INTRODUCTION

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Intergenerational Inequality Matters

Citizens of modern democratic societies hold strongly meritocratic values. Equal opportunity for educational and occupational advancement can and should ensure that each child have a fair chance of economic success. At the same time, parents have the right and the duty to prepare their children as best they can for a secure economic future. These two values may conflict, but a moderate positive correlation between the economic success of parents and children is arguably compatible with both, since this may be interpreted as a sign that most parents are preparing their children well, and that only a small minority are exceptionally advantaged or disadvantaged.

As amply documented in this volume, however, there are quite strong tendencies for children of those at the bottom of the income distribution to find their children at the bottom, with a parallel tendency for those at the top of the income distribution to find their children also at the top. (see figure I.1).

Many will read the data provided in this and succeeding chapters and conclude, with us, that children from the least well-off families do not have a fair chance at attaining the level of economic security most other families manage to attain. This book not only analyzes the extent of economic mobility. It equally seeks to uncover the factors accounting for the success of some families (and the failure of others') attempts to ensure their children an auspicious economic future. Much of what we have learned through this research makes us optimistic concerning the power of social policy to enhance equality of opportunity. For instance, we find that little intergenerational inequality is due to parents passing superior IQ on to their children, and much is due to parents passing their material wealth to their children, at least for those at the top of the income distribution. On the other hand, we find that children may well inherit genetically based behavioral characteristics that strongly affect their labor market success, though the extent of this aspect of the intergenerational transmission process cannot be estimated with much precision, and we are just beginning to find out what those characteristics are. While the evidence for a genetic aspect of the intergenerational

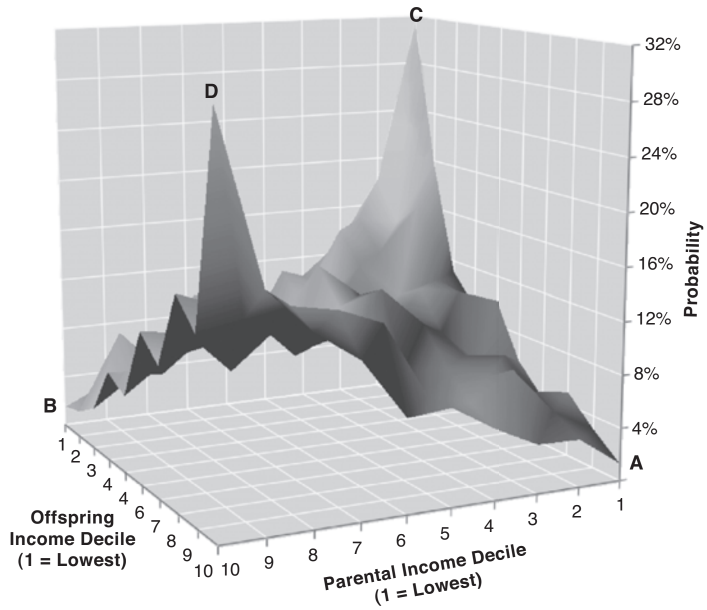

Figure I.1 Probability of offspring attaining given income decile, by parents' income deciles, United States. Based on total family income for black and white participants in the Panel Study of Income Dynamics who were born between 1942 and 1972, and their parents. The income of the children was measured when they were aged 26 or older, and was averaged over all such years for which it was observed. The number of years of income data ranged from 1 to 29 with an average of 11.5; the median year of observation was 1991. Parents' income was averaged over all observed years in which the child lived with the parents. The number of years of income data ranged from 1 to 27 with an average of 11.9; the median year of observation was 1974. The simple age-adjusted correlation of parents' and children's incomes in the data set represented in the figure is 0.42.

Source: Hertz, this volume.

transmission process is suggestive, a major role for the environmental influences of family, neighborhood, and schooling is beyond a doubt. However, conventional measures of schooling attainment do not capture key aspects of this process.

Better Data, New Conclusions

For many years, the consensus among economists was that in the United States, one's income is only very weakly dependent upon the economic success of one's parents.[1]

Early research on the statistical relationship between parents' and their children's economic status after becoming adults, starting with Blau and Duncan (1967), found only a weak connection. For example, the simple correlations between parents' and sons' income or earnings (or their logarithms) in the United States reported by Becker and Tomes (1986) averaged 0.15. Becker (1988) expressed a widely held consensus when, in his presidential address to the American Economics Association, he concluded, "[L]ow earnings as well as high earnings are not strongly transmitted from fathers to sons." (10)

More recent research, some of which is presented in this volume, demonstrates that the estimates of high levels of intergenerational mobility were artifacts of two types of measurement error: mistakes in reporting income, particularly when individuals were asked to recall the income of their parents, and transitory components in current income uncorrelated with underlying permanent income (Bowles 1972; Bowles and Nelson 1974; Atkinson et al. 1983; Solon 1992; Zimmerman 1992). The high noise-to-signal ratio in both generations' incomes depressed the intergenerational correlation. As Bhashkar Mazumder shows in chapter 2, when corrected for these two types of measurement error, the intergenerational correlations for economic status appear to be substantial, many of them three times the average of the U. S. studies surveyed by Becker and Tomes (1986).

The higher consensus estimates of the intergenerational transmission of economic success has stimulated empirical research. The relevant facts on which most researchers now agree include the following: brothers' incomes are much more similar than those of randomly chosen males of the same race and similar age differences; the incomes of identical twins are much more similar than fraternal twins or non-twin brothers; the children of well-off parents obtain more and higher-quality schooling; and wealth inheritance makes an important contribution to the wealth owned by the offspring of the very rich. On the basis of these and other empirical regularities, it seems safe to conclude that the intergenerational transmission of economic status is accounted for by a heterogeneous collection of mechanisms, including the genetic and cultural transmission of cognitive skills and noncognitive personality traits in demand by employers (see Melissa Osborne Groves's contribution, chapter 7), the inheritance of wealth and income-enhancing group memberships such as race (see Thomas Hertz's contribution, chapter 5), and the superior education and health status enjoyed by the children of higher-status families.

