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Volume Author/Editor: Paul J. Taubman, Terence Wales

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Chapter Author: Paul J. Taubman, Terence Wales

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6. Age-Earnings Profiles

In the previous chapter we examined the data for 1955 and 1969 extensively and the data for the initial year, 1958, and 1968 more briefly. There the discussion was centered on the importance of education and other variables in each separate year. In this chapter we make use of such information to construct age-earnings profiles from 1946 to the present.[1] The time-series profiles can be used to examine several questions that generally have been studied only with the use of cross-section data.

First, numerous studies have documented that earnings rise with age at least until middle age. Some economists have theorized that this age-earnings relationship occurs because people invest in on-the-job training that is general and not firm-specific. If such investment increases with education, an age-income profile could initially lie below the profile of those in the next highest education level, but rise more steeply. Moreover, the earnings profile of an "investor" will intersect the profile of the noninvestor, alike in all other capacities, after no more than $1/r$ years, where r is the rate of return on investments in on-the-job training.[2]

An alternative explanation of the rising age-earnings profile is that, because of difficulties in measuring potential productivity and a general uncertainty about the abilities possessed by individuals, firms (as well as governments and universities) are

[1]These are ex post profiles because they are based on incomes actually received by individuals in the same sample. The profiles are only approximate because some interpolation is needed within the sample period and, more seriously, because our sample results apply only to people aged 22 through 47 and must be extrapolated through age 65.

[2]See the excellent summary in Mincer (1970).

engaged in a continual sorting and monitoring process based on performance on the job. If firms initially have little knowledge about potential productivity and if most training on the job is not firm-specific, then starting salaries need not differ by education or ability level. However, if successful performance is dependent upon or correlated with education and ability, then, over time, individuals with more education and ability will be promoted more quickly and will obtain relatively higher incomes. We later present some evidence that is consistent with this explanation.

Second, we can examine the importance of holding ability and other variables constant in constructing age-income profiles. Because omitting ability biases the estimates of the extra earnings from education, differences *between* profiles will be overstated when ability is omitted. Moreover, as the (same) people age, even *within* an education level where, say, average ability is constant, the growth in average income will partially reflect the changed importance of ability.[3] Thus, in the NBER-TH sample, age-income profiles at various education levels are steeper (relative to the high school profile) after standardizing for ability and family background.

SHAPE OF PROFILES

There are several reasons for supposing that the impacts of education on earnings could change over time. First, changes in supply and demand for the differently educated groups will change relative wages. Second, inflation will increase earnings and the values of the education coefficients (although not necessarily the ratio of one to another). Third, there may be a distributed-lag effect of education on earnings due to institutional factors associated with promotion policies and sorting methods or due to the possibility that skills of the highly educated benefit relatively more from aging. Finally, the effect of experience on earnings may vary with education, for there may be more investment in training at different education levels. It should be noted that the last two reasons apply to profiles based on cross-section or time-series data and that the first two reasons apply only to time-series data.

[3] In profiles based on cross-section data, ability need not be constant over different cohorts with the same education. See Appendix J.

We can use the tables for initial-year salary and our estimates of the education coefficients for the years 1955, 1968, and 1969 from Chapter 5 to calculate points on the age-income profiles at the various education levels. For the reader's convenience, we present in Table 6-1 these basic data. In Appendix J, we indicate how to interpolate between these years and extrapolate beyond 1969 to obtain the complete profile.[4] Table 6-2 contains the ratios of earnings at various education levels to the earnings of the average high school graduate for each year. The numbers not in parentheses are based on earnings calculated for people with the same characteristics as the average high school graduate.[5]

[4]The data in Table 6-1 have been estimated from regression equations for individual years. The same results would have been obtained by regressing differences in income between years on the determinants of income.

[5]The numbers in parentheses are obtained when only age is held constant.

