males over 25 in the census tract in which the child grew up, as provided by the 1970 Census Extract Data Sets.[9] Cen-

7. If people with more education than a college degree are treated as having eighteen years of education, the coefficient on parents' education drops slightly, to 0.384, and the coefficient on neighbors' education increases to 0.167. This does not qualitatively alter the basic results of the paper.

8. Alternative weighing approaches do not affect the results significantly. The correlation between 1989 and 1968 weights was 0.96.

9. Adams [1991a, 1991b] provides documentation.

sus tracts typically comprise approximately 5000 people, so fairly small neighborhoods could be defined. The neighborhood was defined as the neighborhood in which the child lived in 1968.[10]

The full sample contains 1550 observations, and the sample for which neighborhood data exist contains 880 observations. The neighborhood sample is smaller because the Institute for Social Research was not able to identify the census tract of every respondent. In addition, not all parts of the United States were tracted in 1970 and 1980. Table I shows summary statistics for the samples with and without neighborhood data. The neighborhood subsample has somewhat more education, possibly because it is easier to identify census tracts in urban areas, which have greater education.

Column (1) of Table II shows the regression used to calibrate the model. The parental effect is estimated to be 0.395, the neighborhood effect is estimated to be 0.149, and the standard deviation of the shock to education is estimated to be 1.79 years. The standard errors reported are robust to the possibility that errors are correlated within census tracts [Moulton 1986]. The estimated neighborhood effect is large: living in an educated neighborhood increases the expected education for one's children by three-quarters as much as marrying an educated spouse, since the effect of each parent is half the total parental effect of 0.395. As discussed below, the coefficient on parents' characteristics is likely to be biased downward, and the coefficient on neighborhood characteristics is likely to be biased upward.

The remaining columns of Table II test how well this linear, genderless model approximates reality. Column (2) distinguishes between mothers' and fathers' effects on their children's education. An $F$-test cannot reject the null hypothesis of equal effects of mothers' and fathers' education. A previous version of this paper obtained similar results using a more general (but much messier) model distinguishing between fathers and mothers, as well as between sons and daughters. $F$-tests also cannot reject the hypotheses that the parental and neighborhood effects are the same for blacks and whites and for sons and daughters. (The power of these $F$-tests may be limited, due to the small sample size.)

Column (3) of Table II checks how well the linear model ap-

10. Similar results were obtained when education in the child's neighborhood was defined as the average education of all the neighborhoods in which the child lived in each of the eight years from 1968 to 1975, weighted by the number of years the child lived in the neighborhood.

TABLE II

CHILDREN'S EDUCATION AS A FUNCTION OF PARENTS' AND NEIGHBORS' EDUCATION

The dependent variable is children's education. Regressions are weighted with the most recent PSID weights. Neighborhood samples use Huber standard errors. Standard errors are in parentheses. Columns (1)–(3) use Huber standard errors allowing for grouped errors within census tracts.

| Variable | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Parents' education | 0.395 | — | 0.27 | 0.430 | 0.371 |
| | (0.051) | — | (0.527) | (0.050) | (0.017) |
| Neighbors' education | 0.149 | 0.150 | −1.109 | — | — |
| | (0.072) | (0.072) | (1.066) | — | — |
| Mother's education | — | 0.154 | — | — | — |
| | — | (0.054) | — | — | — |
| Father's education | — | 0.288 | — | — | — |
| | — | (0.039) | — | — | — |
| Parents' educ. squared | — | — | 0.024 | — | — |
| | — | — | (0.017) | — | — |
| Neighbors' educ. squared | — | — | 0.075 | — | — |
| | — | — | (0.053) | — | — |
| Parents'*neighbors' educ | — | — | −0.039 | — | — |
| | — | — | (0.036) | — | — |
| Constant | 6.815 | 6.956 | 14.68 | 8.098 | 8.88 |
| | (0.931) | (0.930) | (5.869) | (0.645) | (0.196) |
| Adjusted $R^2$ | 0.231 | 0.231 | 0.236 | 0.226 | 0.239 |
| N | 880 | 880 | 880 | 880 | 1550 |

proximates the process of intergenerational transmission by adding quadratic and interaction terms to the regression; an $F$-test cannot reject linearity. Nonetheless, Section IV below estimates a more general Markovian model of intergenerational transmission that does not impose linearity.

Columns (4) and (5) show that there is a stronger correlation between parents' and childrens' education in the sample for which we have neighborhood data than in the full sample. As noted above, the full sample is more representative of the population as a whole. Since I use the (larger) estimate from the neighborhood sample, I may overestimate the effect of sorting on inequality in the calculations below.

