Galton versus the Human Capital Approach to Inheritance

Casey B. Mulligan

University of Chicago

A century ago, Francis Galton proposed a simple yet powerful model of inheritance. Gary Becker's human capital model is often used to analyze important empirical and policy questions, but does it dominate Galton's from a positive point of view? I derive nine implications of the human capital approach that are distinct from Galton's. Evidence from the PSID, SCF, and NLSY micro data sets as well as results reported in previous literatures suggest that four of the unique implications are refuted. Two implications are verified, and mixed results are obtained for three others. Some extensions of economics recently developed by Becker and others, when applied to inheritance, may improve economics' predictions.

I. Introduction

Work on human capital theory by Mincer (1974), Becker (1975), Rosen (1978), and many others provided economics with a powerful theory of income inequality. Nevertheless, until the work of Becker and Tomes (1979, 1986), economics did not have a powerful explanation of how economic inequality is transmitted across generations.

I enjoyed valuable comments on this and related work from Xavier Sala-i-Martin, my dissertation committee (Nancy Stokey, Bob Lucas, and Gary Becker), Sam Bowles, Arthur Goldberger, Jim Heckman, Larry Kotlikoff, Steve Pischke, Sherwin Rosen, Steve Stigler, an anonymous referee, and seminar participants at Columbia, the National Bureau of Economic Research, Stockholm University, the University of California at Los Angeles, the University of Chicago, and the University of Virginia. Derek Neal generously shared comments and a sample from the NLSY. José Scheinkman suggested the testing of implication vii. Song Han and Irina Zavina provided both comments and research assistance.

[*Journal of Political Economy*, 1999, vol. 107, no. 6, pt. 2]
 0022-3808/1999/10706S-0017$02.50

The basic Becker-Tomes model has since become a workhorse in economics, used to explain the distribution of income across families,[1] across regions (Barro and Sala-i-Martin 1992), and across countries (Mankiw, Romer, and Weil 1992; Barro, Mankiw, and Sala-i-Martin 1995).

Goldberger (1989) points out that other fields produced a model of intergenerational mobility ahead of economics. A simple and believable model dates back at least to Francis Galton (1877). Galton argued that a person's characteristics are positively correlated with those of his parents. However, personal characteristics also ''regress to mediocrity'' so that, on average, the personal characteristics of a child are less extreme (i.e., closer to the mean) than those of his parents. Although Galton (1889) often had anatomical characteristics such as height, weight, and eye color in mind, he also applied the model to economic characteristics.[2]

Goldberger (1989) suggests that the Becker-Tomes approach may not offer predictions that are distinct from Galton's approach. Han and Mulligan (1997) and Mulligan (1997) show that, without some auxiliary assumptions, the Becker-Tomes model does look a lot like Galton's model. This paper makes the necessary auxiliary assumptions and derives several distinct implications of the human capital approach. Referring to both new and old empirical results, I show that these implications receive very limited support from the data. I conclude by suggesting how recent extensions of economic analysis by Becker and others might be applied to the problem of intergenerational mobility to generate new and accurate predictions. An Appendix is attached to the paper displaying characteristics of my samples from the Panel Study of Income Dynamics and the National Longitudinal Study of Youth.

II. Galton's Predictions

Galton's (1877) model can be represented as a simple equation:

$$X^i_{t+1} = \alpha + \beta X^i_t + \epsilon^i_{t+1}, \quad \beta \in (0, 1), \tag{1}$$

where subscripts denote generations and superscripts denote family names; X denotes an adult personal characteristic such as height,

[1] Their borrowing constraints assumption is at the center of several other economic models of intergenerational mobility including Loury (1981), Tamura (1991), Glomm and Ravikumar (1992), Bénabou (1994), and Durlauf (1996).

[2] Galton (1889) estimated numerical degrees of regression of only anatomical characteristics. However, his work did include quantitative comparisons of the ''success'' or ''eminence'' of relatives (Galton 1869).

years of schooling, log earnings, or log income; and ϵ represents determinants of personal characteristics that are uncorrelated with parental personal characteristics. Galton (1877, p. 282) suggested that the appropriate model of inheritance has $\beta \in (0, 1)$, and his book on *Natural Inheritance* (1889) estimated β for heights to be about $^2/_3$ when X_t was measured as an average of maternal and paternal characteristics and (because mother's and father's heights were not correlated in his sample) $^1/_3$ when X_t was measured as a single parent's characteristic.[3] Indeed, he even suggested that the same $^2/_3$ dictates the inheritance of any personal characteristic (1889, p. 159).

Three predictions can be derived from Galton's model. First, because $\beta \in (0, 1)$, equation (1) says that an adult child's personal characteristic is positively correlated with that of his parent but, on average, his characteristic is *closer to the population mean*. Second, Galton (1877) emphasizes that cross-sectional inequality (measured by the variance of X_t, e.g.) can be stable over time. In fact, under the assumption that the ϵ's are drawn from the same distribution every generation, there is a *single long-run level of inequality* that is approached over time from any initial conditions. Secular trends in cross-sectional inequality that persisted for many generations would seem to be inconsistent with Galton's model. Third, without amending the theory to predict variation in the parameter α, the Galton model also predicts that *intergenerational mobility is the same within and across groups*. To see this, consider selecting two groups from the population according to the parental characteristic X_t. High-X_t families are more likely to appear in group A whereas low-X_t families are more likely to appear in group B. As long as each group's average ϵ_{t+1} is uncorrelated with its X_t, it is easy to aggregate equation (1) to show that group averages evolve according to a model that is like the micro model (1), with the same parameters α and β! Because $\beta < 1$, this aggregation result also implies that inequality across groups falls over time according to the parameter β even though overall inequality may be stable or even rising over time.

[3] Galton averaged the height of mother and father (adjusting for the fact that women are usually shorter than men) to construct the parental variable. Because much of the empirical literature does not do such averaging, there will not be similar ''midparental'' calculations for economic variables. I ignore the distinction for the remainder of the paper. In later work, Galton (1889, 1890) analyzed a regression equation like (1) but measured characteristics in percentiles or z scores and applied the analysis to a variety of bivariate relationships, not just parent-child comparisons. My reference to ''the Galton model'' is more precisely a reference to his heredity model (1) (Galton 1877), with personal characteristics measured in natural metrics rather than as percentiles or z scores.

TABLE 1

STUDIES OF THE INTERGENERATIONAL PERSISTENCE OF SOME ECONOMIC CHARACTERISTICS

Economic Characteristic	Number of Estimates	Range	Average
1. Years of schooling	8	.14–.45	.29
2. Log earnings or wages	16	.11–.59	.34
3. Log family income	10	.14–.65	.43
4. Log family wealth	9	.27–.76	.50
5. Log family consumption	2	.59–.77	.68

NOTE.—The studies surveyed include Soltow (1965), de Wolff and van Slijpe (1973), Olneck (1977), Harbury and Hitchens (1979), Menchik (1979), Atkinson, Maynard, and Trinder (1983), Behrman and Taubman (1985), Wahl (1985), Kearl and Pope (1986), Smith and Welch (1986), Peters (1992), Barro and Sala-i-Martin (1992), Solon (1992), Zimmerman (1992), Borjas (1994), Lillard and Willis (1994), Couch and Dunn (1995), and Mulligan (1997). See Mulligan (1997, chap. 7) for more details.

A. Regression to the Mean of Economic Characteristics

Five tables from Mulligan (1997) that survey empirical estimates of equation (1) from the economics literature are summarized in table 1. The first row of the table summarizes eight estimates of β when years of schooling is the measured personal characteristic.[4] In the eight estimates surveyed, samples are drawn from the United States, Germany, Malaysia, and Kalamazoo, Michigan. Point estimates range from 0.14 to 0.45, with a cross-study average of 0.29.

Among studies of the intergenerational persistence of log earnings (or log wages), point estimates of β range from 0.11 to 0.59, with a cross-study average of 0.34—quite similar to Galton's $\frac{1}{3}$ estimate for heights. Rows 3 and 4 of table 1 summarize estimates of β when log income or log wealth is the measured characteristic. Point estimates range from 0.14 to 0.65 for income and from 0.27 to 0.76 for wealth. Mulligan (1997) obtains estimates of 0.59 and 0.77 for consumption.

B. The Evolution of Inequality

Has the amount of inequality trended over long periods of time? Williamson and Lindert (1980) suggest that U.S. wealth inequality today is not very different from wealth inequality in 1776. Others (e.g., Soltow 1989) have disputed Williamson and Lindert, suggesting that contemporary America is substantially more equal. Lindert (1986) reports measures of British wealth inequality that

[4] Table 1 does not attempt to thoroughly survey the literature on intergenerational schooling mobility.

have fallen over the past two or three hundred years. Considering the sizable problem of measuring inequality over long time periods, these are mixed results for the simplest version of Galton's model (1).

C. *Intergenerational Mobility within and across Groups*

Mulligan (1997, chaps. 6, 7) considers ''groups'' as ''whites'' and ''blacks,'' or ''northerners'' and ''southerners,'' or ''rich countries'' and ''poor countries,'' or ''ethnic groups'' and argues that—although even Galton (1869) appears to believe that a more complicated model is required to understand cross-group inequality—the evidence is consistent with the strong prediction from the simple Galton model (1) that the same parameter β measuring intergenerational mobility within groups also measures intergenerational mobility across groups.

III. The Human Capital Approach

The ''human capital'' model of inheritance appears in many places in the economics literature, but I refer directly to two papers by Becker and Tomes (1979, 1986). The earlier paper actually introduces a simpler version of the model, which I call the ''intergenerational permanent income model''; the later paper complicates the earlier with a ''borrowing constraint.'' My version of the model is very much in the spirit of Becker and Tomes (1979, 1986), but I explicitly introduce uncertainty, derive several additional results, and discuss the importance of auxiliary assumptions, showing how they are related to results reported elsewhere in the human capital literature.

