THE ASSOCIATION BETWEEN CHILDREN'S EARNINGS AND FATHERS' LIFETIME EARNINGS: ESTIMATES USING ADMINISTRATIVE DATA*

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Abstract

A large and growing literature has examined the intergenerational elasticity (IGE) in earnings in the United States. By using longer panels of earnings, many studies have sought to correct for attenuation bias stemming from measurement error and transitory fluctuations in earnings and thereby have found relatively large estimates of the IGE in earnings – as high as 0.6. Recent papers, such as Haider and Solon (2006), have demonstrated that the association between lifetime earnings and current year earnings varies over the lifecycle and, as a result, the ages at which both fathers' and children's earnings are measured will affect estimates of the IGE in earnings. By using a new dataset that contains nearly career-long earnings histories of fathers and of children's earnings around an age that likely is a good proxy for lifetime earnings, we provide an estimate of the IGE in earnings that corrects for both "life-cycle" biases and attenuation bias. We estimate the association between fathers' and sons' lifetime earnings to be between 0.3 and 0.45 and the association between fathers' and daughters' lifetime earnings to be between 0.2 and 0.3. These estimates imply that the United States is substantially more mobile than recent studies have indicated.

* The views expressed in this paper are those of the authors and should not be interpreted as those of the Congressional Budget Office.

1. Introduction

A large and growing literature has examined the relationship between fathers' and children's earnings or the intergenerational elasticity (IGE) in earnings in the United States and has found a wide range of estimates. The earliest literature (reviewed by Becker and Tomes, 1986) found evidence of the United States being a highly mobile society (with estimates of the IGE in earnings of roughly 0.2). However, estimates based on national longitudinal samples (reviewed by Solon, 1999) found the IGE to be between 0.3 and 0.5, a result which suggests that the actual degree of intergenerational mobility is much lower. A recent estimate based on Social Security Administration earnings records (Mazumder, 2005) found an even greater association between the earnings of fathers and their children (with an IGE of 0.6) and thus implies that the United States is substantially less mobile than previously believed. The accepted explanation for this range of estimates is that attenuation bias due to classical measurement error in fathers' earnings have biased down the estimates based on single-year measures or averages over short panels of fathers' earnings. The earliest estimates used single-year measures of fathers' earnings, those from national longitudinal samples used 4- to 5-year averages in fathers' earnings, while Mazumder (2005) used up to 16-year averages of father's earnings.

A series of recent papers has identified another potential source of bias in estimates of the IGE in earnings—life-cycle bias (Solon, 2002; Haider and Solon, 2006; Grawe, 2006). Haider and Solon (2006) and Bohlmark and Lindquist (2006) demonstrate that the association between lifetime earnings and current-year earnings varies over the life-cycle. As a result, the ages at which both fathers' and children's earnings are measured will affect estimates of the IGE in earnings. Grawe (2006) documents that estimates of the IGE in earnings (using single-year measures of earnings) vary with the age at which sons' and fathers' earnings are measured.

To our knowledge, this paper is the first to provide an estimate of the association between fathers' lifetime earnings and the earnings of their sons and daughters that corrects for life-cycle bias. Most previous estimates average fathers' and children's earnings over the available years of data and adjust for age using flexible controls.[1] By contrast, we measure children's average earnings around an age – 36 – that likely acts as an unbiased proxy for their lifetime earnings (Haider and Solon 2006) and therefore should not lead to life-cycle bias. We also use nearly career-long earnings histories of fathers – averaged over the ages of 20 to 55 – which should eliminate both attenuation bias from measurement error and life-cycle bias from the measurement of fathers' average earnings over only certain age ranges. Furthermore, our estimates come from a new data set containing the mostly uncensored earnings histories for fathers and the uncensored annual earnings of their sons and daughters. The use of these high-quality earnings histories enables us to avoid many of the methodological and data issues – including attenuation bias, life-cycle bias, and censoring – that have confronted earlier researchers.

Our estimates of the association between fathers' and sons' lifetime earnings are between 0.3 and 0.45. These estimates are at the lower end of the range of estimates from the studies surveyed by Solon (1999) and are substantially lower than the estimate in Mazumder (2005) using similar data. Our estimates of the association between

[1] Grawe (2006) is an exception. However, because he uses single-year measures of earnings when estimating the IGE in earnings to more clearly emphasize the existence of life-cycle bias, his estimates of the IGE in earnings likely are seriously attenuated (and are substantially lower than those found in the recent literature).

fathers' and daughters' lifetime earnings are between 0.2 and 0.3, which also are lower than most estimates provided in the literature. These estimates are robust across a wide range of specifications and sample restrictions.

The paper proceeds as follows. Section 2 reviews the literature and discusses the methodological and measurement issues identified by previous studies. Section 3 describes the data. Section 4 describes our methods. Section 5 presents our main results, details our sensitivity checks, and discusses how our results differ from those in previous studies. Section 6 summarizes our conclusions.

2. Methodological and Measurement Issues

The early estimates of the IGE in earnings (surveyed by Becker and Tomes 1986) tend to regress single-year measures of sons' earnings on single-year measures of fathers' earnings (along with flexible controls for age), as in the following model:

$$y_{it} = \alpha + \beta X_{it} + f\left(\gamma, Age_i\right) + \varepsilon_{it}\,. \qquad (1)$$

These studies found relatively small estimates of the IGE in earnings (β), which range around 0.2. However, due to transitory fluctuations in earnings and measurement error, these estimates likely are subject to attenuation bias (Solon 1992, 1999).[2]

To partially address this issue, a large number of studies subsequently used nationally representative data from the Panel Study of Income Dynamics (PSID) and the National Longitudinal Survey (NLS). These studies typically averaged fathers' earnings over a 3- to 5-year period so as to reduce measurement error and attenuation bias. Of the 15 studies surveyed in Solon (1999), only 3 estimate the IGE in earnings to be around 0.2

[2] Solon (1999) notes that because the data sets used in these early analyses tended to have fairly homogenous samples, the attenuation bias is likely to be even greater.

while the other 12 studies estimate it to be between 0.3 and 0.5. The studies with low estimates of the IGE tend to use samples of relatively young men, which is likely related to life-cycle bias as we discuss below. These studies also differed in how they treated observations with low, missing, or zero annual earnings in some years. Some studies (e.g., Zimmerman 1992, Solon 1992) exclude sons and fathers who usually work less than 30 hours per week or who work less than 30 weeks per year and also exclude observations with zero or missing earnings in any year. Others (e.g., Couch and Dunn 1997, Eide and Showalter 1999, Couch and Lillard 1998) exclude years with missing data but include years with zero earnings when computing the averages and also do not exclude part-time workers. Studies that include years with zero earnings and part-time workers tend to find lower estimates of the IGE in earnings than studies that do not.

As noted by Zimmerman (1992) and Mazumder (2005), even estimating equation (1) using 5-year averages of fathers' earnings will likely lead to some attenuation bias, especially in the presence of serially correlated transitory shocks to earnings. Thus, Mazumder (2005) uses Social Security Administration earnings data to calculate average father's earnings over many years of data. His estimates using just 2 years of fathers' earnings data are about 0.25, those using 4 to 7 years of data are about 0.3 to 0.5 (roughly equal to the estimates in most studies), while those using 10 or 16 years of data are much larger, 0.55 to 0.6. These results confirm that attenuation bias is an issue and suggest that "the United States is substantially less mobile than previous research indicated" (Mazumder 2005, p. 235).

In an important paper, Haider and Solon (2006) note that attenuation bias is only one problem in estimating the IGE in earnings. Single-year measures of earnings do not follow classical errors in variables. Instead, the relationship between single-year measures of earnings and lifetime earnings depends upon the age at which the single year of earnings is measured. Because individuals with higher lifetime earnings also tend to experience rapid earnings growth when young, differences tend to be underestimated at younger ages and overestimated at older ages.

