The Inheritance of Economic Status: Education, Class, and Genetics

Samuel Bowles
Herbert Gintis

SFI WORKING PAPER: 2001-01-005

SFI Working Papers contain accounts of scientific work of the author(s) and do not necessarily represent the views of the Santa Fe Institute. We accept papers intended for publication in peer-reviewed journals or proceedings volumes, but not papers that have already appeared in print. Except for papers by our external faculty, papers must be based on work done at SFI, inspired by an invited visit to or collaboration at SFI, or funded by an SFI grant.

©NOTICE: This working paper is included by permission of the contributing author(s) as a means to ensure timely distribution of the scholarly and technical work on a non-commercial basis. Copyright and all rights therein are maintained by the author(s). It is understood that all persons copying this information will adhere to the terms and constraints invoked by each author's copyright. These works may be reposted only with the explicit permission of the copyright holder.

www.santafe.edu
The Inheritance of Economic Status:  
Education, Class and Genetics

Samuel Bowles and Herbert Gintis*  
Department of Economics  
University of Massachusetts  
Amherst, Massachusetts, 01003  
December 22, 2000

Abstract

The perpetuation of a family’s position in the distribution of income from parents to children reflects the genetic and cultural transmission of individual traits, as well as the inheritance of group memberships and income-earning assets. We show that the extent of intergenerational economic status transmission is considerably greater than was thought to be the case a generation ago, the genetic inheritance of traits contributing to the cognitive skills measured on IQ and related tests explains very little of the intergenerational transmission of economic status, even if the heritability of IQ is quite high, and the combined genetic and cultural inheritance processes operating through superior wealth, cognitive levels, and educational attainments of those with well-off parents, while important, do not fully explain the intergenerational transmission of economic status. We identify some overlooked individual traits that enhance economic success that are transmitted across generations.

1 Introduction

Economic status is transmitted from parents to offspring. The perpetuation across generations of a family’s social class, or their position in the distribution of income,

*To appear in Marcus Feldman, ed. Genetics, Behavior and Society, a volume in Neil Smelser and Paul Baltes, eds., International Encyclopedia of the Social and Behavioral Sciences, (Oxford, Elsevier, 2001). We would like to thank Jere Behrman, Anders Bjorklund, Williams Dickens, Marcus Feldman, James Heckman, Tom Hertz, Arjun Jayadev, Christopher Jencks, Casey Mulligan, Robert Plomin, and Cecelia Rouse for their contributions to this paper, Bridget Longridge for research assistance and the MacArthur Foundation for financial support. The authors can be reached at bowles@econs.umass.edu, http://www-unix.oit.umass.edu/~bowles, hgin-tis@mediaone.net, http://www-unix.oit.umass.edu/gintis.
The Inheritance of Economic Status

is generally thought to reflect the combined effects of the genetic and cultural transmission of traits, such as cognitive functioning, that contribute to economic success, as well as the inheritance of income-enhancing group memberships and property. The superior education enjoyed by the children of higher status families contributes to this process of economic inheritance. While recent research has illuminated important aspects of this account, the factors contributing to the extent of intergenerational transmission of status and the ways that genetic and cultural transmission and the inheritance of property and memberships contribute to this process remain obscure.

First, the extent of intergenerational economic status transmission is considerably greater than was thought to be the case a generation ago, with some intergenerational correlations of parent-offspring income exceeding Francis Galton’s original estimate (two-thirds) for height (Galton 1889):97. Second, the genetic inheritance of traits contributing to the cognitive skills measured on IQ and related tests explains very little of the intergenerational transmission of economic status, even if the heritability of IQ is quite high. Third, the combined genetic and cultural inheritance processes operating through superior wealth, cognitive levels, and educational attainments of those with well-off parents, while important, do not fully explain the intergenerational transmission of economic status. We will identify some as yet overlooked individual traits that enhance economic success in the members of both generations and are transmitted across generations.

2 The Intergenerational Transmission of Economic Status

Economic status may be measured in discrete categories—by membership in hierarchically ordered classes, for example—or continuously, by earnings (wages and salaries), income (earnings plus income from property and other sources), an occupational prestige index, or wealth.

The persistence of categorically measured status has been studied using transition matrices, the elements of which, $\mu_{ij}$, are the probability that an individual in class $i$ in period $t$ will be in class $j$ in period $t + 1$. The categorical approach is appealing because so much of economic inequality is associated with group membership. Less obvious advantages of the categorical approach include its attention to distinct transmission processes operating for particular groups—discrimination reproducing racial status differences, or inherited wealth perpetuating the status of the very rich, for example. Finally the categorical approach facilitates study of relationships between categories—sharecroppers and landlords, for example—in understanding the process of transmission. The versatility of this approach, however, comes with a price. The transition matrices and the Markov process models
underlying them provide no readily motivated scalar measure of the degree of status immobility, except in rather special cases (Kanbur and Stiglitz 1986, Conlisk 1990, Dardoni 1993).

By contrast, continuous measures of status—like height in Galton’s example—allow a simple metric of persistence, the intergenerational correlation coefficient $\rho$, the square of which measures the fraction of the variance in this generation’s measure of economic success that is statistically associated with the same measure in the previous generation. We measure the persistence of economic status using a first order Markov process:

$$y_o = (1 - \beta_y) \bar{y} + \beta_y y_p + \epsilon_y. \hspace{1cm} (1)$$

We use subscripts ‘o’ and ‘p’ to refer to offspring and parental measures, respectively, so $y_o$ is an individual’s economic status, adjusted so that its mean, $\bar{y}$, is that of the parental generation, $\beta_y$ is a constant, $y_p$ is the individual’s parental $y$, and $\epsilon_y$ is a disturbance uncorrelated with $y_p$. In this setup, inspired by Galton’s treatment of height, and extended in Goldberger (1989), regression to the mean is measured by $1 - \beta_y$. $^1$ The intergenerational correlation is

$$\rho_y = \beta_y \sigma_{y_p} / \sigma_{y_o},$$

where $\sigma_y$ is the standard deviation of $y$. If $y$ is the natural logarithm of wealth, income or earnings, the standard deviation of $y$ is a common measure of inequality. Thus, if inequality is unchanging across generations, so $\sigma_{y_p} = \sigma_{y_o}$, then $\rho_y = \beta_y$. 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, $\beta_y$ is the percentage change in offspring’s economic success associated with a one percent change in parents’ economic success.