TABLE 6-1
Income at various education levels, 1955, 1968, and 1969 (in dollars)

Education level	*1955*	*1968*	*1969*
A. Age, background, ability, and biography constant			
High school	$ 6,000	$13,968	$13,212
Some college	6,600	15,852	15,423
Undergraduate degree	6,720	17 232	17,280
Some graduate work	6,900	16,908	16,635
Master's	6,612	17,906	17,402
Ph.D.	6,140	16,715	16,774
M.D.	10,332	26,693	27,154
LL.B.	7,150	24,189	24,274
B. Age constant			
High school	6,000	13,968	13,212
Some college	6,970	16,970	16,620
Undergraduate degree	7,320	19,070	19,140
Some graduate work	7,385	18,700	18,430
Master's	7,080	20,000	19,540
Ph.D.	6,489	19,996	20,040
M.D.	10,840	29,920	29,330
LL.B.	7,560	26,617	26,676

TABLE 6-2
Percentages by which earnings of those with higher levels of educational attainment exceed those of the average high school graduate, selected years

	1946	*1955*		*1958*	*1968*	*1969*	
Some college	0	11	(16)	10	14	17	(26)
Undergraduate degree	2	12	(22)	7	23	31	(45)
Some graduate work		15	(23)	13	21	26	(40)
Master's		10	(18)	4	28	32	(48)
Ph.D.		2	(8)	12	43	27	(52)
M.D.		72	(81)	85	91	106	(122)
LL.B.		19	(26)	31	89	84	(102)

The high school profile rises less rapidly than all the others: in every case the entries are larger in 1969 than in 1955. To compare the steepness of the non-high school profiles, we calculate for each education level the percentage change in the Table 6-2 entries; the larger this change, the steeper the profile. These percentage changes, as given in Table 6-3, indicate that the Ph.D. and LL.B. profiles are the steepest, with the some-college and M.D. categories the flattest for the period 1955–1969.[6] Thus, an M.D. earns a large income immediately after graduation, but over time his income grows less rapidly than that of any other group. A lawyer initially earns considerably less than an M.D. but more than a Ph.D. In spite of the faster earnings growth of Ph.D.'s than lawyers, and lawyers than M.D.'s, the income rankings of these three groups are the same around the age of 50 as they are in early years.

A proposition that has been widely accepted in human-capital literature is that the higher the education level, the steeper the age-income profiles. This is not entirely borne out by our results. Although it is true for the high school, some-college and undergraduate-degree comparisons, there appears to be no significant difference between the undergraduate-degree, M.A., and some-graduate-work groups, while the undergraduate-degree growth rate exceeds that of the some graduate work. These conclusions are based on profiles calculated in each instance for a person with the ability and background characteristics of the average high school graduate, whereas most

[6]It should be noted that even if the 1955 entry for Ph.D.'s in Table 6-2 were three times as large, the Ph.D. profile would still be the steeper.

TABLE 6-3
Percentage growth in earnings at various education levels relative to growth in the earnings of high school graduates, 1955 to 1969

	Background, ability, biography, and age held constant, 1955–1969	*Age held constant*
Some college	55	60
Undergraduate degree	158	104
Some graduate work	72	72
Master's	220	166
Ph.D.	1,250	550
M.D.	47	51
LL.B.	342	292

previous studies of profiles have been based on mean earnings by age and education level. For comparison, the numbers on the right in Table 6-3 represent the growth in earnings at each education level holding only age constant. As noted in the previous chapter, the percentage biases from omitting ability and biography are smaller in 1969 than in 1955; hence the ratios of the unadjusted to the adjusted means are greater in 1969, and the profiles based on mean income indicate much less relative growth for those with undergraduate degrees, master's degrees, LL.B.'s, and Ph.D.'s. (The rankings are the same.) This finding and the material on bias adjustment by cohort given in Appendix J suggest that profiles estimated from census data in which ability is not held constant should be viewed cautiously.

Since the initial salaries of those with high school, some college, and an undergraduate degree were about the same and since incomes of the latter two groups were about 10 percent above high school incomes in 1955, the profiles of these two groups were equally steep in terms of experience. (In terms of age, the more educated have a steeper profile.) However, initial earnings in 1947–1949 for those with some college exceeded the initial earnings of B.A. holders, suggesting that the undergraduate-degree experience-earnings profile may be steeper.

