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3. *Education, Experience, and the Distribution of Earnings and Employment: An Overview*

by Jacob Mincer

INTRODUCTION

This chapter examines the effects of education on particular dimensions of the income derived from labor force (market) activity, where education is viewed as an investment in the stock of human skills or the formation of human "capital." Education can affect earnings rates or earnings per unit period of time worked; it can affect labor force participation, especially at different stages of the life cycle; and it can affect the amounts of time worked as reflected by the frequency and duration of unemployment and part-time employment.

The first part of the chapter is a summary of recently completed research[1] on the relation between the distribution of earnings and the distribution of investments in human capital, including both time and resources used to obtain formal schooling and postschool training on the job. The empirical analysis deals with annual earnings of males, classified by education and age.

In the second part of the chapter, the effects of human capital investment on the distribution of employment are examined. These effects are of some importance for the analysis of annual earnings, since the latter are affected not only by rates of pay per unit of time but also by the amount of time (hours and weeks) worked. The employment effects are viewed as consequences of demand and supply factors, which create individual and group differences in labor force participation and in unemployment.

The third part of the chapter discusses the effects of secular trends in education on the structure and inequality of both individual and family income. The educational trends also contribute to changes in the composition of the labor force that influence the distribution of family income. In general, the first part of the chap-

[1] Parts of this chapter draw heavily on the summary chapter of my forthcoming NBER monograph.

ter deals with research that has been completed, whereas the second and third parts report on research still in progress.

HUMAN CAPITAL AND THE DISTRIBUTION OF EARNINGS

A great deal of work on the subject of human capital is devoted to the estimation of profitabilities, volumes, and forms of investment. Empirical calculations are based on comparisons of earnings of workers with differing amounts invested in their human capital. Such calculations follow from the underlying theory that postulates a positive relation between accumulated investments and earnings. The positive and normative importance of the estimated parameters of investment behavior clearly hinges on the degree to which the assumed relation is indeed operative. If the relation between human capital and earnings is a strong one, it should serve as a primary tool for analyzing the structure of earnings and for understanding existing inequalities in labor incomes.

As yet, empirical analyses of income distribution have relied on human capital models only superficially. Direct attempts to relate individual earnings to investments measured in years of schooling show rather weak correlations. The weight attached to human capital analysis cannot rest on such seemingly fragile grounds.[2]

It is important to recognize that schooling is not the only type of investment in human capital, though it is an important early stage in the life cycle of self-investments. Previous estimates (Mincer, 1962) suggest that in terms of costs, the postschool investments of workers who are fully attached to the labor force are not smaller than their schooling investments. Hence the gross relation between schooling and earnings does not adequately represent the human capital earnings function, and this is one reason for the weak empirical correlations.

If we think in life-cycle stages, or contexts in which human capital is built up, the earnings function should include preschool (home) and postschool (job) investments in addition to schooling.[3] In my NBER study (Mincer, 1974) the earnings function was specified to include schooling and postschool investments. Effects of preschool investments were perforce relegated to the unexplained, residual

[2] Good scientific practice requires that we not mislabel the ignorance of investigators as "luck" of income recipients.

[3] In reality, the "stages" can and do overlap. The empirical specification of preschool investment requires information on the quantity and quality of the time and other resources parents devote to the upbringing of their children, before or outside formal schooling.

category. To the extent that preschool investments are positively related to schooling and postschool investments, the role of the latter may be exaggerated by the present analysis.

The first task of the study was to derive and estimate the relation between earnings and the accumulated investments in human capital of workers. This human capital earnings function was then applied to answer two questions: (1) How much of the existing inequality in the distribution of labor income can be attributed to individual differences in investment in human capital? (2) Can the intricate yet rather stable patterns of the earnings structure be understood in terms of the behavior of human capital investment?[4]

Though far from precise or complete, the following answers are suggested by the analysis: About 60 percent of the inequality of distribution in the 1959 annual earnings of white urban males can be attributed to the distribution of investments in human capital. Over periods longer than one year, the explanatory power of human capital is likely to be greater. A great deal of the observed structure of earnings is rendered intelligible by the investment analysis, though it is not uniquely predicted by it.[5]

The summary presented below is by no means comprehensive, nor does the exposition follow the sequence or methods of the analysis. The findings are described broadly and somewhat selectively in terms of the three research objectives of the study.

The Earnings Function

If completion of schooling meant completion of investment in human capital, the earnings function would be approximately estimated by a simple regression of earnings (in logs) on years of schooling.[6] As the present study indicates, the observed correlation using this "schooling model" is rather weak. Variation in earnings associated with age is not captured by the schooling model and is, in part, responsible for the low correlation. Though age can be viewed as an inherent depreciation phenomenon in the human capital

[4] *Earnings structure* refers to the distribution of aggregate earnings and its partition into schooling and age subgroups. *Patterns* refers to the comparative sets of means and variances and the shapes of the component and aggregate distributions of earnings.