Haider and Solon (2006) and Bohlmark and Lindquist (2006) use administrative data to calculate lifetime earnings on samples of men from the United States born between 1931 and 1933 and from Sweden born between 1929 and 1933. They find that current earnings tend to approximate lifetime earnings between roughly the ages of 32 and 40. Because most researchers have tended to assume classical errors in variables, they have not worried about using only single-year measures of children's earnings or the age at which children's earnings are measured. This life-cycle bias may lead to underestimates of the IGE in earnings when using children's earnings measured in their 20s, as many of the studies surveyed by Solon (1999) had done. This insight led Haider and Solon to speculate that "many estimates of the intergenerational earnings elasticity have been subject to substantial attenuation inconsistency from left-side measurement error in addition to the well-known inconsistency from right-side measurement error" (p. 1319). In fact, life-cycle bias may explain why in Solon's (1999) survey, the studies with low estimates of the IGE were the ones with samples of relatively young men (though, as noted above, the samples used in these studies also differed in other dimensions such as the inclusion of observations with years with zero earnings). In the analysis in this paper, we measure sons' and daughters' earnings at or around age 36 to avoid bias from left-side (life-cycle) measurement error.

Of course, life-cycle bias does not just affect the measurement of children's earnings. It also affects the measurement of fathers' earnings, even when multi-year averages of earnings are used. In fact, the use of multi-year averages will reduce noise but is still subject to life-cycle bias could lead to either amplification bias or attenuation bias (Haider and Solon 2006).

The solution to this problem is to use lifetime earnings of fathers when possible. In the analysis presented in this paper, we use nearly career-long averages of fathers' earnings. This solution deals with both "right-side" problems associated with the mismeasurement of fathers' earnings: attenuation bias and life-cycle bias.

In summary, there are three methodological issues highlighted in the literature on the intergenerational transmission of economic stature that must be confronted when estimating the IGE for earnings: (1) attenuation bias from right-side measurement error from using single-year or multi-year averages of fathers' earnings as a proxy for lifetime earnings; (2) right-side life-cycle bias (which can result in either attenuation or amplification bias) when using either a single-year or a multi-year average of fathers' earnings as a proxy for lifetime earnings; and (3) attenuation of amplification bias from left-side life-cycle bias from using single-year or multi-year averages of sons' or daughters' earnings as a proxy for sons' lifetime earnings. We address the first two issues by using a lifetime measure of fathers' earnings. We address the third issue by using sons' and daughters' earnings measured at or averaged around age 36.

There are a few additional measurement issues that also have confronted researchers. With regard to these issues, it is less obvious what the correct choices are so, not surprisingly, studies differ widely on these dimensions. These measurement choices include (1) how to treat years of zero earnings, (2) how to deal with top-coded and non-covered earnings, and (3) whether to include part-time workers.

First, studies that use single-year measures of log fathers' and log children's earnings effectively drop observations with zero annual earnings. Solon (1992) and Zimmerman (1992) average over several years of fathers' earnings and drop observations with zero earnings in any of those years. Other studies make different choices. For example, Couch and Dunn (1997) and Eide and Showalter (1999) includes years of zero earnings for both sons and fathers when constructing log average earnings (dropping observations with zero earnings in every year). Peters (1992), alternatively, excludes years of zero earnings when constructing multi-year averages of earnings. Perhaps as a result, Peters (1992), Eide and Showalter (1999), and Couch and Dunn (1997) estimate relative low IGEs in earnings (ranging from 0.15 to 0.34) while Solon (1992) and Zimmerman (1992) estimate relatively high IGEs (0.4 to 0.5). When Couch and Dunn (1997) exclude observation with years of zero earnings, their estimate increases substantially. Couch and Lillard (1998) show that estimates from the PSID and NLS are sensitive to the decision whether to exclude observations with years of zero earnings. In this paper, we explore the implications of including zeros or dropping observations with any years of zero earnings. Our results are surprisingly robust to this choice.[3]

Second. the papers cited above that use SSA administrative data (Haider and Solon 2006 and Mazumder 2005) have to deal with issues related to the fact that their data are top-coded at the Social Security taxable maximum. In particular, Mazumder reports that, in years when the taxable maximum was relatively low, roughly 50 percent

[3] Mazumder (2005) also explored how sensitive his results were to including observations with some years of zero earnings. Similar to our findings, his estimates are robust to this choice.

of observations have top-coded earnings. As a result, he imputes top-coded earnings using information on a father's race and education. For children, top-coded earnings are imputed using information on sex. Non-covered earnings are not reported in the SSA data used by Mazumder (2005). To deal with this data limitation, he imputes coverage status and earnings for non-covered workers.

In this paper, we use, when possible, uncensored earnings data from SSA, which are available from 1981 onwards. Earnings data prior to 1981 that we use to construct lifetime earnings is potentially top-coded. For these years of earnings data, we impute top-coded earnings using an individual's earnings history. Details of this imputation procedure are described in the Appendix.

Third, some papers (Solon 1992, Zimmerman 1992) restrict their samples to full-time, full-year workers. The use of administrative data on annual earnings precludes such a restriction because information on hours and weeks worked are not available.

3. Data

Our data come from the 1984 Survey of Income and Program Participation (SIPP) matched to Social Security Administration's (SSA) detailed earnings records (DER) and summary earnings records (SER).[4] The 1984 SIPP is a nationally representative sample of households that were initially interviewed between June and September 1983. The SER contain annual earnings for men that are top-coded at the Social Security taxable maximum since 1951. The DER data, by contrast, are not top-coded but are only available since 1978. We restrict our sample to men who, as of the first interview, were

[4] These confidential data have been made available to the Congressional Budget Office for purposes of long-term model development.

born between 1931 and 1949 (so that we have complete earnings histories from age 20 until age 55) and who lived with at least one of their own children who were between the ages of 12 and 21 as of the first interview (born between 1963 and 1972). The sample is further restricted to those fathers and children who provided social security numbers to the Census interviewers and who were successfully matched to the SSA data. 95 percent of fathers were successfully matched, but only 75 percent of children were matched. Our final sample consists of 1,869 father-son pairs and 1,652 father-daughter pairs. We use all siblings who meet the sample restrictions and adjust our standard errors accordingly. All analyses use the 1984 SIPP sample weights. All earnings data are inflated to 2004 dollars using the CPI-U-RS.

The use of SSA earnings records enables us to construct a lifetime earnings measure for a large sample of fathers.[5] Our measure of lifetime earnings is the natural logarithm of average annual earnings from age 20 and age 55, including years of zero earnings. Below, we determine how robust our results are to restricting our sample of fathers to those with positive earnings in every year from age 25 to 55. For all of the fathers in our sample, we observe annual earnings in each year from age 20 to 55, spanning the years 1951 to 2004. Previous studies which relied on data from the PSID and the NLS were limited both by the relatively small samples and by their using fewer years of earnings – typically 3 to 5 years – from which to construct average earnings. These studies also typically drop observations with zero earnings. Couch and Dunn (1996) is an exception.

[5] Social security earnings data have the additional feature of likely being more accurate than earnings reported in surveys (Bound and Krueger 1991).

Prior to 1978, the only data available come from the SER and therefore are limited in two ways. First, they are top-coded at the maximum amount subject to the Social Security tax which varies by year. Second, the SER earnings are available only for jobs covered by Social Security. Over 70 percent of earnings were covered between 1951 and 1956 and 80 percent between 1957 and 1981. Thus, in some specifications, following Mazumder (2005), we redefine our measure of lifetime earnings to be the average of earnings between age 25 and age 55 and restrict our sample to fathers with positive earnings at each of those ages. Alternatively, we restrict our sample to men who did not report being self-employed and who did not report working for Federal or State governments in the 1984 SIPP. After 1981, the DER are also available. Earnings in the DER are not top-coded and represent earnings from all jobs (including self-employment).[6]

The availability of the DER yields a large sample of observations with uncensored earnings data. These data enable us to impute top-coded data using each observation's very rich earnings history. In particular, we use propensity score methods and, alternatively, linear regression to match top-coded observations to uncensored observations from the DER. Because the censoring point varies by year, we implement this matching procedure separately for each age and year for which we have top-coded observations. The matching variables we use include the annual earnings in the 5 years prior to and following the top-coded observation, as well as a set of corresponding indicator variables for whether these earnings would also be top-coded. For top-coded observations at ages under age 25, we use the ten observations on annual earnings

[6] The DER data are available beginning in 1978. However, because of problems with the quality of the data in the DER between 1978 and 1980, we use the SER to measure earnings prior to 1981 and the DER to measure earnings thereafter.

between ages 20 and 30 as matching variables. We then impute top-coded earnings for each top-coded observation with the average earnings among the matched observations using a nearest neighbor matching procedure. Details are provided in the Appendix.