Given the estimated parameters, education is remarkably insensitive to the correlation between spouses' or among neighbors' education: the standard deviation of steady-state education would increase just 1.7 percent if the correlation between neighbors' education doubled from 0.2 to 0.4; it would increase from

1.95 to 1.97 years—only 0.9 percent—if the correlation between spouses' education increased from 0.6 to 0.8. Assuming a 180-day school year, this calculation implies that the standard deviation of education would increase by just six and three days, respectively, in response to these increases in neighborhood and marital sorting. Simultaneous increases in sorting in marriage and in neighborhoods of these magnitudes would increase the steady-state standard deviation of years of education by 2.7 percent, slightly more than the sum of the individual effects. Although these changes are small, they occur relatively quickly: the standard deviation of education will increase 85 percent of the distance to its steady-state value in a single generation following increased sorting.

Note that the sorting changes hypothesized above are extreme, while sorting has been quite stable historically. If anything, sorting has decreased slightly. In 1960 the correlation between the education of males over 25 in the same census tract was 0.180,[11] while in 1990 it had fallen to 0.178. This calculation is based on all census tracts; there were 23,460 in 1960 and 45,377 in 1990. If anything, the growth in the number of tracts should have increased the measure of segregation. (The correlation was calculated from the tract-level distributions of education for males over 25 in the 1960 Census and Summary Tape File 3A of the 1990 Census, using the formula in footnote 4.)

In 1940 the correlation of education between spouses was 0.649. By 1980 this correlation had fallen to 0.633, while by 1990 it had fallen to 0.620.[12] (However, note that Mare [1991] and Kalmijn [1991a, 1991b] find slight increases in assortativeness of marriage using a sorting measure based on the likelihood of crossing educational barriers, such as the high school graduate/some college barrier. Whichever measure is used, the overall impression is of stability in sorting patterns over long periods.)

Measurement error in parents' education biases downward

11. This finding may be partly the result of equalization of incomes among regions of the country during the period.

12. This calculation is based on couples from the 1 percent public use microsamples of the 1940, 1980, and 1990 censuses in which the husband was between the ages of 30 and 45. Sample sizes were 71, 705, 100, 835, and 135, 537 in the 1940, 1980, and 1990 censuses, respectively. Given that men and women have different educational distributions, and that these distributions have mass points, the maximum feasible correlation between spouses' education is less than one. For example, in 1990 the maximum feasible correlation between spouses' education was 0.96. There was a slight decline over the period in the ratio of the actual correlation to the maximum feasible correlation between spouses' education.

the estimated parental effect $\alpha$. Ashenfelter and Krueger [1994] estimate that 8 to 12 percent of measured variance in schooling is due to measurement error, and they cite previous estimates by Siegel and Hodge [1986] and Bielby, Hauser, and Featherman [1977] that between 13 and 20 percent of the variance of schooling is due to measurement error.

Measurement error in parents' education also biases the estimated neighborhood effect $\beta$ upward if parents' education is correlated with neighbors' education. $\beta$ also will be overestimated if parents who value education tend to live in educated neighborhoods.

Under the extreme assumptions that 20 percent of the variance in parents' characteristics were due to measurement error and that none of the effect of parents' education was picked up by the neighborhood, $\alpha$ would be $0.39 \times 5/4 = 0.49$ and $\beta$ would be 0.15. In this case, increases in $\rho_m$ from 0.6 to 0.8 or in $\rho_n$ from 0.2 to 0.4 would increase the steady-state standard deviation of education by approximately 1.5 and 2.2 percent, respectively. However, if $\alpha$ were 0.49, but the true neighborhood effect were 0.075, so that half the coefficient on neighborhood education represented a true neighborhood effect, and the rest represented omitted variable bias and measurement error in parents' education, then an increase in $\rho_n$ from 0.2 to 0.4 would increase the steady-state standard deviation of education by only 1 percent.

Substituting the estimated parameters into (4) implies that the steady-state standard deviation of education will be 1.95 years, which is less than the 2.11 year standard deviation of education among children in the sample.[13] The model's implication that inequality is above its steady-state value is consistent with the fact that the standard deviation of education has been dropping over the past generation. The variance of education may have been greater in previous generations due to greater regional and racial variation in education spending as well as more limited public support of higher education.

Results are likely to be similar for characteristics other than education. The heritability of income is approximately 0.4, according to Solon [1992] and Zimmerman [1992], while Blau and Duncan [1967] find similar correlations for occupational status.

13. Note that this is the standard deviation of years of education for a sample of people young enough to have parents in the PSID. The standard deviation is thus much smaller than it would be in a sample containing both recent and older cohorts.