[5] All these findings are derived from the data of the 1/1,000 sample of the 1960 United States census of population. The sample contains individual information for over 30,000 white urban males less than 65 years of age who had some earnings in 1959.

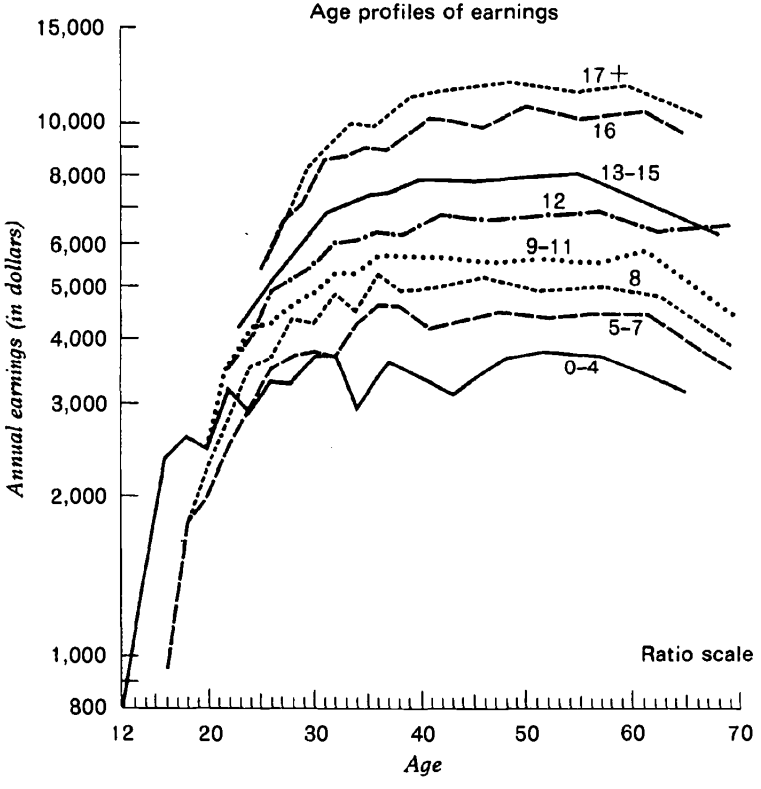
[6] A formal derivation of this result dates back to my unpublished Ph.D. thesis (Mincer, 1957). See also Mincer (1970, Eq. (1a), p. 7).

terminology, the growth of earnings with age is ultimately interpreted in the human capital model as being a consequence of continued net self-investment activities after the completion of schooling.

The theory predicts that investments are concentrated at younger ages, but continue at a diminishing rate throughout much of a person's working life. Because of increasing marginal costs, investments are not incurred all at once in a short period; they are staggered over time and decline continuously—both because benefits decline as the payoff period shortens and because opportunity costs are likely to rise with experience. This is true of gross as well as net investments.

Since earnings are a return on cumulated net investments, they also rise at a diminishing rate over the working life and decline when net investment becomes negative, as in old age. The typical

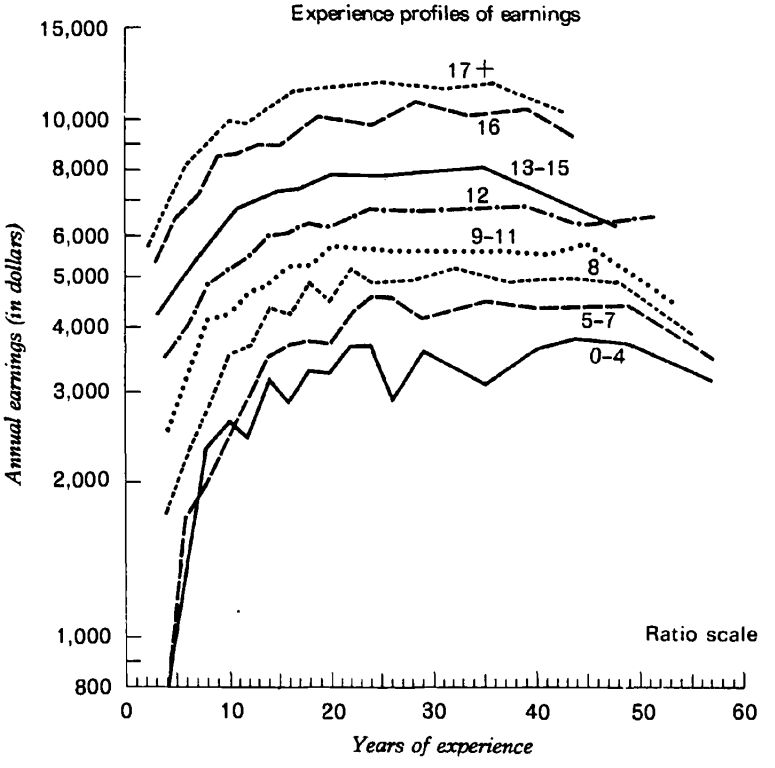
FIGURE 3-1 ***Annual earnings of white nonfarm males, 1959***



(logarithmic) working-life earnings profile is therefore concave, as illustrated in Figure 3-1. Its rate of growth is a positive function of the amount invested and of the rate of return. Its degree of concavity depends on how rapidly investments decline over time. In effect, the earnings profile is directly proportional to the cumulated investment profile. The magnitude of the cumulated investment is not observable, but is a concave function of experience. Hence, to expand the schooling model into a more complete earnings function, the linear schooling term must be augmented by a nonlinear, concave, years-of-experience term.