The transmission of economic success across generations, however, remains something of a black box. Basing our arguments on the consolidation of several data sets, we report in this introduction that the combined inheritance processes operating through superior cognitive performance and educational attainments of those with well-off parents, while important, explain at most half of the intergenerational transmission of income. Moreover, while genetic transmission of earnings-enhancing traits appears to play a role, the genetic transmission of IQ appears to be surprisingly unimportant.

It might be thought that the relative unimportance of IQ in intergenerational inequality is an artifact of poor measurement of the intervening variables relative to the measurement of the income or earnings of parents and offspring. But this does not seem to be the case. Years of schooling and other measures of school attainment, like cognitive performance, are measured with relatively little error. Better measurements will of course help; but we are not likely to improve much on our measures of IQ, and recent improvements in the measurement of school quality have not offered much additional illumination. Our weakness in accounting for intergenerational economic status transmission is not due to measuring the right variables poorly, but to missing some of the important variables entirely. What might these be?

Most economic models treat one's income as the sum of the returns to the factors of production one brings to the market, like cognitive functioning and education. But *any* individual trait that affects income and for which parent-offspring similarity is strong will contribute to the intergenerational transmission of economic success. Included are race, geographical location, height, beauty or other aspects of physical appearance, health status, and some aspects of personality. Thus, by contrast to the standard approach, we give considerable attention to income-generating characteristics that are not generally considered to be factors of production.

In studies of the intergenerational transmission of economic status, our estimates suggest that cognitive skills and education have been overstudied, while wealth, race, and noncognitive behavioral traits have been understudied. As a partial corrective, in chapter 7, Melissa Osborne Groves includes explicit personality variables in modeling intergenerational status transmission. Using the National Longitudinal Surveys, she finds that the inclusion of personality accounts for a larger component of the intergenerational transmission process than measured IQ. Adding a single personality variable—fatalism—reduces the unexplained persistence of earnings by more than four percentage points—more than twice that of cognitive performance. In addition, the transmission of personality contributes to the transmission of earnings between father and son, comparable to estimates of the portion attributed to the inheritance of IQ.

In chapter 1, Greg Duncan, Ariel Kalil, Susan Mayer, Robin Tepper, and Monique Payne describe the extent of resemblance between parents and children and attempt to account for resemblances with traditional measures of family background such as socioeconomic status, educational level, and even general parenting skills. On the basis of two data sets containing seventeen detailed measures of parental behavioral characteristics measured in adolescence and the same characteristics of their children, they find that parents pass on *specific* rather than *general* competencies to their children. Family background and parenting explain only a small part of intergenerational correlations. It follows that disaggregation of individual behavioral characteristics may significantly improve our understanding of intergenerational status transmission.

Measuring the Intergenerational Transmission of Economic Status

Economic status can be measured in discrete categories—by membership in hierarchically ordered classes, for example—or continuously, by earnings, income, or wealth. The discrete approach can allow a rich but difficult-to-summarize representation of the process of intergenerational persistence of status using transition probabilities among the relevant social ranks (Erikson and Goldthorpe 1992). By contrast, continuous measures allow a simple metric of persistence, based on the correlation between the economic status of the two generations. Moreover, these correlations may be decomposed into additive components reflecting the various causal mechanisms accounting for parent-child economic similarity. Both approaches are insightful, but for simplicity of presentation we rely primarily on the continuous measurement of status. For reasons of data availability, we use income or earnings as the measure of economic status, though income (the more inclusive measure) is preferable for most applications. We use subscript p to refer to parental measures, while y is an individual's economic status, adjusted so that its mean, $\bar{y}$, is constant across generations, β_y is a constant, and ε_y is a disturbance uncorrelated with y_p. Thus

$$y - \bar{y} = \beta_y(y_p - \bar{y}) + \varepsilon_y; \tag{1}$$

that is, the deviation of the offspring's economic status from the mean is β_y times the deviation of the parent from mean economic status, plus an error term. The coefficient β_y is a measure of intergenerational income persistence. In the empirical work reviewed below, earnings, income, wealth, and other measures of economic success are measured by their natural logarithm unless otherwise noted. Thus, β_y is the percentage change in offspring's economic success associated with a 1 percent change in parents' economic success. The influence of mean economic status on the economic status of the offspring, 1-β_y, is called *regression to the mean,* since it shows that one may expect to be closer to the mean than one's parents by the fraction 1-β_y (Goldberger 1989).

The relationship between the intergenerational income elasticity, β_y, and the intergenerational correlation P_y is given by

$$\rho_y = \beta_y \frac{\sigma_{y_p}}{\sigma_y},$$

where σ_y is the standard deviation of y. If y is the natural logarithm of wealth, income, or earnings, its standard deviation is a common unit-free measure of inequality. Thus, if inequality is unchanging across generations, so $\sigma_{y_p} = \sigma_y$, then $\rho_y = \beta_y$. However, the intergenerational income elasticity exceeds ρ_y when income inequality is rising, but is less than ρ_y when income inequality is declining. In effect, the intergenerational correlation coefficient ρ is affected by changes in the distribution of income while the intergenerational income elasticity is not. Also, ρ^2 measures the fraction of the variance in this generation's measure of economic success that is linearly associated with the same measure in the previous generation.