These points on the age-earnings profiles describe the effect of education on the distribution of income at different points of time, and in light of some recent literature (Lydall, 1969) it is interesting to consider the relative importance of the effects of ed-

ucation and ability over time.[7] In Table 6-4 we present estimates of the extent to which earnings at the five ability levels differ from the earnings of the average high school graduate. In 1955, those in the top fifth earned about 9 percent more and those in the bottom fifth 8 percent less than the average, and in 1969 the corresponding figures are 15 and −10 percent. Thus, over time the earnings of those at the low end of the ability scale grew less quickly; for the middle fifths, the growth rate was about the same as that of the average high school graduate.

These data can also be used to determine the relative importance of the effects of education and mental ability on earnings. In 1955, the difference between the top and bottom ability fifths of 17 percent is greater than the differential at all education levels except for M.D. and LL.B. (see Table 6-2). In 1969, the 25 percent differential is greater than that of the some-college coefficient and is quite close to all other education coefficients except those for LL.B. and M.D. Since our sample was drawn only from those in the top half of the Armed Forces Qualifying Test distribution, it is almost certain that for those who are at least high school graduates, ability is a more important determinant of the range of the earnings distribution than is education.

The differential growth rates in ability coefficients also suggest to us that the data are more in conformity with a sorting or filtration process than with Mincer's postschooling-investment model. Because of the correlation between steepness and ability, Mincer's model would require that investment be

[7] In this discussion we are assuming that the inclusion of any other variables in the equation would change the ability and education coefficients proportionately. However, because college quality may be correlated with ability but not education, its inclusion could reduce ability coefficients more.

TABLE 6-4
Percentages by which earnings of high school graduates of a given ability exceed those of the average high school graduate, 1955 and 1969

Ability fifth	*1955*	*1969*
1	−7.6	−10.0
2	−3.0	−3.9
3	−1.0	−0.4
4	2.4	2.9
5	9.2	15.0

NOTE: Rank 5 is highest.

greater for the more able. But since ability does not interact with nongraduate education and since the effects of ability grow less quickly than the effects of education, it would also be necessary to have smaller investments by ability at the higher education level. Furthermore, the effects of family and personal background, health, and so on, also grew at varying rates between 1955 and 1969; thus differential investments would be needed for each of these categories. In short, our results have to undergo much ad hoc reasoning to be made consistent with the postschooling-investment model, whereas in the filtration theory, different variables can have different effects over time on performance and on promotions.

The above analysis has been based on average income for people with a given set of characteristics. However, within each education level there is a substantial amount of variation in income even after eliminating the effects of the other measured variables. Table 6-5 contains the regression standard error for each education level for 1955 and 1969. During this period, the range of increase of the standard error (of the residual) was between 214 percent for some college and 286 percent for graduate study. Since the growth in the standard error is greater than the corresponding increase in earnings at each education level (after standardization for the various factors), the distribution about the profiles fans out with age; but, contrary to the findings in Mincer, the increase is not monotonically related to education.[8] Moreover, the differences in the percentage increase between high school and college graduates are quite small, and

[8]This difference in results might disappear if the effects of ability and the other variables were not eliminated.

TABLE 6-5
Standard errors of annual earnings after removal of the effects of measured variables, by education level, 1955 and 1969 (in dollars)

	1955	*1969*	*Percentage change, 1955–1969*	*Percentage growth in average earnings*
High school	$2,700	$ 9,600	255	120
Some college	3,750	11,800	214	133
Undergraduate degree	3,200	12,000	275	157
Some graduate work	2,950	11,400	286	172