Early studies following the work of Blau and Duncan (1967) estimated intergenerational correlations for income or earnings among men in the U.S. to be in the neighborhood of 0.15, leading Becker and Tomes (1986) to conclude that:

 Aside from families victimized by discrimination, regression to the mean in earnings in the United States and other rich countries appears to be rapid…Almost all earnings advantages and disadvantages of ancestors are wiped out in three generations. (S32)

But the appearance of such high levels of mobility was an artifact of two types of measurement error: errors in reporting income, particularly when individuals were

$^1$We gain little explanatory power by using higher order Markov processes to take account of the effects of earlier generations (Warren and Hauser 1997, Behrman and Taubman 1990).
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, Maynard and Trinder 1983, Solon 1992, Zimmerman 1992). The high noise to signal ratio in both generations’ incomes depressed the intergenerational correlation, and when corrected using a variety of methods and distinct data sources, the intergenerational correlations for economic status appeared quite substantial, as is indicated by the data in Table 1.2 Estimated intergenerational correlations generally rise with age, are greater for sons than daughters, and are greater when multiple years of income or earnings are averaged. Behrman and Taubman (1989) using the Michigan Panel Survey of Income Dynamics find that the estimated intergenerational correlation of parental income and offspring earnings is 0.58 when ten years of earnings are used compared to 0.37 for a single year.

Measures of similarity in economic status among siblings also suggest that intergenerational transmission may be substantial. The sibling correlation is the fraction of the variance in siblings’ economic status that can be statistically accounted for by influences they share in common. Of course siblings share influences beyond having the same parents, so the square root of the sibling correlation gives an upper bound estimate for extent of intergenerational transmission (unless, of course, parental economic status differed during the siblings’ formative years). Returning to equation (1), suppose two siblings have income that is generated by the same process and their error terms are uncorrelated, meaning that the only shared influence on their economic success is common parentage. Then the square root of the correlation between the siblings’ income is an estimate of $\rho_Y$. An estimate of the correlation of the natural logarithm of earnings for brothers aged 25–42 in the U.S. is 0.45 (Bjorklund, Eriksson, Jantti, Raam and Osterbacka 1999).3

---

2 Another useful survey of these data is Bjorklund and Jantti (1999), and the discussion in Mulligan (1997) and Solon (2000).
3 Estimates for Denmark, Sweden, Finland and Norway are considerably lower. However the

---

<table>
<thead>
<tr>
<th>Economic Characteristic</th>
<th>Number of Estimates</th>
<th>Range</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>years of schooling</td>
<td>8</td>
<td>0.14–0.45</td>
<td>0.29a</td>
</tr>
<tr>
<td>log earnings or wages</td>
<td>16</td>
<td>0.11–0.59</td>
<td>0.34a</td>
</tr>
<tr>
<td>log family income</td>
<td>10</td>
<td>0.14–0.65</td>
<td>0.43a</td>
</tr>
<tr>
<td>log family wealth</td>
<td>9</td>
<td>0.27–0.76</td>
<td>0.50</td>
</tr>
<tr>
<td>log family consumption</td>
<td>2</td>
<td>0.59–0.77</td>
<td>0.68</td>
</tr>
</tbody>
</table>

Table 1: Intergenerational Persistence of Some Economic Characteristics, $\beta_i$. Source: Mulligan (1999)
a If recent studies of the U.S. only are included these averages are 0.35, 0.33, and 0.38 respectively.
Unlike the entries in a transition matrix, $\mu_{ij}$, which indicate the extent to which one’s prospects are conditioned on one’s origins, the intergenerational correlation, $\rho_y$, is relatively difficult to interpret. We can, however illustrate the degree of conditioning implied by given values of $\rho_y$, assuming that the underlying relationship is linear in $y_0$ and $y_p$ and that both are normally distributed. Figure 1 represents the transition probabilities implied by these assumptions and two different correlation coefficients, $\rho = 0.4$ and $\rho = 0.5$. The horizontal axis represents cumulative position in the income distribution, and the vertical axis represents the probability that an individual in the highest (first) decile of parental income attains at least this position divided by the probability that an individual in the lowest (tenth) decile of parental income attains at least this position. It can be seen, for instance, that an individual whose parents are in the top decile is roughly forty-four times as likely to attain a position in the top decile as an individual whose parents are in the bottom decile when $\rho = 0.5$, and sixteen times as likely when $\rho = 0.4$. Similarly an individual whose parents are in the top decile is about twenty times as likely to attain a position in the top quintile as an individual whose parents are in the bottom decile when $\rho = 0.5$, and nine times as likely when $\rho = 0$. Studies allowing for nonlinear effects in (1) suggest that our assumption of normality may lead these figures to understate the actual degree of persistence in the tails of the income distribution (Corak and Heisz 1999, Cooper, Durlauf and Johnson 1994).

Having established that intergenerational transmission of economic status is substantial in a number of countries, we turn now to the role of various forms of inheritance in the transmission process. Equation (1) is merely a summary of the results of a number of distinct processes having little in common except that they result in parent-offspring similarities for traits statistically associated with the degree of economic success in both generations. While candidates for the list of income generating traits with strong parent-offspring similarity are many, there are few for which both economic relevance and parent-offspring similarity have been empirically demonstrated. Among these are cognitive performance, the level of schooling, and ownership of wealth, each illustrating distinct transmission processes.