Estimates of the intergenerational income elasticity are presented in Mulligan (1997), Solon (1999), and Harding et al. (this volume). The mean estimates reported in Mulligan are as follows: for consumption 0.68, for wealth 0.50, for income 0.43, for earnings (or wages) 0.34, and for years of schooling 0.29. Evidence concerning trends in the degree of income persistence across generations is mixed. Most studies indicate that persistence rises with age, is greater for sons than daughters, and is greater when multiple years of income or earnings are averaged. The importance of averaging multiple years to capture permanent aspects of economic status is dramatized in Mazumder's contribution to this volume (chapter 2). Mazumder used a rich U.S. Social Security Administration data set to estimate an intergenerational income elasticity of 0.27 averaging a son's earnings over four years and a father's earnings averaged over two years. But the estimate increases to 0.47 when seven years of the fathers earnings are averaged, and to 0.65 when sixteen years are averaged.

Do intergenerational elasticities of this magnitude mean that rags to riches is no more than a fantasy for most poor children? The intergenerational correlation is an average measure, and may be unilluminating about the probabilities of economic success conditional on being the child of poor, rich, or middling parents. Calculating these conditional probabilities and inspecting the entire transition matrix gives a more complete picture. The results of a study by Tom Hertz, reported in chapter 5, appear in figure I.1, with the adult children arranged by income decile (from poor to rich, moving from left to right) and with parents arranged by income decile along the other axis. The height of the surface indicates the likelihood of making the transition from the indicated parents' decile to the children's decile.

Though the underlying intergenerational correlation of incomes in the data set that Hertz used is a modest 0.42, the differences in the likely life trajectories of the children of the poor and the rich are substantial. The "twin peaks" represent those stuck in poverty and affluence (though we do not expect the term "affluence trap" to catch on). A child born to the top decile has a 29.6 percent chance of attaining the top decile (point D) and a 43.3 percent chance of attaining the top quintile. A indicates that the child of the poorest decile has a 1.3 percent chance of attaining the top decile, and a 4.3 percent chance of attaining the top quintile. C indicates that children of the poorest decile have a 31.5 percent chance of occupying the lowest decile, and a 51.3 percent chance of occupying the lowest quintile, while B shows that the child of the richest decile has a 1.5 percent chance of ending in the poorest decile, and a 3.5 percent chance of occupying the lowest quintile.

Mobility patterns differ dramatically by race, as reported by Hertz in chapter 5. In particular, the rate of persistence in the bottom decile, a measure of the severity of the intergenerational poverty trap, is much higher for blacks than for whites. Other studies (Corak and Heisz 1999; Cooper et al. 1994) also suggest that distinct transmission mechanisms may be at work at various points of the income distribution. For example, wealth bequests may play a major role at the top of the income distribution, while at the bottom, vulnerability to violence or other adverse health episodes may be more important.

Sources of Persistence: Cultural, Genetic, and Bequest

Economic status does persist substantially across generations. We seek to uncover the channels through which parental incomes influence offspring incomes. We do this by decomposing the intergenerational correlation (or the intergenerational income elasticity) into additive components reflecting the contribution of various causal mechanisms. This will allow us to conclude, for example, that a certain fraction of the intergenerational correlation is accounted for by the genetic inheritance of IQ, or by the fact that the children of wealthy parents are also wealthy.

It is a remarkable fact about correlation coefficients that this can be done. Moreover, the technique we use does not require that we introduce variables in any particular order. Suppose that parents' income (measured by its logarithm, y_p) and offspring education (s) affect offspring income (also measured by its logarithm, y). Like any correlation coefficient, this intergenerational correlation $r_{y_p y}$ can be expressed as the sum of the normalized regression coefficients of measures of parental income $\beta_{y_p y}$ and offspring education β_{ys} in a multiple regression predicting y, each multiplied by the correlation between y_p and the regressor (which, of course, for parental income itself is 1). The normalized regression coefficient is the change in the dependent variable, in standard deviation units, associated with a one standard deviation change in the independent variable. The *direct effect* is the normalized regression coefficient of parental income from this regression. The education component of this decomposition of the intergenerational correlation is called an *indirect effect*. Figure I.2 illustrates this breakdown,[2] which gives

$$r_{yy_p} = \beta_{y_p y} + r_{y_p s}\beta_{ys}.$$

As long as the multiple regression coefficients are unbiased, the decomposition is valid whatever the relationship among the variables. Specifically, it does not require that the regressors be uncorrelated. This decomposition allows us to be more precise about our "black box" claim. When we reported that the standard schooling, cognitive level, and other variables account for less than half of the observed parent offspring similarity of income, for instance, we mean that the direct parental effect is least half of the intergenerational correlation in a number of studies allowing this comparison (Bowles 1972; Bowles and Nelson 1974; Atkinson et al. 1983; Mulligan 1997).

Our strategy is to estimate the size of these direct and indirect effects. Note that the decomposition uses correlations between parental incomes

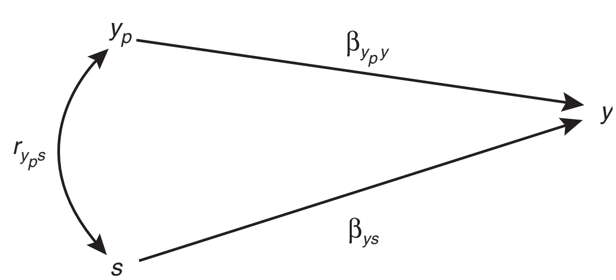

Figure I.2 Representing a correlation as the sum of direct and indirect effects.

and other variables—schooling, in the example—thought to be causally related to the income-generating process. These correlations with parental income need not, of course, reflect causal relationships. But the above decomposition can be repeated for the correlations between parental income and the causes of offspring income, in some cases permitting causal interpretations. For example, a study of the role of wealth in the transmission process could ask why parental income and offspring wealth are correlated. Is it bequests and inter vivos transfers or the cultural transmission of savings behaviors that account for this correlation? Or do we simply not know why parent and offspring wealth is correlated, and as a result should avoid giving the data a causal interpretation? Likewise, parent-offspring similarity in human capital may be due to genetic or cultural inheritance of whatever it takes to persist in schooling and to acquire skills and behaviors that are rewarded in the labor market. Unlike models of parental and child behavior that account for persistence, pioneered by Becker and elaborated by Graw and Mulligan (2002), our approach is more diagnostic, not giving an adequate causal account of the transmission process, but indicating where to look to find the causes. The next sections will explore such decompositions.