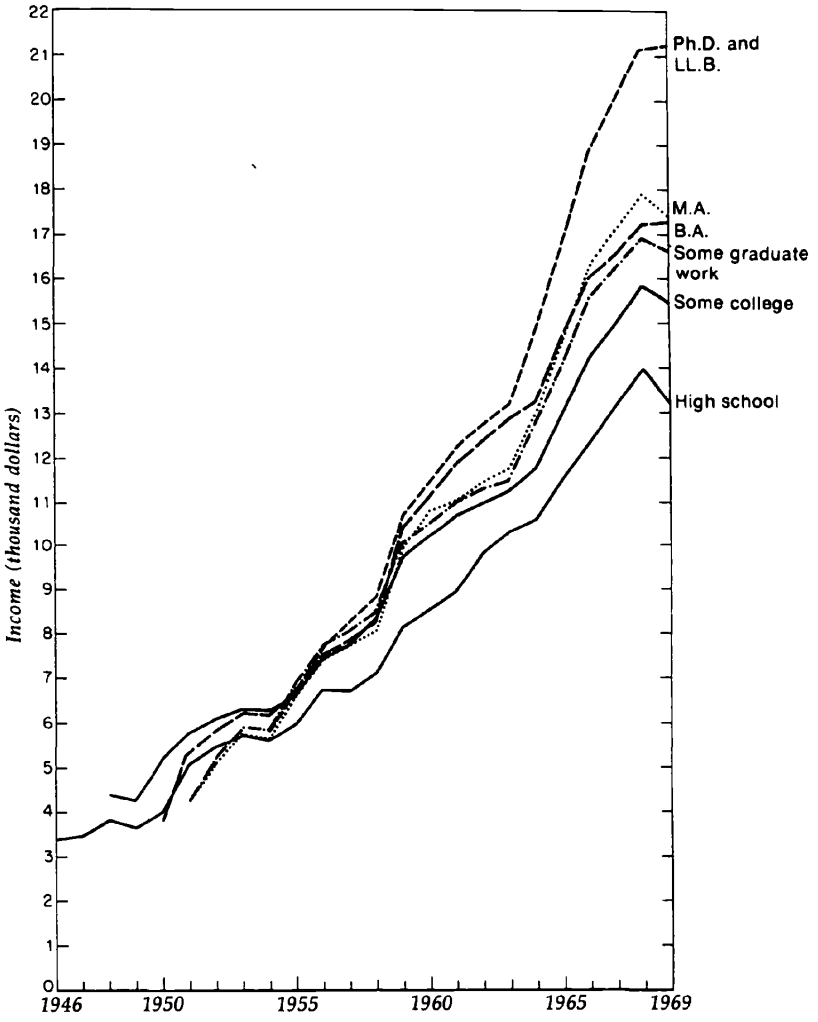
the increase in the standard error relative to the mean earnings is greatest in the high school category.

The preceding discussion of age-income profiles was based on age levels included in our sample, but in order to calculate rates of return, it is necessary to construct the complete profiles. A detailed description of the procedures used is given in Appendix J, and only a brief account will be presented here. From 1955 through 1968, we interpolated incomes of each education group on the basis of mean incomes for the nationwide age-education group corresponding to our sample. Prior to 1955, we used the median income of white males together with our initial-year-income estimates. The complete profiles through 1969 are presented in Appendix J, Table J-4, and some are graphed in Figure 6-1. This graph is in line with the previous discussion and, in addition, indicates the intersection points of different profiles. Because the latter occur in interpolated areas, however, the particular dates and, hence, ages may not be accurate.

Our age-income profiles can be compared with the standard finding in cross-section studies that all age-income profiles reach a peak and then decline at some age above 40. This result is less likely to occur using time-series profiles because of increases in money wage rates over time, attributable to inflation and productivity increases. We removed these effects by deflating by a series on median earnings for white males, and the results, which are not presented, indicate that, at every education level except high school, the peak in the deflated-earnings series occurs in 1968, when the average age was 46.[9] For high school graduates, the peak occurs one year later, although earnings in this year are barely above those of the preceding year. Since 1965 through 1969 were years of high employment, it is not likely that business-cycle influences are a cause of these peaks. All the profiles are concave, with earnings growing faster in early years than in years close to the peak earning period. In general, then, these ex post profiles, after removing inflation and productivity effects, are qualitatively very similar to those found in cross-section studies.

[9]As explained in Chapter 5, the current-salary question referred to main job only. But adjusting the 1969 data for those with more than one job by the 1968–1969 income growth of those with one job would raise the average 1969 earnings by less than 2 percent at each education level and would not alter the above conclusion.

FIGURE 6-1
***Ex post* age-income profiles, 1946–1969**



CROSS-SECTION PROFILES

The information in our sample can also be used in conjunction with cross-section data sets from the late 1940s to construct ex ante profiles.[10] We adjust the data by using our estimates of the bias on the returns to education due to omitting ability and background factors. The interesting uses of these profiles are the comparison of the ex ante and ex post rates of return and the comparison of rates before and after adjusting for the bias.

[10]These data appear in Miller (1960) and for 1949 are similar to those in Becker (1964).