We treat a common measure of economic success, income—that is, the sum of labor earnings (wages and salaries) and returns to assets—as a phenotypic trait differences between the U.S. and the Northern European countries are neither statistically significant nor robust to reasonable variations in estimation technique concerning the autocorrelated structure of transitory income, the inclusion of African Americans in the U.S. sample, and other alternatives. Estimates of the persistence of other measures of economic success such as occupational status fail to confirm any systematic difference among these nations (Bjorklund and Janiti 1999).
Relative Probability of Attainment

Cumulative Position in Income Distribution

Figure 1: Intergenerational Status Transmission when ρ = 0.4 and ρ = 0.5. The vertical axis represents the probability of attaining the decile on the horizontal axis or higher deciles, for an individual from the top decile in parental background, relative to an individual from the bottom decile in parental background.

influenced by the individual’s genotype g, environment e, and ownership of income-earning assets. Genotypic and environmental influences jointly determine individual skills and other traits relevant to job performance, sometimes termed ‘human capital.’ Among the environmental influences are cultural transmission from parents, schools and other learning environments. We transform income, human capital, and assets to their natural logarithms, and then normalize all variables to have zero mean and unit variance, represented by y, l, and k, respectively. Here and below, \(\tilde{y}\) is total income, while y is earnings from labor, represented as a return to human capital. So we have

\[
l = h_y g + \beta_{le} e + \epsilon_l
\]

\[
\tilde{y} = \omega l + \pi k + \epsilon_{\tilde{y}}
\]

which imply the reduced form

\[
\tilde{y} = \omega (h_y g + \beta_{le} e) + \pi k + \epsilon'_{\tilde{y}}
\]

where \(\epsilon'_{\tilde{y}}\) is a disturbance uncorrelated with the independent variables, and the constants \(\omega, h, \beta_{le}, \) and \(\pi\) give the effect in standard deviation units of a standard
deviation change in the relevant variable. Thus $h^2_y$ is the heritability of earnings, namely that portion of the variance of individual earnings that would be explained by the variance of $g$, were $e$ and $g$ uncorrelated.

Using (4), we can decompose the intergenerational correlation $\rho_{\tilde{y}}$, yielding additive terms expressing the contribution of each of the above variables. Let $r_{uv}$ be the simple correlation between variables $u$ and $v$. We can express the intergenerational correlation coefficient as

$$\rho_{\tilde{y}} = \sum r_{j\tilde{y}p} \beta_{j\tilde{y}o}$$

(5)

where $r_{j\tilde{y}p}$ is the simple correlation of the parental economic status measure ($\tilde{y}_p$) with some another variable $j$, and $\beta_{j\tilde{y}o}$ is the normalized regression coefficient of the variable $j$ in an equation like (7) below, predicting the current generation’s economic status ($y_o$). Then if parent offspring similarity in $g$, $e$, and $k$ are the only sources of parent offspring similarity in $\tilde{y}$ (that is, $\epsilon_{\tilde{y}p}$ is uncorrelated with $\epsilon_{\tilde{y}o}$), we can decompose the intergenerational correlation of incomes as follows:

$$\rho_{\tilde{y}} \equiv r_{\tilde{y}o\tilde{y}p} = \omega(h_y r_{k\tilde{y}o\tilde{y}p} + \beta_e r_{e\tilde{y}o\tilde{y}p}) + \pi r_{k\tilde{y}o\tilde{y}p},$$

(6)

expressing three fundamental mechanisms of intergenerational transmission of economic status: genetic, cultural, and asset-based. What can we say about the relative importance of each? To answer this question we consider particular components of the genetic and environmental influences on economic success.

3 The Role of Genetic Inheritance of Cognitive Skill

Both the similarity of parents’ and offspring’s scores on cognitive tests and the statistical association of test scores and earnings are well documented. This suggests an appealing explanation of the process of intergenerational status transmission via inheritance of cognitive skills.

Correlations of IQ between parents and offspring are substantial, ranging from 0.42 to 0.72, the higher figure referring to average parental vs. average offspring IQ (Bouchard and McGue 1981). The contribution of cognitive functioning to earnings has been established using survey data to estimate the natural logarithm of earnings $y$ as a function of a measure of parental economic and/or social status $y_p$, years (and perhaps other measures) of schooling $s$, and performance on a cognitive score $c$—often, in U.S. data sets, the Armed Forces Qualification Test (AFQT), a cognitive test developed to predict vocational success—as well as an error term and other variables, such as work experience, race, and sex, which will not concern us. We may write this equation in a normalized form as

$$y_o = \beta_{y_o y_p} y_p + \beta_{y_o s_o} s_o + \beta_{y_o c_o} c_o + \epsilon_{y_o}.$$

(7)
We have located sixty-five estimates of $\beta_{yo,co}$, appearing in Figure 2. The mean of these estimates is 0.15, indicating that a standard deviation change in the cognitive score, holding constant the remaining variables, changes the natural logarithm of earnings by about one seventh of a standard deviation. By way of contrast the mean value of $\beta_{yo,so}$ is 0.22, suggesting a somewhat larger independent effect of schooling.\footnote{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 found no significant effects (Bowles, Gintis and Osborne 2000).}

*Figure 2:* Normalized Regression Coefficient ($\beta_{yo,co}$) of Cognitive Score on the Logarithm of Income or Earnings by Year: Sixty Five Estimates from Twenty Four Studies (Bowles, Gintis and Osborne, 2000)
where all variables are expressed in normalized form, $\epsilon_c$ and $\epsilon_s$ are error terms uncorrelated with the independent variable in their respective equations.

The cognitive test would ideally be taken by an adolescent just prior to the minimal school leaving age, thereby being a good predictor of adult cognitive functioning while still having an effect on the level of schooling attained. Figure 3 illustrates the causal model implied by equations (7)–(9).

\[ y_p \rightarrow \beta_{yoyp} \rightarrow y_o \]
\[ r_{ypcp} \rightarrow \beta_{ycyp} \rightarrow s_o \rightarrow \beta_{yoYo} \rightarrow y_o \]
\[ c_p \rightarrow \beta_{ycyp} \rightarrow c_o \]
\[ h_c \rightarrow r^g \rightarrow g_p \rightarrow g_o \]

**Figure 3**: A Causal Model of Intergenerational Status Transmission

Equation (5) allows a decomposition of $\rho_y$ showing that the genetic inheritance of IQ contributes to the intergenerational status transmission process because it results in a correlation of parental income with offspring cognitive level $r_{coyp}$, which in turn affects offspring income both directly ($\beta_{coyo}$) and indirectly via its effect on the level of schooling attained ($\beta_{yoYo} \beta_{yoYo}$). Using equation (5) to decompose $r_{coyp}$, we have

\[ r_{coyp} = \beta_{coyp} + r_{ypyp} \left( \beta_{coyp} + h_c^2 \right). \] (10)

