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Economic Interpretations of Intergenerational Correlations

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Measuring intergenerational correlations is as old as empirical social science itself; for example, see Galton's 1869 study of the eminence of relatives or his 1889 analysis of the heights of parents and children. But extensive use of economic theory to interpret these correlations is much more recent. Using basic economic concepts such as supply, demand, investment, incentives, missing markets and so on, theorists hope to explain how and why status is correlated across generations. Economic theory might provide a unified treatment of a variety of socioeconomic indicators—such as earnings, income, occupation or wealth. Or it might predict how taxes, subsidies and economic regulation affect intergenerational mobility and the operation of markets.

However, while the subject matter—earnings, consumption, wealth, occupation—is clearly interesting to economists, it *could* nonetheless be the case that, beyond basic questions of measurement, economic *theory* has not improved our understanding of intergenerational mobility. Goldberger (1989) is quite explicit in this contention. By emphasizing the distinction between genes and environment and by using statistical theory as its main analytical tool, the paper by Samuel Bowles and Herbert Gintis in this issue implicitly concurs with Goldberger. We take this challenge very seriously.

What characterizes an economic approach to mobility? While biologists (and Bowles and Gintis) distinguish "endowments" and "investments" by their source (genetic versus environmental factors), one focus of economic theorists is motivation—that is, sensitivity to prices. Abilities that are "automatically" transmitted from

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parents to children without regard for incentives or deterrents are endowments. Notice that by this definition, endowments might include environmental factors if some aspects of the environment are insensitive to prices. By contrast, investments encompass those skills that are determined in response to the economic environment. One reason that economic theorists might prefer an incentive-based decomposition over a source-based alternative is that without reference to incentives, it is impossible to study efficiency losses associated with public policies like those proposed by Bowles and Gintis.

Since accurate prediction ultimately determines the usefulness of theory, our paper gives the reader a taste of some predictions derived from economic theory and some empirical successes and failures. We provide only a taste, because there are a great many economic models relevant to intergenerational correlations—such as models of educational attainment, neighborhood effects in schooling, family formation and fertility choice, occupational choice and discrimination—and quite a variety of predictions that might be derived from these models. However, a simple model of investment and intergenerational decision making can be interpreted as a conceptual aggregation of many more detailed economic models. We present such a model and from it derive one class of predictions that has received substantial attention in the empirical literature—the role of endowments and credit markets in determining intergenerational correlations.[1]

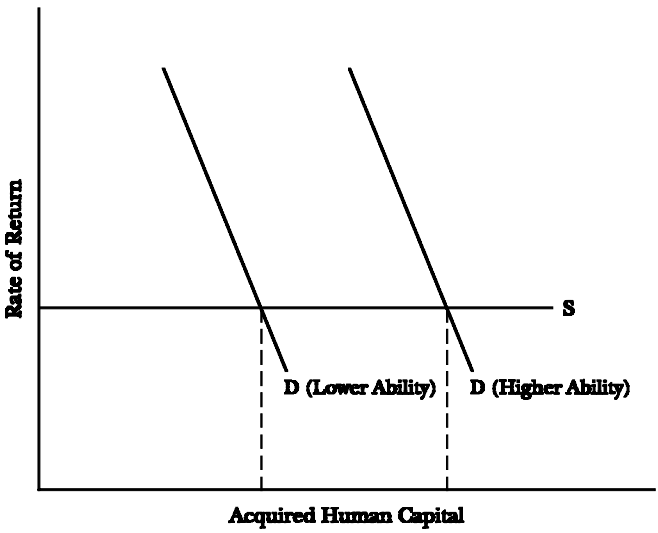
A Theory of Family Investment and Intergenerational Mobility

Becker and Tomes (1979; 1986) present an economic model of intergenerational transmission that has been used and extended to derive several important predictions. Families can bequeath human capital and financial assets and, as a starting assumption, a family's financial asset holdings can be negative. Families choose the level of human capital investment in their children by comparing the returns for the two investments. Assuming that the return to human investment is initially very large, the first dollar bequeathed will be spent on human capital. Since the reward for human capital investment exceeds the cost of investment (foregone interest on financial investments), family resources are increased by this investment. Additional human investments are made until diminishing returns set in and the returns on the two investments are equal.