4. Method

We estimate the following model to determine the IGE in earnings:

$$y_{it} = \alpha + \beta X_{it} + \varepsilon_{it} \quad (2)$$

where:

y_{it} is child's earnings (log of average earnings over an interval centered around age 36); and
X_{it} is father's lifetime earnings (log of average earnings between age 20 and 55).

Because earnings are measured for all of our children and all of our fathers at the same ages, we do not need to make age adjustments as in equation (1). We choose age 36 as the age at which we center our measure of average earnings of the child. Haider and Solon (2006) and Bohlmark and Lindquist (2006) determine the extent to which annual earnings can proxy for lifetime earnings for cohorts of American and Swedish men. Haider and Solon (2006) find that, for their cohort of men born between 1931 and 1933, annual earnings between age 32 and 40 are good proxies for lifetime earnings. Bohlmark and Lindquist find that, for their cohort of men born between 1929 and 1933, annual earnings between age 34 and 40 are good proxies for lifetime earnings. While Haider and Solon do not determine the extent of life-cycle biases for women, Bohlmark and Lindquist find that ages 30 to 33 and age 35 are good proxies for the lifetime earnings of women.

Because the cohorts used in each of these studies are slightly older than the fathers in our sample (and substantially older than our sample of sons and daughters), we replicate Haider and Solon using a sample of men and women born between 1931 and 1949 (the same cohort as our fathers).[7] In particular, we regress annual earnings at each age between 20 and 55 on a measure of lifetime earnings. The coefficient on lifetime earnings determines the extent of life-cycle biases. If that coefficient is close to 1, then these biases will be small. We report these results in Figure 1. We also regress averages of earnings between various age ranges centered on age 36 and report the results in Table 1. From this procedure, it appears that earnings between ages 35 and 37 are reasonable proxies for lifetime earnings for both men and women.

We also replicate Haider and Solon's "reverse regression" to measure the extent of attenuation bias that would result from using single-age measures of earnings. The results are presented in Figure 2 and confirm that estimates using single-age measures of earnings, especially those measured at younger ages, would be severely attenuated.

5. Results

Estimates of the IGE in Earnings

Our primary results are presented in Table 2. In it, we report results of the IGE in earnings where fathers' lifetime earnings are measured as the natural logarithm of average annual earnings (including zeros) from age 20 to 55 and the dependent variable is the natural logarithm of sons' and daughters' earnings measured at various ages. Note

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[7] We impute top-coded earnings for years prior to 1981 and use the non-censored data enable from 1981 onwards and follow Bjorklund (1993) and Bohlmark and Lindquist (2006). Haider and Solon (2006) employ a complex limited dependent variable model to deal with censoring. Our results do not differ appreciably from Haider and Solon's.

that the sample size varies across specifications both because of years with zero earnings and because we do not observe earnings at older ages for our relative young children. Our preferred measure of children's earnings is the log average earnings from age 35 to 37, reported in the first row. The estimate of the IGE in earnings between fathers and sons is 0.313, the estimate between fathers and daughters is 0.208, and the pooled estimate is 0.254.

The next three rows of Table 2 report estimates of the IGE in earnings when we average sons' and daughters' earnings (including zeros) over alternative age ranges centered on age 36 (34 to 38, 33 to 39, and 32 to 40). The estimates are quite robust to changing the ages at which earnings are measured (so long as they are in their 30s) and range from 0.308 to 0.383 for sons and from 0.186 to 0.304 for daughters.

The last six rows of Table 2 report the IGE in earnings when we use single-age measures of sons' and daughters' earnings. When earnings are measured when the children are in their 30s, these estimates range from 0.259 to 0.346 for sons and from 0.169 to 0.305 for daughters. The sample size varies substantially across these rows, however, since observations with zero earnings at that age are dropped due to the log specification.

Table 3 replicates these results using constant sample, which is restricted to fathers with positive earnings at every age from 25 to 55 and children with positive earnings at every age from 34 to 38. This sample restriction reduces our sample to 601 father-child pairs (347 father-son pairs and 254 father-daughter pairs).

The estimates of the IGE in earnings are larger when we impose this sample restriction. When the dependent variable is children's log average earnings from age 35 to 37 (our preferred measure) and fathers' lifetime earnings are measured as log average earnings from age 25 to 55, the estimate of the IGE is 0.443 for sons and 0.348 for the pooled sample. The results are robust to the ages at which we measure earnings, ranging from 0.415 to 0.500 for sons and from 0.301 to 0.386 for the pooled sample.

Table 4 demonstrates the importance of using a lifetime measure of fathers' earnings. In it, we present estimates where the dependent variable is always children's log average earnings from age 35 to 37 and the independent variable is the log of 15 years of fathers' earnings averaged over various ages (25 to 40, 30 to 45, 35 to 50, and 40 to 55). The estimates are generally lower than the estimates using fathers' log average earnings from age 20 to 55, a result that may indicate that attenuation bias may still be an issue even when using 16 years averages of earnings. The estimates generally increase with the age of the father. When we average fathers' earnings over the years 1970 to 1985, regardless of the age of the fathers, we get a larger estimate of the IGE in earnings of 0.329 for sons and 0.221 for daughters.

When we re-estimate these models using our constant sample (Table 5), we find that the estimates are comparable in magnitude to our lifetime measure when we measure fathers' earnings over the 16-year span from age 30 to 45. The estimates are lower, however, when fathers' earnings are measured at young ages (25 to 40) or older ages (35 to 50 or 40 to 55). This life-cycle pattern of the estimates is consistent with what one would expect based on the estimates of life-cycle association between current and lifetime earnings from Haider and Solon (2006) and Bohlmark and Lindquist (2006).

In Table 6, we document the presence of the well-known attenuation bias in estimates of the IGE in earnings when short averages of fathers' earnings are used. We again use our constant sample and, as the dependent variable, children's log average earnings from age 35 to 37 but vary the number of years over which we average fathers' earnings (25 to 55, 30 to 50, 30 to 40, 35 to 40, 35 to 37, and age 36). We present the estimates from the constant sample. The estimates are substantially smaller (0.190) when a single-age measure of fathers' earnings is used, and they are less than half of the estimate when we use fathers' lifetime earnings.

Alternative Measures of Intergenerational Mobility

The estimates of the IGE in earnings presented above provide a single number for the degree of intergenerational mobility. Another often used way of expressing mobility is through a transition matrix. This matrix shows the probability of a child's being in a given quintile of the earnings distribution conditional upon his or her father's position in the lifetime earnings distribution. Table 7 presents a transition matrix by quintile for children and fathers. The table shows a fair degree of earnings mobility across generations. For example, only 27 percent of children, 32 percent of sons, and 24 percent of daughters whose fathers are in the lowest quintile of the lifetime earnings distribution are themselves in the lowest quintile, and 10 percent of these children transition into the highest quintile. 37 percent of children, 45 percent of sons, and 31 percent of daughters with fathers in the highest quintile of the lifetime earnings distribution are themselves in the highest quintile. Roughly 15 percent of these children transition into the lowest quintile.

These estimates are remarkably similar to those presented by Peters (1992) and by Zimmerman (1992) using the NLS. Interestingly, these two studies present widely different estimates of the IGE in earnings for fathers and sons – 0.14 in Peters (1992) and 0.54 in Zimmerman (1992) – because they make different choices regarding their samples (e.g., inclusion of part-time workers, workers with zero earnings in some years, and age of the sons). However, their estimates of the transition matrix between fathers and sons are remarkably similar despite these differences (and are similar to ours). This suggests that the methodological and sample choice issues that have led to the wide range of estimates of the IGE in earnings do not lead to an equally wide range of estimates of transition matrices. Future work should explore the relative robustness of estimates of the intergenerational transition matrix in earnings to choices of samples.

An alternative single-unit measure of intergenerational mobility is the association between children's and father' relative positions in their respective earnings distributions. To create this measure, we regress children's earnings percentile (measured at 35 through 37) on fathers' lifetime earnings percentile. This measure similar to what is commonly estimated by sociologists relating occupational position of children to that of fathers (Beller and Hout 2006). That is we estimate the following OLS regression,

$$p_{it}^{y} = \alpha + \beta p_{it}^{X} + \varepsilon_{it} \tag{3}$$

where:

> p^{y}_{it} is the child's percentile of earnings (measured over an interval centered around age 36); and
> p^{X}_{it} is the father's percentile of lifetime earnings (measured between age 20 and 55).