The Role of Genetic Inheritance of Cognitive Skill

One of the transmission channels deserves special attention not only because of its prima facie plausibility, but also because of the extraordinary attention given to it in popular discussions of the subject. This is the genetic inheritance of cognitive skill. The similarity of parents' and offspring's scores on cognitive tests is well documented. Correlations of IQ between parents and offspring range from 0.42 to 0.72, where the higher figure refers to measures of average parental vs. average offspring IQ (Bouchard and McGue 1981; Plomin et al. 2000). The contribution of cognitive functioning to earnings both directly and *via* schooling attainment has also been established in a variety of studies that estimate determinants of earnings using IQ (and related) test scores. The direct effect of IQ on earnings is estimated from multiple regression studies that typically use the logarithm of earnings as a dependent variable, and that estimate the regression coefficients of a variety of explanatory variables, including performance on a cognitive test, years (and perhaps other measures) of schooling, a measure of parental economic and / or social status, work experience, race, and sex. The indirect effect of IQ operating through its contribution to higher levels of educational attainment is estimated using measures of childhood IQ (along with other variables) to predict the level of schooling obtained.

We have located sixty-five estimates of the normalized regression coefficient of a test score in an earnings equation in twenty-four different studies of U.S. data over a period of three decades. Our meta-analysis of these studies is presented in Bowles, Gintis, and Osborne (2001b). The mean of these estimates is 0.15, indicating that a standard deviation change in the cognitive score, holding constant the remaining variables (including schooling), changes the natural logarithm of earnings by about one-seventh of a standard deviation. By contrast, the mean value of the normalized regression coefficient of years of schooling in the same equation predicting the natural log of earnings in these studies is 0.22, suggesting a somewhat larger independent effect of schooling. We checked to see if these results were dependent on the weight of overrepresented authors, the type of cognitive test used, at what age the test was taken, and other differences among the studies, and we found no significant effects. An estimate of the causal impact of childhood IQ on years of schooling (also normalized) is 0.53 (Winship and Korenman 1999). A rough estimate of the direct and indirect effect of IQ on earnings, call it b, is then $b = 0.15 + (0.53)(0.22) = 0.266$.

Do these two facts—parent-child similarity in IQ and an important direct and indirect causal role for IQ in generating earnings—imply a major role for genetic inheritance of cognitive ability in the transmission of intergenerational economic status? One way to formulate this question is to ask how similar would parental and offspring IQ be if the sole source of the similarity were genetic transmission. Also, how similar would the incomes of parents and offspring be if there were no other transmission channel?

For this we need some insights into genetics (the details are in the appendix and in Bowles and Gintis [2002]), and a few terms—*phenotype, genotype, heritability*, and the *genetic correlation*. A person's IQ—meaning, a test score—is a *phenotypic* trait, while the genes influencing IQ are the person's *genotypic* IQ. *Heritability* is the relationship between the two. Suppose that, for a given environment, a standard deviation difference in genotype is associated with a fraction h of a standard deviation difference in IQ. Then h^2 is the *heritability of IQ*. Estimates of h^2 are based on the degree of similarity of IQ among twins, siblings, cousins, and others with differing degrees of genetic relatedness. The value cannot be higher than 1, and most recent estimates are substantially lower, possibly more like a half or less (Devlin et al. 1997; Feldman et al. 2000; Plomin 1999). The *genetic correlation* is the degree of statistical association between genotypes of parents and children, which is 0.5 if the parents' genotypes are uncorrelated (random mating). But couples tend to be more similar in IQ than would occur by random mate choice (assortative mating), and this similarity is associated with an unknown correlation *m* of their genotypes. The effect is to raise the genetic correlation of parent and offspring to $(1 + m)/2$.

Using the above method of decomposition, the correlation γ between parental and offspring IQ that is attributable to genetic inheritance of IQ alone is the heritability of IQ times the genetic correlation. Thus we have $\gamma = h^2(1 + m)/2$. The correlation between parent and offspring income attributable to genetic inheritance of IQ is simply this correlation, times the normalized effect of IQ on the income of parents, times the analogous effect for the offspring, or γb^2. Another way to see this is to note that the correlation between parental income and offspring IQ, which we would observe were the genetic inheritance of IQ the only channel at work, is γb, and this times the effect of offspring IQ on earnings, which is b, gives the same result.

Using the values previously estimated, we see that the contribution of genetic inheritance of IQ to the intergenerational transmission of income is $(h^2(1 + m)/2)(0.266)^2 = .035(1 + m)h^2$. If the heritability of IQ were 0.5 and the degree of assortation, *m,* were 0.2 (both reasonable, if only ball park estimates), and if the genetic inheritance of IQ were the only mechanism accounting for intergenerational income transmission, then the intergenerational correlation would be 0.01, or roughly 2 percent the observed intergenerational correlation. Note the conclusion that the contribution of genetic inheritance of IQ is negligible is not the result of any assumptions concerning assortative mating or the heritability of IQ: the IQ genotype of parents could be perfectly correlated and the heritability of IQ 100 percent without appreciably changing the qualitative conclusions. The estimate results from the fact that IQ is just not an important enough determinant of economic success.