Figure 1, presented in Becker (1967), captures these ideas. The constant marginal cost (horizontal) supply of funds curve represents a situation in which

[1] Just as the economic theory of intergenerational correlation conceptually aggregates more detailed economic theories of behavior, there is an empirical literature studying the relation between credit constraints, endowments and more detailed behaviors. Summarizing those studies is beyond the scope of our paper—see Cameron and Heckman (1999) for one review—but the results there may be consistent with those of the intergenerational correlation studies we cite.

Figure 1
Simulated Investment in Human Capital



Source: Variation on Becker (1967).

parents can borrow unlimited amounts at the market interest rate. The demand curves represent marginal returns to human investment for two children; the right-hand demand curve belongs to the higher-ability child.[2] Drawing the demand curves this way, we assume child ability complements human capital—that is, the return on investments is higher the higher is child ability. (The positive correlation between child education and parent earnings among wealthy, presumably unconstrained families suggests this complementarity.) Notice that in this framework, parental income and wealth play no role in determining child education or earnings. Only child ability matters.

Combining this economic model of investment with a model of intergenerational ability transmission produces a model of intergenerational mobility. Since earnings are unaffected by family characteristics other than child ability, intergenerational earnings mobility is determined by the transmission of ability. Clearly, the rate of earnings mobility is greater the smaller the association between child and parent ability. In addition, Han and Mulligan (2001) find that earnings mobility should be greater in societies with less variance in ability. The greater is the variance in ability, the more closely earnings reflect ability (holding variance in other factors constant). With relatively less influence of other factors, the correlation between generations increases.

[2] Here, and in the remainder of the paper, when we refer to "ability," we mean endowed ability as opposed to acquired human capital.

While earnings is an often cited measure of economic status, consumption may be more interesting because it is more closely related to welfare. In this model, human capital investments are chosen to maximize family resources. Given the resulting within-family distribution of earnings, parents can transfer consumption between generations and among siblings using bequests. Wealthy parents may wish to bequeath assets to allow their child to consume beyond the child's own wages; poor families may need (or wish) to finance human investment with debt and so leave negative financial bequests. Very able, high-earning children may be left smaller bequests so that less able siblings can be supported with larger gifts.

The implications of the model for consumption mobility are developed in Becker and Tomes (1986) and Mulligan (1997). The reader may recognize this permanent income intergenerational model as a cousin to life cycle models of consumption and earnings. Like life cycle models, this model predicts smoothing of consumption across periods. If consumption is smoothed across generations, then we expect less mobility in consumption than in earnings.[3] In fact, if parental altruism toward children is uncorrelated with parental earnings, the model predicts that consumption does not regress to the mean in percentage terms, an outcome often equated with complete immobility![4] The analogy to life cycle earnings models also produces additional theoretical predictions. Because we expect ability to be more correlated between periods of a person's life than between generations of a family, we expect more intergenerational earnings mobility than life cycle earnings mobility.[5]

Model predictions for consumption and earnings mobility pertain to time series and not a single cross-section. For example, the model above suggests that consumption should grow, over many generations, at the same rate for rich and poor dynasties. But in any one particular generation, aggregate economic shocks may create systematically different intergenerational consumption growth for rich and poor families. As a result, looking at data spanning only two generations, we may see patterns in consumption and earnings mobility that are uncharacteristic for the economy over the long run. Suppose, for example, that the stock market and other assets disproportionately held by richer dynasties earned abnormal returns in the 1980s and 1990s—returns unanticipated by earlier generations. This

[3] In this and all other predictions discussed in this paper, we consider the correlation between the consumption of a parent and a representative child. An alternative would be to measure consumption earned by all members of a family in a given generation, or "dynastic consumption." Lange (2002) shows that the theory predicts that dynastic consumption may regress away from the mean—a sign of extreme immobility—even if individual consumption does regress to the mean.