Table 8 displays our estimate this model. The results show that an increase of father's lifetime earnings of 10 percentiles is associated with sons' being, on average, three percentiles higher in the earnings distribution. The association of percentiles in earnings between fathers and daughters, as it was for the IGE in earnings, is somewhat smaller than for sons: an increase of fathers' lifetime earnings of 10 percentiles is associated with daughters' being, on average, 1.3 percentiles higher in the earnings distribution.

This measure imposes a linear relationship between the position of children in the earnings distribution and the position of fathers in the lifetime earnings distribution and thus, like the IGE, yields a single number for the degree of intergenerational mobility. In order to allow for a potentially non-linear and highly flexible relationship between children's and fathers' positions in their respective earnings distributions, we calculate a simple non-parametric estimate of this relationship.

To do this, we create moving blocks (of four percentiles) of fathers ordered by their percentile in the lifetime earnings distribution. For example, the first block includes all fathers in the first through fourth percentiles of lifetime earnings; the second block includes fathers in the second through fifth percentiles, and the 97th block includes fathers in the 97th through 100th percentiles. For each block, we calculate the percentile in the overall children's earnings distribution at which the 20th percentile, median, and 80th percentile of earnings of the children in that block fall (where earnings of children once again are measured as the average between ages 35 and 37). We do this separately for sons and daughters as well as for all children.

Figures 3 through 5 display this non-parametric relationship between children's relative positions in the earnings distribution (measured at 35 through 37) and fathers' relative positions in the lifetime earnings distribution. The solid line displays the percentile below which 50 percent of children's earnings. Roughly speaking, a child has a 50 percent probability of having earnings below this line given his or her father's position in the lifetime earnings distribution. The two dashed lines display the equivalent 20^{th} and 80^{th} percentiles.

Figure 3 displays the relationship between the percentiles of earnings of fathers and sons. As can be seen, there is a substantial amount of mobility in the middle of the earnings distribution. Sons whose fathers are between the 10^{th} and 80^{th} percentile of the lifetime earnings distribution all have roughly equal distributions of earnings. For example, sons whose fathers have about median lifetime earnings have roughly an 80 percent chance of being below the 80^{th} percentile of earnings, a 50 percent change of being below median earnings, and a 20 percent change of being below the 20^{th} percentile for earnings. Sons whose fathers have about the 10^{th} percentile of lifetime earnings have roughly an 80 percent chance of being below the 75^{th} percentile, a 50 percent change of being below the 45^{th} percentile, and a 20 percent change of being below the 20^{th} percentile. Similarly, for sons whose fathers have about the 80^{th} percentile of lifetime earnings, these percentiles are the 80th, the 60th, and the 30^{th}. Thus, while there is a positive association between fathers' and sons' positions in the earnings distribution, it is very small in the "broad" middle of the lifetime earnings distribution. Between the 10^{th} and 80^{th} percentiles, the linear relationship between fathers' and sons' earnings percentiles is about 0.2.

This large amount of mobility in the broad middle is in striking contrast to the amount at either tail of the distribution of fathers' lifetime earnings. Both above the 80^{th} percentile and below the 10^{th}, the association between fathers' position and sons' is greater than one. That is, that is much less intergenerational mobility in earnings at the top (above the 80th) and at the extreme bottom (below the 10th) of the earnings distribution.

Figure 4 displays the equivalent relationship between fathers and daughters. Like the "broad middle" in the case of sons, there is only a weak and positive relationship between fathers' and daughters' position in the earnings distribution. However in contrast to sons, this weak association is evident at the tails of the distribution as well. Overall for children (Figure 5), there is a weak association between fathers' and children's relative position in the earnings distribution in the broad middle (between the 10th and 80th percentiles) and a stronger association at either tail.

Conclusion

Our estimates of the IGE in earnings are the first which address both attenuation and life-cycle biases that have affected previous estimates. We are able to circumvent these issues primarily through the use of high-quality and nearly career-long SSA earnings histories of a large sample of fathers. We measure sons' and daughters' earnings around an age – 36 – which is likely a good proxy for lifetime earnings according to recent estimates (Haider and Solon 2006; Bohlmark and Lindquist 2006) and is confirmed by our own analysis. The literature to date has been inconsistent in its treatment of years of zero earnings when calculating fathers' lifetime earnings. Our results are sensitive to how we treat years of zero earnings, but not overly so. Our estimates of the IGE in earnings between fathers and sons range between roughly 0.3 and 0.45 and our estimates of the IGE in earnings between daughters range between roughly 0.15 and 0.3. We prefer estimates based on measures of fathers' lifetime earnings that include fathers who occasionally have years of zero annual earnings – these estimates are roughly 0.3 to 0.38 for sons and 0.15 to 0.2 for daughters.

Nonparametric estimates of the association between fathers' and children's relative positions in the earnings distribution show that there is substantial mobility in the broad middle of the distribution (between the 10th and 80th percentiles of the distribution of fathers' lifetime earnings) for sons and over the entire distribution for daughters. For sons whose fathers are at the tails of the lifetime earnings distribution (above the 80th or below the 10th), there is very little mobility. When fathers have very high or very low lifetime earnings, his position is a strong determinant of his son's earnings.

Appendix

We use a sample of earnings for men from the DER to impute earnings for men from the SER, which are potentially subject to top-coding. Table A1 reports the Social Security Taxable Maximum in nominal and real dollars and the percentage of fathers with top-coded earnings data by year, from 1951 to 1980. Between 1951 and 1964, the top-codes were rather low (roughly $22,000 to $26,000 in 2005 dollars). Our sample of fathers, who were born between 1931 and 1949, are relatively young in those years so that, at least initially, relatively few of them have annual earnings above the top-code. However, by 1965, almost half of our sample of fathers has top-coded earnings. 74 percent of our sample have at least one year of earnings that is above the top-code while 41 percent have 10 or more years of top-coded data. After 1981 we use earnings from the DER which are not top-coded.

In order to impute top-coded earnings, we use propensity score methods to match top-coded observations from the SER sample to uncensored observations from the DER sample. We use the rich panel data on earnings available in both surveys as our conditional variables. In particular, we estimate:

$$P(y_{a,t} > T_t) = F\left(\alpha + \sum_{j\in(-5,-1)(1,5)} \beta_j y^*_{(a+j),(t+j)} + \sum_{j\in(-5,-1)(1,5)} \gamma_j \left(y_{(a+j),(t+j)} > T_{t+j}\right)\right)$$

where

$y_{a,t}$ is uncensored earnings at age *a* in year *t*;
T_t is the Social Security Taxable Maximum in year *t*;
$y^*_{a,t}$ is equal to T_t if censored and to $y_{a,t}$ is uncensored.

All earnings and top-codes are converted to real 2005 dollars using SSA's average wage index series.[8] We use this model to construct propensity scores for both the SER and

[8] Available at http://www.ssa.gov/OACT/COLA/awiseries.html.

DER samples and use propensity score methods to match each top-coded observation from the SER to a number of uncensored observations from the DER. The imputed value is the average of the values from the matched sample.

Alternatively, we use linear regression to impute top-coded data by estimating:

$$y_{a,t} = \alpha + \sum_{j\in(-5,-1)(1,5)} \beta_j y^*_{(a+j),(t+j)} + \sum_{j\in(-5,-1)(1,5)} \gamma_j \left(y_{(a+j),(t+j)} > T_{t+j}\right) + \varepsilon_{a,t}$$

using the DER sample. The imputed values for top-coded observations in the SER are the predicted values from this model.

References

Becker, Gary S. and Tomes, Nigel, "Human Capital and the Rise and Fall of Families." *Journal of Labor Economics*, July 1986, 4, S1-S39.

Bjorklund, Anders. "A Comparison between Actual Distributions of Annual and Lifetime Income: Sweden 1951-89." *Review of Income and Wealth*, December 1993, 39(4), pp. 377-86.

Bohlmark, Anders and Lindquist, Matthew J. "Life-Cycle Variations in the Association between Current and Lifetime Income: Country, Gender and Cohort Differences." *Journal of Labor Economics*, forthcoming.