Mulligan's [1995] OLS estimate of the intergenerational correlation of consumption is approximately 0.6.[14] Herrnstein and Murray [1994] claim that intelligence is about 60 percent heritable and issue dire warnings about the effects of alleged recent increases in assortative mating by intelligence. If $\alpha$ were 0.6 and $\beta$ were 0.149, an increase in $\rho_n$ from 0.6 to 0.8 would increase the steady-state standard deviation by only 2.8 percent.[15] A doubling of $\rho_m$ from 0.2 to 0.4 would increase the steady-state standard deviation of education by 3.1 percent.

## III. Sorting and Persistence of Inequality

Although changes in sorting have only a small impact on inequality, they have a somewhat more significant impact on the intergenerational correlation of education. The steady-state correlation between the educational attainment of a parent and his or her child is

$$\text{corr}_{\infty}(z_{i,t}, z_{i,t+1}) = \alpha(1 + \rho_m)/2 + \beta\rho_n. \tag{6}$$

A doubling of $\rho_n$ from 0.2 to 0.4 will increase the intergenerational correlation of education by 8.6 percent, from 0.346 to 0.375. An increase in $\rho_m$ from 0.6 to 0.8 will increase the intergenerational correlation by 11.4 percent, from 0.346 to 0.385. (However, recall that these hypothesized changes in $\rho_m$ and $\rho_n$ are many times greater than changes experienced historically.)

Since sorting increases the intergenerational correlation of education, inequality among dynasties will be more sensitive to sorting than inequality among individuals. Define "discounted dynastic education" as

$$D_{i,t} = E\sum_{t=1}^{\infty}\delta^t z_{i,t}, \tag{7}$$

14. Mulligan [1995] finds that the intergenerational correlation of consumption is approximately 0.8 when parental income is used as an instrument for parental consumption. This is the highest estimate of intergenerational correlation I have seen. If parental income influences children's consumption directly, instrumental variables estimation techniques may lead to significant upward biases in estimates of heritability. It is not clear how to reconcile such a high correlation in consumption with the lower correlations in income documented by Solon [1992] and Zimmerman [1992]. In any case, if $\alpha = 0.8$ and $\beta = 0.149$, assortative marriage begins to play a more important role: an increase in $\rho_m$ from 0.6 to 0.8 will increase the standard deviation of consumption by 8.3 percent.

15. However, note that this model may not be appropriate for examining the genetic transmission that Herrnstein and Murray believe drives intergenerational correlation of intelligence.

where $\delta$ is the discount rate.[16] Assuming that the population is in steady state,

(8) $$D_{i,t} = \sum_{t=1}^{\infty} \delta^t \left[ \mu - \left( \alpha \frac{1 + \rho_m}{2} + \beta \rho_n \right)^t (\mu - z_{i,t}) \right],$$

where $\mu$ denotes the mean level of education. Then the steady-state variance of discounted dynastic education is

(9) $$\sigma_D^2 = \frac{\sigma_\infty^2}{[1 - \delta(\alpha(1 + \rho_m)/2 + \beta \rho_n)]^2}.$$

Assuming an intergenerational discount rate of 0.5, an increase in $\rho_m$ from 0.6 to 0.8 would increase the standard deviation of discounted dynastic education by 3.4 percent, and an increase in $\rho_n$ from 0.2 to 0.4 would increase it by 3.6 percent.

Under the model, sorting by education will slow convergence in education among ethnic groups, and this effect will be exacerbated if childrens' education is influenced by the "ethnic capital" of their group, as in Borjas [1992]. However, if there is substantial sorting on purely ethnic grounds, sorting by education will have only a minor impact on the rate of convergence among ethnic groups.

To see this fact, consider a model with both neighborhood and ethnic group effects. Suppose that

(10) $$z_{i,t+1} = k + \alpha \left( \frac{z_{i,t} + z_{i',t}}{2} \right) + \beta \sum_{j=1}^{n} \frac{z_{j,t}}{n} + \gamma z_{g,t} + \varepsilon_t,$$

where $\gamma$ measures the strength of ethnic transmission, and $z_{g,t}$ is the human capital of ethnic group $g$ at time $t$. (I assume that a child of parents from two different ethnic groups has equal probability of becoming a member of either.) Suppose that a randomly drawn fraction of each ethnic group $w_m$ marries within the ethnic group, that a fraction $w_n$ lives in an ethnic neighborhood, and that the remainder sort by education alone. Given the linearity of the model, one can calculate average education of a group in period $t + 1$ as if the fraction $w_m + (1 - w_m)\rho_m$ of the ethnic group marry a spouse with the average education of people in the ethnic group, and the fraction $(1 - w_m)(1 - \rho_m)$ marry a spouse with the average education in the society as a whole. Thus,

