Volume Title: Schooling, Experience, and Earnings

Volume Author/Editor: Jacob A. Mincer

Volume Publisher: Columbia University Press

Volume ISBN: 0-870-14265-8

Volume URL: http://www.nber.org/books/minc74-1

Publication Date: 1974

Chapter Title: Age and Experience Profiles of Earnings

Chapter Author: Jacob A. Mincer

Chapter URL: http://www.nber.org/chapters/c1766

Chapter pages in book: (p. 64 - 82)

4

Age and Experience Profiles of Earnings

The experiments reported in the previous section were meant to provide evidence on the extent to which the schooling model is applicable to the analysis of earnings. They indicate the need for caution in extending the schooling model beyond the "overtaking" subset of earnings distributions, even for qualitative analyses. Confidence in the validity of the schooling model as a *component* of human capital analysis is strengthened, but it is necessary to turn to the post-school phase of investment behavior in order to extend the analysis to the whole earnings distribution.

If productivity-augmenting investments in human capital continue after the completion of schooling, the time distribution of these investments over the working life [1] creates age variation in earnings, referred to as the age profile. In proceeding to the empirical analysis of earnings profiles in the light of the investment model, no claim is made, of course, that the observed age profile of an individual re-

1. My analysis does not cover the "post-retirement" stage of the life cycle. At that stage, special emphasis must be placed on depreciation of human capital and on the behavior of the labor supply, subjects which are beyond the scope of the present study.

flects only investment behavior. Elements of chance, of changing market opportunities, and of biopsychological development are important. Nonetheless, there is evidence that work experience is much more important than age in affecting productivity and earnings. I interpret productivity-augmenting work experience as an investment phenomenon. The assumption of costless opportunities for augmenting productivity, which is sometimes implied in the notion of "learning by doing," cannot be descriptive of labor markets where labor mobility is the norm rather than the exception.[2] At any rate, the investment interpretation lends itself to empirical analysis. The proper question is how well the investment model handles the data, and whether alternative models can do better.

Given individual differences in investment behavior, earnings profiles differ both among and within schooling groups. I study first the typical shapes of earnings profiles of individuals at a given level of schooling. I then inquire into differences among such *average* earnings profiles of different schooling groups. Later I consider the consequences of *individual* differences in earnings profiles among persons who have the same amount of schooling.

The earnings data shown in Chart 4.1 are mean earnings in the sample of men, by years of schooling and by two-year age intervals up to age 40, and five-year age intervals thereafter.[3] Experience profiles are shown in Chart 4.2. Profiles of annual and weekly earnings in log scales are shown in Charts 4.3 and 4.4. The basic features of the age profiles are easily summarized: except for the initial years of gainful activity, earnings are higher at higher levels of schooling, and increase with age through much of the working life. The absolute and, more consistently, relative rate of increase in annual earnings

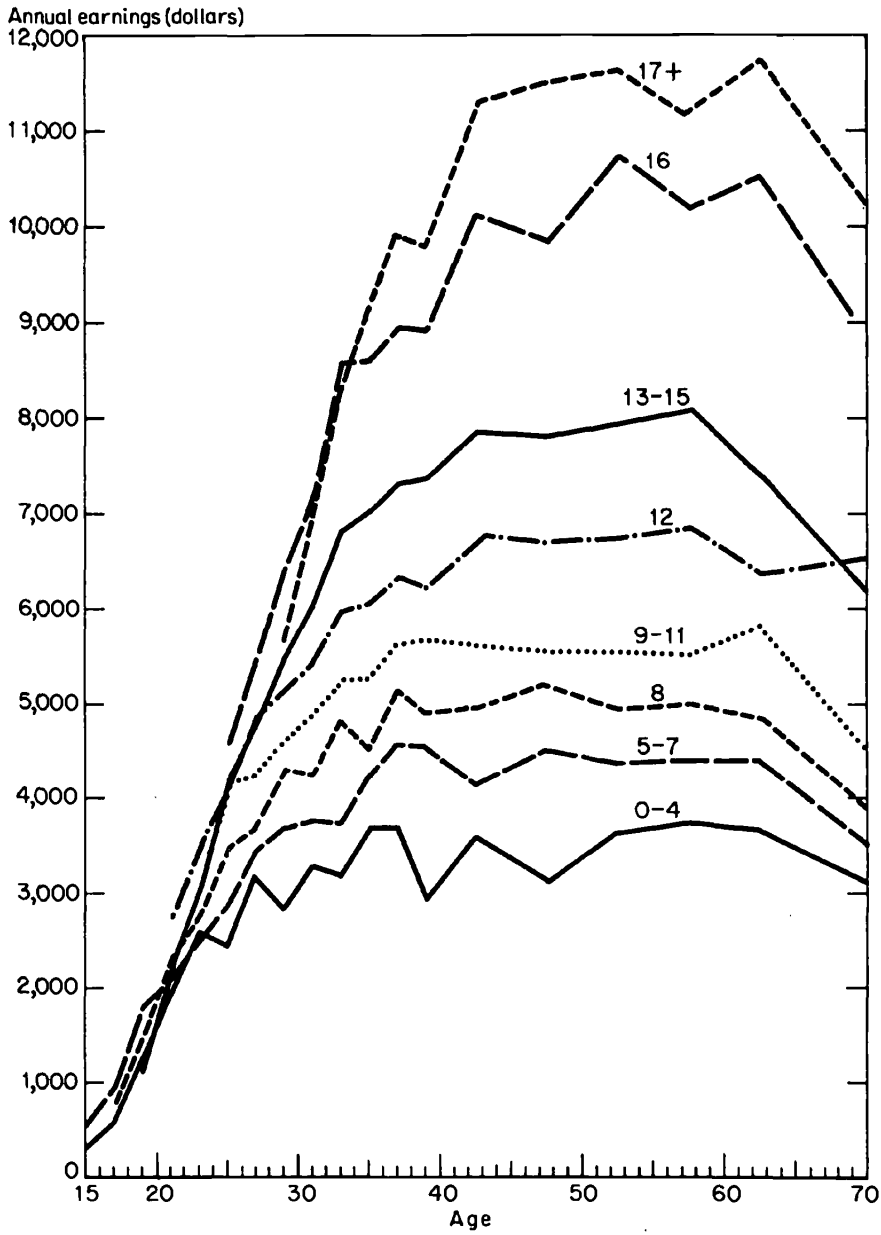
2. The argument is spelled out by Becker (1964, pp. 45–47): Greater opportunities for learning will attract larger supplies of labor. Consequently, the steeper earnings profiles will shift downward to intersect the flatter ones, giving rise to opportunity costs of learning.