This function can be applied in multiple regression analysis to earnings data of individuals who differ in both schooling and age. Although age is not the same as work experience, the latter can be estimated as actual age minus estimated age at completion of schooling (shown in the right panel of Figure 3-1). Clearly, direct

FIGURE 3-1 ***(continued)***



SOURCE: Mincer (1974, Chart 4, p. 68).

information on experience is necessary for specifying earnings functions of individuals whose attachment to the labor force is not continuous.[7]

The form of the earnings function is also of interest. It can be fitted either to dollar earnings or to logs of earnings. In part, this choice depends on whether the focus of interest is on absolute or relative earnings inequalities. However, if dollar values are used, investment variables (schooling and experience) must also be expressed in dollar terms. If they are recorded in units of time—years of schooling and years of experience—the dependent variable, earnings, must be expressed in logs. Given the data restrictions and the focus of interest of this chapter, the logarithmic formulation was used here. Another choice concerns postschool investment as a function of time. Here there is no guidance from theory, except that annual installments of postschool investment—and, *a fortiori,* their "time equivalents"[8]—must decline over the working life. A given form of the investment time profile implies a particular form of the earnings profile. To take the two simplest forms, a linear investment decline implies a parabolic experience function, while an exponential decline of investment ratios gives rise to a type of Gompertz function. The latter yields a somewhat better fit, though such discrimination is rather weak. For the Gompertz curve, a nondeclining earnings profile is required—a condition that is satisfied if data are restricted to four decades of working life and to weekly (or hourly) earnings. These conditions are fulfilled in the empirical analyses of annual earnings when weeks worked during the year are used as a standardizing variable.

The two forms of the human capital earnings function used in the analysis are the logarithmic parabola (P) and the Gompertz curve (G):

$$(P)\ lnE_{s,t} = lnE_0 + r_s s + r_p k_0 t - \frac{r_p k_0}{2T} t^2$$

$$(G)\ lnE_{s,t} = lnE_0 + r_s s + \frac{r_p k_0}{\beta}(1 - e^{\beta t})$$

where $E_{s,t}$ is gross annual earnings of a worker with s years of schooling and t years of work experience; r_s and r_p are rates of re-

[7] Analysis of female earnings demonstrates dramatically that it is experience rather than age that matters. See Malkiel and Malkiel (1971) and Mincer and Polachek (1973).

[8] The *time equivalent* is the ratio of investment costs to gross earnings. Gross earnings include investment expenditures.

turn on schooling and postschool investments, respectively; k_0 is the investment-income ratio at the start of work experience; β is the annual decline of this ratio; and T is the positive net investment period.

In principle, the earnings function represents a unification of analyses of investment parameters and of income distribution. It provides an analytical expression for the earnings profile as an individual growth curve. Its coefficients are estimates of rates of return and volumes of investment. At the same time, the coefficient of determination of the multiple regression measures the fraction of total earnings inequality (variance of logs) attributable to the measured distribution of investments in human capital.

Note that, in contrast to conventional procedures, the regression procedure for the earnings function makes possible the separation of estimates of rates of return to schooling from the rates on other investment activities. Although in the empirical work, estimates of the rate of return to schooling are produced unambiguously, this is not true of the rate on postschool investments. Rough tests of the difference between these parameters are possible, however, and at the aggregative level of information used here, the null hypothesis of no difference cannot be rejected. Tests can also be performed on the question: Are rates of return different at different schooling levels? The results indicate that rates decline as schooling level rises, although this is not true when hourly or weekly rather than annual earnings are considered.

The earnings function approach also makes it possible to study the relation between schooling and postschool investments. In dollar volumes, the relation is found to be positive. This finding is consistent with a notion of complementarity between the two investment forms, but it does not prove it. The positive correlation may mean simply that in comparing individual lifetime investment programs, the scale of investment varies more than its composition. Logically, individuals should substitute one form of investment for the other, given the comparative advantages of the two forms of investment and a differing relative price structure for each. Yet, because of similar ability and opportunity constraints in schooling and in job training, individuals tend to invest more or less in both. Evidently, scale effects outweigh the substitution effects.

It should be noted that although the more educated put more resources into postschool investments, they do not spend more time at it. The investment-earnings ratio would measure the amount of time (in years) spent in investment (training) activity, provided only

expenditures of time were involved. On the average, the correlation between time equivalents (investment-earnings ratios) of school and postschool investments appears to be negligible. The opportunity cost of an hour is, of course, greater at higher levels of schooling; hence the positive correlation between dollar volumes of investment when time volumes are uncorrelated.