A. *Setup of the Model*

Becker and Tomes (1979, 1986) admit that biological and other mechanical considerations are important for understanding the intergenerational transmission of inequality. However, they insist that economic forces are at work as well. They begin by assuming that earnings ''ability'' or ''endowments'' are transmitted across generations in an exogenous way, perhaps according to Galton's model (1). An adult child's ability affects his or her lifetime earnings e_{t+1}, but so do the human capital investments h_{t+1} made by parents. Equation (2) formulates the determination of earnings, partitioning the ability of a child into two components, B_{t+1} and λ_{t+1}:

$$e_{t+1} = e(h_{t+1}, B_{t+1}, \lambda_{t+1}) = B_{t+1}\lambda_{t+1}h_{t+1}^{\nu}, \quad \nu \in [0, 1], \tag{2}$$

where ν is a constant. Labor supply is exogenous, so ability and human capital are the only determinants of earnings. I assume that the value of B_{t+1} is known by parents when they make decisions that affect children but λ_{t+1} is unknown. The variable λ_{t+1} formalizes the idea that parents cannot perfectly anticipate what the adult earnings of their children will be or how human investments might affect earnings.[5]

Parents begin with resources I_t, which are a combination of lifetime earnings and financial transfers that they received from their parents. Parents spend I_t on three items: their own lifetime consumption c_t, financial transfers to their child x_{t+1}, and investments in the human capital of their child h_{t+1}. The parental budget constraint is therefore

$$I_t = (1 + r_t)x_t + e_t = c_t + x_{t+1} + h_{t+1}. \tag{3}$$

A child may also enjoy income from two sources: lifetime earnings and financial transfers from his parents. He spends his income on his own lifetime consumption c_{t+1}. Equation (4) displays the child's budget constraint:

$$I_{t+1} = (1 + r_{t+1})x_{t+1} + e_{t+1} = c_{t+1}. \tag{4}$$

I assume for simplicity that there are only two generations (there are no grandchildren to receive transfers from children). The main results can be generalized to a many-generation model.[6]

The rate of return on financial assets has an anticipated component $1 + r$ and an unanticipated component χ_{t+1}:

$$1 + r_{t+1} = (1 + r)\chi_{t+1}. \tag{5}$$

The shocks λ and χ are assumed to be jointly normally distributed and uncorrelated with B_t and I_t; B_{t+1} and I_t may be correlated with each other.

Parents choose human capital investments h_{t+1} and financial transfers x_{t+1} with the intention of maximizing the consumption of parents and children. *Consumption* is the motivating force for the Becker-Tomes economic agents, who have the following objective function:[7]

[5] Becker and Tomes (1986) do not explicitly model uncertainty, but their discussion on p. S22 is consistent with my formulation.

[6] Becker and Tomes (1979) obtain identical results for a many-generation model by assuming that the relevant utility function is $u(c_t, I_{t+1})$, where u is a homothetic function.

[7] For $\sigma = 1$, the objective function is $\ln c_t + \alpha E[\ln c_{t+1}]$.

$$\frac{\sigma}{\sigma - 1} c_t^{(\sigma-1)/\sigma} + \alpha \frac{\sigma}{\sigma - 1} E[c_{t+1}^{(\sigma-1)/\sigma}], \quad \sigma, \alpha > 0, \tag{6}$$

where the expectations operator represents the integral over all possible realizations of the shocks (λ, χ), weighting by the density.

There are two versions of the Becker-Tomes model. In both versions, parents can affect the consumption allocation of the family in two ways. First, they can adjust their human capital investments, changing the adult earnings of a child. Parents can also transfer financial resources to their children. But in the 1986 version of their model, they cannot borrow against the earnings of children:

$$x_{t+1} \geq 0. \tag{7}$$

The first version is essentially an intergenerational version of Friedman's (1957) life cycle permanent income hypothesis because it places no restrictions on the ability of parents to borrow against the earnings potential of their children. The second version—and the version that Becker and Tomes (1986) seem to prefer—does not allow parents to borrow against the earnings potential of their children.

B. Five Auxiliary Assumptions

The functional form assumptions made above are not crucial for the results, but five auxiliary assumptions are needed to obtain clear predictions: (*a*) $\lambda = \chi$, (*b*) the efficient human capital investment does not vary too much, (*c*) few enough families are borrowing constrained, (*d*) preferences do not vary too much across families, and (*e*) σ is sufficiently large and ν sufficiently small.

Han and Mulligan (1997) show that, without these auxiliary assumptions, it is hard to distinguish the human capital model from Galton's model of inheritance. Without defending these assumptions, the present paper shows that they can be used to derive implications that are distinct from Galton's and then looks at some of the evidence that might verify or refute those predictions.

To see the utility of assumption *a*, consider some results relating to the chosen human capital investment. In the intergenerational permanent income model—and in the borrowing constraint model in families for which the borrowing constraint does not bind—parents make the ''efficient'' human capital investment h_{t+1}^*. The investment h_{t+1}^* equates the risk-adjusted expected returns on human capital and financial investments:

$$E[\lambda_{t+1} c_{t+1}^{-1/\sigma}] \frac{\partial (B_{t+1} h_{t+1}^{\nu})}{\partial h} \Bigg|_{h_{t+1}^{*}} = E[\chi_{t+1} c_{t+1}^{-1/\sigma}](1 + r).$$

If $\chi \neq \lambda$, then the analysis must include a consideration of the different risk adjustments for human ($E[\lambda c^{-1/\sigma}]$) and financial investment ($E[\chi c^{-1/\sigma}]$). Since these differential risk adjustments have not been considered in the literature and their effects are not obvious, I abstract from them and set $\chi = \lambda$. This means that the efficient human capital investment depends *only* on r and the child's ability B_{t+1}; it does not depend on parental income. If B_{t+1} is correlated with parental income, this result still holds, but we would observe a correlation between e_{t+1} and I_t. When the borrowing constraint binds, actual human capital investments are less than h_{t+1}^{*} and will be related to parental income.

The utility of assumptions *b*–*e* is made clear as we derive more predictions of the model.

C. *Borrowing-Constrained and Unconstrained Families*

Equations (2), (3), (4), and (5) can be combined to form a single intergenerational budget constraint for the permanent income model:

$$c_{t+1} = [e_{t+1}^{*} + (1 + r_{t+1})(I - h_{t+1}^{*})] - (1 + r_{t+1}) c_t, \tag{8}$$

where h_{t+1}^{*} is the ''efficient'' human capital investment and e_{t+1}^{*} is the corresponding level of earnings for the child, defined as

$$e_{t+1}^{*} \equiv B_{t+1}^{1/(1-\nu)} \left(\frac{\nu}{1 + r} \right)^{\nu/(1-\nu)} \lambda_{t+1}.$$

If the borrowing constraint $x_{t+1} \geq 0$ is imposed, the intergenerational budget constraint (8) applies only for $c_{t+1} \geq e_{t+1}^{*}$. For $c_{t+1} < e_{t+1}^{*}$, the earnings technology $e(h, B, \lambda)$ dictates the possibilities for a family to transfer consumption between parents and child:

$$c_{t+1} = e(I_t - c_t, B_{t+1}, \lambda_{t+1}). \tag{9}$$

Unlike the permanent income intergenerational budget constraint, this segment of the budget constraint is not linear because the slope of the earnings function with respect to h is not the same for all levels of h. Combining the constraint (8) for $c_{t+1} \geq e_{t+1}^{*}$ and the constraint (9) for $c_{t+1} < e_{t+1}^{*}$, we have for each λ an intergenerational budget constraint in the $[c_t, c_{t+1}]$ plane with a linear segment above the vertical position $c_{t+1} = e_{t+1}^{*}$ and a curved segment below $c_{t+1} = e_{t+1}^{*}$.

It is useful to think about two mutually exclusive groups of families

in the borrowing constraint model (Runkle [1991] does a similar partition in his study of life cycle savings). Group 1 includes parents making financial transfers to children ($x_{t+1} > 0$): $(I_t, B_{t+1}) \in \Delta$. Group 2 includes parents not making financial transfers to children ($x_{t+1} = 0$): $(I_t, B_{t+1}) \notin \Delta$.

Because group 1 and group 2 are distinguished according to their chosen financial transfer, they can be referred to as ''the unconstrained'' and the ''borrowing constrained'' or ''families participating in financial markets'' and ''families not participating in financial markets.'' It can also be useful to designate group 1 by the values of the exogenous variables (I_t, B_{t+1}). Given the constants of the problem, there exists a subset Δ of the $[I_t, B_{t+1}]$ plane such that all unconstrained families have $(I_t, B_{t+1}) \in \Delta$ and all constrained families have $(I_t, B_{t+1}) \notin \Delta$.

D. *Intergenerational Consumption Mobility*

To understand the intergenerational dynamics of consumption inequality in the two models, it is useful to derive the expansion paths in the $[c_t, c_{t+1}]$ plane. Analytical solutions are available in my formulation of the model. The intergenerational permanent income model has

$$\ln c_{t+1} = \left[\sigma \ln \alpha + \sigma \ln(1 + r) + \sigma\mu_\lambda + \frac{\sigma}{2}\left(\frac{\sigma - 1}{\sigma}\right)^2 \sigma_\lambda^2\right] + \ln c_t + \epsilon_{t+1}.$$

The borrowing constraint model has

$$\ln c_{t+1} = \begin{cases} \left[\sigma \ln \alpha + \sigma \ln(1 + r) + \sigma\mu_\lambda + \frac{\sigma}{2}\left(\frac{\sigma - 1}{\sigma}\right)^2 \sigma_\lambda^2\right] + \ln c_t + \epsilon_{t+1} & \text{if } (I_t, B_{t+1}) \in \Delta \\ \beta\left[\sigma \ln \alpha + \sigma \ln(1 + r) + \sigma\mu_\lambda + \frac{\sigma}{2}\left(\frac{\sigma - 1}{\sigma}\right)^2 \sigma_\lambda^2\right] + (1 - \beta)\ln e_{t+1}^* + \beta \ln c_t + \beta\epsilon_{t+1} & \text{if } (I_t, B_{t+1}) \notin \Delta, \end{cases}$$

$$\beta \equiv \frac{\nu}{\nu + \sigma(1 - \nu)}, \quad \epsilon_{t+1} \equiv \ln \lambda_{t+1} - E[\ln \lambda_{t+1}],$$

$$\Delta \equiv \left\{(I, B) \,|\ln I - \frac{1}{1 - \nu} \ln B \geq \ln\left[1 + \frac{(\alpha\mu)^{-\sigma}(1 + r)^{1-\sigma}}{\nu}\right] - \frac{1}{1 - \nu} \ln \frac{1 + r}{\nu}\right\};$$

TABLE 2

IMPLICATIONS OF THE HUMAN CAPITAL APPROACH

i.	Consumption does not regress to the mean among families that participate in financial markets
ii.	Consumption regresses to the mean less rapidly than earnings if enough families participate in financial markets
iii.	Consumption regresses to the mean (in percentage terms) across generations if some families are borrowing constrained. Consumption regresses to the mean less rapidly and consumption inequality grows more rapidly among families that participate in financial markets
iv.	Earnings regress to the mean (in percentage terms) across generations but more rapidly among families that participate in financial markets
v.	Earnings of adult children are more equal among families that participate in financial markets
vi.	Human capital investments are less correlated with parental income among ''unconstrained'' families
vii.	Greater public provision of schooling increases intergenerational earnings mobility and decreases intergenerational consumption mobility
viii.	Financial transfers from parents to children are more likely in families in which children earn more
ix.	With parental human capital investments held constant, adult children with richer parents should earn less

$(I_t, B_{t+1}) \in \Delta$ if and only if $x_{t+1} > 0$; μ_λ and σ_λ denote the mean and standard deviation of $\ln \lambda$.

In the permanent income model, the expansion path is linear so that parental consumption differences that are associated with parental income differences (rather than parental differences in α and r) do not regress to the mean in percentage terms across families in the permanent income model. The same is true for unconstrained families in the borrowing constraint model. If we assume either that α and r are the same for all families or that they are observed by an econometrician, a regression of $\ln c_{t+1}$ on $\ln c_t$ (and perhaps controls for cross-family differences in α and r) should yield a coefficient of one in a sample of families making financial transfers. This is result i (see table 2) from the human capital approach that is different from the Galton model.