3. Earnings data by single-year intervals were also calculated from the 1/1,000 sample. These showed apparently erratic sawtooth patterns in the profiles, particularly at older ages. This, however, should not be interpreted to mean that typical individual profiles fluctuate erratically over the life cycle. Sample sizes for single years of age and schooling are often quite small. They decrease with age, particularly in higher schooling groups. The pronounced instability of the year-by-year sample averages of earnings can be accounted for by sampling fluctuations as well as earnings variances that are large and increase with age.

CHART 4.1

AGE PROFILES OF EARNINGS OF WHITE, NONFARM MEN, 1959

(annual earnings classified by years of age, for indicated schooling groups)

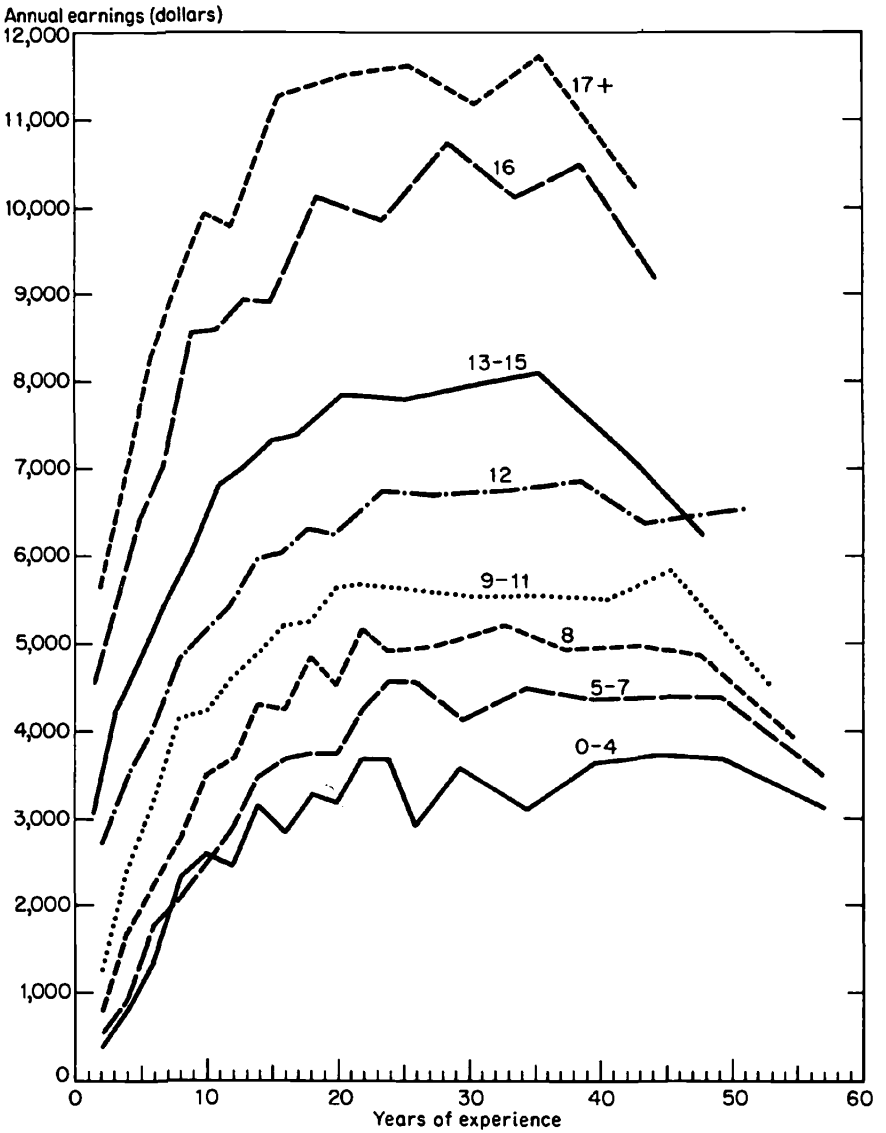


NOTE: Figures on curves indicate years of schooling completed.

SOURCE: 1/1,000 sample of U.S. Census, 1960.