The genetically transmitted portion of this correlation is the term $r_{ypyp} h_c^2 / 2$, since the direct path $r^g$ from $g_p$ to $g_o$ is just the genetic relatedness of parents and natural offspring, which is 1/2. Summing the direct and indirect effects we have the contribution of genetic inheritance of IQ to intergenerational transmission of earnings

\[ \rho^g_c = r_{ypyp} r^g h_c^2 (\beta_{yoYo} \beta_{yoYo} \beta_{yoYo} + \beta_{yoYo}) \] (11)

We have already introduced representative values for $\beta_{yoYo} (0.22)$ and $\beta_{yoYo} (0.15)$. Estimates (Jencks 1979) of $r_{ypyp}$ suggest a value of 0.35, and we take as an estimate of $\beta_{yoYo}$ the preferred estimate of Winship and Korenman (1999), which is 0.53. Therefore $\rho^g_c = 0.047 h_c^2$, indicating that even for $h_c^2 = 1$, the genetic inheritance of IQ accounts for a rather modest portion of the observed levels of intergenerational
The Inheritance of Economic Status

economic status transmission. The considerably lower values for $h_c^2$ suggested by recent research of Devlin, Daniels and Roeder (1997), Otto, Christiansen and Feldman (1995), and Plomin (1999) are consistent with the conclusion that one twentieth or less of the observed intergenerational status transmission is due to genetic inheritance of IQ. Some of the data used in this exercise are not very precisely estimated ($h_c^2$ in particular) but the main point is robust with respect to reasonable alternative values.

It could 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 paper (Thorndike 1919) on “social intelligence.”

Some alternative test instruments, such as Robert Sternberg and collaborators’ “practical intelligence” (Sternberg, Wagner, Williams and Horvath 1995, Williams and Sternberg 1995), predict economic success in particular occupations. But the fact that the quest that Thorndike launched has yielded no robust alternative to IQ cautions against treating the possible existence of economically important but as yet unmeasured general cognitive skills as anything more than speculation.

Indeed we are inclined to think that available estimates overstate the importance of general cognitive skill as a determinant of earnings for the simple reason that taking a test is more than a little like doing a job—the results measure performance, which is the joint effect of skill along with other contributors such as the disposition to follow instructions, persistence, work ethic, and other traits likely to contribute independently to one’s earnings. H. J. Eysenck (1994):9 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.

5 The calculation is

$$\rho_g^B = 0.35 \frac{h_c^2}{2} (0.22(0.53) + 0.15) = 0.047h_c^2.$$  

This of course assumes there is no assortative mating of parents. If parental IQ phenotypes have correlation $m$, and if the heredity coefficient $h_c$ is the same for parents as for offspring, then $r_g^B = (1 + h^2m)/2$. It follows that the maximum value $\rho_g^B$ could have, which occurs when $h_c = 1$, is $0.047(1 + m)$.

6 For an early skeptical assessment, see Robert Thorndike and Saul Stein (1937). We treat this issue at some length in Bowles et al. (2000).
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. The importance of the performance rather than capability aspect of the test score as a determinant of earnings is suggested Bishop (1991), who found a measure of computational speed on time tested exams to be a more robust predictor of earnings than two alternative measures—a normalized sum of academic tests as well as a measure of technical competence.

4 The Inheritance of Wealth and Educational Attainment

The intergenerational inheritance of income-earning assets provides an alternative explanation that competes for simplicity with the inherited cognitive skills account. Table 1 shows that the intergenerational correlation for wealth status is quite substantial—within the range of parent offspring similarity in cognitive scores—and that it exceeds the persistence of family income (to which it contributes) which in turn exceeds the persistence of earnings (which do not include income from property). While comparisons of imprecisely estimated parameters across differing data sets are notoriously unreliable, Mulligan (1997) uses a single data set and common methods for his estimates of persistence with respect to earnings, income, wealth and consumption. His results confirm that consumption, wealth and income regress to the mean more slowly than do earnings or wages.

These data are consistent with the inherited wealth account of economic status persistence. But for most individuals and families, income from property constitutes a negligible fraction of their total income. Only among the very well-to-do is property a major source of income. Correspondingly, 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 U.S. constituted between two and four percent of deaths over the years 1960-1995.

Because wealth inheritance contributes to intergenerational income persistence, one would expect to find that persistence varies with the level of wealth of the individual’s parents. For instance, in a rare study with sufficient sample size to derive good estimates of persistence for different positions in the distribution of income (Corak and Heisz 1999) the degree of income persistence for the very rich was markedly greater than for the rest of the distribution, with $\rho_y = 0.8$ for the top percentile.

However, the apparent simplicity of the inherited wealth account is misleading. The intergenerational persistence of wealth is not explained simply by bequests but reflects as well parent-offspring similarities in traits influencing wealth accumulation, such as orientation towards the future, sense of personal efficacy, work ethic,
schooling attainment, and risk-taking. Some of these traits covary with the level of wealth: less well off people are more likely to be risk averse, to discount the future and have a low sense of efficacy, for example (Bardhan, Bowles and Gintis 2000, Fong 2000). Because of this positive effect of wealth on the traits conducive to wealth accumulation, along with the fact that the wealthy often enjoy higher rates of return on their investments, the transmission processes need not be characterized by regression toward the mean. Thus, if in an equation analogous to (1) for wealth, there is no reason to rule out situations for which \( \beta_k > 1 \), implying high levels of wealth persistence and growing wealth inequality over time (progression away from the mean). Periods of apparently increasing wealth inequality such as the United States between the late 18th and late 19th centuries (Williamson and Lindert 1980) may have been characterized by extraordinary levels of persistence, though there is no direct evidence to confirm this. Thus wealth accumulation over generations has been modeled as a non-ergodic dynamic process in which two or more classes differentiated by wealth level persist indefinitely (Galor and Zeira 1993).