This result requires some of the auxiliary assumptions. Suppose that α and r vary across families and are unobservable to the econometrician but, in the spirit of the Becker-Tomes model, fail to be negatively correlated with parental income.[8] In this case, we have a slightly modified result for the permanent income model: a regres-

[8] One might argue, as Mulligan (1997) does, that altruism α and the financial rate of return r vary across families in a way that is correlated with parental income. However, the basic Becker and Tomes model is about the way in which borrowing constraints and the human capital investment process affect intergenerational mobility rather than forces that determine α and r.

sion of ln c_{t+1} on ln c_t should yield a coefficient of at least one when parental income is used as an instrument for ln c_t. However, with enough heterogeneity in α or r, the regression coefficient may be less than one for a sample of group 1 families in the borrowing constraint model because group 1 is not a representative sample with respect to α and r. The magnitude of this ''selection bias'' is larger when group 1 is relatively small and larger when there is greater unobserved variation in α or r relative to parental income.[9]

Adult child earnings in the permanent income model are identically equal to the level of earnings e^*_{t+1} associated with the ''efficient'' human capital investment h^*_{t+1}. Because e^*_{t+1} is a function of ability and ability regresses to the mean according to a Galton-type process (1), earnings regress to the mean in the permanent income model. Although the permanent income model of earnings is equivalent to a Galton model, when combined with result i, it produces the unique prediction ii: if few enough families are borrowing constrained, consumption regresses to the mean across generations less rapidly than earnings.

If the efficient human capital investment does not vary across families, it is easy to show that consumption regresses to the mean across group 2 families in the borrowing constraint model. Auxiliary assumption *e* implies that the slope of the expansion path is $\beta < 1$. The assumed homogeneity of B_{t+1} among group 2 families implies that there is no omitted variable bias or selection bias. This gives us result iii: that consumption regresses to the mean in percentage terms in the borrowing constraint model, and more rapidly in group 2.

Because the ratio c_{t+1}/c_t is independent of income or wealth for families that participate in the financial market, log consumption follows a random walk as long as the families remain participants. Over time, some families (by luck) attain higher and higher consumption levels, and consumption inequality grows among financial market participants. Some group 1 families in the borrowing constraint model will eventually join group 2 and some group 2 families will join group 1. This group switching can be enough to produce a stable distribution of consumption for the entire population.[10] Because, by assumption, all families participate in financial markets in the permanent income model, the cross-sectional variance of log consumption is predicted to grow over time in that model.

[9] Han and Mulligan (1997) and Mulligan (1997, chaps. 3, 8) discuss the selection bias more extensively.

[10] To obtain a stable distribution, the constant term in the expression for the expansion path must be sufficiently small. See Laitner (1992) or Navarro-Zermeno (1993) for a discussion.

E. Intergenerational Earnings Mobility

A closed-form solution for e_{t+1} is not available for the borrowing constraint model. However, one can be derived in terms of an implicit function $H(I_t, B_{t+1})$ whose derivatives can be computed analytically: for the borrowing constraint model,

$$\ln e_{t+1} = \begin{cases} -\frac{\nu}{1-\nu}\ln(1+r) + \frac{1}{1-\nu}\ln B_{t+1} + \frac{\nu}{1-\nu}\ln\nu + \mu_\lambda + \epsilon_{t+1} & \text{if } (I_t, B_{t+1}) \in \Delta \\ \ln H(I_t, B_{t+1}) + \mu_\lambda + \epsilon_{t+1} & \text{if } (I_t, B_{t+1}) \notin \Delta, \end{cases}$$

$$\frac{\partial \ln H}{\partial \ln B_{t+1}} < \frac{1}{1-\nu},$$

$$\frac{\partial \ln H}{\partial \ln I_t} = \frac{I_t}{I_t - [H(I_t, B_{t+1})/B_{t+1}]^{1/\nu}}\beta > 0.$$

The earnings in the borrowing constraint model are more persistent in group 2. To see this, first notice that, according to auxiliary assumption *b*, B_{t+1} varies little across families relative to I_t; I_t (and therefore e_t) is thereby a relatively poor predictor of e_{t+1} for group 1 families but a better predictor for group 2 families for which I_t is a direct determinant of e_{t+1}.

We can also show result v: that earnings are more unequal among the adult children of borrowing-constrained families. From the expression for $\ln e_{t+1}$, the variance of log earnings is approximately

$$\nu(\ln e_{t+1}) \approx \begin{cases} \frac{1}{(1-\nu)^2}\nu(\ln B_{t+1} | (I_t, B_{t+1}) \in \Delta) + \nu(\epsilon_{t+1}) & \text{if } (I_t, B_{t+1}) \in \Delta \\ \left(\frac{\partial \ln H}{\partial \ln B_{t+1}}\right)^2 \nu(\ln B_{t+1} | (I_t, B_{t+1}) \notin \Delta) + \nu(\epsilon_{t+1}) & \\ + \left(\frac{\partial \ln H}{\partial \ln I_t}\right)^2 \nu(\ln I_t | (I_t, B_{t+1}) \notin \Delta) & \text{if } (I_t, B_{t+1}) \notin \Delta \\ + 2\left(\frac{\partial \ln H}{\partial \ln I_t}\frac{\partial \ln H}{\partial \ln B_{t+1}}\right) c(\ln I_t, \ln B_{t+1} | (I_t, B_{t+1}) \notin \Delta). & \end{cases}$$

The gap between group 1 and group 2 inequality depends on the B_{t+1} inequality within each group. However, parental income inequality contributes to earnings inequality among group 2 families but not among group 1. As parental income inequality becomes important relative to inequality in the efficient human capital investment, group 2 earnings equality becomes relatively large.

If ability and the efficient human capital investment are not too variable across families, human capital investments are less correlated with parental income among ''unconstrained'' families. To see this, consider the formula for the chosen human capital investment:

$$\ln h_{t+1} = \begin{cases} -\frac{1}{1-\nu}\ln(1+r) + \frac{1}{1-\nu}\ln B_{t+1} + \frac{1}{1-\nu}\ln \nu & \text{if } (I_t, B_{t+1}) \in \Delta \\ \frac{1}{\nu}\ln H(I_t, B_{t+1}) - \frac{1}{\nu}\ln B_{t+1} & \text{if } (I_t, B_{t+1}) \notin \Delta. \end{cases}$$

If B_{t+1} does not vary much across families or is not highly correlated with parental income, then the equation above shows that the correlation between $\ln h_{t+1}$ and $\ln I_t$ is higher for group 2 families.

According to results iii and iv, the presence of a borrowing constraint increases intergenerational consumption mobility and decreases intergenerational earnings mobility. To the extent that the public provision of schooling allows children from borrowing-constrained families to achieve higher levels of schooling by alleviating the borrowing constraint, the borrowing constraint model predicts result vii: Greater public provision of schooling increases intergenerational earnings mobility and decreases intergenerational consumption mobility.

Results iv–vii obviously depend heavily on the auxiliary assumption *b*.[11] If *b* were not true, the human capital approach would have fewer predictions that are distinct from Galton's. Furthermore, a large variance of B_{t+1} relative to the variance of I_t means that *low*-earnings children in the borrowing constraint model receive greater financial transfers because the condition for receiving a financial transfer is $c_{t+1} > e^*_{t+1}$. Thus I emphasize result viii of the human capital approach and its auxiliary assumptions: Financial transfers from parents to children are more likely in families in which children earn more.

[11] Tomes (1981, p. 928), Becker and Tomes (1986, p. S37), and Becker (1989, p. 515) do suggest that they believe results iv and vi to be fairly general. They do not discuss result v.

F. Human Capital, Ability, and Family Background

In this subsection, I consider a group of adult children whose parents made the same human capital investments. How are earnings related to parental income among this group of adult children?

As I have specified them, the permanent income and Galton models of earnings are equivalent one-dimensional models and are thereby ill suited for answering this question. Consider a more general model with two dimensions of ''ability'' determining earnings. In the permanent income model, one dimension of ability might shift the earnings function whereas another determines the efficient (and actual) human capital investment.[12] Denote these two dimensions B_{t+1} and B^*_{t+1}, respectively, and let them be positively correlated with each other and their corresponding values in the parental generation, B_t and B^*_t.

In the permanent income and Galton models, every adult child in a group with the same human capital investment—by definition—must have the same ability along the dimension of ability that determines the efficient human capital investment (B^*_{t+1}). If this were the only dimension of earnings ability, then every adult child in the same group has the same anticipated earnings; earnings are therefore unrelated to parental income within the group.[13] With anticipated earnings determined by both dimensions of ability, the dimension B_{t+1} (and therefore anticipated earnings) would not necessarily be the same for all adult children in the group. Because B_{t+1} is positively correlated with B^*_t and B_t (the two dimensions of parental ability), the earnings of adult children are positively related to parental income within a group of adult children whose parents made the same human capital investments.

Now consider constrained families in the borrowing constraint model. Actual human capital investments are less than efficient human capital investments, with the gap determined by parental in-

[12] In one example of such a two-dimensional ability model, one dimension of ability would shift the earnings function in an additive way (leaving the slope of the earnings function—and therefore the efficient human capital investment—unchanged), whereas a second would affect the slope of the earnings function. To the extent that men earn more than women but schooling and other human capital investments do not *increase* earnings at different rates for the two genders, gender may be an example of the first ability dimension. Intelligence quotient, ''learning ability,'' and ''scholastic aptitude'' are examples of the second dimension of ability because these abilities are often associated with more effective schooling investments.

[13] If observed earnings were determined by ability plus measurement and forecast errors (λ is an example of a forecast error), earnings would not necessarily be identical for each child. If the measurement and forecast errors were uncorrelated with parental income, it would still be true that observed earnings are unrelated to parental income within the group.

come. Simple closed-form solutions are not available for the more general model, but I can display formulas for earnings and human capital investments up to a linear approximation:

$$\begin{aligned} \ln e_{t+1} &= a \ln B_{t+1} + b \ln B^*_{t+1} + c \ln h_{t+1} + \epsilon_{t+1}, \\ \ln h_{t+1} &= d \ln B^*_{t+1} + f \ln I_t, \quad a, b, c, d, f > 0. \end{aligned} \tag{10}$$

The first equation follows from the fact that, in this more general model, earnings depend on the two dimensions of anticipated ability B_{t+1} and B^*_{t+1}, on human capital h_{t+1}, and on the shock ϵ_{t+1}. The second equation approximates the decision rule of constrained families: more human capital is invested when the efficient level is higher or when family income is higher.

The equations (10) can be used to derive the following expression for earnings as a function of human capital and parental income:

$$\ln e_{t+1} = a \ln B_{t+1} - \frac{b}{d} f \ln I_t + \left(c + \frac{b}{d} \right) \ln h_{t+1} + \epsilon_{t+1}. \tag{11}$$

Notice that human capital is related to earnings for two reasons: human capital directly increases earnings ($c > 0$), and more able people enjoy greater human capital investments ($b/d > 0$).