16. Obviously, this concept is a bit ad hoc. On the other hand, if wages are approximately exponential in education, and utility is log, it may not be a terrible welfare indicator.

$$z_{g,t+1} = k + \theta z_{g,t} + [\alpha + \beta + \gamma - \theta]\mu_t, \tag{11}$$

where $\mu_t$ denotes the average education of all members of the population, and $\theta$, the persistence of group differentials, equals $\alpha + \beta + \gamma - (1 - w_m)(1 - \rho_m)\, \alpha/2 - (1 - w_n)(1 - \rho_n)\beta$. Assuming that $\alpha + \beta + \gamma < 1$, all groups converge to the same steady state independently of sorting. However, they approach the steady state more quickly if more members of the group match with spouses and neighbors from outside the group and if more of these people have spouses and neighbors with the average education in the population as a whole.

Changes in sorting by education will have only a minor impact on $\theta$, the persistence of inequality among ethnic groups when groups sort strongly by ethnicity—precisely the circumstances under which disparities among ethnic groups are likely to have the most social significance. For example, if $w_m = 0.7$ and $w_n = 0.5$, then the increases in sorting in marriage and neighborhoods described above would increase $\theta$ from 0.460 to 0.472 and 0.475, respectively.[17]

There has been a debate about the relative importance of reducing sorting by race and ethnicity and reducing sorting by socioeconomic status. The analysis in previous sections implies that educational sorting will have little effect on inequality among individuals. The analysis in this section suggests that if groups sort highly by ethnicity, ethnic disparities in education will be more sensitive to changes in ethnic sorting than to changes in educational sorting.

## IV. Generalizing the Model

The previous sections assumed that education was transmitted by a first-order linear process. Theoretically, sorting could have a bigger impact on inequality either if education were transmitted through a nonlinear process or if there were a highly heritable latent variable that influenced education. In this section I argue that an initial examination of the data suggests relaxing these assumptions will not change the conclusion that sorting has only minor effects on inequality.

17. In a regression of childrens' education on parents' education, neighbors' education, and the average education of their ethnic group, ethnic education is insignificant (and negative), so I assume that $\gamma = 0$.

*IV.A. Markovian Analysis*

In order to examine the effect of marital sorting on inequality in a more general Markovian context, I divided the population into six educational categories: (1) elementary school and below, (2) some high school, (3) high school, (4) some college, (5) college, and (6) more than college. I then estimated the probability that a child is in each category conditional on each parent's category. Given the estimated Markovian transition matrix, it is possible to solve for the steady-state distribution of education that would obtain if a proportion $\Psi$ of the population chose spouses with the same education while everyone else chose spouses randomly.[18] As $\Psi$ increases from 0.6 to 0.8, the steady-state standard deviation of education increases by approximately 1.1 percent.

A similar transition matrix was constructed to examine the effect of sorting by neighborhood. The population was divided into four quartiles, corresponding to the quartiles of the education distribution by neighborhood, and a transition matrix was constructed for children's education as a function of parents' average education and neighborhood average education.[19] In analyzing the effect of sorting by neighborhood, I assume that the correlation between spouses' education was 0.6 and that the sum of parental education is a sufficient statistic for the effect of parental education. The analysis indicates that an increase in $\rho_n$ from 0.2 to 0.4 increases the steady-state standard deviation of education from 1.327 to 1.329 years—just over one-tenth of 1 percent.

Because many of the cells in the estimated transition matrix would have been empty, it was impossible to use finer categories, to simultaneously allow for nonlinearities in parental and neighborhood transmission, or to distinguish the effects of mothers' and fathers' education. For example, it was impossible to estimate the distribution of education for children whose mother has a college education, father has an elementary school education, and typical neighbor has a high school education.

18. One weakness of this approach is that it does not account for the fact that people who do not match with others of the same education are likely to match with people of similar education. That is, this procedure gives equal weight to all the off-diagonal cells in the transition matrix rather than weighting cells near the diagonal more heavily than those far from the diagonal.

19. It is impossible to use the breakdown into six categories above, because there were no neighborhoods in which the average male over 25 had more than a college education.

If children's education is a nonlinear function of parents' and neighbors' education, average steady-state education may depend on sorting. Under the estimated Markovian transition matrices, average steady-state education increases slightly with the correlation between neighbors' education and declines slightly with the correlation between spouses' education.[20] Average steady-state education would fall 0.15 percent in response to an increase in the correlation between spouses' education from 0.6 to 0.8. As discussed in the conclusion below, the implication that the average level of education will be reduced by increased correlation between spouses' education is likely to be overturned by endogenizing $\alpha$ (the parental effect).