[4] If parental altruism and earnings are positively correlated, consumption regresses away from the mean and the gap between rates of consumption mobility and earnings mobility is even larger. Greater mobility in earnings is to be expected even if there is a negative covariance between parental earnings and altruism as long as this covariance is limited in magnitude. Some of the results depend on functional form. See the cited papers.

[5] We owe this point to Gary Becker. A few empirical studies of intergenerational labor supply correlations (for example, Antel, 1992; Mulligan, 1996) have looked at the analogous implication, with some disagreement as to whether the evidence supports the theory.

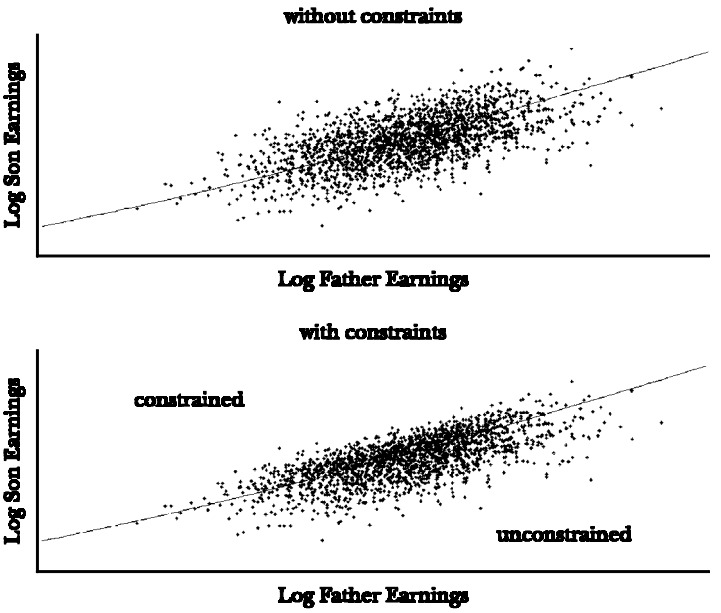
would create higher intergenerational consumption growth for richer dynasties and thereby less consumption mobility, but this situation would be temporary. Perhaps more importantly, to the extent that returns to human investments increased among high-skilled workers in this same period, earnings mobility would also be temporarily lower. With this in mind, we must be careful interpreting existing empirical estimates of mobility, because most available data pertain to only one or two generations—typically born in the 1950s and 1960s. Are we learning from low mobility estimates that economic status is relatively immobile, or only that these one or two generations were exposed to aggregate shocks that disproportionately favored richer families?

To this point, the discussion has assumed perfect credit markets and that households can borrow as much as they desire, across generations, if necessary. However, if a family is credit constrained, they would like to borrow against the child's future earnings to finance human investment, but they are unable to do so. Since the family is prohibited from borrowing, the child acquires less human capital and so the return on such investment is higher than that on financial bequests. Clearly, the parent in such a family does not wish to bequeath assets; the child is better off if these funds are invested in human capital. In this setting, earnings persist across generations both because ability persists (as was discussed before) and because credit constraints limit educational choice (see also Loury, 1981).

Based on this analysis, economists point to three factors that should determine whether credit constraints bind. First, societies with well-functioning credit markets—or good alternatives to credit market financing of human investment—should have fewer constrained families and experience greater intergenerational earnings mobility. Second, family income is also a factor, since wealthy parents are able to finance human investments out of their own wealth even when credit markets are unavailable. Finally, endowed ability of the child is relevant. Because high-ability children warrant greater human capital acquisition, families with high-ability children are more likely constrained than families with low-ability children (holding parental earnings constant) if ability complements human capital. Figure 2 illustrates this outcome using computer-simulated data according to parameter values set in Han and Mulligan (2001, case 3, but excluding "market luck"). The top panel shows parent and child log earnings in a world with perfect access to credit markets; the bottom panel presents the same population without credit markets. In both panels of the figure, the line in the figure divides families that are affected by the constraint (above the line) from those that are not (below the line). Within a group of families with equal parent earnings, human capital and earnings are limited for children of highest ability—those found at the top of the joint earnings distribution—since these children require the most human investment (and ultimately earn the most).