Among a group of adult children whose parents made the same human capital investments, the efficient human capital investment and its corresponding dimension of earnings ability B^*_{t+1} are highest for children of poor parents and lowest for children of rich parents. If B^*_{t+1} were the only dimension of earnings ability ($a = 0$), earnings of adult children would clearly be *negatively* related to parental income within a group of adult children whose parents made the same human capital investments. Families with low parental income appear in the group only because human capital investments in children have relatively high returns (i.e., highly able children) whereas families with high parental income appear in the group because human capital investments in children have relatively low returns (i.e., less able children).

But there are two dimensions of ability, and this unique implication of the borrowing constraint model is weakened because the second dimension of ability B_{t+1} is associated with high earnings of adult children and may be positively correlated with B^*_t and B_t (and therefore with parental earnings and income). However, with the auxiliary assumption maintained throughout the paper—that ability is a relatively unimportant determinant of earnings—this second effect is limited, and we can expect a negative partial correlation of e_{t+1} and I_t whose magnitude is related to the ratio b/d. We have result ix:

When parental human capital investments are held constant, adult children with rich parents should earn less.

Equations (10) and (11) show that b/d measures the ''reverse causation'' or ''self-selection'' component of the correlation between earnings and human capital—that more able people enjoy greater human capital investments. In Section IV*E*, I try to obtain information about the magnitude of b/d from the literature on education, earnings, and ability such as Griliches and Mason (1972) and Willis and Rosen (1979).

IV. Tests of the Uniquely Economic Predictions

This section presents evidence on the nine uniquely economic predictions of the Becker-Tomes model from the literature as well as from my own calculations using the Panel Study of Income Dynamics (PSID), the 1989 Survey of Consumer Finances (SCF), and the National Longitudinal Study of Youth (NLSY). Two of my data sets as well as one used in the literature permit the isolation of a group of families that are very unlikely to be borrowing constrained as defined by Becker and Tomes (1986).

A. Results from the Literature

That implication ii and part of implications iii and iv have been verified in a variety of studies can be seen in table 1, which shows that both consumption and earnings regress to the mean but consumption regresses more slowly. It is not surprising from the point of view of either the Galton or human capital approaches that consumption and earnings regress to the mean across generations. Perhaps more surprising is the very slow rate of regression to the mean of consumption.

An implication of the permanent income version of the Becker-Tomes model—that the variance of log consumption grows over time—seems to be refuted by the little evidence that we have. The relevant time frame is centuries because the Becker-Tomes model is an intergenerational model, but it does not appear that consumption inequality has been growing in the United States or the United Kingdom over the past two or three hundred years.

Tomes (1981) uses a probate data set that allows him to separate his sample into groups 1 and 2 and tests implication vi, that parental human capital investments are more highly correlated with parental income in group 2. Using years of schooling as a measure of human capital, he verifies the prediction, finding a stronger correlation between an adult child's educational attainment and his or her par-

ent's income for children not receiving a financial inheritance. Mulligan (1997, chap. 8) verifies the prediction using the same samples that are used to analyze consumption and wages in table 3 below. The question remains, Why do the different group 1 and group 2 effects of parental income on schooling fail to show up as different effects of parental income on wages? Tomes's and related results may be artifacts of the top-coding of measured human capital investment at 16 or 18 years of schooling.

There is a related literature on the sensitivity of schooling decisions to the amount of tuition charged and whether that sensitivity varies with parental income.[14] Conflicting results have been reported. Furthermore, it is not clear what the Becker-Tomes model predicts for the relationship between tuition, schooling, and parental income.

In my derivation of result vii, I ignore the tax side of public schooling. The taxes used to finance public schooling might have an effect on intergenerational mobility regardless of the importance of borrowing constraints. Cooper (1996) studies intergenerational income mobility and offers some analysis of the tax side of the problem, using a ''redistribution'' variable that measures the extent to which local school districts use state government funds. The hypothesis of no interaction between ''redistribution'' and parental income in an equation for child's income can be rejected at standard significance levels. However, it is difficult to compare the Cooper results with the predictions of the Becker-Tomes model. First, the model has very different predictions for wage and consumption mobility, but Cooper measures income, which is not exactly wages and not exactly consumption. Second, income is divided by ''needs,'' with needs a function of family size. The Becker-Tomes predictions for this normalized income variable are more complicated. Third, Cooper's interaction results imply that moderate differences in the redistribution variable are associated with intergenerational persistence coefficients of two or three (remember that Becker-Tomes and Galton predict a coefficient between zero and one)! Below I report some additional results that might facilitate a comparison with the predictions of the Becker-Tomes model.

B. Data Description

My first data set is drawn from the 1968–89 waves of the PSID (both the Survey Research Center [SRC] and Survey of Economic Oppor-

[14] See Kane (1994) and Cameron and Heckman (1996) for references and some recent results.

tunity samples) and exploits the PSID's practice of continuing to interview sample members even when they split off from households in the original wave. For example, suppose that a 10-year-old girl was part of a 1968 wave family. She turned 25 in 1983 and married a 30-year-old man with two children. If she lives with these three people, then information about each of them is included in the PSID. It is the children from the original wave of the PSID who, in later waves, form their own households (such as the woman in my example) that make up my intergenerational samples. These adult children are particularly interesting because we know a lot about their economic activity *and* have many years of data on their parents.

A lot of information is gathered on each PSID family, including age, earnings, schooling, employment, income, housing, and certain expenditures. I also use information from two special waves of the PSID—1984 and 1989—which inquired about wealth. Because I focus on PSID children who eventually form their own households, all of this information is available for both the adult children and their parents. I use the information to construct measures of the economic status of parents in the years 1967–72 and measures of the economic status of the adult children nearly 20 years later—1984–89.

Mulligan (1997) discusses all the details of the construction of samples and the computation of income and other variables. I offer here a somewhat detailed explanation of only one measurement issue that I believe to be the most important for this study: the measurement of consumption. It is the assumption that consumption by parents and children is what motivates behavior that generates the uniquely economic implications, but (to my knowledge) consumption is measured in no empirical studies of intergenerational mobility. I estimate the consumption of a father (or child) and his family. The PSID provides data on a household's expenditures on food for consumption at home, food eaten out, rent, mortgage payments, property taxes, and utilities. My primary measure is constructed as a weighted average of food at home, food away from home, rent, and the value of the family's house. This weighted average is a measure of nondurable consumption because the weights are taken from a regression, using data from the Consumer Expenditure Survey, of nondurable consumption on food at home, food away from home, rent, and the value of the family's house.[15]

[15] The Consumer Expenditure Survey regressions are reported in Skinner (1987). The 1972–73 survey was used to generate the weights for father's consumption and the 1983 survey for children's consumption, but father's weights are quite similar to those used for the children. The two regressions of nondurable consumption using Consumer Expenditure Surveys have $\bar{R}^2 = .724$ (1972–73) and $\bar{R}^2 = .680$

Both of these family measures differ from an individual's consumption. For example, it is not obvious how to correct for family composition. Children in my sample are at different stages of their life cycles: only some are married, and only some have children. My empirical models therefore include variables indicating the marital situations of parental and adult child households. With the idea that people choose to be married or to have children, I do not divide family expenditure by family size or by ''adult equivalents'' or by ''family needs.''

In order to get as close as possible to a lifetime measure, single-year measures are averaged over 1969–72 for fathers and over 1984–87 for adult children and then transformed to logarithms.[16]

I divide my PSID and SCF samples into two groups. Group 1 includes adult children who have received, or expect to receive, an inheritance of $25,000 or more. Group 2 includes adult children who have not received, and do not expect to receive, an inheritance of $25,000 or more.

According to a literal interpretation of the theory, groups 1 and 2 should be defined according to $x_{t+1} > 0$ and $x_{t+1} = 0$. A financial inheritance of $500 would place a family in group 1 according to the literal interpretation. This may not be a satisfactory way to map the data into the model because the *only* role for inheritances in the model is to provide for consumption by children. In reality, inheritances may serve other purposes. This may be especially true for very small inheritances, which, for example, may be received by children to pay funeral expenses of parents. I therefore define groups 1 and 2 according to $x_{t+1} \geq \$25{,}000$ and $x_{t+1} < \$25{,}000$.

The adult children in my PSID sample were in their thirties at the time they reported their inheritance or expectation of an inheritance. Some of these children, of course, are not expecting an inheritance but because of unforeseen circumstances may receive an inheritance later in life. Or some children may expect an inheritance but never actually receive one. Nevertheless, I believe that it is the *expectation* of an inheritance that is most relevant to the Becker-Tomes model. Remember that the purpose of measuring inheritances is to determine whether or not parents were borrowing constrained *when human capital investments were made for the children*. It is very likely that the parents of an adult child who, between the ages of 25 and 40, has received or expects to receive an inheritance were

(1983). Results with two other measures of consumption are reported in Mulligan (1997).

[16] My primary consumption measure cannot be constructed for 1988 and 1989 because, since 1988, the PSID questionnaire no longer inquires about expenditures on food and utilities.

not financially constrained when they were making human capital investments for the child. Because financial surprises can occur as parents and child age, it is less likely that the parents of an adult child of age 50 or 60 who receives or expects to receive an inheritance were financially unconstrained many years earlier when human capital investments for the child were made.

Mulligan (1997) shows that progressive estate taxes can modify some implications of the model. Although several adult children in my intergenerational PSID sample and my SCF cross-section samples have received or expected to receive inheritances in excess of $25,000, it is unlikely that more than a few were subject to the progressive federal estate tax.

In both the PSID and SCF samples, we can investigate the Becker-Tomes hypothesis that inheritances occur in families with high-earnings children.[17] High-earnings children are much more likely to receive an inheritance in both samples.[18] See Appendix tables A1 and A2 for other summary statistics of the group 1 and 2 PSID samples.

Subsection *E* uses statewide measures of public schooling quality. Children in my PSID sample are born in the years 1951–61 and typically graduate from high school between 1968 and 1978, so, whenever possible, I chose schooling quality measures for one of the years 1968–78. The measures are taken from the *Digest of Educational Statistics* (various issues) and the *Biennial Survey of Education in the United States* (various issues) and include public school pupil/teacher ratios (based on student enrollment and student attendance) for the school year 1969–70, the average annual salary of total instructional staff in full-time public elementary and secondary day schools for the school year 1969–70, current public elementary and secondary day school expenditure per pupil for the school year 1969–70, the fraction of elementary and secondary students in the state enrolled in private schools in the fall of 1970, average Scholastic Aptitude Test math and verbal scores for the school year 1974–75, and the fraction of high school graduates taking the SAT in 1990–91.

Subsection *F* studies the relationship between wages, schooling, and family background using the sample from the NLSY used by Neal and Johnson (1996). The NLSY is a panel data set of 12,686

[17] The SCF is especially well suited for this test because it oversamples rich families.