### IV.B. Latent Variable

Another restrictive assumption of the model is that education is transmitted by a first-order process; i.e., that children's education is influenced only by parents' education. Theoretically, moderate heritability of education could mask stronger heritability of an underlying latent variable. To see this, suppose that $z$ is a persistent latent variable influencing education, and that education, denoted $y$, equals $z + \theta$, where $\theta$ is i.i.d. with mean 0 and variance $\sigma_\theta^2$. Assume that the correlation between spouses' latent variables is the same as the correlation between their observed years of education, and that there are no neighborhood effects.[21] Under this model, the estimate of $\alpha$ will be subject to attenuation bias, as in errors-in-variable models. The probability limit of the estimated heritability of education will be

$$\text{plim } \hat{\alpha} = \frac{\sigma_Z^2}{\sigma_\theta^2 + \sigma_Z^2}\alpha. \tag{12}$$

Note that $\sigma_z^2 + \sigma_\theta^2 = \sigma_y^2$. The probability limit of the estimated shock to education will be

$$\text{plim } \hat{\sigma}_\epsilon^2 = (\alpha - \hat{\alpha})^2\sigma_{z,t-1}^2\left(\frac{1 + \rho_m}{2}\right) + \sigma_\epsilon^2 + \sigma_\theta^2 + \hat{\alpha}^2\sigma_\theta^2\left(\frac{1 + \rho_m}{2}\right). \tag{13}$$

Under the latent variable model, the steady-state variance of education will be

20. Sorting has similar effects on average predicted income given education, which is itself a nonlinear function of education.

21. Neighborhood effects are statistically insignificant in the estimated latent variable model.

$$(14) \qquad \sigma_\infty^2 = \frac{2\sigma_\epsilon^2}{2 - \alpha^2(1 + \rho_m)} + \sigma_\theta^2.$$

On the one hand, greater values of $\alpha$ imply that steady-state inequality of the latent variable will be more sensitive to the correlation between spouses' education. On the other hand, for a given $\hat{\alpha}$, greater $\alpha$ implies greater variance of $\theta$, the i.i.d. variable influencing education. The greater is $\sigma_\theta^2$, the less sensitive will inequality be to the correlation between spouses' education. Thus, even if education is influenced by a latent variable that is much more heritable than education itself, sorting will not necessarily have a large influence on the steady-state distribution of education.

It is possible to estimate the latent variable model by using grandparents' education as an instrument for parents' education. Note that the IV estimate will yield the underlying $\alpha$ for the latent variable, since grandparents' education is correlated with the parents' values of $z$, the latent variable, but not with their realization of $\theta$. By (12) the ratio of the OLS and IV estimates of $\alpha$ will be $\sigma_z^2/(\sigma_z^2 + \sigma_\theta^2)$. Since $\sigma_z^2 + \sigma_\theta^2$ equals $\sigma_Y^2$, the variance of children's education, which is observable, it is possible to solve for $\sigma_\theta^2$. This in turn makes it possible to solve for $\sigma_z^2$, the shock to the latent variable and thus to use (14) to examine how the steady-state standard deviation of education changes with the correlation between spouses' education.

Estimation of the latent variable model using grandparents' education as an instrument for parents' education is sensitive to the choice of sample, as illustrated in Table III. Estimation using the full sample suggests that $\alpha$ is approximately 0.44, while estimation with the smaller sample for which neighborhood data exist yields $\alpha = 0.64$.[22] When neighbors' education is included, the IV estimate of $\alpha$ increases to 0.67, but neighbors' education is insignificant in the regression. Since the sample for which data are available on neighbors is less representative of the nation as a whole than is the full sample, the 0.44 estimate may be preferable. If grandparents directly contribute to their grandchildren' education, the IV estimates will be biased upward. Equations (12) through (14) imply that under the parameters estimated from the full sample, an increase in $\rho_m$ from 0.6 to 0.8 will increase $\sigma_\infty$ by

22. Grandparents' education is measured as the mean education of all grandparents for whom data were available.

TABLE III
INSTRUMENTAL VARIABLES ESTIMATES OF THE IMPACT OF PARENTS' EDUCATION ON CHILDREN'S EDUCATION

The dependent variable is education at 28 years of age. Parents' education is instrumented with grandparents' education. All samples are weighted using the most recent PSID weights. Standard errors are in parentheses. Columns 2–3 use Huber standard errors allowing for grouped errors within Census tracts.