The study of earnings regression nonlinearities is a good example of the general theme that intergenerational mobility is an aggregate of several economic behaviors. Focusing on the role of parent earnings, Becker and Tomes (1986,

Figure 2
Simulated Investment in Human Capital With and Without Credit Constraints



Source: Grawe (2001b).

p. S14) present the seminal hypothesis: earnings are less mobile among low-earning families. However, recent studies have considered the joint implications of credit market quality, parental earnings and child ability for intergenerational earnings correlations. Han and Mulligan (2001) suggest that the pattern predicted by Becker and Tomes is mitigated by the fact that high-ability children tend to come from high-earning parents. They report numerical simulations showing how a positive correlation between parental earnings and child ability thwarts detection of differing rates of mobility with current data sets. Corak and Heisz (1999) further suggest that credit constraints will rarely bind at the bottom of the parental earnings distribution if these children are typically less able and receive their desired education in public schools. Since high-earning parents can self-finance human investments, they too are unconstrained. Thus, Corak and Heisz speculate that middle-earning families may be most susceptible to credit constraints; earnings mobility then would be least prevalent among families in the middle of the parent earnings distribution. Grawe (2001b) generalizes this point, showing that almost any monotonic child-parent earnings relation can be derived from the model either with or without borrowing constraints. Grawe demonstrates that researchers who wish to attribute to credit constraints observed differences in earnings mobility between parent earnings groups can partially evaluate the credibility of this interpretation using quantile regressions. Quantile regressions allow researchers to see

whether the observed change in mobility is found at the top or the bottom of the joint distribution; Figure 2 shows that evidence of credit constraints will be found only at the top.[6]

Credit constraints also have implications for intergenerational correlations of consumption. Where credit constraints limit the achievement of children relative to parents as measured by earnings, they also mean that parents are less able to shift consumption in the child's generation toward consumption of the parent. Thus, credit constraints produce intergenerational consumption mobility. However, if enough families have access to credit markets, consumption remains less mobile than earnings across generations. Further, groups exhibiting greater intergenerational earnings mobility may be expected to have less intergenerational consumption mobility since mobility in earnings is a signal of well-functioning credit markets.

Empirical Successes and Failures of Economic Models of Intergenerational Credit Constraints

Data clearly show that children from richer families enjoy more human investment and earnings. But this observation may simply represent the covariance of child ability and parent income. Indeed, Cameron and Heckman (1998) find no relationship between parent income and child education, controlling for cognitive ability.[7] In addition, Mulligan (1999) finds a strong positive correlation between child's earnings and parental income after controlling for measures of human investment. These findings suggest that persistence of ability causes intergenerational status correlations. Using the insights of Becker and Tomes (1979; 1986), researchers have employed intergenerational correlations to test for and measure distortions caused by credit market imperfections.

One way to investigate this issue is through analysis of cross-country evidence on whether countries with greater public provision of human capital experience greater intergenerational mobility. For example, educational subsidies are exceptionally high in Scandinavian countries, and intergenerational effects of family income and family background appear to be weaker there than in the United States (Björklund and Jäntti, 1997; Björklund et al., 2000). Similarly, Grawe (2002) finds that intergenerational mobility in Canada, which has large education subsidies, is equal to or greater than that in the United States. More broadly, Grawe suggests comparing mobility in developed countries, which as a group may spend relatively

[6] This method only "partially" evaluates the interpretation, because it is also possible for all types of nonlinearities to be found in the quantile regression either with or without credit constraints. The point is that a researcher who interprets a nonlinearity at the mean as evidence of credit constraints also assumes linearity would have resulted in the absence of credit constraints. The quantile regressions can help assess whether this interpretation is consistent with the data.

[7] Of course, some argue that cognitive test scores are themselves dependent on parental income. See Mayer (1997) for a discussion of recent and past work relating income to test scores.

high amounts on educational subsidies, to mobility in less developed countries, such as Ecuador, Nepal, Pakistan and Peru. The results do point toward less earnings mobility in the less developed countries.