[18] Figure 8.4 in Mulligan (1997) shows that less than 20 percent of families with an annual income of less than $20,000 receive or expect to receive sizable inheritances, roughly 30 percent of families with an annual income of $20,000–$100,000 receive or expect to receive sizable inheritances, and about 50 percent of families with an annual income of more than $100,000 receive or expect to receive sizable inheritances. Figures 8.2 and 8.3 are histograms of received and expected inheritances in the PSID and SCF samples.

people born between 1957 and 1964 and interviewed between 1979 and 1991. The first wave included a nationally representative sample, a representative sample of blacks, and a representative sample of Hispanics. Neal and Johnson pool the three samples and measure the wage rates of the respondents in 1990 and 1991. The survey measures educational attainment, some test scores, and characteristics of the high school attended by the respondent. The data set also includes information on parental schooling, occupation, and county of residence, which I use to estimate parental income.

C. *Simple Regression Results for Consumption and Wages*

I regress the log of the adult child's consumption on the log of the parents' consumption, age polynomials for the parents and the children, and a gender dummy for the adult child. The regressions are estimated separately for the two groups. I interpret the coefficients on parental consumption as estimates of the parameters β and γ from the model

$$\ln X^i_{t+1} = \begin{cases} \text{constant} + \gamma \ln X^i_t + \epsilon^i_{t+1} & \text{if } x^i_{t+1} \geq 25{,}000 \\ \dfrac{\beta}{\gamma}(\text{constant}) + \dfrac{\gamma - \beta}{\gamma}\phi \ln e^{i*}_{t+1} + \beta \ln X^i_t + \dfrac{\beta}{\gamma}\epsilon^i_{t+1} & \text{if } x^i_{t+1} < 25{,}000, \end{cases} \tag{12}$$

where X is measured as consumption in panel A of table 3 and wages in panel B; e^{i*}_{t+1} denotes that level of the child's consumption in which parents switch from human capital transfers to financial transfers; e^{i*}_{t+1} varies across families because it depends on the ability of the child; and ϵ^i_{t+1} includes surprises, family-specific degrees of intergenerational altruism, and measurement errors. The constant term is the same across families and, under the consumption interpretation, depends on the common component of altruism and the expected rate of return on financial assets. The term $\phi = 1$ ($\phi = 0$) when X is measured as consumption (wages). Notice that parents wish to make negative financial transfers when $c_{t+1} < e^*_{t+1}$. If those parents are unable to do so, then they do not participate in the financial market at all, and the implications iii and iv require $\gamma \neq \beta$.

Four results are suggested by panel A of table 3. First, as was suggested in table 1, consumption is more persistent across generations than wages. Second, more persistence of consumption is observed when parental income is used as an instrument for parental consumption. The difference between the ordinary least squares (OLS)

TABLE 3

INTERGENERATIONAL CONSUMPTION AND WAGE PERSISTENCE, WITHIN GROUPS

PSID Sample	Sample Size		OLS: Group 1: $x_{t+1} \geq$ \$25,000	OLS: Group 2: $x_{t+1} <$ \$25,000	Instrumental Variables: Group 1: $x_{t+1} \geq$ \$25,000	Instrumental Variables: Group 2: $x_{t+1} <$ \$25,000
	A. Intergenerational Persistence of Log Family Consumption					
All	219	1,562	.45	.55	.65	.70
			(.08)	(.03)	(.12)	(.04)
SRC only	135	739	.63	.58	.90	.74
			(.10)	(.04)	(.15)	(.06)
Sons only	106	761	.41	.55	.65	.71
			(.12)	(.05)	(.17)	(.06)
	B. Intergenerational Persistence of Log Wage					
All	185	1,243	.33	.32	.42	.49
			(.08)	(.03)	(.11)	(.04)
SRC only	115	651	.31	.33	.35	.54
			(.10)	(.04)	(.14)	(.06)
Sons only	90	612	.41	.32	.61	.50
			(.13)	(.04)	(.19)	(.05)

NOTE.—Reported are coefficients on log parental status in a regression of log adult child's status on a dummy for daughters, parental and child marriage variables, and a quadratic in both the child's and the parental head of household's age. Standard errors are in parentheses. Economic status is measured as family consumption in panel A of the table and hourly earnings in panel B. Log parental income is the instrumental variable for family consumption, and average earnings of 1970 Census PUMS respondents in similar sex, race, occupation, industry, and regional categories are used as instruments for wages (see Mulligan [1997] for more details). Samples in panel B (wages) are those sampled in panel A whose parents reported a one-digit occupation, a two-digit industry, and county of residence; who report positive earnings in at least one of the years 1984–88 during which they lived in their own adult household; and whose parental head of household reported positive earnings in at least one of the years 1967–71.

and instrumental variable estimates is consistent with unobserved components of altruism or with errors in the measurement of parental consumption. Third, there is a slight indication that—as predicted by the borrowing constraint models—consumption regresses to the mean more slowly among families that are making financial bequests ($\beta < \gamma$). This is suggested by the instrumental variable results for the SRC sample. The coefficient on parental log consumption is 0.90 for group 1 and 0.74 for group 2. The OLS and other instrumental variable results, on the other hand, do not suggest $\beta < \gamma$. Fourth, log consumption appears to regress to the mean even among those families making sizable financial transfers. Group 1 coefficients on log parental consumption range from 0.65 to 0.90 for the SRC only sample. A coefficient of one can be rejected in most cases, whereas the Becker-Tomes models suggest a coefficient of one. According to the regression results, we appear to have a situa-

tion of $\beta = \gamma < 1$, which is inconsistent with borrowing constraints and with intergenerational altruism that is independent of parental income.

The borrowing constraint model also has predictions for the persistence of wages in the two groups. According to implication iv, earnings or wages may regress to the mean more slowly in group 2 than in group 1. Panel B of table 3 reports separate estimates of the dependence of a child's wage on that of his or her father for the two groups.[19] The OLS estimates are not very different for the two groups. However, the instrumental variable estimates are different especially for the SRC and sons samples. In the sons sample, the intergenerational persistence of wages is 0.61 in group 1 and 0.50 in group 2, whereas persistence is greater for group 2 in the SRC sample.

It is also clear from table 3 that consumption is more persistent than earnings or wages in *both* group 1 and group 2. The difference in group 1 is predicted by the borrowing constraint model because group 1 families look like permanent income families. However, an important difference between the persistence of consumption and earnings in group 2 is not predicted by the borrowing constraint model.

Related to the empirical model (12), and perhaps less related to the predictions iii and iv, is a nonlinear version of equation (1). Allowing the degree of intergenerational mobility to vary with the level of economic status might capture the nonlinearities in (12); it is expected that consumption mobility will decrease with parental consumption and earnings mobility will increase with parental earnings. Mixed results have been found in the literature (Mulligan 1993, 1997; Cooper, Durlauf, and Johnson 1994).

D. Schooling, Inheritance, and Wage Inequality

Are earnings more equal among the group 1 families? Table 4 reports a measure of wage inequality among group 1 and group 2 families in the PSID and SCF. There is no evidence that wages are more equal among adult children families that make financial transfers. The first row of the table reports measures of wage inequality among sons from the PSID. There actually appears to be slightly more wage inequality among the sons of group 1 families! The standard deviation of the log wage is 0.59 and the 90-10 wage differential is 1.51 compared to 0.54 and 1.32 for group 2, although results are somewhat different for a similar SCF sample (row 2).

[19] For analyses of selection bias, see Mulligan (1997, chap. 8).

TABLE 4

INHERITANCE AND WAGE INEQUALITY AMONG SONS

	GROUP 1: $x_{t+1} \geq \$25{,}000$			GROUP 2: $x_{t+1} < \$25{,}000$		
DATA SOURCE	Share	Standard Deviation (ln w)	90/10	Share	Standard Deviation (ln w)	90/10
PSID intergenerational sample	13%	.59	1.51	87%	.54	1.32
1989 SCF aged 25–35	32%	.57	1.26	68%	.60	1.50

NOTE.—"90/10" is the log of the ratio of wages at the ninetieth and tenth percentiles. In order to represent the U.S. male population, the PSID sample includes SRC sons only. The SFC samples are weighted to represent the overall U.S. population. Only men are included. The SCF shares in the table differ slightly from those in the text because age is defined as the son's age in the table and as the respondent's age in the text. Also, female-headed households are excluded from the calculations in the table.

Mulligan (1997, chap. 8) shows that the results reported in table 4 are not sensitive to the distinction between actual and expected inheritances, to the distinction between $x_{t+1} > 0$ and $x_{t+1} > \$25{,}000$, and to the sampling of adult children at later ages.

E. Public Schooling and Intergenerational Mobility

If public schooling serves to alleviate the borrowing constraints that prevent families from making the "efficient" human capital investment, we have implication vii: that greater public provision of schooling increases intergenerational wage mobility and decreases intergenerational consumption mobility. I measure quality of public elementary and secondary schooling at the state level according to the average teacher salary, expenditures per pupil, the teacher/pupil ratio based on attendance, the teacher/pupil ratio based on enrollment, and the fraction of students in the state who attend public schools rather than private schools. One might argue that all the variables are positively related to the quality of public schooling. In fact, with the exception of the fifth variable (fraction of public enrollment), all the schooling quality variables are positively correlated with each other.

One way to test implication vii is to interact a measure of schooling quality with log parental wage (consumption) in a regression of log adult child wage (consumption) on log parental wage (consumption), schooling quality, and the other control variables used in the regressions reported in table 3. In the 40 possible regressions (two measures of economic status, four PSID samples, and five quality variables), the estimated coefficient on the interaction term was

TABLE 5

PUBLIC SCHOOLING QUALITY AND INTERGENERATIONAL MOBILITY

	PUBLIC SCHOOLING QUALITY MEASURE				
SAMPLE	Teacher Salary	Spending per Pupil	Teacher/Pupil (Attendance)	Teacher/Pupil (Enrollment)	Public Fraction
	A. Top 10 − Bottom 10 Intergenerational Wage Persistence				
All	−.03	.04	.05	−.11	.01
SRC only	.09	−.06	.14	−.09	−.11
Sons only	−.12	.02	.10	.01	−.06
	B. Top 10 − Bottom 10 Intergenerational Consumption Persistence				
All	.10	.18	.06	−.01	−.12
SRC only	.22	.24	−.05	−.12	−.12
Sons only	.26	.23	−.13	−.32	−.04

NOTE.—Reported are the differences between coefficients on log parental wage (family consumption) in two-stage least-squares regressions of log adult child's wage (family consumption) on a dummy for daughters, parental and child marriage variables, and a quadratic in both the child and the parental head of household's age for a sample of residents of the top 10 public schooling quality states and residents of the bottom 10 schooling quality states. Samples and first-stage regressors are as in table 3. The top states in average salary are N.J., Ill., Wash., N.D., N.M., Mich., D.C., Calif., Alaska, and N.Y.; the bottom states are Miss., Ark., N.D., Ala., S.C., Idaho, Tenn., S.D., Okla., and La. The top states in average expenditure per pupil are Mich., Ill., Wash., Md., Ore., Conn., N.J., D.C., Alaska, and N.Y.; the bottom states are Miss., Ala., Ky., Tenn., Ark., Ga., Idaho., Okla., N.C., and S.C. The top states in average teacher/pupil attendance are S.D., N.Y., Wyo., Kans., Ore., Nebr., N.D., Maine, D.C., and Vt.; the bottom states are Hawaii, Ohio, Ala., Nev., Wash., Miss., Calif., Ga., Tenn., and Utah. The top states in average teacher/pupil enrollment are S.D., Iowa, Wyo., Kans., Ore., Nebr., N.D., Maine, D.C., and Vt.; the bottom states are Hawaii, Ind., Ala., Nev., Wash., Miss., Calif., Ga., Tenn., and Utah. The top states in public school enrollment fraction are Utah, N.C., Okla., Alaska, Ark., Ga., Ala., S.C., W.Va., and Miss.; the bottom states are Hawaii, Conn., Mass., Ill., N.J., N.H., Wisc., N.Y., Pa., and R.I.

never statistically significantly different from zero, with one exception. That exception occurred in a consumption regression with the SRC sample with schooling quality measured as the teacher/pupil ratio based on enrollment.[20] The magnitude of the coefficient was quite large in this case: one fewer pupil per teacher is associated with 0.05 more intergenerational persistence! Although statistically insignificant in the other regressions, the estimated interaction coefficient sometimes did have the correct sign and an economically significant magnitude. Table 5 illustrates the magnitudes by reporting the difference between the intergenerational persistence within the top 10 schooling quality states and the bottom 10 schooling quality states.