Bound, John and Krueger, Alan B. "The Extent of Measurement Error in Longitudinal Earnings Data: Do Two Wrongs Make a Right?" *Journal of Labor Economics*, January 1991, 9(1), pp. 1-24.

Bound, John and Solon, Gary. "Double Trouble: On the Value of Twins-Based Estimation of the Return to Schooling." *Economics of Education Review*, April 1999, 18(2), pp. 169-82.

Chadwick, Laura and Solon, Gary . "Intergenerational Income Mobility Among Daughters." *American Economic Review*, March 2002, 92(1), pp. 335-44.

Couch, Kenneth A. and Dunn, Thomas A. "Intergenerational Correlations in Labor Market Status: A Comparison of the United States and Germany." *Journal of Human Resources*, Winter 1997, 32(1), pp. 210-32.

Couch, Kenneth A. and Lillard, Dean R. "Sample Selection Rules and the Intergenerational Correlation of Earnings." *Labour Economics*, September 1998, 5(3), pp. 313-329.

Eide, Eric R. and Showalter, Mark H. "Factors Affecting the Transmission of Earnings across Generations: A Quantile Regression Approach." *Journal of Human Resources*, Spring 1999, 34(2), pp. 253-67.

Grawe, Nathan D. "Lifecycle Bias in Estimates of Intergenerational Earnings Persistence." *Labour Economics*, forthcoming.

Haider, Steven J. "Earnings Instability and Earnings Inequality of Males in the United States: 1967-1991." *Journal of Labor Economics*, October 2001, 19(4), pp. 799-836.

Haider, Steven J. and Solon, Gary. "Life-Cycle Variation in the Association between Current and Lifetime Earnings." *American Economic Review*, forthcoming.

Peters, H. Elizabeth. "Patterns of Intergenerational Mobility in Income and Earnings." *Review of Economics and Statistics*, August 1992, 74(3), pp. 456-66.

Mazumder, Bhashkar. "Fortunate Sons: New Estimates of Intergenerational Mobility in the U.S. Using Social Security Earnings Data." *Review of Economics and Statistics*, May 2005, 87(2), pp. 235-55.

Solon, Gary. "Biases in the Estimation of Intergenerational Earnings Correlations." *Review of Economics and Statistics*, February 1989, 71(1), pp. 172-74.

Solon, Gary. "Intergenerational Mobility in the United States." *American Economic Review*, June 1992, 82(3), pp. 393-408.

Solon, Gary. "Intergenerational Mobility in the Labor Market," in Orley C. Ashenfelter and David Card, eds., *Handbook of Labor Economics*, vol. 3A. Amsterdam: North-Holland, 1999, pp. 1761-1800.

Zimmerman, David J. "Regression Toward Mediocrity in Economic Stature." *American Economic Review*, June 1992, 82(3), pp. 409-29.

Table 1.
Estimates of the Association Between Lifetime and Annual Earnings: Multi-Age Averages

	All	Men	Women
Forward Regression (λ)			
Age 35 to 37	1.06	0.98	0.99
Age 34 to 38	1.11	1.02	1.05
Age 33 to 39	1.14	1.04	1.07
Age 32 to 40	1.13	1.05	1.07
Reverse Regression (θ)		Men	
Age 25 to 40		0.68	
Age 30 to 45		0.75	
Age 35 to 50		0.68	
Age 40 to 55		0.52	
Age 25 to 55		0.92	
Age 25 to 45		0.80	
Age 28 to 42		0.72	
Age 32 to 40		0.65	
Age 35 to 37		0.53	

Source: Author's calculations from the 1984-SIPP SAA matched file

Table 2.
Estimates of the Intergenerational Elasticity between Children's Earnings and Fathers' Lifetime Earnings

Age of Child at which Earnings are Measured	Elasticity Between Fathers and Sons/Daughters/Both								
	Sons			Daughters			Both		
	Coef	SE	n	Coef	SE	n	Coef	SE	n
Age 35 to 37	0.313	0.074	1,000	0.208	0.077	820	0.254	0.054	1,820
Age 34 to 38	0.383	0.104	801	0.304	0.119	653	0.319	0.078	1,454
Age 33 to 39	0.308	0.083	560	0.272	0.097	466	0.257	0.063	1,026
Age 32 to 40	0.337	0.101	353	0.186	0.111	290	0.245	0.077	643
Age 20	0.018	0.037	1,690	0.063	0.053	1,444	0.033	0.031	3,134
Age 22	0.045	0.039	1,717	0.114	0.053	1,444	0.073	0.032	3,161
Age 24	0.162	0.035	1,712	0.233	0.051	1,427	0.186	0.028	3,139
Age 26	0.222	0.044	1,719	0.336	0.064	1,439	0.263	0.043	3,158
Age 28	0.242	0.042	1,728	0.283	0.049	1,401	0.255	0.036	3,129
Age 30	0.346	0.049	1,709	0.305	0.060	1,385	0.326	0.044	3,094
Age 32	0.331	0.045	1,681	0.250	0.054	1,353	0.297	0.037	3,034
Age 34	0.333	0.061	1,480	0.251	0.067	1,159	0.302	0.051	2,639
Age 36	0.259	0.059	1,166	0.169	0.072	924	0.219	0.046	2,090
Age 38	0.309	0.069	738	0.251	0.110	571	0.258	0.063	1,309

Source: Author's calculations from 1984-SIPP SSA matched file.

Notes: Children's earnings is the natural log of annual earnings averaged over the ages indicated.
Fathers' lifetime earnings is the natural log of average annual earnings from age 20 to 55.
Years with zero earnings are included in fathers' lifetime earnings and in multi-age averages of children's earnings.

Standard errors are adjusted for the fact that some fathers appear in the sample more than once.

Table 3.

Estimates of the Intergenerational Elasticity between Children's Earnings and Fathers' Lifetime Earnings: Constant Sample, Dropping Observations with Zero Earnings

Age of Child at which Earnings are Measured	Elasticity Between Fathers and Sons/Daughters/Both								
	Sons			Daughters			Both		
	Coef	SE	n	Coef	SE	n	Coef	SE	n
Age 35 to 37	0.443	0.093	347	0.268	0.110	254	0.348	0.079	601
Age 34 to 38	0.454	0.093	347	0.288	0.108	254	0.363	0.077	601
Age 34	0.470	0.109	347	0.305	0.115	254	0.379	0.082	601
Age 35	0.415	0.103	347	0.291	0.115	254	0.344	0.082	601
Age 36	0.500	0.107	347	0.112	0.161	254	0.301	0.110	601
Age 37	0.459	0.107	347	0.267	0.110	254	0.355	0.081	601
Age 38	0.448	0.120	347	0.345	0.191	254	0.386	0.119	601

Source: Authors' calculations from 1984-SIPP SSA matched file.

Notes: Children's earnings is the natural log of annual earnings averaged over the ages indicated.
Fathers' lifetime earnings is the natural log of average annual earnings from age 25 to 55.
Sample is restricted to fathers with positive earnings at every age from 25 to 55 and to children with positive earnings at every age from 34 to 38.

Standard errors are adjusted for the fact that some fathers appear in the sample more than once.

Table 4.

Estimates of the Intergenerational Elasticity between Children's Earnings Between Age 35 and 37 and Fathers' Earnings

16-Year Span of Ages over which Father's Earnings are Measured	Elasticity Between Fathers and Sons/Daughters/Both								
	Sons			Daughters			Both		
	Coef	SE	n	Coef	SE	n	Coef	SE	n
Age 20 to 55	0.313	0.074	1,000	0.208	0.077	820	0.254	0.054	1,820
Age 25 to 40	0.109	0.050	985	0.051	0.062	799	0.072	0.039	1,784
Age 30 to 45	0.232	0.057	991	0.083	0.069	809	0.155	0.043	1,800
Age 35 to 50	0.259	0.043	996	0.162	0.060	818	0.209	0.035	1,814
Age 40 to 55	0.258	0.053	987	0.161	0.051	816	0.209	0.039	1,803
Years 1970 to 1985	0.319	0.076	999	0.227	0.065	820	0.263	0.050	1,819

Source: Authors' calculations from 1984-SIPP SSA matched file.

Notes: Children's earnings is the natural log of annual earnings averaged over the ages indicated.
Fathers' lifetime earnings is the natural log of average annual earnings from age 20 to 55.