The Gompertz curve is a familiar empirical representation of industrial growth. That it fits an individual growth curve is no mere coincidence, since the staggered investment interpretation is suitable in both cases. There is a widespread view that differs with this interpretation of individual earnings growth. According to this view, the individual earnings curve is intrinsically an age phenomenon; it reflects productivity changes due to inherent biological and psychological maturation, leveling off early and declining much later because of declining physical and intellectual vigor.

There is evidence, however, to indicate that this inherent age factor affects earnings only to a minor degree. In data where age and work experience are statistically separable, the earnings curve is found to be mainly a function of experience, not of age, in terms of both its location in the life cycle and the sizes and signs of its growth rates. Earnings profiles differ by occupation, sex, and color in systematic ways not attributable to the phenomena of aging. What is sometimes thought to be an alternative interpretation of experience as learning and of the earnings profiles as "learning curves" is not at all inconsistent with the human capital investment interpretation, provided it is agreed that learning in the labor market is not costless. Even if there exist apparently costless differential opportunities for "learning by doing" among jobs, competition tends to equalize the net returns, thereby imposing opportunity costs on such learning.

Accounting for Income Inequality

As noted before, if only years of schooling are used in the earnings function, the correlation between years of schooling and log-earnings of males of working age is less than 10 percent. This does not mean, however, that schooling is unimportant. In part, the correlation is low because direct costs in schooling and related quality aspects of education are not well measured by a mere counting of school years. Moreover, the effects of postschool investments, when not explicitly specified, obscure the effects of schooling on earnings.

If postschool investments are important and differ among individuals, the distribution of earnings will be increasingly affected by

returns to accumulating postschool investments as the number of years of experience increases. If postschool investments are not strongly correlated with schooling, the correlation between schooling and earnings will continuously decline with the passage of years of experience. In fact, the correlation between time equivalents (for a definition, see footnote 8) of school and postschool investment is weak, and the correlation between log-earnings and years of schooling declines continuously after reaching an initially strong coefficient of determination of one-third before the first decade of experience is over.

Theoretically, the correlation between earnings and schooling would be highest at the outset of work experience, if postschool investment costs were included as part of income. Although such initial gross earnings are not observable, the distribution of observed net earnings six to nine years later is likely to resemble the distribution of initial gross earnings. Net earnings are less than gross earnings, but both rise as postschool investments cumulate. After some years, therefore, net earnings begin to exceed the level of initial gross earnings. This "overtaking point" is reached after, at most, $1/r$ years of experience, where r is the rate of return to postschool investments. Hence, this point is reached before the first decade of experience is over. This is also the approximate time when we observe the highest correlation between earnings and schooling.

The coefficient of determination (.33) between schooling and earnings within the overtaking subset of the earnings distribution represents an estimate of the fraction of earnings inequality that is attributable to differences in years of schooling, since earnings are then least affected by postschool investments. The inequality of earnings at overtaking is about 75 percent of aggregate inequality, which suggests that the distribution of schooling accounts for 25 percent of the total variance ($.33 \times .75$). Fifty percent of aggregate inequality, measured by the variance of logs of annual earnings, is attributable to the joint distributions of schooling and postschool investments.[9] The 50 percent figure is an understatement, however, since actual rather than time-equivalent years of schooling were used. The actual count of years fails to reflect either

[9] The aggregate log-variance of earnings in 1959 was .68. It was .51 in the overtaking set. The residual variance from the regression of log-earnings on schooling was .34 in the overtaking set. On the assumption of homoscedasticity of residuals from the earnings function, the "explained" variance in the aggregate is $(.68 - .34) = .34$, which is half of total inequality.

the variation in expenditures of time and money among students attending schools of the same quality or quality differences among schools. An upward correction of the variance of schooling investments to take account of such individual differences raises the explanatory power of schooling to about one-third of the aggregate and raises the joint effects of school and postschool investments to about 60 percent.

These conclusions are based on econometric analyses in which the earnings function was fitted to the microdata of the 1/1,000 sample (Mincer, 1974, Table 10). Even with the use of only two variables—years of schooling and years of experience, where years of schooling are unadjusted for quality and time equivalents of experience are assumed the same for all persons—the explanatory power of the earnings function compares favorably with results of statistical studies of comparable microdata that employ a large number of explanatory variables on a more or less ad hoc basis.[10]

It appears that the substantive conclusions about the quantitative and qualitative importance of human capital investments in the distribution of earnings are not much affected when the population coverage is expanded from white urban males to all males in 1959 or is changed from (male) persons to family units.

The Earnings Structure

Several prominent features of the "skill" (schooling and experience) structure of earnings appear rather stable in temporal and regional comparisons. Aggregative skewness and the growth of inequality with age are the best known. To these we may add patterns of variances and patterns of age profiles of variances within schooling groups which are less familiar and perhaps also less stable.