CHART 4.2

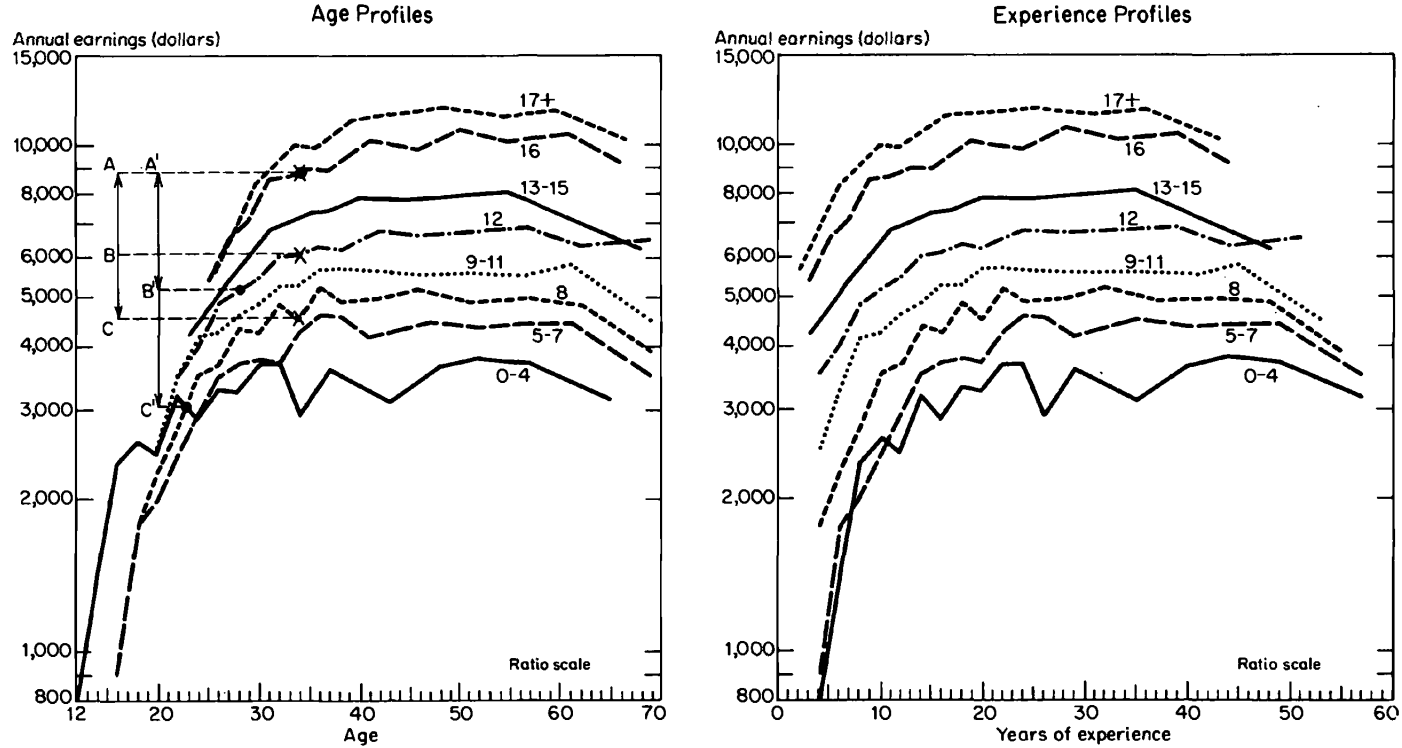
EXPERIENCE PROFILES OF EARNINGS OF WHITE, NONFARM MEN, 1959
(annual earnings classified by years of experience, for indicated schooling groups)



NOTE: Figures on curves indicate years of schooling completed.
SOURCE: 1/1,000 sample of U.S. Census, 1960.

CHART 4.3

AGE AND EXPERIENCE PROFILES OF RELATIVE ANNUAL EARNINGS OF WHITE, NONFARM MEN, 1959

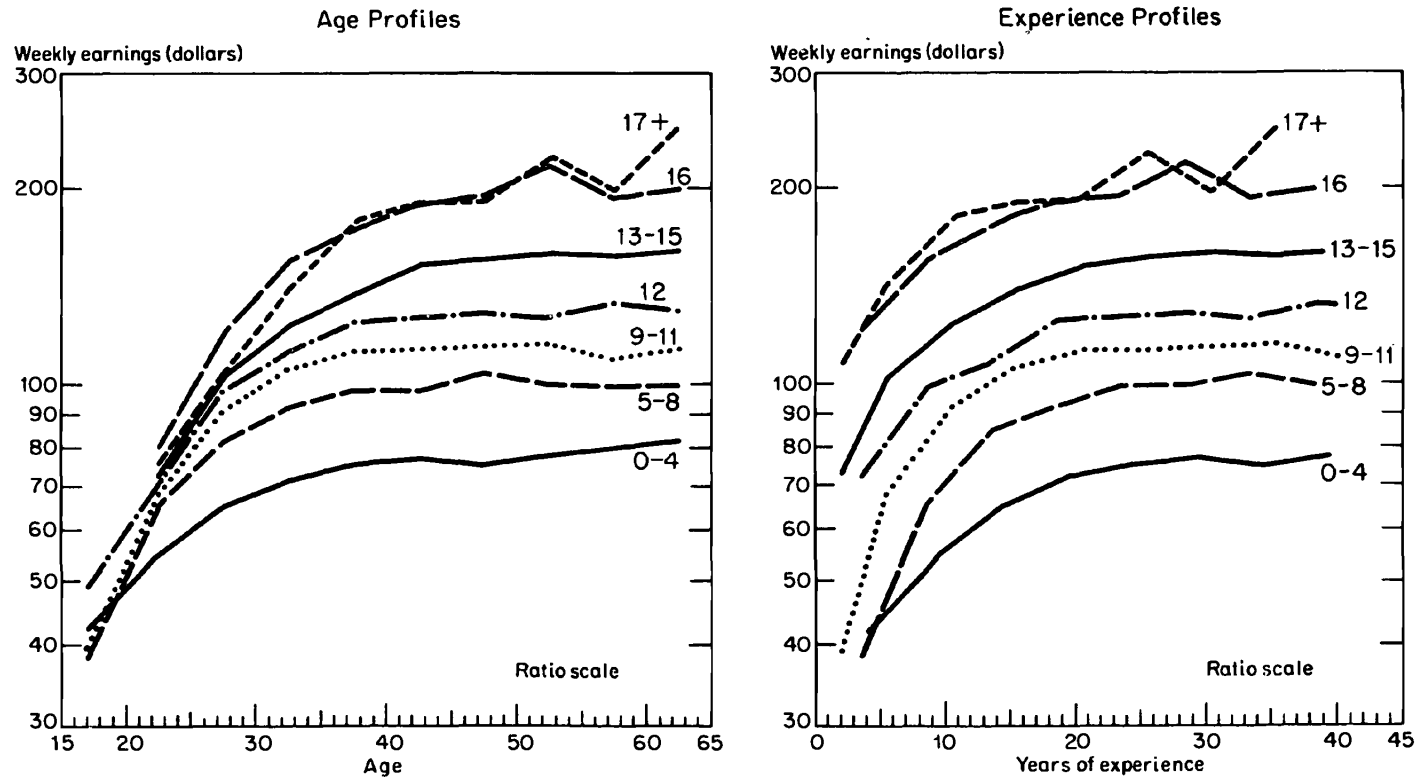


NOTE: Figures on curves indicate years of schooling completed.