Might the small contribution of genetic inheritance of IQ to parent-offspring similarity of incomes be the result of measurement error in the cognitive measures? There are two issues here. First, what is the *reliability* of the test: whatever the test measures, does it measure well? Second, what is the *validity* of the test: does the test measure the right thing? The concern that the tests are a very noisy measure is misplaced. In fact, the tests are among the more reliable variables used in standard earnings equations (reliability is measured by the correlation between tests and retests, between odd and even numbered items on the tests, and by more sophisticated methods). For the commonly used Armed Forces Qualification Test (AFQT), for example—a test used to predict vocational success that is often used as a measure of cognitive skills—the correlation between two test scores taken on successive days by the same person is likely to be higher than the correlation between the same person's reported years of schooling or income on two successive days.

The second concern, that the tests measure the wrong thing, is weightier and less easy to address with any certainty. Could it be that cognitive skills not measured on existing test instruments are both highly heritable and have a major impact on earnings, thereby possibly explaining a more substantial fraction of the transmission process? The search for general cognitive measures that are substantially uncorrelated with IQ and predictive of success in adult roles began with Edward Thorndike's (1919) paper on "social intelligence." Some alternative test instruments, such as Robert Sternberg and collaborators' "practical intelligence" (Sternberg et al. 1995; Williams and Sternberg 1995) predict economic success in particular occupations. But despite the substantial fame and fortune that would have accrued to success in this area, the quest that Thorndike launched three generations ago has yielded no robust alternative to IQ, let alone one that is highly heritable. Thus, the possible existence of economically important but as yet unmeasured heritable general cognitive skills cannot be excluded, but should at this stage be treated as somewhat wishful speculation.

Indeed, we are inclined to think that available estimates *overstate* the importance of general cognitive skill as a determinant of earnings, since in many respects taking a test is like doing a job. Successful performance in either case results from a combination of ability and motivation, including the disposition to follow instructions, persistence, work ethic, and other traits likely to contribute independently to one's earnings. This is the reason we eschew the common label of a test score as "cognitive skill" but rather use the more descriptive term "cognitive performance." Eysenck (1994, 9), a leading student of cognitive testing, writes, "Low problem solving in an IQ test is a measure of performance; personality may influence performance rather than abstract intellect, with measurable effects on the IQ. An IQ test lasts for up to 1 hour or more, and considerations of fatigue, vigilance, arousal, etc. may very well play a part." Thus some of the explanatory power of the cognitive measure in predicting earnings does not reflect cognitive skill but rather other individual attributes contributing to the successful performance of tasks.

Genetic and Environmental Inheritance

Although the genetic inheritance of IQ explains little of the intergenerational transmission process, this does not rule out the possible importance of other genetically transmitted traits. Indeed, the remarkable income similarity of identical twins compared to fraternal twins suggests that genetic effects may be important. We will use the similarity of twins to estimate the genetic heritability of income as well as the environmental component of intergenerational transmission.

But two words of caution are in order. First, as we will demonstrate, our estimates are quite sensitive to variations in unobserved parameters. Second, it is sometimes mistakenly supposed that if the heritability of a trait is substantial, then the trait cannot be affected much by changing the environment. The fallacy of this view is dramatized by the case of stature. The heritability of height estimated from U.S.-twin samples is substantial (about 0.90, according to Plomin et al. 2000). Moreover there are significant height differences among the peoples of the world: Dinka men in the Sudan average 5 feet and 11 inches—a bit taller than Norwegian and U.S. military servicemen and a whopping 8 inches taller than the Hadza hunter-gatherers in Southern Africa (Floud et al. 1990). But the fact that Norwegian recruits in 1761 were *shorter* than today's Hadza shows that even quite heritable traits are sensitive to environments. What *can* be concluded from a finding that a small fraction of the variance of a trait is due to environmental variance is that policies to alter the trait through changed environments will require nonstandard environments that differ from the environmental variance on which the estimates are based.

Consider the case of South Africa, where in 1993 (the year before Nelson Mandela became president) roughly two-thirds of the intergenerational transmission of earnings was attributable to the fact that fathers and sons are of the same race, and race is a strong predictor of earnings (Hertz, 2001). That is, adding race to an equation predicting sons' earnings reduces the estimated effect of fathers' earnings by over two thirds. Because the physical traits designated by "race" are highly heritable and interracial parenting uncommon, we find a substantial role of genetic inheritance in the intergenerational transmission of economic status. Yet, it is especially clear in the case of South Africa under apartheid that the economic importance of the genetic inheritance of physical traits was derived from environmental influences. What made the genetic inheritance of skin color and other racial markers central to the transmission process were matters of public policy, not human nature, including the very definition of races, racial patterns in marriage, and the discrimination suffered by nonwhites. Thus, the determination of the genetic component in a transmission process says little by itself about the extent to which public policy can level a playing field.

Our estimates of heritability use data on pairs of individuals with varying degrees of shared genes and environments. For example, identical and fraternal twins are exposed to similar environments during their upbringing but fraternal twins are less closely related genetically than identical twins. Under quite strong simplifying assumptions (explained in the appendix to Bowles and Gintis 2002), one can exploit the variation in genetic and environmental similarities among pairs of relatives to estimate heritability of a trait such as income, years of schooling, or other standard economic variables. Taubman (1976) was the first economist to use this method. The model underlying the following calculations assumes that genes and environment affect human capital, which produces earnings, as the equation below indicates, but the effects of wealth and other contributions to income are unaffected by genes and environment, and will be introduced subsequently.