Years with zero earnings are included in fathers' lifetime earnings and in multi-age averages of children's earnings.

When fathers' earnings are averaged from 1970 to 1985, we also control for a quadratic in age.

Standard errors are adjusted for the fact that some fathers appear in the sample more than once.

Table 5.

Estimates of the Intergenerational Elasticity between Children's Earnings Between Age 35 and 37 and Fathers' Earnings: Constant Sample, Dropping Observations with Zero Earnings

16-Year Span of Ages over which Father's Earnings are Measured	Elasticity Between Fathers and Sons/Daughters/Both								
	Sons			Daughters			Both		
	Coef	SE	n	Coef	SE	n	Coef	SE	n
Age 20 to 55	0.443	0.093	347	0.268	0.110	254	0.348	0.079	601
Age 25 to 40	0.357	0.096	347	0.170	0.165	254	0.282	0.090	601
Age 30 to 45	0.459	0.107	347	0.241	0.150	254	0.377	0.092	601
Age 35 to 50	0.385	0.100	347	0.262	0.115	254	0.331	0.080	601
Age 40 to 55	0.326	0.090	347	0.214	0.085	254	0.266	0.067	601

Source: Authors' calculations from 1984-SIPP SSA matched file.

Notes: Children's earnings is the natural log of annual earnings averaged over the ages indicated.
Fathers' lifetime earnings is the natural log of average annual earnings from age 20 to 55.

Years with zero earnings are included in fathers' lifetime earnings and in multi-age averages of children's earnings.

When fathers' earnings are averaged from 1970 to 1985, we also control for a quadratic in age.

Standard errors are adjusted for the fact that some fathers appear in the sample more than once.

Table 6.

Estimates of the Intergenerational Elasticity between Children's Earnings Between Age 35 and 37 and Fathers' Earnings Averaged over Varying Lengths: Constant Sample, Dropping Observations with Zero Earnings

Age Span over which Fathers' Earnings are Measured	Elasticity Between Fathers and Sons/Daughters/Both								
	Sons			Daughters			Both		
	Coef	SE	n	Coef	SE	n	Coef	SE	n
Age 25 to 55	0.443	0.093	347	0.268	0.110	254	0.348	0.079	601
Age 30 to 50	0.430	0.098	347	0.274	0.126	254	0.361	0.082	601
Age 30 to 40	0.352	0.096	347	0.153	0.154	254	0.276	0.088	601
Age 35 to 40	0.345	0.104	347	0.183	0.149	254	0.284	0.091	601
Age 35 to 37	0.249	0.093	347	0.224	0.144	254	0.247	0.083	601
Age 36	0.190	0.081	347	0.192	0.065	254	0.205	0.054	601

Source: Authors' calculations from 1984-SIPP SSA matched file.

Notes: Children's earnings is the natural log of annual earnings averaged over the ages indicated.
Fathers' lifetime earnings is the natural log of average annual earnings from age 20 to 55.

Years with zero earnings are included in fathers' lifetime earnings and in multi-age averages of children's earnings.

When fathers' earnings are averaged from 1970 to 1985, we also control for a quadratic in age.

Standard errors are adjusted for the fact that some fathers appear in the sample more than once.

Table 7.
Transition Matrices between Children's Age 35 to 37 Earnings and Fathers' Lifetime Earnings

		Children's Earnings, by Quintile				
		Bottom	2nd	3rd	4th	Top
Fathers' Earnings by Quintile	Bottom	26.6	24.9	21.9	16.3	10.3
	2nd	21.1	22.9	20.5	19.2	16.3
	3rd	17.8	19.4	23.9	21.2	17.7
	4th	18.4	16.3	20.9	24.6	20.0
	Top	15.9	16.2	12.6	18.8	36.6

		Sons' Earnings, by Quintile				
		Bottom	2nd	3rd	4th	Top
Fathers' Earnings by Quintile	Bottom	32.0	25.6	18.7	13.3	10.4
	2nd	21.7	24.1	20.7	19.0	14.6
	3rd	16.6	20.8	23.9	23.5	15.2
	4th	16.4	18.6	22.4	26.2	16.4
	Top	12.6	10.5	14.0	18.2	44.8

		Daughters' Earnings, by Quintile				
		Bottom	2nd	3rd	4th	Top
Fathers' Earnings by Quintile	Bottom	23.7	21.6	23.4	16.9	14.4
	2nd	20.7	23.6	17.5	21.5	16.7
	3rd	18.4	18.0	25.0	22.1	16.5
	4th	17.3	18.5	18.1	24.5	21.7
	Top	19.8	18.6	15.2	15.6	30.8

Source: Author's calculations from 1984-SIPP SSA matched file.

Notes: Children's earnings is the natural log of annual earnings averaged over the ages indicated.

Fathers' lifetime earnings is the natural log of average annual earnings from age 20 to 55.

Years with zero earnings are included in fathers' lifetime earnings and in multi-age averages of children's earnings.

Table 8.

Children's Position in the Earnings Distribution on Fathers' Position in the Earnings Distribution

	Coef	SE
All Children	0.209	0.021
Sons	0.292	0.027
Daughters	0.129	0.030

Notes:

Fathers' Earnings: natural log of average earnings from age 20 to 55.

Children's Earnings: natural log of average earnings from age 35 to 37.

The earnings distributions of sons and daughters are treated separately in rows 2 & 3.

Appendix Table 1
Percentage of Fathers with Top-Coded Data by Year, 1951 to 1980

Year	Social Security Taxable In Nominal Dollars	Social Security Taxable In Real (2005) Dollars	Percent of Fathers w/ Top-Coded Earnings in that Year	Percent of Fathers w/ Age ≥ 20 and ≤ 55 in that Year	w/ Top-Coded Earnings Conditional on Age ≥ 20 and ≤ 55 in that Year
1951	$3,600	$22,857	0.0	3.3	0.0
1952	3,600	22,460	0.1	7.8	1.1
1953	3,600	22,305	0.4	12.4	3.2
1954	3,600	22,152	0.8	18.1	4.2
1955	4,200	25,933	1.2	23.3	5.0
1956	4,200	25,495	3.1	29.2	10.7
1957	4,200	24,742	4.3	36.2	11.8
1958	4,200	24,033	7.1	43.2	16.5
1959	4,800	27,293	8.0	50.3	15.9
1960	4,800	26,784	12.4	56.6	22.0
1961	4,800	26,537	15.7	63.4	24.7
1962	4,800	26,294	21.4	71.6	29.8
1963	4,800	25,899	27.5	78.3	35.2
1964	4,800	25,592	34.5	83.6	41.2
1965	4,800	25,218	41.8	87.6	47.7
1966	6,600	33,690	31.7	92.0	34.4
1967	6,600	32,669	40.3	95.6	42.2
1968	7,800	37,175	37.1	97.8	37.9
1969	7,800	35,571	45.4	100.0	45.4
1970	7,800	33,934	50.8	100.0	50.8
1971	7,800	32,517	57.1	100.0	57.1
1972	9,000	36,421	54.2	100.0	54.2
1973	10,800	41,113	48.5	100.0	48.5
1974	13,200	45,698	38.5	100.0	38.5
1975	14,100	45,079	37.5	100.0	37.5
1976	15,300	46,281	39.5	100.0	39.5
1977	16,500	46,910	41.2	100.0	41.2
1978	17,700	48,247	42.7	100.0	42.7
1979	22,900	57,059	31.7	100.0	31.7
1980	25,900	58,117	27.6	100.0	27.6

Memo: Percent of sample with:

Ever top-coded earnings	74.0
5 or more years of top-coded data	54.0
10 or more years of top-coded data	41.0

Notes: SS Tax max inflated to 2005 dollars using CPI-U-RS
Fathers appearing in the data more than once (because they have multiple children) are included here multiple times. Results are similar if they are only included once. Sample Size: 3,521

Appendix Table 2.
Sample Demographics

	Mean	10th	50th	90th
Father's Age in 1984	44	38	45	51
Year Father Turned 20	1959	1953	1959	1966
Year Father Turned 55	1994	1988	1994	2001
Father's Education in 1984				
less than HS	23%	--	--	--
HS	34%	--	--	--
some college	19%	--	--	--
college plus	24%	--	--	--
Race/Ethnicity				
Non-Hispanic White	85%	--	--	--
Non-Hispanic Black	7%	--	--	--
Hispanic	5%	--	--	--
Other	3%	--	--	--
Age of Father when Child was Born	27.5	22	27	34
Child's Gender				
Male	53%			
Female	47%			
Child's Age in 1984	16	13	17	20
Child's Age in 2004	36	33	37	40