These cross-country results have two interpretations based on the model presented above. One interpretation emphasizes credit constraints, as in the Becker and Tomes (1979; 1986) analysis, and sees differential education subsidies as the source of different mobility rates across countries. Another interpretation emphasizes ability heterogeneity, as in the Han and Mulligan (2001) analysis, recognizing the exceptional diversity found in the United States and in some developing countries. Unfortunately, with data from only a few countries, it is difficult to differentiate these hypotheses or to rule out alternative explanations.

Credit constraints have also been studied using single country data by comparing rates of mobility across parent earnings groups. Early studies focused on the Becker and Tomes (1979; 1986) conjecture that earnings mobility is greatest among high-earning families. However, Berhman and Taubman (1990) and Solon (1992) find the opposite pattern in the United States. In Canada, the conjecture is also rejected. With around 400,000 families, the data set used by Corak and Heisz (1999) is the largest intergenerational data set in the literature and hence is the data set best suited for detecting differences in mobility across earnings groups. Corak and Heisz find that mobility is lowest among middle-earning families. Other studies have looked for, and failed to find, differences in returns to schooling across parental income groups (see reviews by Cameron and Heckman, 1999; Cameron and Taber, 2000; or Card, 1999, for an opposing view).

But this finding may not contradict the theory as much as remind us that parental income is a crude measure of credit constraint susceptibility; child ability also matters. Several studies attempt to disentangle child ability from parent earnings. Shea (2000) examines three factors that are presumed to be uncorrelated with parent ability (union status, industry and job loss), uses them as instruments for father's income and finds less income mobility among the poor. Alternatively, Behrman and Taubman (1990) look at the timing of earnings over the life cycle. Father's ability is correlated with the present value of his lifetime earnings, but even people of high ability may experience lean years, especially at the beginning of a career, which is often when child investments are made. Behrman and Taubman measure father's earnings at the time the child is a teenager and at another point roughly a decade later. They find less intergenerational earnings mobility when using the earlier measure of father's income.[8] However, Behrman and Taubman's finding is anticipated not only by the credit constraints theory, but also the life cycle

[8] However, the authors acknowledge that the decision to measure fathers in the child's fifteenth year was made to minimize the estimated mobility. In fact, the correlation between parent and child earnings would have been reduced by one-third to one-half if either age 14 or age 16 had been used. A decrease in estimated earnings mobility of approximately one-third might yet be attributable to credit market imperfections.

theory of earnings, as Grawe (2001a) notes. For fathers as a group, inequality of log earnings grows with age. If measured permanent income is a scalar multiple of true permanent income and the scalar increases with age, then the estimated effect of father's income on son's will naturally diminish with age. This effect explains one-third of the variation between reported elasticity estimates. Finally, Grawe (2001b) uses the quantile regression method described above to test the hypothesis that credit constraints cause the earnings mobility patterns observed in Canada. Contrary to the predicted effect of credit constraints, the data exhibit greater mobility among sons found at the bottom of the joint distribution. Given the Canadian government's support of education, this finding may point us back to the institutional features that differ across countries.

The studies above explore variables that, in theory, determine the likelihood of a binding credit constraint—country, parental income and child ability. Another approach is to partition families into two groups by their likelihood of being credit constrained. Theory predicts that the group that is more likely constrained will experience less intergenerational earnings mobility and more intergenerational consumption mobility. Using a sample created from Social Security earnings files, Mazumder (2001) separates families by net worth. He finds lower earnings mobility in families with low net worth than in families with high net worth, although the standard errors are too large to reject equality.[9] In contrast, Mulligan (1997) partitions families by bequest behavior: one "unconstrained" group for whom children received or expect to receive bequests of at least $25,000 (1989 dollars) and another "possibly constrained" group with small or zero actual and anticipated bequests.[10] Consistently, less mobility is found in consumption than in earnings. He also often reports that the partition with more consumption mobility has less earnings mobility, although not always in the direction predicted by the theory.[11] Finally, Mulligan (1999) partitions families according to the quality of public schooling in their state of residence and often finds more consumption mobility in groups with less earnings mobility. We are not aware of a noneconomic model predicting either the observed gap between consumption and earnings mobility or that groups with more consumption mobility have less earnings mobility.