Here are the assumptions. First, genes and environments have additive effects—genes and environment may be correlated, but the direct effect of "good genes" on earnings (its regression coefficient) is independent of the quality of the environment, and conversely. Thus an individual's earnings can be written

$$\text{earnings} = h(\text{genes}) + \beta(\text{environment}) + \text{idiosyncratic effects}.$$

Second, within-pair genetic differences (for the fraternals) are uncorrelated with within-pair environmental differences (for example, the good-looking twin does not get more loving attention). Third, the environments affecting individual development are as similar for members of fraternal sets of twins as for the identical sets. Fourth, the earnings genotypes of the two parents are uncorrelated (random mating). Given these assumptions, the heritability (h^2) of earnings is twice the difference between the earnings correlations of identical and fraternal twins. As the difference between these two correlations is 0.2 in the best data sets available (the Swedish Twin Registry studied by Anders Björklund, Markus Jäntti, and Gary Solon in chapter 4, and a smaller U.S. Twinsburg data set studied by Ashenfelter and Krueger [1994]), these assumptions give an estimate of h^2 equal to 0.4.

Because the correlation of genes for the fraternal twins is 0.5 (due to random mating), the implied correlation of fraternal twins' earnings due to genetic factors is $h^2/2$. The fact that the observed correlation of twins' earnings exceeds this estimate is explained by the fact that twins share similar environments. Thus, once we know h^2, we can use information about the degree of similarity of these environments to estimate how large the environmental effects would have to be to generate the observed earnings correlations.

The assumptions concerning random mating and common environments are unrealistic, and can be relaxed. First, we need an estimate of m_y, the correlation of parents' earnings genotypes. The relevant measure is the earnings *potential* (the correlation of actual earnings would understate the degree of assortation, because many women do not work full time). The degree of assortation on phenotype is likely to be considerably larger than on genotype for the simple reason that the basis of the assortation is the phenotype not the genotype (which is unobservable), and the two are (for the case of earnings, as we will see) not very closely related. Assuming that the genotype for potential earnings of parents is half as similar as are the actual incomes of brothers, the correlation would be about 0.2.

Second, note that because it was assumed that the environments experienced by the two identical twins are not, on the average, more similar to the environments of the two fraternal twins, the fact that within twin-pair earnings differences are less for the identical twins must be explained entirely by their genetic similarity. But if the identical twins experience more similar environments (because they look alike, for example) than the fraternals, the estimate will overstate the degree of heritability.

It is likely that identical twins share more similar environments than fraternal twins and other siblings (Loehlin and Nichols 1976; Feldman et al. 2000; Cloninger et al. 1979; Rao et al. 1982). Estimates of the extent to which identical twins environments are more similar than those of fraternal twins are quite imprecise, and we can do no better than to indicate the effects of using plausible alternative assumptions. Just how sensitive the estimates are to reasonable variations in the assumptions concerning differences in the correlations of twins' environments can be estimated by assuming some degree of statistical association of genes and environment, with the correlated but not identical genes of the fraternal twins giving them less correlated environments than the identical twins.

Table I.1 presents estimates based on various magnitudes of this genes-environment effect. As the assumed correlation between genes and environment increases, the correlation of the environments of the identical twins rises, and because this then explains some of the earnings similarity of the identical twins, the resulting estimate of heritability falls.

The Swedish Twin Registry data set assembled by Björklund, Jäntti, and Solon, analyzed in chapter 4, has data not just on twins, but on many pairs with varying degrees of relatedness (half-siblings, for example) and may allow for more robust estimates using the methods developed by Cloninger et al. (1979), Rao et al. (1982), and Feldman et al. (2000).

We take the third numerical column of table I.1 as the most reasonable set of estimates. Using these, two striking conclusions follow. First, the heritability of earnings appears substantial. Second, the environmental effects are also large. The normalized regression coefficient of environment on earnings is $\beta_e = 0.38$, which may be compared with the normalized regression coefficient for a measure of years of schooling in an earnings equation, from our earlier meta-analysis, which is 0.22. Thus, these estimates suggest that while educational attainment captures important aspects of the relevant environments, it is far from exhaustive.

TABLE I.1
The Effect of the Assumed Correlation of Genes and Environment on Estimates of the Heritability of Earnings

	Assumed Correlation of Genes and Environment			
	0.00	0.50	0.70	0.80
Heritability of Earnings	0.50	0.29	0.19	0.13
Normalized Regression Coefficient:				
Genes on earnings	0.71	0.54	0.44	0.36
Environment on earnings	0.29	0.33	0.38	0.44
Correlation of Environments:				
Fraternal twins	0.70	0.70	0.70	0.70
Identical twins	0.70	0.80	0.90	0.97

Notes: The association of genes with environment is represented by the normalized regression coefficient of genes on environment. This table assumes that parental earnings-determining genes are correlated 0.2, and the correlation of fraternal twins' environment is 0.7. We use the correlations of income for identical twins of 0.56 and of fraternal twins of 0.36, taken from the U.S. Twinsburg Study, and assume that these are also the correlations of earnings.

What is the intergenerational correlation of earnings implied by our estimate of β_e and h? To answer this question, in addition to h and β_e, we require the correlation of parents' earnings with genes (which is already implied by our estimates) and the correlation of parents' earnings with environment. The first column in table I.2 gives our estimates. The genetic contribution is simply h times the correlation between parental earnings and offspring genotype, or $h^2(1 + m)/2$. The environmental contribution, similarly, is β_e times a correlation of parents' earnings and

TABLE I.2
Contribution of Environmental, Genetic, and Wealth to Intergenerational Transmission

	Earnings	*Income*
Environmental	0.28	0.20
Genetic	0.12	0.09
Wealth		0.12
Intergenerational correlation	0.40	0.41

Notes: The income column and the estimated contribution of wealth are discussed below. The environmental vs. genetic breakdown assumes the figures in the third numerical column in table I.1.

environment (namely 0.74) selected to yield a total intergenerational earnings correlation of 0.4.