Like wealth levels, schooling attainments persist across generations although, as Table 1 indicates, less so. Nonetheless, father-offspring correlations for years of schooling reported by Behrman and Taubman (1989) are substantial (0.34, and would be closer to 0.4 were they corrected appropriately for errors in measurement). As in the case of wealth, the persistence of schooling attainments results from actions taken by parents and offspring, and these are influenced by beliefs and preferences that are themselves subject to intergenerational transmission. Some of the individual dispositions favoring high levels of school attainment are correlated with parental schooling levels and incomes, thereby fostering higher levels of educational attainment by the children of the well educated. This tendency is exacerbated where the children of the less well off experience schooling as a hostile or unpleasant environment, and where their families limited incomes and inability to borrow make the students’ potential labor services valuable to the family.

Moreover in a number of countries, including the U.S., the rate of return to education is considerably higher for those with more than twelve years of schooling than for others (Ashenfelter and Rouse 2000, Hauser, Warren, Huang and Carter 2000), thereby providing little incentive for schooling attainment for the children of the less well educated. Unlike investment in capital, however, investment in one’s own earning capacities must eventually confront diminishing returns given the limited nature of one’s working life, thus limiting the degree of persistence and favoring regression toward the mean.

Because schooling attainment is persistent and has clear links to skills and perhaps other traits that are rewarded in labor markets, this human capital based account of intergenerational status transmission has strong \textit{prima facie} plausibility, especially when deployed with the inherited cognitive skills account. Indeed it was
once commonly assumed that when 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, with the direct effect
of parental on offspring earnings vanishing; i.e., $\beta_{y_0 y} = 0$ in (7).

But as the measurement of school quality has improved over the years, estimates of $\beta_{y_0 y}$ have proven resilient. Note that $\beta_{y_0 y} / \rho_y$ measures the importance
of the direct effect of parental economic status relative to the total amount of inter-
genational transmission. Casey Mulligan (1997), controlling for a large number
of measures of school quality as well as the AFQT and standard educational and
demographic variables, finds that an estimate of parental income is an important
and statistically significant predictor of the natural logarithm of the hourly wage
rate in 1990 and 1991 in the National Longitudinal Study of Youth. A bit more
than two fifths of the gross statistical association between parental and offspring
economic success ($\rho_y$) apparently operates independently of the influences of these
conditioning variables. Specifically, the effect of an estimate of the logarithm of
parental income on offspring’s logarithm of income in a regression conditioned
on measures of schooling quantity and quality, employment, and cognitive perform-
ance is between two fifths and one half of the estimated effect of parental income
unconditioned on these variables. Mulligan’s work repeats the finding in Atkinson
et al. (1983) for a sample with direct measures of incomes of fathers and sons in the
U.K. in which two thirds or more of the substantial intergenerational transmission of
income status is independent, in the sense just defined, of the covariation of parental
income with a range of measures of son’s schooling including the number of Or-
dinary and Advanced level exams taken, and the selectivity of the school. Finally,
Bowles and Nelson (1974) found that between thirty three and sixty percent of the
covariation of parental economic status and respondent’s income (not its logarithm)
was not accounted for by the statistical association of parental status with childhood
IQ or years of schooling.

It is possible, of course that $\beta_{y_0 y}$ measures the effects of wealth inheritance
(none of the three studies includes measures of parental wealth or bequests) directly
on earnings or indirectly via effects on unmeasured determinants of earnings, such
as quality of schooling. But this seems unlikely given the very small number of
individuals receiving any significant bequest in the samples in question. A more
cautious interpretation is that it indicates an important gap in our understanding of
how economic status is passed on from generation to generation: roughly half of
the intergenerational transmission coefficient is unaccounted for.\footnote{It is also true
that we can typically statistically account for less than half of the variance of the
earnings or income using the conventional variables described above. But this fact
does not explain our limited success in accounting for the intergenerational correlation,
as this measures only that part of the variation of earnings that we can explain statistically by parental economic status.}

\begin{flushright} December 22, 2000 \end{flushright}
5 The Relative Importance of Genetics, Culture and Bequests

Our approach thus far has been to assess the contribution to intergenerational transmission of measured individual traits such as years of schooling and IQ, building up the intergenerational correlation from well-established empirical estimates. Our finding that schooling and IQ fall far short of an explanation of the intergenerational correlation, however, tells us little about the importance of environmental and genetic contributions to the transmission process, for it is likely that genetic influences extend far beyond measured cognitive skills and that environmental influences other than years of schooling (and other educational measures) are also important.

<table>
<thead>
<tr>
<th>Study</th>
<th>Monzygotic Correlation</th>
<th>Dizygotic Correlation</th>
<th>Brothers’ Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twinsburg(a)</td>
<td>0.56</td>
<td>0.36</td>
<td></td>
</tr>
<tr>
<td>Twinsburg(b)</td>
<td>0.63</td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td>Australian Twins(c)</td>
<td>0.68</td>
<td>0.32</td>
<td></td>
</tr>
<tr>
<td>U.S. Brothers(d)</td>
<td></td>
<td></td>
<td>0.45</td>
</tr>
</tbody>
</table>

**Figure 4:** Earnings and Genetic Similarity of Monozygotic Twins, Dizygotic Twins, and non-Twin Brothers.

Notes: (a) Ashenfelter and Krueger (1994), with earnings measure log wage; (b) Rouse (1999) and personal communication, with earnings measure log wage; (c) Miller et al. (1995), with earnings measure log occupational income; (d) Bjorklund and Jantti (1999), with earnings measure log annual earnings.