Results for intergenerational wage persistence reported in table 5 are quite mixed. Greater quality of public schooling decreases in-

[20] I experimented with another schooling quality measure: average teacher salary as a fraction of state per capita earnings. The interaction term was not statistically significantly different from zero except in one case: a consumption regression with the SRC sample.

tergenerational wage persistence in some cases but increases it in others. Somewhat more consistent results are shown for intergenerational consumption persistence, which, according to the teacher salary and expenditure per pupil measures, is greater in states with higher quality of public schooling.

F. Human Capital, Ability, and Family Background

It is not surprising that earnings or wage of an adult child is positively correlated with the income of his parents when he was young. The positive intergenerational wage correlations reported in table 1 and panel B of table 3 are consistent with such a result. The Becker-Tomes model predicts this, but with some auxiliary assumptions, it also predicts that parental income should not be positively correlated with the earnings or wage of children once parental human investments are held constant.

Recall from Section III that one of the auxiliary assumptions is that people with higher efficient human capital investments have higher ''earnings ability'': they would earn more even if their human capital were held constant. In terms of equations (10) and (11), the auxiliary assumption requires $b/d > 0$. Equation (11) shows that b/d is related to the ''ability bias'' that occurs when one is estimating the effectiveness of human capital investments for producing earnings; human capital is positively correlated with earnings because it directly produces earnings ($c > 0$) and because high-ability people may receive greater human capital investments ($b/d > 0$). When human capital is measured as years of schooling and ability is measured as a test score, Duncan (1968), Griliches and Mason (1972), and Bowles and Nelson (1974) find that the ability bias explains 20–30 percent of the correlation between schooling and wages. These studies suggest that b/d is positive and has a nontrivial magnitude. Willis and Rosen (1979), who measure human capital as college attendance, argue that the ability bias may actually be zero or even negative because quitting school early is indicative of good earnings prospects. Griliches (1977) also presents a model with a negative correlation between schooling and ability. It remains an open question whether the true magnitude of b/d is significant.

Bowles (1972) finds a positive correlation between earnings and parental income (number of siblings is held constant). When he adds years of schooling to the earnings regression (which can be interpreted as an estimate of eq. [11]), the estimated coefficient on parental income is reduced but is still economically and statistically significantly different from zero. Bowles's result seems inconsistent with the Becker-Tomes implication ix, but in his comment on

Bowles's paper, Becker (1972) argues that years of schooling is only a crude measure of human capital. A tougher test of implication ix requires additional measures of parental human capital investment.

Table 6 reports some tests of this prediction with the NLSY, a data set that permits both the measurement of parental income and the measurement of a number of proxies for parental human capital investments. Column 1 of table 6 reports some estimated coefficients from a regression of the log adult child wage, where the wage is an average of hourly earnings reported in 1990 and 1991 (or just one of the years when unavailable for both), on an age quadratic, a gender dummy, a quadratic in estimated log parental permanent income, and a dummy for the presence of both a mother and father at age 14. Parental income is estimated in three steps. First, I use the 1970 Census Public Use Microsample (PUMS) to estimate average family income and earnings of the household head for cells defined by race, one-digit occupation, work status, and sex of the head. Second, I use the Bureau of Economic Analysis's Regional Economic Information System (REIS) to compute per capita earnings, per capita income, and earnings per worker for every county in the United States. Third, I use micro data from the PSID to compute a regression of log average family income (averaged over the years 1967–71) of households with children on two cell-average variables estimated from the census and the three county averages from REIS. I use the coefficients from that regression (which has 791 observations and an adjusted R^2 of .48) and information on the one-digit occupation, race, sex, and county of the parental household head of the NLSY respondent to predict log parental permanent income.[21] My ''all'' sample is all NLSY respondents who report average hourly earnings for 1990 or 1991, who report race, parental one-digit occupation, educational attainment, and whether the high school attended was private and college prep, and who took the Armed Forces Qualification Test (AFQT) administered by the NLSY.

Equation (11) applies only to group 2 families, but the NLSY does not allow me to identify such families as I do in the PSID or SCF. Log estimated parental income is therefore entered nonlinearly, and the coefficient reported on the linear term can be interpreted as the

[21] Standard errors in the table are not corrected for the ''first-stage'' errors in estimating log parental income. However, because of the number of observations and the fairly large R^2 in the first stage, such corrections at most affect the least significant digits reported in the table. Standard errors are corrected for the ''clustering'' of observations by estimated parental income, but since the median cell size is two, the corrections are quite small.

elasticity at the sample mean log parental income. We see in column 1 that the elasticity is 0.41 at the mean and is increasing with parental income. The nonlinearity is weak enough so that the elasticity, even when evaluated at tenth percentile income, is statistically and economically significant. This is the pattern in all the quadratic specifications I have estimated (including those not reported here).[22]

As in Bowles (1972), column 2 of the table introduces the usual educational attainment measures. The elasticity with respect to log parental permanent income at the mean falls by a third but is still economically and statistically significantly different from zero. As Becker (1972) argues, educational attainment is a crude measure of parental human capital investment. If so, column 2 is consistent with the Becker-Tomes model because the regression error term includes parental human capital investments that are positively correlated with parental income. To alleviate this problem, column 3 introduces two measures of the quality of the high school education: whether the high school attended by the respondent was private and whether it was college preparatory. Both variables have an important impact on wages, but the estimated coefficient on log parental income is only slightly changed. For a smaller sample of respondents, the NLSY reports some additional measures of high school quality such as the pupil/teacher ratio, the average starting salary of teachers with a bachelor of science degree, and the fraction of students who begin the tenth grade but do not graduate (three observations with ridiculous reports are omitted). Column 4 reruns the regression of column 3 with the smaller sample and displays very similar estimates. Column 5 introduces the additional schooling quality variables, showing that all have an economically and (sometimes marginally) statistically significant partial correlation with adult wages.

Although Becker (1972) emphasizes the difficulty of measuring human capital investments, it is also likely that parental income is imperfectly measured. Rather than proxying for human capital, the schooling quality variables may actually proxy for unmeasured components of parental income. In this second case, my tests of the Becker-Tomes implication ix are actually biased toward finding a small or zero coefficient on measured parental income.

[22] According to auxiliary assumption *b*, there exists a level of parental income that, to a first approximation, partitions the sample into groups 1 and 2. A quadratic term in parental income for the full sample is one way to allow the elasticity to vary across parental income groups. I have also tried dropping from the sample all families with estimated parental income above the mean. These estimates are consistent with the quadratic specifications reported in the table, with the estimated elasticity equal to roughly half of the linear term coefficients reported in the table and, with only one exception, statistically significantly different from zero.

TABLE 6

WAGES, HUMAN CAPITAL, AND FAMILY BACKGROUND FROM THE NLSY

	Sample							
	All			Additional School Variables			Additional School Variables (Men)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimated log parental permanent income	.410	.267	.259	.274	.263	.182	.339	.258
	(.023)	(.022)	(.022)	(.027)	(.028)	(.029)	(.038)	(.039)
(Log permanent income − average)^2	.242	.104	.098	.126	.125	.109	.152	.131
	(.033)	(.030)	(.030)	(.041)	(.041)	(.041)	(.057)	(.057)
Both mother and father present	.048	.012	.011	−.007	−.001	−.003	−.017	−.021
	(.018)	(.017)	(.017)	(.021)	(.021)	(.020)	(.029)	(.028)
Years of schooling		.050	.047	.046	.046	.029	.031	.013
		(.005)	(.005)	(.007)	(.007)	(.007)	(.011)	(.011)
GED		−.006	−.001	.025	.028	−.005	.041	.007
		(.028)	(.029)	(.041)	(.041)	(.041)	(.054)	(.054)
High school graduate		.079	.080	.082	.086	.049	.118	.080
		(.022)	(.022)	(.029)	(.028)	(.029)	(.036)	(.036)

College graduate		.100	.096	.089	.094	.085	.069	.059
		(.025)	(.025)	(.033)	(.033)	(.032)	(.051)	(.050)
Private high school			.072	.065	.093	.101	.011	.020
			(.031)	(.046)	(.050)	(.049)	(.064)	(.063)
College prep high school			.033	.023	.023	−.004	.016	−.009
			(.016)	(.021)	(.021)	(.022)	(.031)	(.031)
High school pupil/teacher ratio					.004	.005	.005	.006
					(.002)	(.002)	(.003)	(.002)
Average starting teacher salary in high school/1,000					.011	.016	.010	.014
					(.008)	(.007)	(.010)	(.010)
Dropout rate in high school					−.032	−.010	−.103	−.081
					(.070)	(.066)	(.103)	(.100)
Normalized AFQT score						.109		.109
						(.011)		(.015)
Observations	5,226	5,226	5,226	3,247	3,247	3,247	1,688	1,688
Adjusted R^2	.139	.236	.238	.222	.223	.245	.176	.202
Standard error	.473	.445	.445	.450	.450	.443	.441	.434

NOTE.—The dependent variable is the log average hourly wage rate for 1990 and 1991. Independent variables include a constant, a gender dummy, and an age quadratic. Standard errors are in parentheses and are corrected using the STATA cluster command, with cells defined according to estimated log parental income. Log parental permanent income is estimated (see text). "Average" (used in quadratic terms) is computed for a sample of 5,226. "Dropout rate" is a fraction between zero and one. "Normalized AFQT score" is the variable used by Neal and Johnson (1996) in their wage regressions. It removes year of birth effects and normalizes the sample mean and standard deviation to be zero and one.