None of these features is inevitable. Yet—perhaps surprisingly, given the human capital model—they all can be explained by the correlation between the stock of human capital at any stage in the life cycle and the volume of subsequent investment. That this correlation is positive in dollar terms is understandable if individual differences in ability and opportunity affecting investment behavior tend to persist over much of the life cycle. The positive correlation between schooling and postschool investment is an example of such behavior.

Several implications of this positive correlation in dollar terms

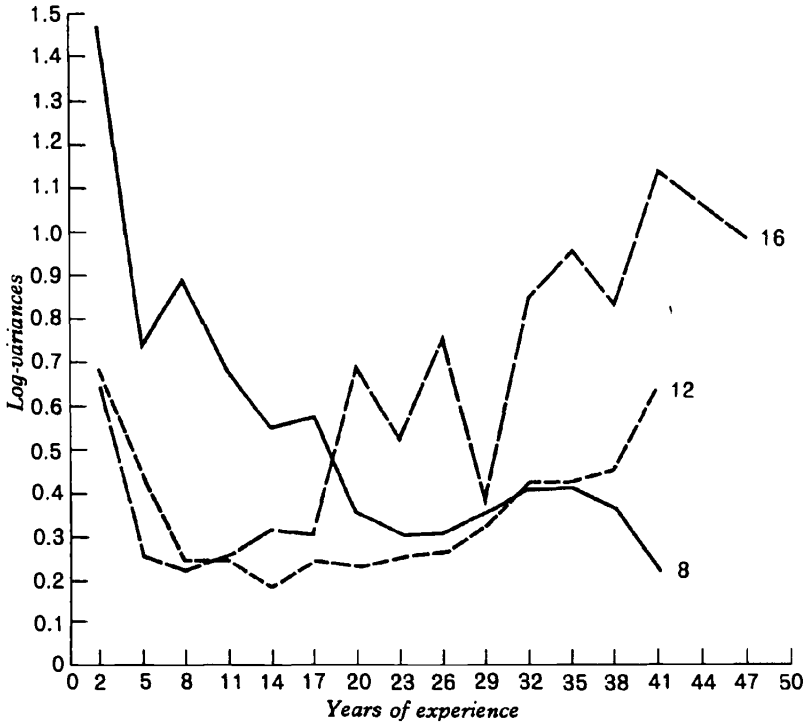
[10] See, for example, Jencks et al. (1972).

are observable. Dollar profiles of earnings "fan out" with experience and, *a fortiori,* with age, both across and within school groups. Dollar variances therefore increase with experience and with age. Similarly, because the dispersion of dollar schooling costs increases with the level of schooling, variances of earnings increase with level of schooling. Since mean earnings increase with age and with schooling, there is a positive correlation between means and variances in age and schooling subgroups of the earnings distribution. This correlation contributes to the appearance of positive skewness in the aggregate earnings distribution. This factor is independent of, and in a way more basic than, the shape of the distribution of schooling, which also contributes to the positive skewness of earnings. The change in the distribution of schooling from a positive to a negative skew during the past two decades implies that the distribution of schooling is no longer an important factor in explaining the persistence of positive skewness in the distribution of earnings. Indeed, the 1959 distribution of earnings at the overtaking stage of the life cycle is no longer skewed. The aggregate distribution, however, remains positively skewed.

If we define relative skill differentials in wages by percentage differentials in wage rates among schooling groups at comparable years of experience, we find that these are practically invariant over the working life. Since the logarithmic experience profiles of wages are concave, this finding implies that relative wage differentials among schooling groups increase with age. However, *within* schooling groups, relative wage differentials, measured by variances of logs, show different profiles depending on the level of schooling. As Figure 3-2 shows, the experience profile is clearly U-shaped for the high school group, which is at the center of the schooling distribution. The profile for the group with higher schooling mainly increases, whereas the profile for the lower schooling group decreases and becomes approximately horizontal.

It can be shown (Mincer, 1974, Part II, Ch. 4) that both the intergroup wage differentials and the inequality patterns within the middle levels of schooling reflect a negligible correlation between postschool earning capacity and time-equivalent postschool investment. The same absence of correlation underlies the previously noted invariance of experience profiles of relative wage differentials among schooling groups. The phenomenon arises if experience profiles of postschool investments, in time-equivalent units, are not systematically different among schooling groups. Put another

FIGURE 3-2 ***Experience profiles of log-variances of 1959 earnings of males (schooling groups: 8, 12, 16)***



SOURCE: Mincer (1974, Chart 6.2, p. 104).

way, it arises when the elasticity of postschool investments (in dollars) with respect to postschool earning capacity is, on the average, unitary. At the same time, the correlation between postschool investments and earning capacity, and the corresponding elasticity, apparently increases with schooling level.

The central tendency of the elasticities and the systematic positive relation between schooling level and elasticity of investment with respect to earning capacity raise questions for further research. In this connection, it is noteworthy and suggestive that very similar patterns are found in studying the consumption function. The "long-run" elasticity of saving with respect to income is not clearly different from unity, and the "short-run" or cross-sectional elasticity increases with schooling level (see the chapter by Solmon in this volume).