The fact that the earnings and schooling attainments of identical twins (more technically, monozygotic twins, which we abbreviate to ‘mz’ in equations) appear to be substantially more similar than fraternal twins (or dizygotic, which we abbreviate to ‘dz’ in equations) suggests that genetically inherited traits other than cognitive skills may account for some of the intergenerational correlation of earnings. Taubman (1976) uses a sample of monozygotic and dizygotic twins to measure the relative importance of genes and environment in income determination.
twins. Second, the twin data are not corrected for errors in measurement. An adequate treatment of this problem requires information on the degree of correlation of errors, which seems likely to be higher for the identical than the other twins. If this supposition is correct, error correction would increase the monozygotic correlations by less than the dizygotic correlations. Third, the identical twins are all same-sex pairs, while the dizygotic twins include mixed sex pairs, and sex contributes to the within pair difference in economic success. The brothers data set addresses this latter issue, but includes as social siblings, unrelated members of the same household, so the genotypic correlation among them is less than 0.5. All three problems imply that the naïve calculation of heritability from these data will constitute an overestimate.

It may be of interest, nonetheless to see what this estimate yields. Assuming the degree of similarity of the environmental influence on earnings and schooling attainments is identical for the two sets of twins, we can calculate the heritability of these phenotypic traits as

\[ h^2_i = 2(r_{mz}^i - r_{dz}^i), \]

where \( r_{mz}^i \) and \( r_{dz}^i \) are the correlations of the monozygotic and dizygotic twins for trait \( i \). Twin correlations from Ashenfelter and Krueger (1994) for hourly wages and from Behrman and Taubman (1989) for years of schooling attained yield estimates of \( h^2_i = 0.4 \) for both traits. Assuming that the correlation of parental genotypic and phenotypic income is \( h_y \) itself, the estimated contribution genetic inheritance to the intergenerational transmission of these measures of status is just \((r^y h^2_y)\) or one-fifth. While this estimate may overstate its influence, we do not doubt that genetic inheritance plays a role, perhaps a substantial role in the intergenerational transmission of economic status, even if (as we have seen) this process operates substantially independently of the

---

9 However the difference in the earnings correlation between monozygotic and same sex pairs of dizygotic twins in the NRC (Taubman 1976) sample and the Swedish Twin Registry (Isacsson 1997) is 0.24 (in both data sets).

10 Estimates of \( h_i \) and \( \beta_{iei} \) are not very sensitive to assumptions concerning the degree of assortative mating, measured by the correlation of parental phenotypes, \( m_i \) but depend critically on assumptions concerning the difference in the environmental correlations experienced by the dizygotic and monozygotic twins, \( r_{mz}^{ei} \) and \( r_{dz}^{ei} \), respectively. Relaxing these assumptions requires that \( h_i \) and \( \beta_{iei} \) be estimated simultaneously, using the equations below, where the subscript \( i \) refers to the trait in question:

\[ r_{mz}^i = \beta_{iei}^2 r_{ei}^{mz} + h_i^2 \]
\[ r_{dz}^i = \beta_{iei}^2 r_{ei}^{dz} + h_i^2 (1 + h^2 m_i)/2 \]

The greater the difference in the environmental correlations, the lower is the estimate of \( h_i^2 \) and the higher is the estimate of \( \beta_{iei}^2 \). Correspondingly, larger values of \( m_i \) increase the estimate of \( h_i^2 \) and decrease the estimate of \( \beta_{iei}^2 \). If the correlation for earnings-affecting environments for monozygotic and dizygotic twins are 0.8 and 0.7 respectively (rather than both being 0.8), and if \( m_i = 0.25 \), the estimates reported in the text obtain.
cognitive skills measured on available tests.

Similar methods yield estimates for the environmental effects. If the correlation of parental income and the environmental influences on offspring income is approximated by the correlation of parental (permanent) income or other measures of socioeconomic status with offspring schooling attainment, the estimate of $r_{e0}\gamma_p$ is about 0.45. An estimate of $\beta_{le}$ is obtained from the Ashenfelter Krueger twin data as $(r_{mz} - h^2)/r_{mz}^e$, where $r_{mz}^e$, the correlation of monozygotic twins’ environments, is assumed to be 0.8, giving a value of 0.2. Thus the environmental contribution to the intergenerational correlation of earnings ($\beta_{le}r_{e0}\gamma_p$) is the same magnitude as the genetic contribution, namely 0.2, giving an intergenerational correlation for earnings of 0.4.

Note that $\beta_{le} = \sqrt{0.2} = 0.45$ is an estimate of the effect on earnings, in standard deviation units, of a standard deviation change in the environmental influences on human capital and hence on earnings, and may be compared with $\beta_{ys}$, the mean estimate of which in our metaanalysis is just half of $\beta_{le}$, suggesting that while educational attainment captures important aspects of the relevant environments it is far from inclusive.

Figure 5: An Expanded Model of Intergenerational Transmission of Income. The dashed lines represent our causal model but are not used in our calculations.

To complete the analysis we turn to the intergenerational correlation for income, including returns to property, and thus take account of the intergenerational transmission of assets. Figure 5 illustrates the causal model of the determination of income underlying equations (2) and (4), with the paths from $y_p$ through $g_{y0}$ and $e_o$ to $y_o$ depicting the transmission process for earnings addressed in the paragraphs immediately above. The contribution of wealth inheritance to the transmission process is simply the correlation of parental income and offspring wealth ($r_{ypk_o}$) multiplied by the contribution of offspring wealth to offspring income, expressed as a normalized regression coefficient, $\pi$. An estimate of $\pi$ is simply $\gamma$, the percentage change in income associated with a one percent change in assets suitably normalized. If the rate of return on one’s assets is constant, $\gamma$ is simply the share of
income from assets as a fraction of total income. Expressing $\pi$ as a normalized regression coefficient we have

$$\pi = \gamma \frac{\sigma_k}{\sigma_{\tilde{y}}}.$$ 

The inequality of property holdings is considerably greater than the inequality of earnings or of income, and as a result $\gamma$ is likely to differ among families, with values approaching zero for the asset poor, and approaching unity for the very wealthy. This implies that importance of wealth inheritance in the intergenerational persistence of economic status is likely to differ by wealth level. If the variance of the logarithm of assets is four times the variance of the logarithm of incomes (the variance of a logarithm is a common unit free measure of dispersion) we have $\pi = 0.2(2) = 0.4$. Finally, if $r_{yp0}$ is midway between the intergenerational correlations for income (0.43) and for wealth (0.50), or 0.46, the property inheritance contribution to the intergenerational income correlation becomes $0.2(2)(0.46) = 0.18$.