Column 6 of table 6 introduces the normalized AFQT score of the NLSY respondent, a variable that probably proxies for both parental human capital investments h_{t+1} and earnings ability B_{t+1}. Introducing the AFQT variable substantially reduces the estimated coefficient on the linear parental income term, but that coefficient is economically and statistically significantly different from zero. Columns 7 and 8 of the table reproduce some results for a sample of men only. Results are quite similar to those from the pooled men-women samples, although standard errors are larger because of the smaller sample size.[23] Because estimated coefficients on parental income are significantly positive in all my regressions, the Becker-Tomes implication ix seems to be refuted unless some very important parental human capital investments both are omitted from my regressions and are highly correlated with parental income.

V. Conclusions

Following Goldberger (1989), I compare Galton's model of inheritance with human capital models. Economic status regresses to the mean across generations in both kinds of models, a prediction that is consistent with the facts.

With some auxiliary assumptions, it can be shown that the economic models have several distinct predictions. One of them, that consumption regresses to the mean more slowly than earnings or wages, is consistent with my own estimates and estimates reported in the literature. Another accurate prediction is that high-earnings children are more likely to receive inheritances. Six other unique hypotheses find little support in the data.

Some rejected hypotheses concern the distinction between ''families that participate in financial markets'' and ''borrowing-constrained families,'' stating that intergenerational mobility is different in the two groups. Is it possible that my failure to find different intergenerational mobility in group 1 and group 2 is the result of my failure to correctly identify families as either group 1 or group 2? Three possible mistakes might occur in the designation of families as group 1 or group 2: (*a*) some group 1 families are incorrectly designated as group 2, (*b*) some group 2 families are incorrectly designated as group 1, and (*c*) both types of families are incorrectly designated. Since the borrowing constraint model predicts

[23] Similar results are also obtained from median regressions with a larger sample including NLSY respondents who do not participate in the labor force and whose wage is assumed to be below the median of observably similar NLSY respondents. Very similar results are also obtained when a black dummy and two indicators of family reading habits are included as regressors.

that the intergenerational mobility of group 1 families is so different from that of group 2 families and different from a pooled sample of group 1 and group 2 families, my strategy for designating families is to commit mistake *a* but to avoid mistakes *b* and *c*. I study adult children who, *between the ages of 25 and 35*, report their expectations about inheritance. I suspect that an adult child of that age expecting a sizable inheritance is quite unlikely to have parents who were either too poor or too unwilling to transfer resources to children so that the efficient human capital investment was not affordable.[24] If the human capital investment of a child expecting a sizable inheritance is less than efficient, why did not parents reduce the inheritance and increase the human capital investment? In other words, I am quite confident that the families designated group 1 are in fact in group 1. Some additional group 1 families may have been misdesignated as group 2 but, unless *most* of my group 2 families are in fact in group 1 (which means that just about every family is in group 1; but why then is the borrowing constraint model interesting?), the borrowing constraint model predicts that consumption should not regress to the mean and that intergenerational earnings or wage mobility should be greater among my group 1 families.[25]

Because the empirical success of the nine implications is so limited, one can conclude that the observed intergenerational dynamics of measures of economic status are not the result of borrowing constraints. Of course, one cannot necessarily conclude that borrowing constraints do not exist. In the Becker-Tomes model, these constraints can exist without affecting intergenerational mobility if diminishing returns to human capital investments are unimportant in the empirically relevant range, parents are unwilling to intergenerationally substitute consumption, or another auxiliary assumption fails.

I omit three sets of predictions of the economic models that Becker and Tomes (1986) emphasize. First, they point out that, when parental earnings are held constant, a child's earnings should be negatively correlated with earnings of grandparents. Behrman and Taubman (1985), Wahl (1985), and Mulligan (1993) study this partial correlation. However, it is unlikely that the grandparental

[24] I suspect that the marginal human capital investment for many children is the completion of high school, attending college, or the completion of college—an investment that occurs between the ages of 16 and 24. The marginal investment decision was therefore made only a few years before the children in my sample reported their inheritance.

[25] Defining groups 1 and 2 by splitting the PSID roughly in half according to 1988 parental net worth, Gaviria (1998) recently found more intergenerational earnings persistence in group 2 and argued that my splitting fails to distinguish the groups.

prediction is unique to the economic approach. Instead, the prediction derives from the fact that Becker and Tomes study a two-state variable system. A two-state variable mechanical system would also predict a nonzero partial grandparental correlation. The second set of predictions is concerned with the fact that all children have two biological parents. Two-sex mechanical and economic models are likely to share many predictions regarding the sorting of marriage partners and degrees of intergenerational mobility. Third, I ignore the potentially different implications of the Becker-Tomes and mechanical approaches for fertility.

I also omit two sets of predictions emphasized in the literature. First, a literature is concerned with the Becker-Tomes hypothesis that intergenerational transfers are altruistically motivated. For example, Altonji, Hayashi, and Kotlikoff (1992) look at the distribution of consumption within the family as parents and adult children age, and Laitner and Juster (1996) find that an important fraction of people do not accumulate wealth with the intention of passing it on to their children; but these tests are not directly concerned with intergenerational mobility. The results are very interesting for fiscal policy issues and for proponents of models of altruistically motivated intergenerational transfers. Transfers are altruistically motivated in the Becker-Tomes models, but there exist other interpretations of those models sharing many of the implications tested in this paper. Second, the economic and Galton models can have very different predictions for the effects of policy interventions. However, without any ''policy experiments'' generating the data, these predictions are not independently testable.[26]

The challenge to economists is to produce a model of intergenerational mobility with predictions that are (*a*) distinct from Galton's and (*b*) true. At least two areas of Becker's recent research will contribute to such a model. The first is the field of crime and social interactions. Several studies suggest that neighborhood effects and other social interactions have important effects on the development of children (Case and Katz 1991; O'Regan and Quigley 1996; Cutler and Glaeser 1997). Second, I argue elsewhere (Mulligan 1997) that an economic theory of altruism generates empirically valid predictions for intergenerational mobility as well as other behavior. Theories of preferences and social interactions are a different approach

[26] The post–World War II GI Bill was one potentially important government policy that alleviated intergenerational borrowing constraints. Were the postwar earnings of World War II GIs less sensitive to parental income? There is not yet any direct evidence on this (direct evidence would be a data set with the earnings of GIs and their parents); although see Behrman et al. (1980) and Behrman, Pollak, and Taubman (1989) for some indirect evidence.

to the problem of intergenerational mobility than Becker took in his work with Nigel Tomes, but are consistent with his recent work on other problems including addiction (Becker and Murphy 1988; Becker 1996), life cycle savings (Becker and Mulligan 1997), and social interactions (Becker and Murphy 1997). Although it was two decades ago that Becker took some early steps to show that economics offers some unique implications concerning earnings and income inequality, he is still showing us the power of the economic approach to these problems.

Appendix

PSID and NLSY Sample Characteristics

Tables A1, A2, and A3 report summary statistics for the PSID samples used in table 3 and the NLSY samples used in table 6.

TABLE A1

SAMPLE CHARACTERISTICS: GROUP 1 ($x_{t+1} \geq \$25{,}000$)

	Observations	Mean	Standard Deviation	Minimum	Maximum
	Sons and Daughters				
Age in 1986	219	31.8	2.57	27	36
Average family income (1984–88)	219	34,460	23,736	543	191,891
Average nondurable consumption (1984–87, estimated)	219	16,101	9,004	689	66,375
Average hourly "wage" (1984–88)	214	9.25	6.95	.80	69.72
	Head of Parental Household				
Age in 1968	219	42.3	7.51	29	67
Average family income (1967–71)	219	32,995	21,582	5,949	119,037
Average nondurable consumption (1969–72, estimated)	219	18,772	7,673	5,125	40,624
Average hourly "wage" (1967–71)	196	11.03	6.80	1.60	44.41

NOTE.—Data (except age and schooling) are converted to 1982 dollars using the consumer price index (CPI) for all items (1992 *Economic Report of the President*).

TABLE A2

SAMPLE CHARACTERISTICS: GROUP 2 ($x_{t+1} < \$25{,}000$)

	Observations	Mean	Standard Deviation	Minimum	Maximum
	Sons and Daughters				
Age in 1986	1,562	31.3	2.63	25	36
Average family income (1984–88)	1,562	26,277	18,893	79	270,242
Average nondurable consumption (1984–87, estimated)	1,562	12,947	6,914	135	64,630
Average hourly "wage" (1984–88)	1,492	8.09	5.08	.16	53.04
	Head of Parental Household				
Age in 1968	1,562	40.0	7.32	22	74
Average family income (1967–71)	1,562	28,054	19,561	3,575	234,521
Average nondurable consumption (1969–72, estimated)	1,562	17,008	7,541	3,537	50,476
Average hourly "wage" (1967–71)	1,340	10.06	7.49	.15	90.84

NOTE.—Monetary data are converted to 1982 dollars using the CPI for all items (1992 *Economic Report of the President*).

TABLE A3

SAMPLE CHARACTERISTICS: NLSY

	Observations	Mean	Standard Deviation	Minimum	Maximum
Wage (1990–91 average)	5,226	9.81	5.33	1.05	70.00
Log wage (1990–91 average)	5,226	2.16	.51	.07	4.25
Female	5,226	.49	.50	0	1
Log estimated parental permanent income	5,226	11.49	.38	9.95	12.44
Mother and father present at age 14?	5,226	.77	.42	0	1
Years of schooling	5,226	13.1	2.34	0	20
GED	5,226	.08	.28	0	1
High school graduate	5,226	.76	.42	0	1
College graduate	5,226	.22	.41	0	1
Private high school	5,226	.06	.23	0	1
College preparatory high school	5,226	.30	.46	0	1
Normalized AFQT score	5,226	.11	.97	−2.45	2.07
Pupil/teacher ratio in high school	3,247	19.3	4.2	3.7	54.3
Starting teacher annual salary	3,247	31,782	3,593	16,078	66,333
Dropout rate in high school	3,247	.12	.13	0	.98

NOTE.—Monetary data are converted to 1990 dollars using the CPI for all items (1992 *Economic Report of the President*).

References

Altonji, Joseph G.; Hayashi, Fumio; and Kotlikoff, Laurence J. ''Is the Extended Family Altruistically Linked? Direct Tests Using Micro Data.'' *A.E.R.* 82 (December 1992): 1177–98.

Atkinson, Anthony B.; Maynard, Alan K.; and Trinder, Chris G. *Parents and Children: Incomes in Two Generations*. London: Heinemann, 1983.

Barro, Robert J.; Mankiw, N. Gregory; and Sala-i-Martin, Xavier. ''Capital Mobility in Neoclassical Models of Growth.'' *A.E.R.* 85 (March 1995): 103–15.

Barro, Robert J., and Sala-i-Martin, Xavier. ''Convergence.'' *J.P.E.* 100 (April 1992): 223–51.