SOURCE: 1/1,000 sample of U.S. Census, 1960.

CHART 4.4

AGE AND EXPERIENCE PROFILES OF RELATIVE WEEKLY EARNINGS OF WHITE, NONFARM MEN, 1959



NOTE: Figures on curves indicate years of schooling completed.

SOURCE: 1/1,000 sample of U.S. Census, 1960.

diminishes with age, becoming negative, if it changes at all, during the last decade of working life. There is no visible decline at these later ages in weekly earnings. Apparently, declines in weeks worked per year are the main factor in the decline of annual earnings during the preretirement years (cf. Table 7.2, column 3).

The differences among schooling groups are systematic: *at given ages* the absolute and relative rate of growth of earnings increases with schooling. Earnings level off at earlier ages in the lower schooling groups. Since earnings reach a plateau at later ages in the most highly educated groups, both dollar and relative annual earnings differentials among schooling groups grow with age until age 45–50, and later still for weekly earnings.

The picture changes drastically when earnings profiles are compared by years of work experience rather than age.[4] Chart 4.3 shows that the *experience profiles* of log earnings tend to converge[5] with growing years of experience, in contrast to age profiles, which diverge with growing years of age.

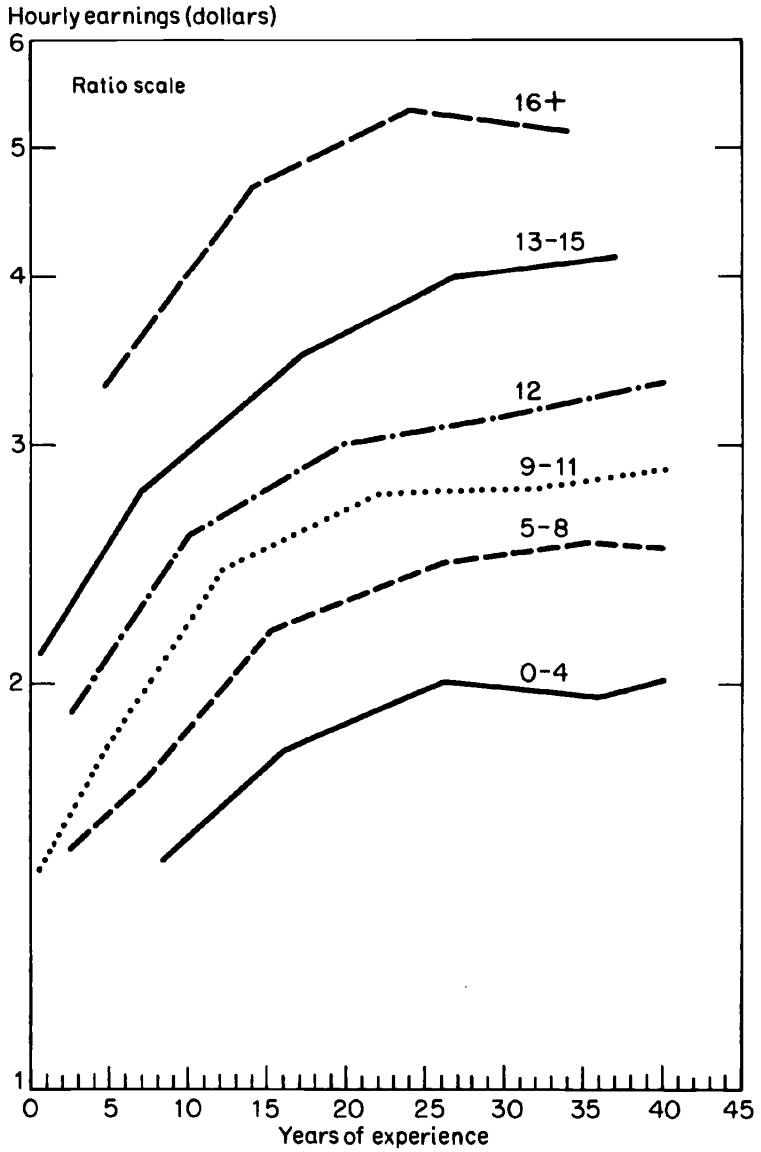
Logarithmic experience profiles of weekly and hourly earnings, shown in Charts 4.4 and 4.5, are more nearly parallel, suggesting that relative "skill" (measured by schooling attainment) differentials in wage rates do not change perceptibly with years of experience.[6] Dollar differentials do increase with experience in annual earnings, and in weekly and hourly rates as well, though not nearly as much as they do with age. In view of the parallelism or convergence of

4. Years of experience start at ages indicated in column 3 of Table 3.1.

5. The degree of convergence of experience profiles of *annual* earnings is partly affected by the state of the labor market, since in a recession unemployment rates increase more among the young and unskilled than in other groups.