| Sample | Full | Neighborhood | Neighborhood |
|---|---|---|---|
| Parents' education | 0.436 | 0.640 | 0.670 |
| | (0.029) | (0.073) | (0.112) |
| Neighbors' education | | | −0.076 |
| | | | (0.131) |
| Constant | 8.14 | 5.47 | 5.97 |
| | (0.329) | (0.907) | (0.892) |
| $R^2$ | 0.231 | 0.173 | 0.158 |
| N | 1550 | 880 | 880 |

1 percent under the latent variable model, compared with 0.8 percent under the baseline model in which education is directly transmitted by parents. Under the parameters estimated with the neighborhood sample, an increase in $\rho_m$ from 0.6 to 0.8 would increase the steady-state standard deviation of education by 1.1 percent under the baseline model but by 2.1 percent under the latent variable model.[23]

## VI. CONCLUSION

Authors from a variety of political perspectives have argued that America is caught in a tide of increasing inequality and segregation. The data reviewed in this paper indicate that Americans are not sorting any more than before, at least in marriage and in neighborhoods. The calibration suggests that increased correlation between spouses or among neighbors would have a minor effect on inequality of moderately heritable characteristics. Dramatic increases in marital sorting would increase the standard deviation of education by only 1 percent, or approximately three days. Even assuming that the OLS coefficient on neighborhood education in a regression predicting childrens' educational attainment can be fully attributed to a causal neighborhood ef-

23. The currently available data do not suggest the presence of any neighborhood effects under the latent variable model, so it is uninteresting to examine the effect of neighborhood sorting under this model.

fect, doubling of sorting in neighborhoods would increase the standard deviation of education by 1.7 percent. Even if inequality between neighborhoods were completely eliminated, the steady-state standard deviation of education would fall by only 1.6 percent. Increased sorting is likely to have a somewhat more important impact on the intergenerational correlation of education.

These conclusions are subject to several caveats. It is possible that sorting has stronger effects at the extreme tails of the distribution. The Markov analysis may not have been fine enough to determine the effects of segregation in inner-city ghettos, or among Native Americans in South Dakota. Also, more complex latent variable models might also yield larger effects of sorting on inequality. However, the initial exploration of these issues reported in Section IV suggests that the results are fairly robust. It is also possible that neighborhoods have stronger effects on outcomes other than years of schooling. For example, people may be more likely to commit crimes if their neighbors commit crimes [Glaeser, Sacerdote, and Scheinkman 1996]. Sorting is also likely to affect the quality of schooling in ways that are not captured by the years of schooling alone. A fuller analysis would examine the case of multiple, correlated, heritable characteristics, as proposed by Goldberger [1979].

Another limiting assumption is that individuals are affected only by their parents' and neighbors' characteristics, rather than by the entire distribution of characteristics in the society. Thus, the model cannot evaluate arguments that sorting reduces empathetic connections between groups and society, and thus political support for redistribution. Similarly, it cannot capture Wilson's [1987] argument that segregation increases statistical discrimination. More generally, the model cannot capture any tendency of sorting to exacerbate political conflict or widen social and cultural gaps within the population.

To the extent that people learn from classmates and coworkers, sorting by an individual's *own* academic ability or productivity in schools or workplaces may have larger effects on inequality than sorting by *parental* characteristics, since an individual's future characteristics are presumably more highly correlated with his or her current characteristics than with parental characteristics. Ironically, this fact suggests that the form of sorting which is often seen as most egalitarian may be most likely to significantly increase inequality. There is some evidence that sorting by individuals' own characteristics is increasing. Herrnstein and Murray [1994] present anecdotal, but fairly convincing, evidence of increased sorting by academic ability in higher education. Kremer and Maskin [1996] present evidence that sorting in workplaces has increased.

Another limitation of the model is that it takes $\alpha$, the effect of parents' education on their children's education, as exogenous to sorting patterns. Becker [1981] argues that parents have greater incentive to invest in their children's education if this investment increases the chance their children will marry a desirable spouse. Imperfectly assortative marriage due to imperfect information, search costs, or other frictions in the marriage market can be seen as a tax on parents' investments in their children, with the proceeds going to their children-in-law. Increasing the efficiency of sorting will raise the private return to parental investment in education closer to the social return, presumably leading to increases in $\alpha$.[24]

If improvements in the matching technology lead parents to increase investment in education, thus increasing $\alpha$, both the variance and the average level of education will increase [Becker 1981]. In situations in which the average level of education changes, one may wish to measure inequality using the coefficient of variation, $\sigma/\mu$, rather than the standard deviation of education. (The standard deviation of education may still provide a good proxy for the standard deviation of log permanent earnings, however.) Under this model, with its additive error term, increases in $\alpha$ will reduce the coefficient of variation. In general, however, there is no reason to presume that across-the-board increases in parental investment in children will affect the coefficient of variation one way or the other.