The estimate that genetic inheritance may account for almost one-third of the intergenerational correlation is somewhat unexpected, in light of our negative findings concerning the inheritance of IQ. The surprising importance of both environment and genes points to a puzzle. If the genetic contribution is not strongly related to IQ and if the environmental contribution is much larger than the contribution of years of schooling, what are the mechanisms accounting for persistence of income over the generations? We shall return to this puzzle, but will turn to data other than twin studies first, to show that the same puzzle arises elsewhere.

Human Capital

Because schooling attainment is persistent across generations and has clear links to skills and perhaps other traits that are rewarded in labor markets, an account of the transmission of intergenerational status based on human capital has strong prima facie plausibility. The data already introduced allow a calculation of the portion of the intergenerational income correlation accounted for by the more extensive schooling received offspring of high-income parents (measured in years). This is just the correlation of parent income and offspring schooling (about 0.45) multiplied by the normalized regression coefficient of schooling in an earnings equation (0.22 from our meta-analysis) or 0.10. This is a substantial contribution, particularly in light of the fact that it is restricted to the effects of years of schooling operating independently of IQ (because our estimate of 0.22 is from earnings functions in which the regressors include the AFQT test or a similar instrument). The full contribution—including the effect of schooling on IQ and its effect on earnings, as well as the direct effect of schooling on earnings holding constant IQ—is 0.12.

It used to be commonly assumed that once adequate measures of schooling quality were developed, the only effects of parental economic status on offspring earnings would operate through effects on cognitive functioning and schooling, and that the direct effect of parental status on offspring earnings would vanish. But even as the measurement of schooling quality has improved over the years, the estimated direct effect of parental incomes (or earnings) on offspring earnings has turned out to be remarkably robust. For example, Mulligan (1999), using early 1990s data from the (U.S.) National Longitudinal Study of Youth, first estimated the effect of a change in the logarithm of parental earnings on offspring's logarithm of earnings without controlling for any other factors, and then controlled for a large number of measures of school quality, as well as the AFQT and standard educational and demographic variables. He found that between two-fifths and one-half of the gross (unconditional) statistical relationship of parental and offspring earnings remains even after controlling for the other factors.

These results just reaffirm the black box puzzle using entirely different data and methods: more than half of the intergenerational transmission coefficient is unaccounted for.[3]

Taking account of the better health enjoyed by the children of the well-to-do than that of poor children (Case et al. 2001), along with the fact that poor health has substantial effects on incomes later in life (Smith 1999), would probably account for a substantial part of the intergenerational transmission process. The role of health in the process is particularly striking because parental incomes appear to have strong impacts on child health that are not accounted for by either the health status of the parents nor by the genetic similarity between parents and children. Moreover, as John Loehlin shows in chapter 6, while there are modest but highly significant intergenerational correlations of personality and attitude variables, these correlations are unlikely to account for more than a small part of the intergenerational correlation of incomes, given our current ability to measure accurately these individual characteristics.

Wealth Effects

Economic success can be passed on in a family through the inheritance of wealth as well as inter vivos wealth transfers to children. Remarkably little scholarly attention has been given to this mechanism, in part because no representative panel data-set with adequate measures of other earnings determinants exists, in which the second generation has reached the age whereby the inheritance of wealth typically has been completed. We are aware of only one study that addresses this problem by following the second generation to their deaths, and it estimates a much higher intergenerational wealth correlation (Menchik 1979). But while inheritances of wealth clearly matter for the top of the income distribution, we doubt whether such transfers play an important role for most families. Very few individuals receive inheritances of significant magnitude. Mulligan (1997) estimates that estates passing on sufficient wealth to be subject to inheritance tax in the United States constituted between 2 and 4 percent of deaths over the years 1960–95. Even though this figure leaves out quite substantial inheritances as well as transfers that occur during life, it seems unlikely that for most of the population a substantial degree of economic status is transmitted directly by the intergenerational transfer of property or financial wealth.

It thus seems likely that the intergenerational persistence of wealth reflects, at least in part, parent-offspring similarities in traits influencing wealth accumulation, such as orientation toward the future, sense of personal efficacy, work ethic, schooling attainment, and risk-taking. Some of these traits covary with the level of wealth: for example, less well-off people are more likely to be risk averse, to discount the future, and to have a low sense of efficacy. Because of this correlation of wealth with the traits conducive to wealth accumulation, parent-offspring similarity in wealth may arise from sources independent of any bequests or transfers.

Whatever their source, for families with significant income from wealth, parent-offspring wealth similarities can contribute a substantial fraction to the intergenerational persistence of incomes. Using the same decomposition methods as described earlier, this contribution is the correlation of parent income and child wealth times the normalized regression coefficient of wealth in an income equation. We use data from the Panel Study of Income Dynamics (PSID) analyzed by Charles and Hurst (2003). The correlation between parent income and child wealth (both in natural logarithms) in this data set is 0.24. The average age of the children is only thirty-seven years, and so this correlation does not capture inheritance of wealth at death of the parents. To get a rough idea of the normalized regression coefficient, one way to proceed is by starting with the percentage change in income associated with a 1 percent change in wealth; this elasticity will range from virtually zero (for those with little or no wealth) to one (for those with no source of income other than wealth). A plausible mean value (based on average factor income shares) for the U.S. population is 0.20. We convert this to a normalized regression coefficient by multiplying by the ratio of the standard deviation of log wealth to the standard deviation of log income, also from the PSID data set provided by Charles and Hurst (forthcoming). This calculation suggests that higher-income parents' tendency to have wealthier children contributes 0.12 to the intergenerational correlation of incomes.