[9] Using a sample created from Survey of Income and Program Participation data with fewer observations and fewer years of observation, Mazumder (2001) finds a similar degree of income mobility among the low net worth group and tremendous income mobility among the high net worth group; this result is statistically significant. Gaviria (1998) also uses net worth to partition families, in intergenerational samples drawn from the Panel Study of Income Dynamics, and for some of those samples finds more wage mobility in the high net worth group.

[10] The "child" respondents are asked their expectations concerning bequests at age 25–35.

[11] Interestingly, there is a different link between child's *schooling* and parental income among those children receiving or expecting bequest; Tomes (1981) reports a similar finding in a study of families whose bequests were including a probate sample.

Progressive Policy and Intergenerational Mobility

Perhaps one goal of government policy is to alter earnings and consumption mobility by changing family investments. In this section, we examine two such policies—public investment in human capital and bequest taxes—and show how the economic theory above guides us to deeper understanding of sometimes counterintuitive results.

In the United States, direct government investments in human capital are substantial. Education expenditures alone exceed $450 billion annually, or more than $5,800 per person between the ages of 5 and 24. In addition, federal outlays on health exceed $350 billion per year. To focus on the theory of human capital investment, suppose the government finances these expenditures with borrowing and repays the debt later with receipts from recipients of these investments.[12]

In many cases, government investments are substitutes for private investments. For example, both private and public schools may teach a child to read, and when a child has learned to read at one school, there is little return to time spent learning reading at the other school. Thus, reductions in private investments may partially or completely offset government investments. There are three cases to consider. First, if public investments fall short of the efficient level and no credit constraints exist, then families simply invest the difference between the public investment and the efficient level. In this case, government investment crowds out private investment dollar-for-dollar and has no net effect.[13] Clearly, there will be no effect on intergenerational mobility of either earnings or consumption in this case. The second case is identical to the first, except that credit constraints exist. While we still expect some reduction in private investments (as parents use part of the government aid to increase their own consumption indirectly), the government investment serves as a partial substitute for credit market access, and so child education and earnings will increase. Thus, government education spending should reduce the education and earnings gap between children of rich and poor families, decrease the intergenerational education and earnings correlations, but decrease intergenerational consumption mobility. In the third case, government investment in human capital exceeds the efficient level. In this case, total human capital increases. As a result, intergenerational earnings mobility increases while consump-

[12] In our analysis, we also assume that lump sum taxes are employed by the government. For a model along these lines, see Becker and Murphy (1988). Becker and Tomes (1979) and Mulligan (1997) study the issue of non-lump-sum taxation as it relates to mobility.

[13] Note the assumption in the model that government and private human capital investments are substitutes. Goldberger (1989) points out that if government investments are modeled as complementary investments that raise the return to private education expenditures, then this offsetting behavior will not occur. Becker and Tomes (1986) and Becker (1989) acknowledge this possibility, but point out that the substitutable qualities of the two types of investments are clear, while the complementary characteristics are not—in fact, it may be that some government investment programs reduce the return to private spending. For instance, see Peltzman (1973). This motivates the decision to model government and private investments as substitutes.

tion mobility is unaffected. Hence, an observation that countries with larger public human capital expenditures have more earnings mobility is not evidence of credit constraints, unless those countries also have less consumption mobility.

A wide range of empirical evidence documents partial offsetting in private investment decisions. At a basic level, public high schools have not increased total educational attainment by 12 years. Disturbingly, Peltzman (1973) finds that by providing dramatically cheaper and lower quality colleges and universities, public education funding has in some cases actually resulted in decreased total educational expenditures. In addition, crowding out is documented in public health by Scrimshaw (1978), in prenatal care by Jacobson (1980) and in the School Lunch Program by Long (1991). Crowding out is also consistent with the finding that school quality differences do not alter the rate of either consumption or earnings mobility in cross-section (Mulligan, 1999; although Cooper, 1996, reports a dramatic effect on earnings mobility).