Improved matching also reduces incentives for parents to adjust their consumption to the mean so as to smooth consumption across generations, since improved matching causes less educated people to expect worse marriages for their children and more educated people to expect better ones. The consequent reduction in the desire for consumption smoothing across generations will cause less educated people to save more and

24. However, note that to the extent that imperfectly assortative marriage arises not because of imperfect informational or search costs, but because people trade off education against other valued characteristics in the marriage market, and to the extent that parents share children's willingness to make this exchange, imperfectly assortative marriage will not necessarily lead parents to invest less in education.

highly educated people to save less, making the long-run distribution of assets more equal. Thus, the direct effect of increased sorting on inequality may be partially counteracted by behavioral responses.

This paper has focused on the distributional impact of sorting, an issue that underlies much concern about sorting. However, several writers have argued that sorting may have efficiency costs [Bénabou 1993, 1996; Durlauf 1992, 1994; Fernandez and Rogerson 1992], and in order to address policy questions surrounding sorting, it is necessary to consider efficiency as well. In general, sorting will reduce average output if it hurts the poor more than it helps the rich. Technically, this will be the case if there are negative cross-derivatives in output as a function of agents' types. On the other hand, if these cross-derivatives are positive, sorting will increase average output. If there are zero cross-derivatives, as assumed in the linear model in this paper, there will be no effect of sorting on average output. Thus, while sorting has a first-order effect on inequality, it has a second-order effect on average output. While this paper has argued that the first-order effect of sorting on inequality is fairly small, it is theoretically possible that the second-order effect on output could nonetheless be substantial.

Individuals will choose efficient sorting patterns under perfect markets, but may choose inefficient patterns under credit constraints or other market imperfections [Becker 1981; Bénabou 1993, 1996]. To judge the cost-effectiveness of government interventions meant to affect sorting, it is necessary to quantify both these distortions and the relevant cross-derivatives. This paper does not imply that any specific policies designed to reduce sorting are not worthwhile; they should be judged on their own merits. The elimination of government-imposed distortions that encourage sorting is likely to be desirable on both efficiency and equity grounds. For example, housing vouchers are likely to be preferable to concentrated government-subsidized housing. On the other hand, in many cases, substantial expenditures are needed to induce even small changes in sorting (as indicated, for example, by the history of school-busing programs). In such cases, resources devoted to reducing poverty would be better spent on direct investments in the poor rather than on reshuffling the rich and poor to be nearer each other. In any case, this paper implies that those concerned with inequality and poverty should focus their attention directly on the education and incomes of the poor rather than on the secondary issue of sorting.

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## REFERENCES

Adams, Terry K., Documentation for 1970 and 1980 Census Extract Data Sets (1991a).
——, Documentation for 1968–1985 PSID-Geocode Match Files (1991b).
Ashenfelter, Orley, and Alan Krueger, "Estimates of the Economic Return to Schooling from a New Sample of Twins," *American Economic Review,* LXXXIV (1994), 1157–73.
Atkinson, A. B., *The Economics of Inequality* (Oxford, UK: Clarendon Press, 1975).
Becker, Gary, *A Treatise on the Family* (Cambridge, MA: Harvard University Press, 1981).
Becker, Gary S., and N. Tomes, "An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility," *Journal of Political Economy,* LXXXVII (1979), 1153–89.
Bénabou, Roland, "Workings of a City: Location, Education, and Production," *Quarterly Journal of Economics,* CVIII (1993), 619–52.
——, "Heterogeneity, Stratification and Growth: Macroeconomic Implications of Community Structure and School Finance," *American Economic Review,* LXXXVI (1996), 584–679.
Bielby, William, Robert Hauser, and David Featherman, "Response Errors of Non-Black Males in Models of the Stratification Process," D. L. Aigner and A. S. Goldberger, eds., *Latent Variables in Socioeconomic Models* (Amsterdam: North-Holland, 1977), pp. 227–51.
Blau, Peter M., and Otis Dudley Duncan, *The American Occupational Structure* (New York, NY: Wiley, 1967).
Blinder, Alan S., "A Model of Inherited Wealth," *Quarterly Journal of Economics,* LXXXVII (1973), 608–26.
——, "Inequality and Mobility in the Distribution of Wealth," *Kyklos,* XXIX (1976), 607–38.
Borjas, George, "Ethnic Capital and Intergenerational Mobility," *Quarterly Journal of Economics,* CVII (1992), 123–50.
——, "Ethnicity, Neighborhoods, and Human Capital Externalities," *American Economic Review,* LXXXV (1995), 365–90.
Case, Anne C., and Lawrence F. Katz, "The Company You Keep: "The Effects of Family and Neighborhood on Disadvantaged Youths," NBER Working Paper No. 3705, 1991.
Cavalli-Sforza, Luigi Luca, and Marcus Feldman, *Cultural Transmission and Evolution: A Quantitative Approach* (Princeton, NJ: Princeton University Press, 1981).
Corcoran, Mary, Roger Gordon, Deborah Laren, and Gary Solon, "Effects of Family and Community Background on Men's Economic Status," NBER Working Paper No. 2896, 1989.
Crane, Jonathan, "The Epidemic Theory of Ghettos and Neighborhood Effects on Dropping out and Teenage Childbearing," *American Journal of Sociology,* XCVI (1991), 1226–59.
Cutler, David, and Edward Glaeser, "Are Ghettos Good or Bad?" unpublished manuscript, 1995.
Durlauf, Steven N., "On the Evolution of Economic Status across Generations," Social Systems Research Institute, Working Paper No. 422, University of Wisconsin Madison, 1992.
——, "Neighborhood Feedbacks, Endogenous Stratification, and Income Equality," Social Systems Research Institute, University of Wisconsin Madison, Working Paper No. 9328, 1993.