6. "Skill" differentials in wages are commonly measured by the percentage difference between adult male wage rates in sets of pairs of narrowly defined occupations, one skilled, the other unskilled. The choice of pairs, the definition of wages, and the changing skill contents make the interpretation of such comparisons and of trends in them as trends in relative factor prices rather uncertain. The often steep rise of earnings with age suggests that differing age distributions in the occupations being compared are another source of ambiguity in these measures. For example, an acceleration of upward trends in schooling raises the average age in the lower schooling and skill groups and lowers it in the upper groups. This produces an apparent narrowing of relative wage differentials, which may be misinterpreted as a relative price effect of the change in relative supplies of skills. Standardization for age is not sufficient, however. As we have seen, relative wages increase with age. But my finding of near-parallelism of the experience profiles suggests that standardization for experience is the more appropriate procedure.

CHART 4.5
EXPERIENCE PROFILES OF AVERAGE HOURLY EARNINGS OF WHITE NONFARM MEN, 1959



NOTE: Figures on curves indicate years of schooling completed.
SOURCE: Fuchs (1967, Table A-1).

logarithmic experience profiles, the strong increase in relative earnings differentials by age must be attributed entirely to the faster rate of growth of earnings at earlier compared to later years of experience. Let the earnings profiles be interpreted as being a consequence of post-school investments. Then the life-cycle or profile rate of growth g_t of log earnings at time t is derived from the log-earnings function (1.15) in its continuous form:

$$g_t = r_t k_t + \frac{d}{d_t} \ln (1 - k_t). \tag{4.1}$$

Assume rates of return r_t to post-school investment to be fixed, and think of the ratio (k_t) of investment to gross earnings as a "time-equivalent" amount of investment incurred in period t. Let the second term on the right of (4.1) be either negligible or unrelated to levels of schooling. Then the empirical findings suggest that, *at given ages,* the amount of "time" people invest in human capital increases with the years of their schooling. The longer-schooled, however, do not spend more "time" than the less-schooled at *comparable years of experience.* Indeed, the convergence of logarithmic experience profiles means that, over the working life, the more educated workers spend less "time" in post-school investment activities. Profiles of annual earnings converge, but profiles of weekly earnings are parallel, and it is not clear which is more appropriate for gauging the comparative "time" measures.[7]

Another interpretation of convergence is that rates of return to post-school investment, rather than volumes, differ among schooling groups. By (4.1) the steeper growth in earnings in the lower schooling groups may reflect a higher rate of return to post-school investments (r_t) rather than a larger time-equivalent (k_t). An attempt was made to ascertain this by deflating the observed rates of growth of earnings, at comparable stages of experience, by the available estimates of

7. The parallelism of weekly earnings indicates that convergence of annual earnings, or the margin by which less schooled persons spend more "time" in post-school investment, arises from their lower employment levels when they are young. To the extent that the greater discontinuity of employment of poorly educated young men represents labor mobility—people in search of better jobs—the periods of unemployment can be properly reckoned as "time" spent in investment. If, however, the differences in employment experience between them and the more educated represent differences in length of involuntary unemployment or in leisure preferences, "time" spent in post-school investments is overstated for the former.

TABLE 4.1
ESTIMATES OF POST-SCHOOL INVESTMENTS IN DOLLARS AND TIME-EQUIVALENTS PER PERSON

Years of Schooling	Dollars $C(10-15)$ (1)	Years $k(10-15)$ (2)	Dollars C_{ps} (3)	Years K_{ps} (4)
0–4	$3,470	1.23	$10,120	3.78
5–7	4,430	1.26	13,350	4.27
8	4,310	1.10	13,570	3.56
9–11	6,000	1.26	14,220	3.10
12	5,920	1.05	15,420	2.68
13–15	7,550	1.09	17,270	2.46
16	8,300	1.09	30,500	3.25

NOTE: Y_p = earnings at peak; Y_s = earnings at overtaking; r = rate of return.

Col. 1: $C(10-15) = (Y_{15} - Y_{10})/r$ = dollar investments between the tenth and fifteenth year of experience.

Col. 2: $k(10-15)$; $(\ln Y_{15} - \ln Y_{10})/r$ = year-equivalents of investment between the tenth and fifteenth year of experience.

Col. 3: $C_{ps} = (Y_p - Y_s)/r$ = total dollar post-school investments.

Col. 4: $K_{ps} = (\ln Y_p - \ln Y_s)/r$ = total year-equivalents of post-school investments.

SOURCE: Earnings data from Charts 4.1–4.3; r from Table 3.1, column 9.

overall rates of return, assuming that they are similar to rates of return on post-school investments. The results, shown in column 2 of Table 4.1, indicate that the deflated slopes decline as schooling level increases, but increase mildly above the high school level.[8]

Table 4.1 also contains estimates of total amounts of net post-school investment incurred by workers in each schooling group over their working life, in dollars and "year-equivalents" (columns 3 and 4). It can be seen that total dollar values rise with schooling, but the time-equivalents are only weakly related to schooling. Total year-equivalents of post-school investment calculated from estimated wage rate data (Chart 4.5) are very similar in all schooling groups and amount to three to four years.

8. The observed convergence may also be due to "vintage" or obsolescence effects. Obsolescence diminishes total investment and its rate of decline over time (Becker, Koeune). This is reflected in flatter and less concave earnings profiles, presumably at higher levels of skill (schooling).

TABLE 4.2
ALTERNATIVE ESTIMATES OF POST-SCHOOL INVESTMENT COSTS PER PERSON, 1939, 1949, 1958

Year	Esti-mates	Years of Schooling: 8 C_s	8 C_{ps}	8 K_{ps}	12 C_s	12 C_{ps}	12 K_{ps}	16 C_s	16 C_{ps}	16 K_{ps}
1958	Old	2.2	4.9		2.8	7.6		24.1	28.8	
	New		9.2	3.9		11.7	2.9		22.9	3.3
1949	Old	1.8	4.4		6.4	9.7		18.0	27.4	
	New		8.2	3.8		15.4	4.2		30.9	4.4
1939	Old	1.3	3.9		5.2	8.5		14.7	15.2	
	New		7.0	4.6		14.1	4.9		17.8	3.6

C_s = investment in schooling in constant dollars (thousands).
C_{ps} = post-school investment in constant dollars (thousands).
K_{ps} = post-school investment in year-equivalents.
SOURCE: Mincer (1962, Table 1 and appendix data).