While the aggregate picture points to offsetting investments, there is evidence that programs targeted to low-income families, like early childhood education, have been successful in raising levels of human capital (Barnett, 1992; Heckman, 1999). Perhaps the predicted relationship between school funding and intergenerational mobility is found in the long run, because the intergenerational education correlation diminished following increased government education expenditures at the beginning of the twentieth century (Featherman and Hauser, 1976), although less is known about secular trends in the degree of consumption or earnings mobility.

Regulation of financial investments have also been used to reduce intergenerational status correlations. We focus here on the bequest tax. While few families face the inheritance tax in the United States, other countries, like France and Sweden, apply inheritance taxes to a wider population. Such taxes reduce the incentive to give bequests to children. However, economic theory suggests that the effect on intergenerational mobility depends on which measure of economic status—earnings or consumption—is used and how a policy changes the marginal tax rate structure.

If bequests are taxed at a flat rate, then a simple model like that of Becker and Tomes (1979; 1986) implies that families face a lower incentive to invest in financial assets (and a lower opportunity cost to invest in human capital). But as Mulligan (1997) points out, the resulting model is identical to the original model of Becker and Tomes except that the gross rate of return to financial assets is reduced by the level of the tax. While families will individually alter their behavior, there is no effect on the analysis of intergenerational earnings and consumption mobility: earnings mobility results from transmission in ability, while consumption does not regress to the mean.

Graduated rate bequest taxes do affect earnings and consumption mobility. Suppose the tax has two marginal tax rates: zero percent is paid on small bequests, and some higher marginal rate is paid on large estates. Under this policy, high-earning parents are more likely to face a high bequest tax rate than are low-earning parents. The higher the tax rate, the lower the return to financial investments and

so the greater the investment in human capital. This results in less intergenerational earnings mobility, because high-earning parents are given a larger incentive to invest in education.

The impact of a progressive bequest tax on consumption mobility can be broken into three parts. Low-consumption families are unaffected since they are not taxed. Families wealthy enough to bequeath large estates will experience lower dynastic consumption growth than in a no-tax world. However, the predictions concerning consumption mobility are exactly like those of the previous flat tax analysis. Finally, those families who bequeath exactly the amount at which the progressive tax rate kicks in, on the margin, will use human capital investments to transfer consumption to their children since the tax raises the cost of bequests. As a result, they experience a higher degree of consumption mobility. Across the entire population, the policy increases intergenerational consumption mobility—a pattern opposite that predicted for earnings mobility.

A Concluding Defense of Economic Theory

As any economics student can attest, economic theory is costly to master. If economic theories of intergenerational correlations fail to produce verifiable predictions, those who propose we proceed without theory have a strong case. For the sake of brevity, this paper focuses on the insights theory generates in understanding credit market failure and intergenerational correlations. This is not meant to detract from other successful theoretical contributions that we incompletely note here.

For instance, the economic theory of fertility (Becker and Lewis, 1973) represents an important departure from many biological approaches, featuring a budget constraint in which number of children interacts with the quality of each child. From this, a negative relationship between family size and child achievement is derived—a relationship found in some empirical work. (However, Kessler, 1991, and others question the origin of the correlation, citing multicollinearity in number of siblings and birth order.) Neighborhood effects suggested in models of locally controlled schools (Benabou 1993; 1996) are found among immigrant groups (Borjas, 1992). The similarity of the earnings of sons and sons-in-law, predicted by matching models of marriage (Becker, 1973), is confirmed by Atkinson, Maynard and Trinder (1983) and Lam and Schoeni (1993; 1994). Mulligan (1997, p. 339) extends this result, pointing out that matching models imply that intergenerational mobility should be similar for sons and daughters, a result found in U.S. data. Finally, the economic theory of discrimination has been fruitfully applied to intergenerational correlations by Smith and Welch (1986) and Card and Lemieux (1994), among others.

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