The differential patterns of log-variances by schooling level can also be analyzed by age. The ranking of log-variances of earnings is inverse to schooling level at young ages and positive at older

ages. Also, the age-schooling profiles of absolute and relative wage distributions aggregate to the well-known "leptokurtic" shape, with a skewness that is positive in dollars and negative in logarithms. Together with some observation on correlations of earnings of respondents in a 1959 survey of a Consumers Union panel,[11] the distinctive profiles of relative variances constitute strong evidence for the human capital theories and against the purely stochastic theories of income distribution. Systematic rather than chance variation is the dominant component of individual earnings histories and of individual differences in earnings.

HUMAN CAPITAL AND THE DISTRIBUTION OF EMPLOYMENT

The data show that the more educated and experienced workers enjoy larger annual earnings than their less-skilled fellows for two reasons: Their wage rates per hour are higher, and the amount of time they spend in gainful employment during the year is greater. Consequently, inequality in the distribution of annual earnings exceeds the inequality in the distribution of wage rates.

Part of the individual variation in weeks and hours of work during a given year is unrelated to human capital characteristics. Estimates suggest, however, that as much as half of the variation can be attributed to human capital differentials. Since close to one-third of the inequality in annual earnings is attributable to the distribution of time worked, about 15 percent can be ascribed to effects of human capital on the distribution of employment. Though this is a description of average effects in the male labor force, the effects differ systematically by schooling and experience. In particular, the relative importance of employment compared with that of wage rate effects is greater at lower levels of schooling as well as at older ages. At lower levels of schooling the impact of education and job experience is about equally divided between gains in wage rates and gains in employment stability. In contrast, the effects at higher levels of education are accounted for largely by gains in pay rates.[12]

On the average, no more than half of the differences in time spent in employment are due to unemployment. Differentials in labor force participation and in unemployment are therefore of roughly

[11] Mincer (1974, Table 14). For a description of the data sources, see Juster (1964, App. C).

[12] The long hours of work reported by some highly trained professionals such as physicians and business executives are the well-known exceptions.

equal importance in understanding the effects of human capital on the distribution of employment.

Theoretically, the employment effects of human capital can originate on both the demand and the supply sides of the labor market. Of course, the demand-supply distinction is not to be equated with the statistical categories of unemployment and of out-of-the-labor-force status. For example, unemployment often originates in layoff, but it also occurs in the course of job quitting and of labor force entry or reentry.

Labor Supply Effects

Effects of education and other training on the amount of time individuals allocate to the labor market derive, in part, from the increase in market earning power resulting from education. Education may also affect the allocation of time by affecting tastes and productivities in nonmarket activities. If education raises market earning power more than it raises productivity in nonmarket activities, the opportunity cost of nonmarket time increases—which tends to increase the time devoted to earning activities. Against this, however, must be balanced the resultant increase in income, which is likely to increase the demand for consumption time or leisure. It may be argued that lifetime income or wealth, rather than current income, is the appropriate income variable in labor supply functions. Wealth does not necessarily increase as a result of education, even if wages increase. If the rate of return to investment in education is equal to a competitive market interest rate, wealth is not augmented by investment, and income effects are nil. If rates of return are higher, wealth is increased, but at a rate lower than the wage rate.[13] As long as rates of return are not exorbitant, substitution effects may well dominate, resulting in more time devoted to the labor market by the more educated and experienced workers.

In part, then, the longer hours per week and greater labor force participation of the more educated may be explained by a possible dominance of the substitution variable in the labor supply function, that is, by their greater market earning power. Note that this is not inconsistent with a "backward-bending" labor supply hypoth-

[13] If w_2 is the wage rate of a worker who has s_2 years of schooling and if w_1 is the wage rate of another worker who has s_1 years of schooling, a simple human capital model suggests that $ln\ w_2 - ln\ w_1 = r\,(s_2 - s_1)$, where r is the rate of return to schooling. Let $r = r_0 + \Delta r$, where r_0 is the market rate. Then $ln\ w_2 - ln\ w_1 = r_0\,(s_2 - s_1) + \Delta r\,(s_2 - s_1)$. The percentage increase in wealth is given by the second term on the right. Therefore, the elasticity of wealth with respect to the wage rate is $\Delta r/r < 1$.

esis, according to which hours of work are expected to decline if wealth increases as rapidly as the wage rate. The latter condition and the decline in hours are observed in historical time series, but not in the cross-sectional education-related wage structure.

Essentially the same analysis applies to life-cycle changes in the labor supply of individuals. With a wealth level that, on the average, does not change much during the working life, hours of work and labor force participation grow as the wage rate grows. When depreciation begins to outstrip gross investment in human capital as a consequence of aging and/or obsolescence, the wage rate begins to decline. The decline in hours of work and in labor force participation begins about that time also.[14]

Since the work experience of more educated persons begins some years later than that of persons with less education and since their postschool investments are no smaller, it is not surprising that the more educated retire later in life. Their much higher labor force participation rate in later stages of life, such as in the 60-to-69 age group (Bowen & Finegan, 1969), is to a large extent simply the obverse of their much lower market work rates at ages 15 to 24, when most of them are still in school. In other words, when comparisons are made by years of experience rather than age, the differences in participation rates are small throughout the working life.