To calculate the contribution of $g_o$ and $e_o$ to the intergenerational correlation of income we simply multiply the contributions estimated above by the path from earnings (or human capital) to income. We estimate this (following the above reasoning) as

$$\omega = (1 - \gamma_o) \frac{\sigma_f}{\sigma_{\tilde{y}}}.$$ 

If the variance of human capital is four fifths as large as the variance of income, then $\omega = 0.72$. Of course this value would be close to unity for population groups with no source of income other than earnings (if $\gamma_o = 0$, then $\sigma_{\tilde{y}} = \sigma_f$), and could be much smaller among the wealthy.

The implied contributions to the intergenerational persistence of income based on the above assumptions are genetic = 0.14, environmental = 0.14, asset based = 0.18, giving an intergenerational correlation of 0.46 which, as one would expect, somewhat exceeds the analogous correlations for earnings alone. These results are illustrated in Figure 6.

The substantial contribution of wealth inheritance to intergenerational transmission of economic status among the wealthy is unsurprising, and the mechanisms through which it works relatively transparent. But the same cannot be said for the genetic and environmental contributions, for as we have seen, neither IQ nor schooling provides an adequate account of these influences. Thus both genetic and environmental influences remain black boxes. We know they are important but we do not know why.

11 For example, if the rate of return on capital is 7 percent, and the average capital holding is three times the average income, $\gamma$ is about 0.2.

12 We need to assume, plausibly, we believe, that $h_y \equiv h_{\tilde{y}}$ and $re_o y_p \equiv re_o \tilde{y}_p$.
The Inheritance of Economic Status

Earnings Income

environmental \( r_{o\nu_p\beta_l e} = 0.2 \) \( o r_{o\nu_p\beta_l e} = 0.14 \)
genetic \( h_{\gamma_l}^2 r_{\gamma_l} = 0.2 \) \( o h_{\gamma_l}^2 r_{\gamma_l} = 0.14 \)
wealth \( \pi r_{k_o\gamma_p} = 0.18 \)

intergenerational correlation \( = 0.4 \) \( = 0.46 \)

Figure 6: Contribution of Environmental, Genetic, and Wealth Inheritance to Intergenerational Transmission

6 Understanding Intergenerational Status Transmission

Understanding the process of intergenerational status transmission is hampered by two habits of mind. One is thinking of the intergenerational transmission process as a literal handing-down of such things as good genes and material wealth. The other is limiting the benefits being handed down to skills. What offspring get from their parents may be less important than what both parents and children are or do. Rather than focusing on the handing-down of skills, a more inclusive approach might return to the accounting expression for \( \rho_{\gamma} \) expressed in equation (5) and ask: what does transmission require? A list of variables contributing in an accounting sense to the intergenerational correlation is of course not an explanation of how transmission works, but it is a very useful start. Equation (5) makes clear that transmission is accomplished by variables meeting just two criteria: (i) they account for variations in the economic success of the current generation (like the right hand side variables in (7) with their estimated coefficients \( \beta_j \)) and (ii) they are correlated with the economic success of the previous generation \( (r_{j\gamma_p}) \). Of course any variable that contributes to economic success in both generations, and for which parent-offspring similarity is substantial meets these two criteria.

Students of the persistence of economic status frequently identify “skills” as the critical individual traits subject to transmitted on the grounds that skills earn rewards in competitive labor markets. But other traits are persistent across generations and are arguably as important as determinants of income—for example, race, national citizenship, number of children, and as we have seen, wealth ownership. Another example of high levels of parent-offspring similarity for a non-skill trait contributing to economic success is obesity in women, which is a strong predictor of low earnings. Height predicts high earnings for men, and good looks predicts high earnings for both men and women, the latter independently of whether they hold jobs interacting with the public. Bowles et al. (2000) provide a survey of empirical...
evidence concerning these and many other nonskill determinants of economic success. While many of these traits are inherited from parents (in at least one of the usual senses of vertical cultural transmission, bequest, and genetic transmission) in some cases parent-offspring similarity arises by other means—common nationality, for example.

Two such variables will illustrate our argument: (i) group membership and (ii) personality and other individual traits that contribute to earnings but are not skills in the usual sense.

Suppose economic success is influenced not only by a person’s traits, but also by characteristics of the individuals with whom the person typically interacts. Suppose also that these interactions are not random, but are more likely to take place with individuals who share membership in a group, so equation (7) is now modified as

\[ y_o = \beta_{y_o}y_p + \beta_{y_o}c_o + \beta_{y_o}x + \epsilon_{y_o}. \]  

where \( x \) represents the average level of schooling, economic success, cognitive functioning, wealth level of the group of which the individual is a member. Group membership may also affect the \( \beta \)'s as well as the additive effects modeled in (12), of course, as in Cooper et al. (1994). Groups may be residential neighborhoods, ethnic or racial groups, linguistic groups, citizens of a nation, or any other set of individuals who typically interact more with one another than with those who do not share common membership.

Group effects on economic success are well documented and may arise for a number of reasons (Durlauf 1997, Borjas 1995), including discrimination, conformist effects on behavior, differential access to information, complementarities in production (a person’s productivity is higher when working with better educated people, for example). The importance of group effects on intergenerational persistence of economic status is suggested in the work of Cooper et al. (1994) on the importance of one’s neighborhood, and by the fact that the correlation among brothers’ earnings for the U.S. estimated by Bjorklund et al. (1999) falls by 0.1 when the sample is restricted to whites; i.e., brothers typically share racial status, and when that contribution to the similarity of economic outcomes between siblings is removed from the sample, the brothers’ correlation falls by roughly a quarter.

A less transparent but common source of group effects is the fact that individuals typically coordinate their activities by the use of conventions, namely behaviors that are individually beneficial as long as most other members of the group behave the same way. Driving on the right side of the road is an example, as are many rules of division of resources such as fifty-fifty, finders keepers, or first-come first-served, and customs such as mode of dress, language use, and manners. In residential communities, behaviors contributing to maintaining personal safety, environmental
quality and other amenities may also be conventions. Conventions may persist over long periods of time, and they differ from group to group. Some contribute to the economic success of the members of the group (e.g., truth telling or respect for property rights) while others are economically counter-productive (e.g., toleration of corruption), thereby giving rise to group effects on individual income.