Note: The sample consists of children (boys and girls) born between 1963 and 1972 (age 12 to 21 in 1984) from the first wave of the 1984 panel of the SIPP who can be matched with a male parent. Fathers are restricted to be 20 or younger in 1951 and 55 or

Figure 1.
Estimate of Life-Cycle Bias: Annual Earnings on Lifetime Earnings by Gender

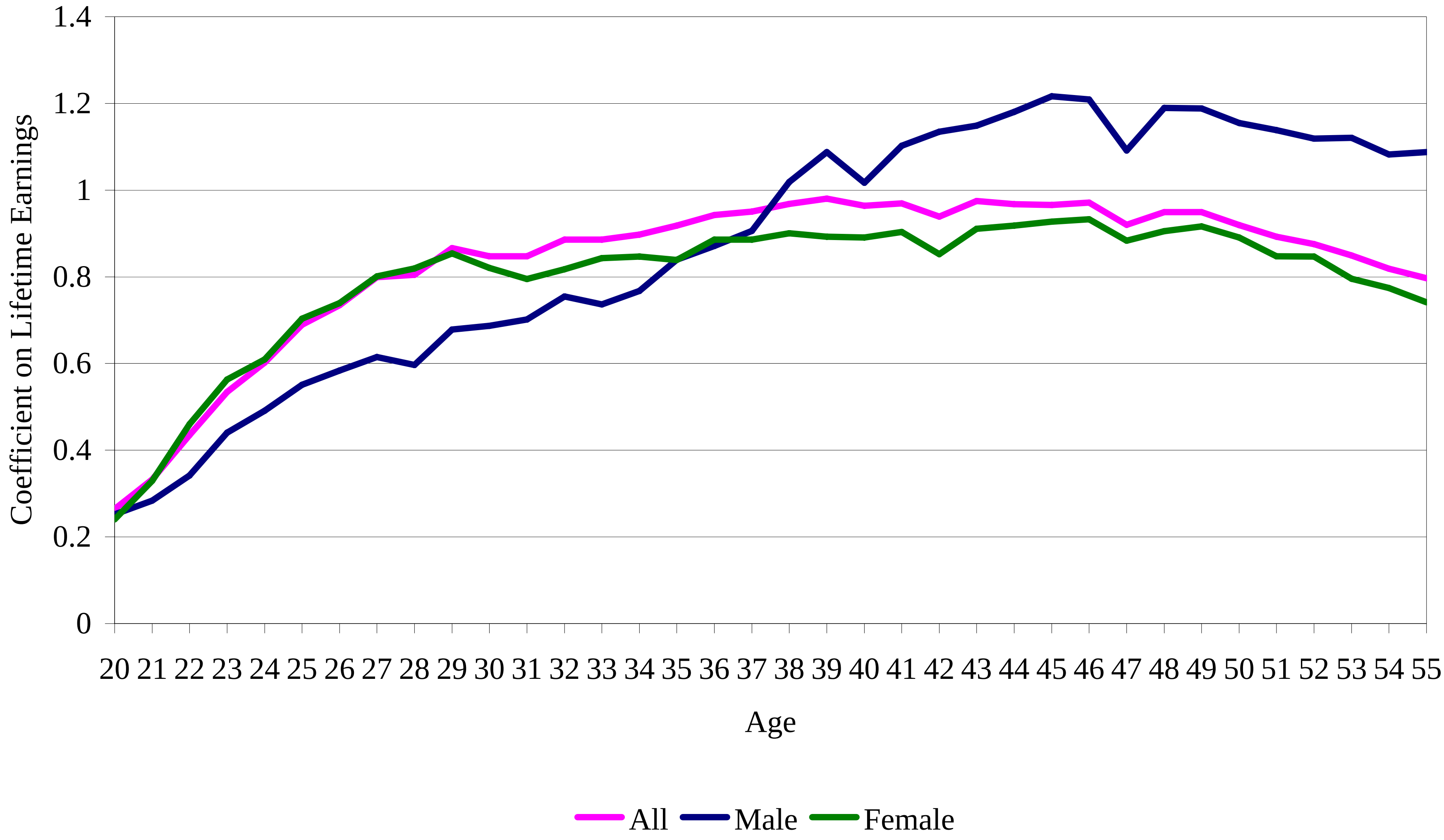

Figure 2.
Estimate of Attenuation Bias: Lifetime Earnings on Annual Earnings for Men

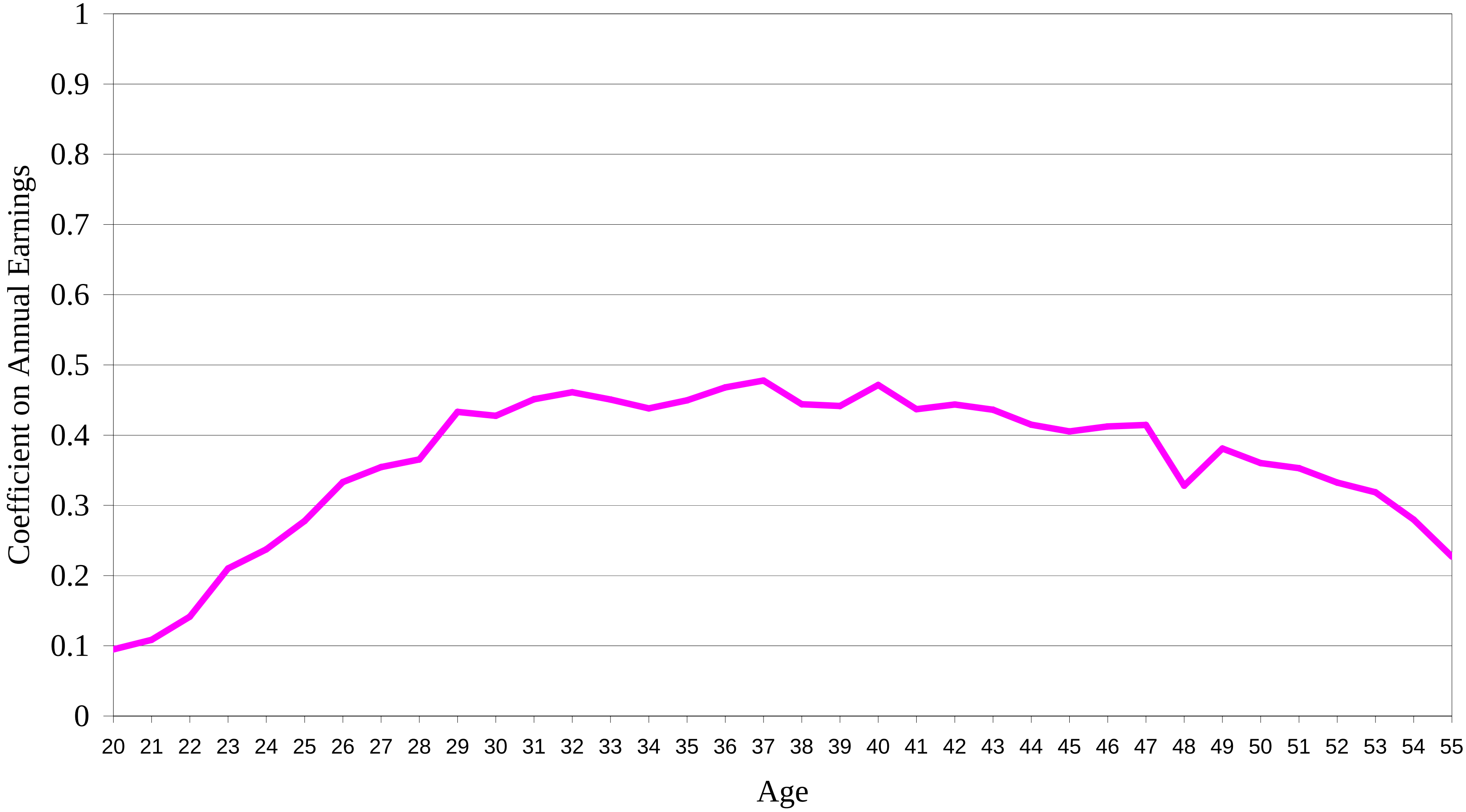

Figure 3.
Son's Position in the Earnings Distribution by Father's Position in the Earnings Distribution
(Moving Block of 4 Positions)