In a previous study, dollar estimates of post-school investment were calculated in a stepwise fashion by estimating instalments of such investments (Mincer, 1962). The totals in dollars and time-equivalents are here re-estimated from the same data, and a comparison of the old and new estimates is shown in Table 4.2.

The old estimates are very similar to the new at the college level, but about half the size at lower levels, primarily because the 0–4 schooling group age profile was used as the "zero investment" base line in the disaggregated procedure. It is difficult to believe that individuals in the lowest schooling group incur no post-school investments, but it may also be argued that the "no-investment" profile is not horizontal but concave, for biological reasons. It is perhaps best, therefore, to consider the alternative estimates in Table 4.2 as bracketing the true values. This would mean, in turn, that the time-equivalents in the table are also overstated somewhat, particularly at the lower levels of schooling. If the time values are midway between the two estimates, the dollar volumes of post-school investment are overstated 20–25 per cent on average when a horizontal shape is assumed for the zero investment profile.

The investment behavior inferred from the earnings profiles,

though in some respects unclear, is quite plausible in the light of human capital theory. The logarithmic concavity of the earnings profiles is actually strongly implied by the analysis of optimal distribution of human capital investments over the life cycle.[9]

The differences among schooling groups are plausible: those who invest more (dollars) in schooling also spend more in post-school investments. Greater ability and better access to financing opportunities are common factors in both forms of investment. These factors evidently dominate whatever incentives and opportunities exist for substitution between the two kinds of investment. As for time-equivalent measures of investment, the cross-sectional figures in Tables 4.1 and 4.2 indicate a negative or zero correlation between time spent in schooling and in post-school investments. Over time, total schooling and post-school investments grew in dollar terms. However, schooling expenditures grew more rapidly than expenditures on post-school investments (compare C_s with C_{ps} in Table 4.2). The growth of public subsidies to education may have been an important incentive for substituting schooling for job training. In time units, this substitution accelerated the upward trend in years of schooling and reduced somewhat the time spent in job training.

The empirical findings about levels and shapes of the average earnings profiles in the different schooling groups imply the following intergroup differentials in earnings:

1. Dollar differentials among schooling groups increase with experience. Because the earnings profiles are concave, the increase is much more pronounced with age.

2. Relative intergroup differentials in annual earnings grow with age, but diminish with experience. Weekly and hourly relative wage differentials among schooling groups do not perceptibly change with experience. Given a sufficiently small decline in differentials by experience, the increase by age is due to a strong logarithmic concavity of the earnings profiles. As already explained, concavity of earnings reflects diminishing investments over the working life.

The intergroup differentials account for only a part of the total inequality (variance) among individuals within age or experience groups intragroup dispersion—differentials in earnings among indi-

9. See Becker (1967, Part I, Chap. 1), and Ben-Porath (1968).

viduals of the same schooling and age—is the other component of the variance. Because both components of inequality are large, we cannot explain variances in age or schooling subgroups without a prior analysis of ungrouped, individual data.[10]

Before we proceed to an econometric analysis of earnings profiles, it will be useful to consider somewhat more closely two important qualifications to the investment interpretation of earnings profiles: (1) The allocation of investment over the life cycle cannot be simply "read into" the *cross-sectional* profiles, which represent earnings differences among distinct individuals who differ by age. Though they had the same years of schooling, the different cohorts may have had different patterns of post-school experience.[11] (2) The life-cycle earnings profile partly reflects biopsychological development: of maturation at young ages and decline at older ages. This development is systematic and largely independent of (exogenous to) the individual's will. To the extent that this development creates a concave earnings profile, the investment interpretation must be modified.

Granted the validity of these qualifications in principle, their weight remains to be settled on empirical grounds: (1) How different are cohort earnings profiles from cross-sectional profiles in the same schooling groups, abstracting from economywide fluctuations and secular trends? (2) How important are the "inherent" age effects in the observed earnings profiles? Empirical evidence is needed to indicate whether we are dealing with major objections or minor qualifications. Scanty though it is, some evidence on the matter is available, and it bears consideration:

1. In a study based on annual income data of the Current Population Survey, H. P. Miller calculated average annual age-income profiles of U.S. men in each of the several schooling groups for

---

10. In my analysis of 1950 data (Mincer, 1957, 1958), variances in age and schooling groups were explained only in terms of intergroup differentials observed in typical earnings profiles. No contradiction arises in dollar variances, but the structure of relative variances is more intricate, as will be shown.

11. It should be clear, however, that even if major problems were to be posed by the differences between cohorts and cross sections and between "autonomous" and investment-induced components of earnings profiles, they do not represent arguments against a human capital analysis. When better understood, these phenomena can and will be incorporated into the human capital models.

1956–66. Cohort changes in income can be calculated from these data by comparing pairs of cross sections. Individuals in a given schooling group who were 25 years old in 1956 were 35 in 1966. In Chart 4.6, the percentage rate of growth of their income in this period is the ordinate of the upper (solid) line corresponding to age 25 on the horizontal scale, while the ordinate of the lower (broken) line at this point shows the growth rate from age 25 to 35 in the 1956 cross section.[12]

The upper and lower lines are similar in shape, i.e., cohort profiles are similar in shape to the cross sections. They are displaced upward by some 20–30 per cent per decade in most schooling groups and ages, that is, actual growth of income was that much greater in each cohort than in the cross section—a common effect of economy-wide secular growth.