——, “A Theory of Persistent Income Inequality,” Social Systems Research Institute Working Papers, University of Wisconsin Madison, v9443, 1994.

Fernandez, Raquel, and Richard Rogerson, “Income Distribution, Communities and the Quality of Public Education: A Policy Analysis,” NBER Working Paper No. 4158, 1992.

Galton, F., *Natural Inheritance* (London: Macmillan, 1889).

Glaeser, Edward, Bruce Sacerdote, and Jośe A. Scheinkman, “Crime and Social Interactions,” *Quarterly Journal of Economics,* CXI (1996), 507–48.

Goldberger, Art, “Family Data Analysis: Assortment, Selection, and Transmission,” University of Wisconsin, unpublished, 1979.

Herrnstein, Richard J., and Charles Murray, *The Bell Curve: Intelligence and Class Structure in American Life* (New York, NY: The Free Press, 1994).

Hill, Martha, *The Panel Study of Income Dynamics: A User's Guide* (Newbury Park, CA: Sage Publications, 1992).

Kalmijn, Matthijs, “Status Homogamy in the United States,” *American Journal of Sociology,* XCVII (1991a), 496–523.

——, “Shifting Boundaries: Trends in Religious and Educational Homogamy,” *American Sociological Review,* LVI (1991b), 786–800.

Kremer, Michael, and Eric Maskin, “Wage Inequality and Segregation by Skill,” MIT, unpublished, 1996.

Mare, Robert D., “Five Decades of Educational Assortative Mating,” *American Sociological Review,* LVI (1991), 15–32.

——, “Demography, and the Evolution of Educational Inequality,” J. Baron, O. Grusky, and O. Teiman eds., *Social Differentiation and Social Inequality: Theoretical and Empirical Inquiries,* Essays in honor of Johan Pock (Boulder, CO: Westview Press, 1996).

Moulton, Brent R., “Random Group Effects and the Precision of Regression Estimates,” *Journal of Econometrics,* XXXII (1986), 385–97.

Mulligan, Casey, “Economic and Biological Approaches to Inheritance: Some Evidence,” Working Paper, University of Chicago, 1995.

Pearson, K., “Mathematical Contributions to the Theory of Evolution,” III Regression, Heredity, and Panmixia,” *Philosophical Transactions of Royal Society of London* (1896), A187, 253–318.

Pritchett, Lant, “Divergence, Big Time,” Policy Research Working Paper 1522, Background paper for World Development Report 1995, 1995.

Reich, Robert, “Secession of the Successful,” *New York Times Magazine* (January 20, 1991), 16–17.

Siegel, Paul, and Robert Hodge, “A Causal Approach to the Study of Measurement Error,” in Hubert Blalock and Ann Blalock, eds., *Methodology in Social Science Research* (New York, NY: McGraw-Hill, 1986), 28–59.

Solon, Gary, “Intergenerational Income Mobility in the United States,” *American Economic Review,* LXXXII (1992), 393–408.

Wilson, William Julius, *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy* (Chicago, IL: University of Chicago Press, 1987).

Zimmerman, David J., “Regression toward Mediocrity in Economic Stature,” *American Economic Review,* LXXXVIII (1992), 409–29.