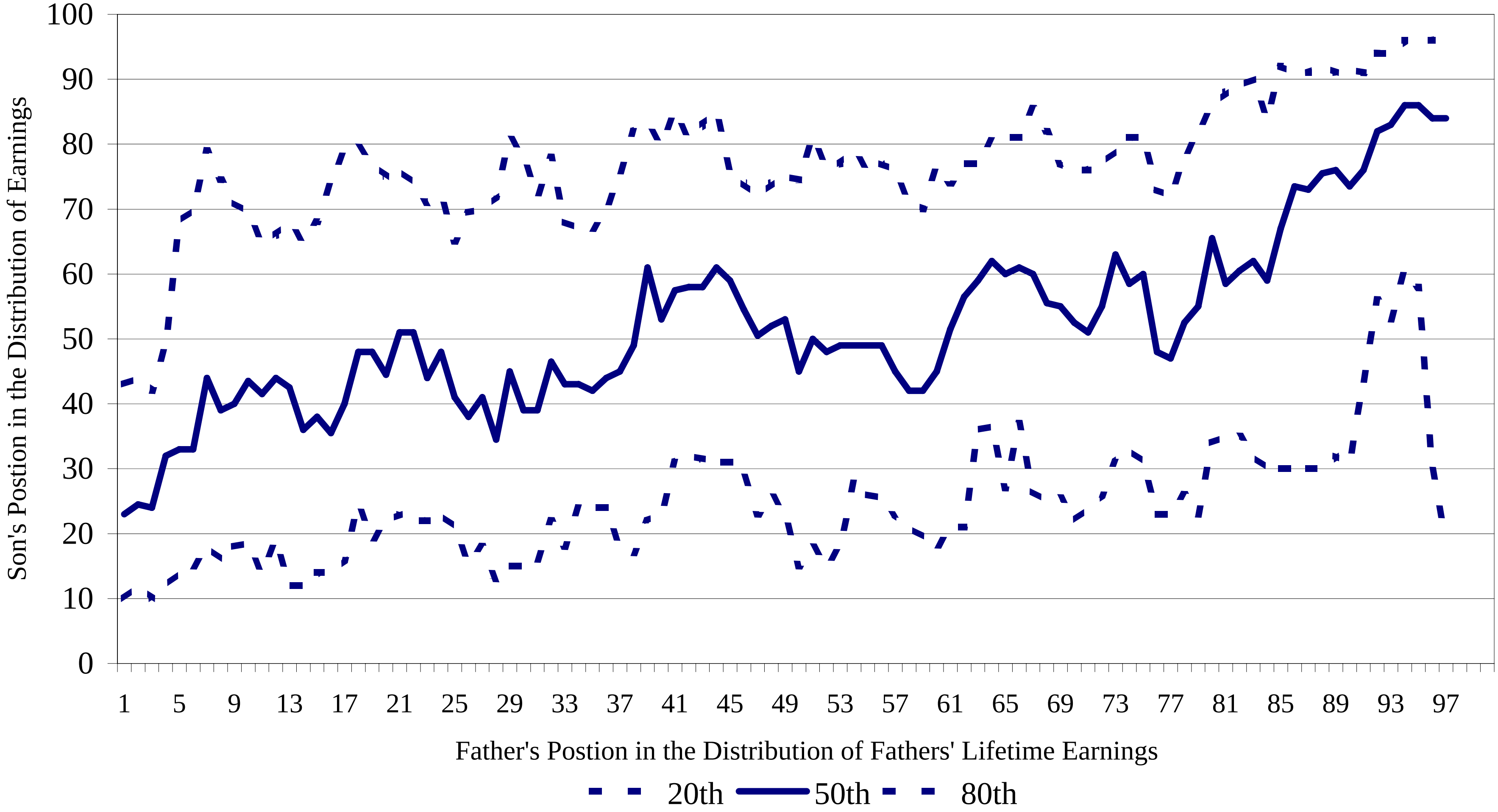

Figure 4.
Daughter's Position in the Earnings Distribution by Father's Position in the Earnings Distribution (Moving Block of 4 Positions)

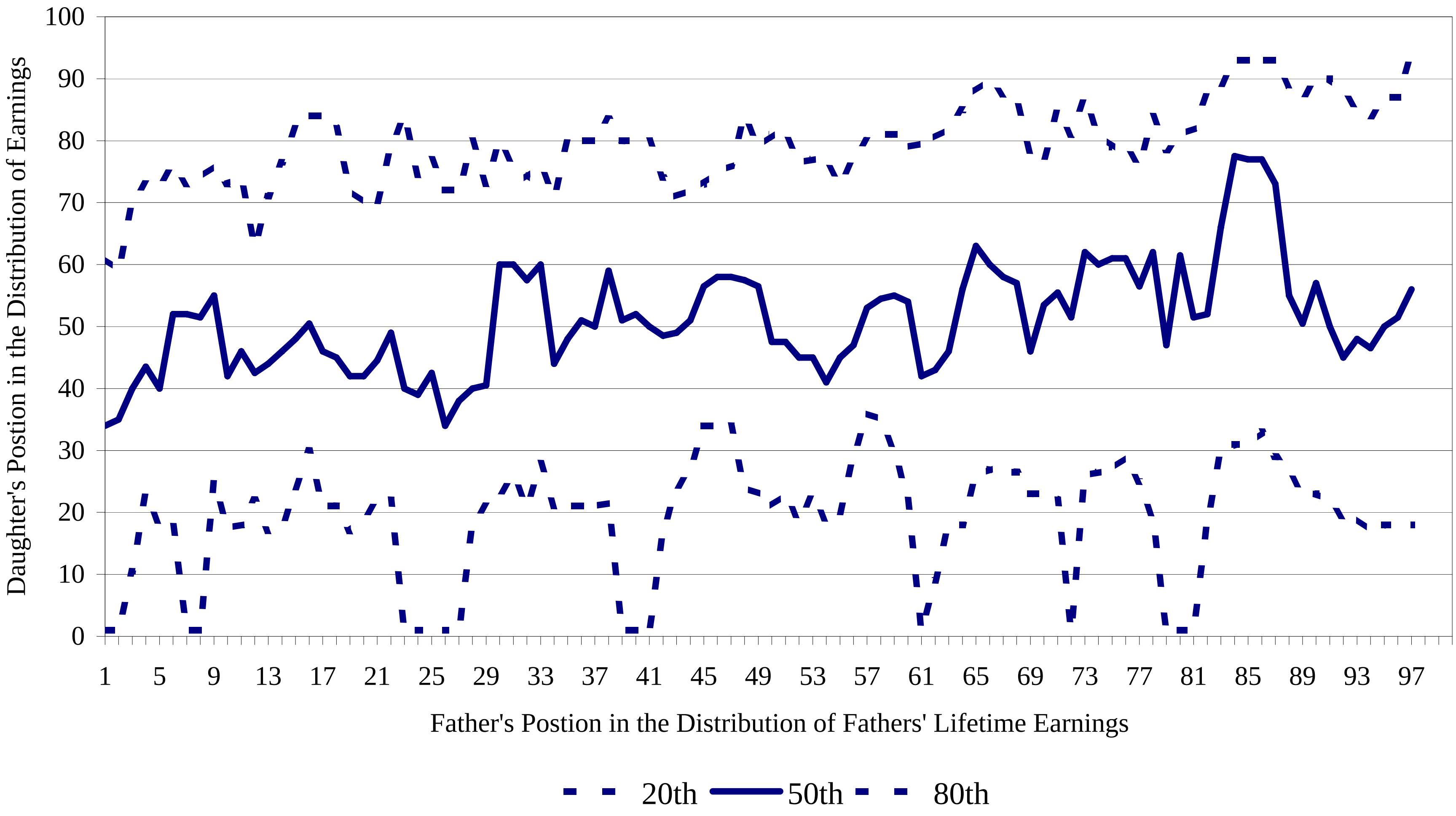

Figure 5.
Children's Position in the Earnings Distribution by Father's Position in the Earnings Distribution
(Moving Average of 4 positions)