Becker, Gary S. ''Schooling and Inequality from Generation to Generation: Comment.'' *J.P.E.* 80, no. 3, pt. 2 (May/June 1972): S252–S255.

———. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. 2d ed. Chicago: Univ. Chicago Press (for NBER), 1975.

———. ''On the Economics of the Family: Reply to a Skeptic.'' *A.E.R.* 79 (June 1989): 514–18.

———. *Accounting for Tastes*. Cambridge, Mass.: Harvard Univ. Press, 1996.

Becker, Gary S., and Mulligan, Casey B. ''The Endogenous Determination of Time Preference.'' *Q.J.E.* 112 (August 1997): 729–58.

Becker, Gary S., and Murphy, Kevin M. ''A Theory of Rational Addiction.'' *J.P.E.* 96 (August 1988): 675–700.

———. ''Social Economics: Developments in a New Field.'' Working paper. Chicago: Univ. Chicago, August 1997.

Becker, Gary S., and Tomes, Nigel. ''An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility.'' *J.P.E.* 87 (December 1979): 1153–89.

———. ''Human Capital and the Rise and Fall of Families.'' *J. Labor Econ.* 4, no. 3, pt. 2 (July 1986): S1–S39.

Behrman, Jere R.; Hrubec, Zdenek; Taubman, Paul; and Wales, Terence J. *Socioeconomic Success: A Study of the Effects of Genetic Endowments, Family Environment, and Schooling*. Amsterdam: North-Holland, 1980.

Behrman, Jere R.; Pollak, Robert A.; and Taubman, Paul. ''Family Resources, Family Size, and Access to Financing for College Education.'' *J.P.E.* 97 (April 1989): 398–419.

Behrman, Jere R., and Taubman, Paul. ''Intergenerational Earnings Mobility in the United States: Some Estimates and a Test of Becker's Intergenerational Endowments Model.'' *Rev. Econ. and Statis.* 67 (February 1985): 144–51.

Bénabou, Roland. ''Human Capital, Inequality, and Growth: A Local Perspective.'' *European Econ. Rev.* 38 (April 1994): 817–26.

Borjas, George J. ''Long-Run Convergence of Ethnic Skill Differentials: The Children and Grandchildren of the Great Migration.'' *Indus. and Labor Relations Rev.* 47 (July 1994): 553–73.

Bowles, Samuel. ''Schooling and Inequality from Generation to Generation.'' *J.P.E.* 80, no. 3, pt. 2 (May/June 1972): S219–S251.

Bowles, Samuel, and Nelson, Valerie I. ''The 'Inheritance of IQ' and the Intergenerational Reproduction of Economic Inequality.'' *Rev. Econ. and Statis.* 56 (February 1974): 39–51.

Cameron, Stephen V., and Heckman, James J. ''The Dynamics of Educational Attainment for Blacks, Hispanics, and Whites.'' Working paper. New York: Columbia Univ., December 1996.

Case, Anne C., and Katz, Lawrence F. ''The Company You Keep: The Effects of Family and Neighborhood on Disadvantaged Youths.'' Working Paper no. 3705. Cambridge, Mass.: NBER, May 1991.
Cooper, Suzanne J. ''Redistribution and the Persistence of Income Inequality.'' Working paper. Cambridge, Mass.: Harvard Univ., February 1996.
Cooper, Suzanne J.; Durlauf, Steven N.; and Johnson, Paul A. ''On the Evolution of Economic Status across Generations.'' In *Proceedings of the Social Statistics Section of the American Statistical Association*. Alexandria, Va.: American Statis. Assoc., 1994.
Couch, Kenneth A., and Dunn, Thomas A. ''Intergenerational Correlations in Labor Market Status: A Comparison of the United States and Germany.'' Working paper. Syracuse, N.Y.: Syracuse Univ., May 1995.
Cutler, David M., and Glaeser, Edward L. ''Are Ghettos Good or Bad?'' *Q.J.E.* 112 (August 1997): 827–72.
de Wolff, P., and van Slijpe, A. R. D. ''The Relation between Income, Intelligence, Education and Social Background.'' *European Econ. Rev.* 4 (October 1973): 235–64.
Duncan, Otis Dudley. ''Ability and Achievement.'' *Eugenics Q.* 15 (March 1968): 1–11.
Durlauf, Steven N. ''A Theory of Persistent Income Inequality.'' *J. Econ. Growth* 1 (March 1996): 75–93.
Friedman, Milton. *A Theory of the Consumption Function*. Princeton, N.J.: Princeton Univ. Press (for NBER), 1957.
Galton, Francis. *Hereditary Genius: An Inquiry into Its Laws and Consequences*. London: Macmillan, 1869.
———. ''Typical Laws of Heredity.'' *Proc. Royal Inst. Great Britain* 8 (February 1877): 282–301.
———. *Natural Inheritance*. London: Macmillan, 1889.
Gaviria, Alejondro. ''Intergenerational Mobility, Siblings' Inequality and Borrowing Constraints.'' Working paper. La Jolla: Univ. California, San Diego, March 1998.
Glomm, Gerhard, and Ravikumar, B. ''Public versus Private Investment in Human Capital: Endogenous Growth and Income Inequality.'' *J.P.E.* 100 (August 1992): 818–34.
Goldberger, Arthur S. ''Economic and Mechanical Models of Intergenerational Transmission.'' *A.E.R.* 79 (June 1989): 504–13.
Griliches, Zvi. ''Estimating the Returns to Schooling: Some Econometric Problems.'' *Econometrica* 45 (January 1977): 1–22.
Griliches, Zvi, and Mason, William M. ''Education, Income, and Ability.'' *J.P.E.* 80, no. 3, pt. 2 (May/June 1972): S74–S103.
Han, Song, and Mulligan, Casey B. ''Human Capital, Heterogeneity, and the Estimation of Degrees of Intergenerational Mobility.'' Discussion Paper no. 97-3. Chicago: Univ. Chicago, Population Res. Center, May 1997.
Harbury, C. D., and Hitchens, D. M. W. N. *Inheritance and Wealth Inequality in Britain*. London: Allen & Unwin, 1979.
Kane, Thomas J. ''College Entry by Blacks since 1970: The Role of College Costs, Family Background, and the Returns to Education.'' *J.P.E.* 102 (October 1994): 878–911.
Kearl, James R., and Pope, Clayne L. ''Unobservable Family and Individual Contributions to the Distributions of Income and Wealth.'' *J. Labor Econ.* 4, no. 3, pt. 2 (July 1986): S48–S79.
Laitner, John. ''Random Earnings Differences, Lifetime Liquidity Con-

straints, and Altruistic Intergenerational Transfers.'' *J. Econ. Theory* 58 (December 1992): 135–70.
Laitner, John, and Juster, F. Thomas. ''New Evidence on Altruism: A Study of TIAA-CREF Retirees.'' *A.E.R.* 86 (September 1996): 893–908.
Lillard, Lee A., and Willis, Robert J. ''Intergenerational Educational Mobility: Effects of Family and State in Malaysia.'' *J. Human Resources* 29 (Fall 1994): 1126–66.
Lindert, Peter H. ''Unequal English Wealth since 1670.'' *J.P.E.* 94 (December 1986): 1127–62.
Loury, Glenn C. ''Intergenerational Transfers and the Distribution of Earnings.'' *Econometrica* 49 (July 1981): 843–67.
Mankiw, N. Gregory; Romer, David; and Weil, David N. ''A Contribution to the Empirics of Economic Growth.'' *Q.J.E.* 107 (May 1992): 407–37.
Menchik, Paul L. ''Inter-generational Transmission of Inequality: An Empirical Study of Wealth Mobility.'' *Economica* 46 (November 1979): 349–62.
Mincer, Jacob A. *Schooling, Experience, and Earnings*. New York: Columbia Univ. Press (for NBER), 1974.
Mulligan, Casey B. ''Intergenerational Altruism, Fertility, and the Persistence of Economic Status.'' Ph.D. dissertation, Univ. Chicago, August 1993.
———. *Parental Priorities and Economic Inequality*. Chicago: Univ. Chicago Press, 1997.
Navarro-Zermeno, Jesus Ignacio. ''A Model of Bequests and Intergenerational Mobility.'' Ph.D. dissertation, Univ. Chicago, August 1993.
Neal, Derek A., and Johnson, William R. ''The Role of Premarket Factors in Black-White Wage Differences.'' *J.P.E.* 104 (October 1996): 869–95.
Olneck, Michael R. ''On the Use of Sibling Data to Estimate the Effects of Family Background, Cognitive Skills, and Schooling: Results from the Kalamazoo Brothers Study.'' In *Kinometrics: Determinants of Socioeconomic Success within and between Families*, edited by Paul Taubman. Amsterdam: North-Holland, 1977.
O'Regan, Katherine M., and Quigley, John M. ''Teenage Employment and the Spatial Isolation of Minority and Poverty Households.'' *J. Human Resources* 31 (Summer 1996): 692–702.
Peters, H. Elizabeth. ''Patterns of Intergenerational Mobility in Income and Earnings.'' *Rev. Econ. and Statis.* 74 (August 1992): 456–66.
Rosen, Sherwin. ''Substitution and Division of Labour.'' *Economica* 45 (August 1978): 235–50.
Runkle, David E. ''Liquidity Constraints and the Permanent-Income Hypothesis: Evidence from Panel Data.'' *J. Monetary Econ.* 27 (February 1991): 73–98.
Skinner, Jonathan. ''A Superior Measure of Consumption from the Panel Study of Income Dynamics.'' *Econ. Letters* 23, no. 2 (1987): 213–16.
Smith, James P., and Welch, Finis R. ''Closing the Gap: Forty Years of Economic Progress for Blacks.'' Manuscript. San Diego, Calif.: Rand, February 1986.
Solon, Gary. ''Intergenerational Income Mobility in the United States.'' *A.E.R.* 82 (June 1992): 393–408.
Soltow, Lee. *Toward Income Equality in Norway*. Madison: Univ. Wisconsin Press, 1965.
———. *Distribution of Wealth and Income in the United States since 1798*. Pittsburgh: Univ. Pittsburgh Press, 1989.

Tamura, Robert. ''Income Convergence in an Endogenous Growth Model.'' *J.P.E.* 99 (June 1991): 522–40.
Tomes, Nigel. ''The Family, Inheritance, and the Intergenerational Transmission of Inequality.'' *J.P.E.* 89 (October 1981): 928–58.
Wahl, Jenny Bourne. ''Fertility in America: Historical Patterns and Wealth Effects on the Quantity and Quality of Children.'' Ph.D. dissertation, Univ. Chicago, December 1985.
Williamson, Jeffrey G., and Lindert, Peter H. *American Inequality: A Macroeconomic History*. New York: Academic Press, 1980.
Willis, Robert J., and Rosen, Sherwin. ''Education and Self-Selection.'' *J.P.E.* 87, no. 5, pt. 2 (October 1979): S7–S36.
Zimmerman, David J. ''Regression toward Mediocrity in Economic Stature.'' *A.E.R.* 82 (June 1992): 409–29.