In sum, labor supply functions may explain why hours of work and labor force participation increase with education and why the more educated retire later in life but do not have a longer working life in terms of years. The observed positive correlation between education and employment, however, does not prove the dominance of substitution in cross-sectional labor supply functions, even if the attenuation of income effects is true. Other factors which help to account for the observed correlation are health differentials and differences in demand conditions and in job turnover, to mention a few. The empirical sorting out of these factors has barely begun.

A much stronger case for the labor supply hypothesis as an explanation of education-associated differences in employment can be made for the observed differences among women. Their strong substitution responses in the allocation of time between market and home are an accepted explanation of the historical growth of

[14] The decline in hours precedes the decline in wage rates. Therefore, annual earnings decline before wage rates do. A detailed analysis of these lags is contained in current NBER research by Becker and Ghez (in press).

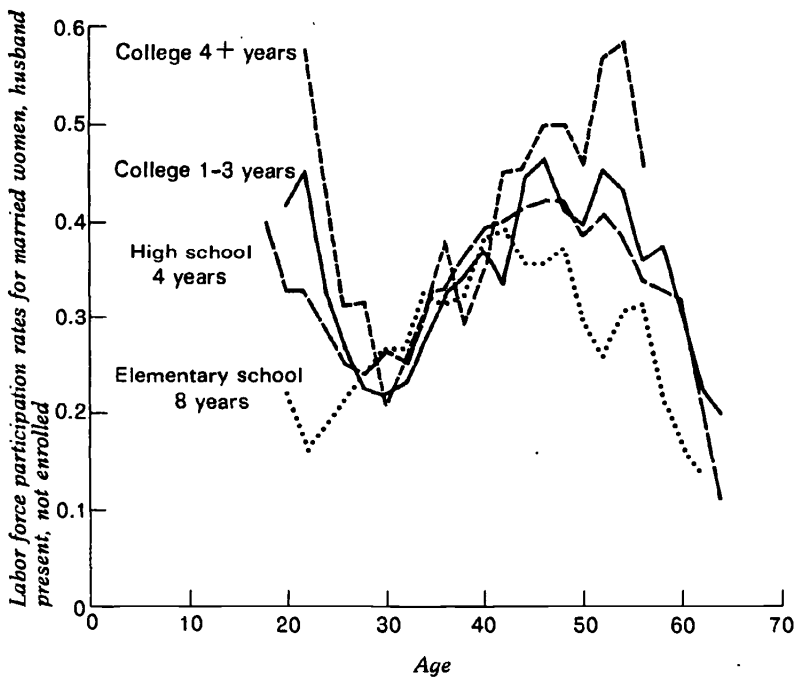
the female labor force. The differences in hours and weeks of market work among educational groups are much larger among women than among men, but it does not appear that this is due to greater health, demand, or job turnover differences among women with different educational levels.

As shown in Figure 3-3, the age profiles of female labor force participation rates are a great deal higher for more educated women. In all groups, participation declines when family demand for work at home increases: there are pronounced withdrawals from the labor market in all educational groups when there are young children in the family. The interesting finding is that the more educated women, who otherwise spend more time in the labor market, reduce their market work to take care of their children, particularly their preschoolers, more than do women with less education.[15]

If the quantity and opportunity cost of the mother's time, which was shifted from market to home, represents dimensions of what I

[15] These findings are the focus of current research at NBER by Arleen Leibowitz. See Chap. 7 in this volume.

FIGURE 3-3 ***Education and labor force status of women, United States, 1960***



SOURCE: Leibowitz (1972).

call "preschool" investments to human capital of children, these findings may serve as an empirical basis for the expansion of the human capital earnings function. The expanded function may contribute to the explanation of phenomena such as the importance of family background in children's school performance and the positive correlation between the educational attainment of children and that of their parents, particularly the mother. Whether these preschool investments have an independent effect on earnings, beyond affecting school attainment of the child, can be answered only by the expanded human capital earnings function. In any case, the greater earnings—and, presumably, also consumption capacities—of children may be viewed in the family context as a part of the return on the education of mothers. If so, the profitability of educating women may be understated by inferring it from their own earnings alone.

Unemployment Differentials

The time workers supply to the labor market exceeds the actual time they spend in employment by the amount of unemployment they experience. In part, the reduced employment of the less educated is attributable to the greater amount of unemployment they experience.

In studying unemployment differentials, decisions of employers and of workers must be considered. On the supply side, the greater the frequency with which workers enter, reenter, and leave the labor force or change jobs, the greater the frictional unemployment they encounter in the process. Much of the unemployment of married women and of students is attributable to their "dual job holding" with frequent seasonal, and otherwise induced, mobility between nonmarket and market activities. This inter-labor force mobility is clearly a more important explanation of the inverse relation between education and unemployment among women than among men, since education has a stronger effect on labor force attachment of women than of men.