Table 4.3 shows the vertical displacement of the cohort from the cross-sectional profiles at selected ages in the several schooling groups. The variation in these numbers may reflect "non-neutrality" in income growth, in favor of more educated and younger males, or it may represent a relative understatement in the cross section of the cohort post-school investments of these groups. Whichever the correct interpretation may be, the concavity of logarithmic profiles is evident in cohorts. Indeed, the suggested non-neutrality would result in more pronounced concavity in the cohort than in the cross section and a greater divergence of profiles with advancing age.

2. Studies of 1964 and 1966 earnings of economists and a companion study of 1966 earnings of all full-time employed persons reported to the National Register of Scientific and Technical Personnel[13] included data on years of professional work experience in addition to six other characteristics: age, years of schooling, profession, type of employer, work activity, and sex.

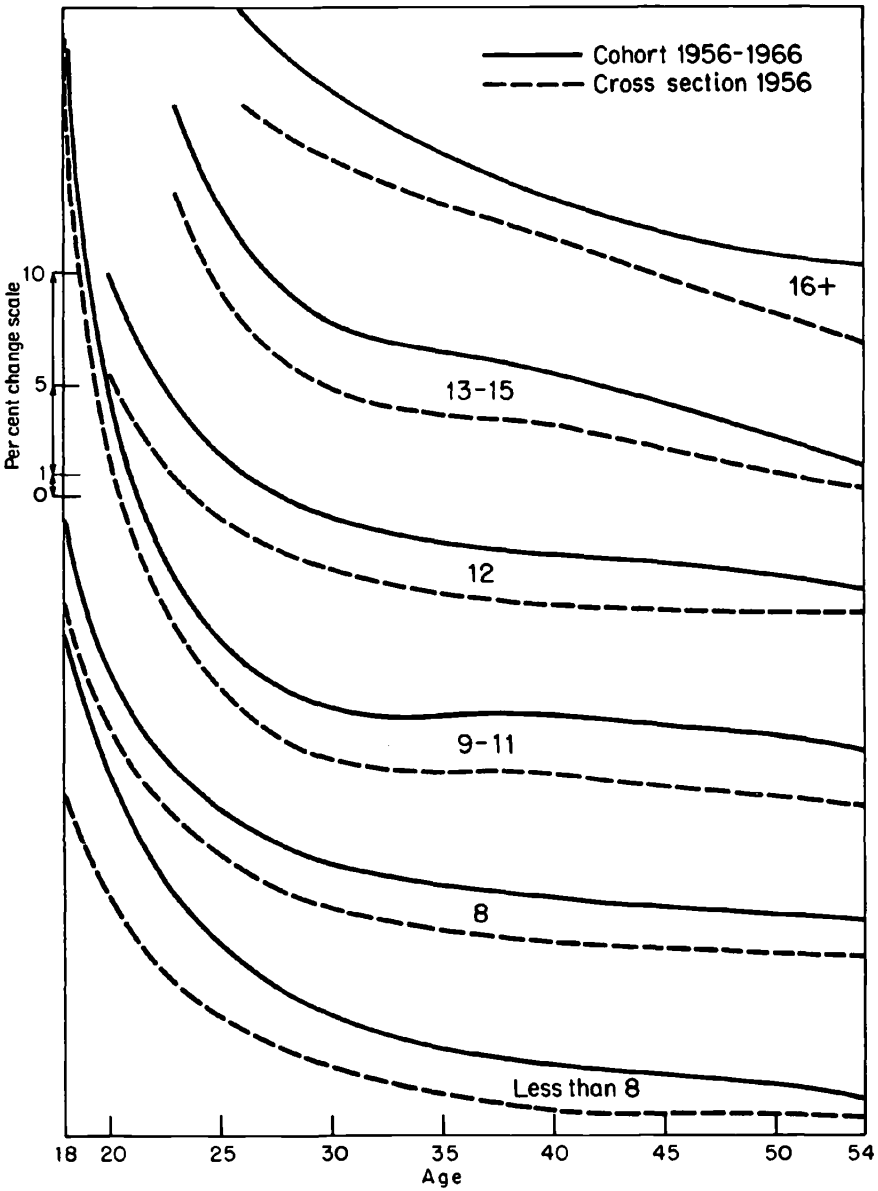
Economists of the same years of schooling and age had a considerable dispersion of years of work experience: About 20 per cent

12. The years 1956 and 1966 were chosen because of their similar cyclical positions. The use of income rather than earnings is a minor drawback.

13. The 1964 study is reported in Tolles et al. (1965). The studies are based on over 10,000 reports from economists, and over 200,000 reports from all personnel in the Register. The very informative multivariate statistical analysis of the data was designed and carried out by E. Melichar of the Federal Reserve Board.

CHART 4.6

AGE PROFILES OF DECADAL PERCENTAGE CHANGES IN MALE INCOMES, BY SCHOOLING COHORTS, 1956–66, AND IN CROSS SECTION, 1956



NOTE: Figures on curves indicate years of schooling completed.
SOURCE: U.S. Bureau of the Census (August 1968, Table 11).

TABLE 4.3
ANNUAL GROWTH RATE OF INCOME OF MEN IN SELECTED AGE AND SCHOOLING GROUPS, 1956–66
(income in 1966 dollars)

Age in 1956	Years of Schooling					
	Under 8	8	9–11	12	13–15	16 or More
25	3.2%	2.2%	2.4%	2.7%	3.5%	4.0%
30	2.3	2.1	2.4	2.4	3.0	3.1
35	2.2	2.1	2.6	2.3	3.1	2.2
40	2.2	2.1	2.7	2.3	2.4	1.7
45	1.8	1.8	2.8	2.0	1.9	2.1
50	1.4	1.8	2.8	1.6	1.7	2.5

SOURCE: U.S. Census (1968, Table 11).

of persons in the same five-year age interval differed by more than 10 years of work experience (Tolles et al., 1965, Table 7, p. 40). This variability and the large sample sizes permitted a statistically significant separation of the effects of age and of experience on earnings. Correlation of log earnings of economists with years of experience yielded an R^2 of .41; correlation with years of age yielded $R^2 = .23$. For all scientists, the simple coefficient of determination of earnings with experience was .34; with age, it was .24. In the multiple regressions on the seven characteristics, length of professional experience and schooling (measured by highest degree) were the two most powerful, and age was the least important, variable (Tolles and Melichar, 1968, Table II-2, p. 60; and Tolles et al., 1965, p. 64).