This figure, while substantial, may be an underestimate, as it is based on data that, for the reasons already mentioned, does not capture a key transmission process, namely inheritance of wealth upon the death of one's parents. Moreover, the estimate should be adjusted upward to take account of the tendency for those with greater wealth to have higher average returns on their wealth (Bardhan et al. 2000; Yitzhaki 1987). Greater parental or personal wealth may also raise the rate of return on schooling and other human investments, but we have no way to take account of this empirically. For a sample of very rich parents, the contribution of wealth to the intergenerational correlation would be much higher, of course. For a sample of families with very limited wealth, the contribution would be nearly zero. The difference in the contribution of wealth-effects across the income distribution is a reflection of the heterogeneous nature of the transmission process mentioned earlier. Because of the very skewed distribution of wealth, the family with the mean level of wealth (to which our estimates apply) is considerably wealthier than the median family.

Conclusion

In chapter 3, David Harding, Christopher Jencks, Leonard Lopoo, and Susan Mayer present data showing that parent-child family income correlations fell somewhat between 1961 and 1999, as did the income gap between nonwhites and whites. Moreover, they find that the income gap between those raised by advantaged and disadvantaged parents narrowed during the 1960s but has shown no trend since. This moderately egalitarian trend is more promising than recent evidence that points to a much higher level of intergenerational transmission of economic position than was previously thought to be the case. Our main objective in this book has been to assess this historically persistent process of intergenerational transmission and the apparently robust mechanisms accounting for it. Table I.3 summarizes our best estimates of the

Table I.3
The Main Causal Channels of Intergenerational Status Transmission in the United States

Channel	*Earnings*	*Income*
IQ (conditioned on schooling)	0.05	0.04
Schooling (conditioned on IQ)	0.10	0.07
Wealth		0.12
Personality (fatalism)	0.03	0.02
Race	0.07	0.07
Total Intergenerational Correlation Accounted For	0.25	0.32

Notes: For each channel, the entry is the correlation of parent income with the indicated predictor of offspring income, multiplied by its normalized regression coefficient in an earnings or income equation. The total is the intergenerational correlation resulting from these channels, in the absence of a direct effect of parents' status on offspring status.

Source: Calculations described in Bowles and Gintis (2001).

relative importance of the main causal channels we have been able to identify. The only entry not previously explained is the first, which is an estimate of the correlation between parental income and child IQ multiplied by our estimate of the normalized effect of IQ on earnings, conditioned on, among other things, years of schooling. The estimates for IQ, schooling, and personality in the income column are simply those in the earnings column adjusted to take account of the effect of earnings differences on income differences, suitably normalized as described in Bowles and Gintis (2002). Thus, we do not take account of the way that these earnings determinants may affect the rate of return to one's wealth. By contrast, we assume that the race effect is of the same magnitude in determining the returns to both human capital and conventional wealth (if the race effect on incomes worked solely via an effect on earnings, its contribution to the intergenerational earnings correlation would be significantly greater).

While the estimates in table I.3 are quite imprecise, the qualitative results are not likely to be affected by reasonable alternative methods. The results are somewhat surprising: wealth, race, and schooling are important to the inheritance of economic status, but IQ is a less important contributor and, as we have seen above, the genetic transmission of IQ is even less important.

A policymaker who is concerned about intergenerational transmission of economic status will face two difficult sets of issues. First, many of the policies that might affect the intergenerational transmission of economic status are controversial. Eliminating racial discrimination would reduce one component of the heritability of income, but achieving this goal is difficult. Improving educational achievement, especially for those whose parents have relatively low levels of schooling, would reduce intergenerational transmission both directly, because of the impact of schooling, and perhaps also indirectly by providing a more open network of group memberships and mating choices that are less homogeneous by income class. But improving educational achievement is another goal that is easier stated than accomplished.

A second broad set of problems is normative. As Adam Swift argues in chapter 9, a zero correlation between parental and child incomes is not a morally desirable goal because there are important values of family life and privacy that would be compromised by any serious attempt to disconnect completely the fortunes of parents and children. Moreover, as dramatized by Marcus Feldman, Shuzhuo Li, Nan Li, Shripad Tuljapurkar, and Xiaoyi Jin in chapter 8, parental self-interest as well as parental altruism leads families to maintain a strong and culturally justified interest in the economic futures of their children. Thus, rather than pursuing an abstract (and to our minds unattractive) objective of zero intergenerational correlation, a better approach might be to ask which mechanisms of intergenerational transmission are unfair, and to direct policies accordingly. The role of race in transmitting status from generation to generation is clearly unfair. Many people regard the strong correlation between parental income and child health as morally suspect, and many feel the same way about high levels of wealth inheritance. Large majorities favor policies to compensate for inherited disabilities. Other mechanisms of persistence—the genetic inheritance of good looks, for example—strike most people as unobjectionable and not an appropriate target for compensatory policy interventions. Even if some consensus could be formed on which of these mechanisms are morally suspect, the policy implications would be far from clear. For example, the possible incentive effects on parental behaviors of reduced parental influence on child success would have to be estimated and considered.

Addressing the policy challenge will require not only moral clarity about these and related issues, but a better accounting of which causal mechanisms are at work in producing the substantial levels of intergenerational persistence of economic differences. We hope the research presented in this book will contribute to a renewed commitment to dealing with this pressing social issue.

Notes

1. The analysis presented below is drawn from Bowles and Gintis (2002).
2. This decomposition can be found in Blalock (1964) and is described in the Appendix in Bowles and Gintis (2002). Goldberger (1991) describes the standard regression model with normalized (mean zero, unit standard deviation) variables on which it is based.
3. It is also true that we *can* usually account statistically for less than half of the variance of the earnings or income using the conventional variables described earlier. But this fact does not explain our limited success in accounting for the intergenerational correlation, as this correlation measures only that part of the variation of earnings that we can explain statistically by parental economic status.