Individuals are born into many groups (residential, racial, national, linguistic and others) and group membership often persists over many generations. Because group membership contributes to economic success in current and parental generations and persists across generations, \( r_{xy} \beta_{y,1} > 0 \) and is thus a contributor to the intergenerational transmission process.

Our second example concerns individual dispositions such as a sense of personal efficacy, work ethic, or a low time discount rate (strong orientation toward the future). These traits are not skills in any sense. Rather they contribute to individual economic success because they increase the gains from exchange in situations where contracts are incomplete. The importance of these aspects of personality stems from the fact that in an important class of exchanges, including the hiring of labor, borrowing and lending, or the exchange of goods of uncertain quality, it is impossible to specify all relevant aspects of the exchange in a contract enforceable by the courts. Where this is the case, the actual terms of the exchange are influenced by the degree of trust, honesty, hard work, and other dispositions of the parties to the exchange. The empirical importance of these traits are suggested in a number of studies (Duncan and Dunifon 1997, Heckman, Hsee and Rubinstein 1999, Bowles et al. 2000).

As earnings constitute by far the largest share of income for almost all individuals, the workings of the labor market are especially important in the process of intergenerational transmission. A widespread form of employment is the following: the employer offers a wage and the promise to retain the employee in subsequent periods as long as the employees work performance is found adequate. To make the threat of termination effective, of course, the wage and other aspects of the job must be worth keeping, that is preferable to termination, subsequent job search and the expected alternative employment. The employee’s personality will influence how effective this contract is, and hence the value of the employee in the eyes of the employer.

Consider, for example, the extent to which the employee discounts the future (the rate of time preference). A very present-oriented employee will not value the promise of continued employment in the future, hence will require a higher wage to motivate hard work in the present, and hence is less likely to be employed. Another example is the sense of personal efficacy: a fatalistic worker who believes that the probability of termination is unaffected by her or his own actions will be costly to motivate under this type of contract.
Our collaborator, Melissa Osborne, has studied the economic importance and intergenerational persistence of fatalism, as measured by the Rotter Scale. The Rotter Scale is a common measure of the degree to which individuals believe that important events are caused by external events rather than by their own actions. Her study of a sample of U.S. women and their parents (Osborne 2000) has produced two major findings. First, the Rotter Scale is a statistically significant and large influence on earnings. Second, the Rotter Scale is persistent from parents to offspring. Osborne has also studied a sample of women in the England and found that measures of social maladjustment taken at age eleven (the Bristol Social Adjustment Scale), such as aggression and withdrawal, are strong predictors of earnings at age thirty three. The influence of the Rotter Scale in Osborne’s U.S. study is somewhat smaller than the average influence of IQ in our meta-analysis. The influence of aggression and withdrawal is considerably larger. There are no measures of intergenerational persistence in the Osborne’s English data set, but other studies suggest that parent child similarity in measures of social maladjustment may be quite high.

We know relatively little about the intergenerational transmission process for personality traits relevant to economic success, other than cognitive functioning. However Melvin Kohn’s 1969’s study of child rearing values of parents suggests that at least for some traits, experiences in the workplace are generalized and passed by the process of vertical cultural transmission. Kohn categorizes his adult sample by the degree of self-determination that each experiences on the job, ranging from those who are relatively unsupervised to those who are closely directed by superiors. Kohn found that parents with high levels of occupational self-direction emphasize curiosity, self-control, happiness and independence as values for their children, while those with low occupational self-direction emphasize conformity to external authority. Two thirds of the statistical association between class position and parental values was explained by the covariation between class and occupational self-direction. He concluded:

Whether consciously or not, parents tend to impart to their children the lessons derived from their own social class and thus help prepare their children for a similar class position.

Kohn did not measure the effects of parental values on their behaviors as parents, or effects on child development. However, subsequent work by Osborne does suggest that the degree of self-direction has significant effects on earnings later in life.

7 Conclusion

In this paper we have shown that recent evidence points to a higher level of intergenerational transmission of economics position than previously thought. Moreover,
although the level of intergenerational IQ inheritance is also considerable, the latter accounts for little of the former. Indeed, some combination of environmentally and genetically transmitted noncognitive personality traits probably account for most of the correlation between the economic positions of parents and children. Personality differences, like group membership, affect earnings and display parent-offspring similarity. They thus join the genetic and cultural inheritance of cognitive skills, property bequests and other influences of wealth, and parent-offspring similarity in schooling attainments as aspects of the process of intergenerational transmission of economic status.

We do not know, of course, if a more inclusive view of the transmission process and of the traits being transmitted taking account of group effects, personality, and other aspects would substantially improve our empirical account of the intergenerational correlation. For many of the traits we have identified data are available that would permit an assessment of their importance in the transmission process.

However, for many of the personality variables, we lack good research on the transmission process. Heritability estimates for these variables are quite reliant on comparisons of monozygotic and dizygotic twins which may substantially over-estimate heritability, and consequently underestimate the role of vertical cultural transmission and other influences of siblings’ shared (family) environments. We know that schooling contributes to cognitive functioning independently of genetic inheritance but that most of the contribution of schooling to economic success is unrelated to the learning of cognitive skills in school (Bowles et al. 2000, Gintis 1971). It seems likely that schools contribute to economic success in part by fostering personality traits rewarded in labor markets, rather than simply by enhancing cognitive functioning, but this appears not to be the case for either the Rotter Scale or the social maladjustment measures studied by Osborne.

REFERENCES


Bardhan, Pranab, Samuel Bowles, and Herbert Gintis, “Wealth Inequality, Credit Constraints, and Economic Performance,” in Anthony Atkinson and François
Bourguignon (eds.) Handbook of Income Distribution (Dortrecht: North-Holland, 2000).


December 22, 2000


Winship, Christopher and Sanders Korenman, “Economic Success and the Evolution of Schooling with Mental Ability,” in Susan Mayer and Paul Peterson