The studies showed that for economists under the age of 35, five additional years of age provided a $300–$400 advantage, given the same length of experience, while an additional five years of experience were associated with a gain of $1,500–$2,000, given the same age (Tolles et al., 1965, p. 42). If so, the net age effect is about 20 per cent of the combined effect of age and experience on earnings at the younger ages. The net incremental value (partial regression coefficient) of years of experience declined as length of service increased, but the increments remained positive throughout the observed working lives (Tolles et al., 1965, pp. 43, 49, 50).

The partial regression coefficient of age showed a decelerating progression of salary with age which continued to about age 50, and then became negative, that is, a net decline was associated with advancing age (Tolles et al., 1965, p. 70). Compared to the gross effect, the net effect of age was quite small, but the net effect of experience was almost as large as the gross effect (Tolles et al., 1965, Figure 1, pp. 66–67).

The findings for all scientific professions are similar to those for economists. The observed experience profiles of earnings differ a great deal among specialities, type of employer, and type of work activity. These differences can be attributed to the differential effects of experience.

If we interpret the contribution of years of experience as investment-induced effects on earnings, and the contribution of age as the "inherent" effects of biopsychological individual development, the quantitative evidence of the AEA studies strongly supports the interpretation of observed earnings profiles in terms of investment in human capital.

It is important to note, however, that the "age effect," small though it is, contributes to the concavity of the observed earnings profiles. If ignored, as it is perforce in the current study, investment is overstated somewhat (20 per cent was suggested above) at ages below 35, though understated later.[14]

Even if experience is shown to be a much more powerful determinant of earnings than age, nevertheless an objection to the investment interpretation of the earnings profile could be made on the ground that the growth of earnings with experience may reflect the prevalence of institutional arrangements such as seniority provisions in employment practices. Such practices, however, do not contradict the productivity-augmenting investment hypothesis, unless it can be shown that growth of earnings under seniority provisions is largely independent of productivity growth.[15]

A recent BLS study, *Seniority in Promotion and Transfer Provisions,* makes clear that this is not the case. The study is based on an examination of virtually all major collective bargaining agreements (1,851 in all), each covering 1,000 workers or more (exclusive

14. This is comparable to the conclusions reached on the basis of Table 4.2.
15. In this study, productivity growth is not assumed to be costless.

of railroads, airlines, and government). The majority of the agreements, covering over 70 per cent of workers subject to the agreements, contain specific provisions for promotions. The absence of such provisions is typical of industries with one or more of the following characteristics: (1) Sharply differentiated skills and upward movement to journeyman status through apprenticeship; (2) labor agreements where no promotion is possible within the bargaining unit; and (3) relatively high enterprise mortality, employee turnover, or sporadic or seasonal employment (*Seniority,* p. 3). Promotion based *only* on seniority occurred in agreements covering less than 2 per cent of workers (*Seniority,* p. 5). In all other cases seniority was considered *jointly* with merit, skill, aptitude, and other factors. Seniority was cited as a *principal* factor in agreements covering 20 per cent of the workers. However, in agreements covering 50 per cent of the workers, seniority applied only if other qualifying factors were the same among the employees being considered for promotion. A typical clause is:

> When a vacancy occurs in one of the higher rate crafts, employees with seniority shall be given full consideration before an appointment is made; however, seniority shall not be the governing factor and shall not prevent the transfer or appointment of an employee with less seniority, whose ability and qualifications are greater than those of the senior employee under consideration for the work on the higher paid job (*Seniority,* p. 6).

Seniority is more important as a factor in promotion of blue-collar than of white-collar workers. It is least important in the professional, technical, sales, and supervisory categories of jobs. Skill and ability are the principal nonseniority factors in agreements covering about 75 per cent of the workers. Education is mentioned in only about 7 per cent of the agreements as a factor in promotion.

In most of the agreements the employer is required to make selections for promotion from the group of employees who had expressed an interest in the vacancy. In some agreements promotion is restricted to specific employees in a line of progression, but such "automatic" promotions are largely confined to smaller or narrower job units—usually with a narrow occupational classification. A few agreements call for tests to be administered to workers applying for promotion. Many call for a (1–2 months) trial and training period on the new job. Such a period allows the company to determine whether

the employee can perform the job satisfactorily and gives the employee time to decide whether the job suits him. The bid for promotion can be costly: disqualification during the probationary period is considered in most of the agreements, and while in most of them the disqualified worker is allowed to return to his previous job, in some penalties are attached, such as some loss of seniority rights, and even downward job transfers (*Seniority,* p. 31).

Long training periods following the promotion were in most instances unnecessary, since employees covered by the provisions (unlike those in formal training or apprenticeship programs) ordinarily had acquired the necessary skills in lower-rated jobs, or were advanced through a series of semiskilled tasks requiring relatively little training at each step. This situation is a vivid demonstration of the processes of accumulation of human capital on the job.

In sum, it appears that productivity is a major criterion for promotion in rules developed in collective bargaining. Moreover, the confinement of "automatic" promotion to narrow job classifications is an indication that productivity growth looms larger the bigger the job advancement.

The negligible role of school education in promotion is consistent with the view that post-school productivity growth is causally related not to schooling but to post-school investments. This view was supported by evidence (Table 3.4, above) of a declining correlation between schooling and earnings as work experience accumulates.