On the demand side, differences in unemployment among education and skill groups occur for several reasons:

1 Industries differ in the degree of skill and education of their work forces. The volatility of demand for labor and the consequent labor turnover and unemployment are, in part, related to the volatility of final consumer demand, which differs by industry. For example, the demand for services is more stable than the demand for durables, construction, and capital

goods. On the whole, though the correlation is weak, the more educated workers are employed in the more stable industries.

This correlation appears to be somewhat stronger for women than for men.

2 A more basic demand factor in creating skill differentials in unemployment results from complementarity and substitution relations between labor and capital in the production process. There is limited evidence, observed in some sectors of the economy, that physical capital is more easily substitutable for unskilled than skilled labor. If short-run fluctuations in output are produced with relatively fixed physical capital, the employment of unskilled labor must fluctuate more than that of skilled labor. Consequently, the less educated in the labor force are observed to have higher layoff rates and unemployment rates in the cross section and greater amplitudes of them during the business cycle.

3 A third factor which operates jointly on the demand and supply side of the labor market is the specificity of training and experience workers acquire on the job. Employers invest resources in hiring, training, and experience of employees to the extent that the resulting increases in productivity are realized in their firms rather than elsewhere. In order to guard against capital losses resulting from quits and layoffs, it is mutually advantageous for employers and workers to share the cost of such investments (Becker, 1964).

Specifically trained workers earn more than they would in alternative employments, but less than their marginal products in the firm. Consequently, such workers are more reluctant to quit, and their employers are less inclined to lay them off. This structure of labor turnover implies reduced frictional and, to some extent, cyclical unemployment. Insofar as specific postschool investments are related to educational attainment, they are a factor in the unemployment differentials observed by education. Worker self-investments appear to increase roughly in proportion to investments in schooling. This positive relation between schooling and postschool investment can be explained by common selective factors of opportunity, ability, and motivation. Employers, in turn, tend to invest more in the more educated workers, either because specificity is more likely in more complex jobs or because they think education confers a greater capacity and motivation for training.

Though geographic mobility increases, quit rates diminish as education increases. Both phenomena are consistent with the specific training hypothesis and cannot be explained by capital complementarities. However, educational differences in layoff rates and in length of job tenure with the same employer are consistent with both hypotheses. It should be noted that unemployment differentials implied by the complementarity hypothesis are directly linked to education. Those resulting from specific training are

more properly attributed to specific postschool investments, not to school education.

4 Unemployment is affected not only by the incidence of job separation but also by its duration; duration of unemployment is inversely related to education. The probable reasons are the educated worker's greater efficiency of search time and the employer's greater investment in finding him. The greater efficiency is a result of greater incentives and capacity to acquire information by using financial and other resources rather than one's own time. The greater employer search cost reflects greater specificity of job training at higher levels of schooling, as well as greater concern for individual differences in worker quality.

5 The complementarity hypothesis suggests that in the process of economic growth, defined by growth of physical capital per unit of labor, the demand grows more rapidly for skilled labor than for unskilled labor. If the upgrading of skills does not proceed rapidly enough, above-equilibrium rates of return and greater-than-average unemployment at lower skill levels may persist. Though rates of return to education apparently declined during the first half of this century and remained roughly stable thereafter, there is no clear evidence that education-related unemployment differentials have shown any corresponding changes in the long run. The shortage of good data inhibits strong statements, but these findings tend to cast doubt on the notion of perennial skill shortages.

6 A variety of institutional factors may account for differences in unemployment and labor force participation among educational groups. Minimum wages on the demand side, and income maintenance programs on the supply side, tend to price low-quality labor out of the market. Inexperienced and uneducated workers whose market wage is less than the minimum wage have higher unemployment and reduced labor force participation.

Income maintenance programs such as welfare payments and old-age pensions under Social Security were designed to benefit mainly the low-earning, usually least-educated population. A recognition that these programs contained some disincentives to work led to their liberalization; some additional earnings were allowed without reducing benefits. One consequence of liberalization is an increase in intermittent labor force participation, with attendant frictional unemployment.

Seasonal workers are generally less skilled and educated than the average worker. The unemployment compensation system encourages seasonal work and converts the reported status of some from "out of the labor force" to "unemployed." This does not nec-

essarily affect earnings, but it may do so if it converts employment into unemployment by discouraging seasonal dovetailing.

In conclusion, it is worth noting, particularly from a policy point of view, that unless the complementarity hypothesis is of some importance, the greater stability of employment of more educated people is not directly attributed to schooling in this analysis, though it is related to human capital investment and education in a broader sense.

SECULAR TRENDS IN EDUCATION AND INCOME INEQUALITY

The inequality in the distribution of earnings is affected primarily by the dispersion in the amounts of human capital invested and by the average magnitude and the dispersion in the rates of return.

If skills are measured by time equivalents of investment in human capital, skill differentials in wages change in proportion to the rates of return.[16] If the upgrading of skills persistently lagged behind increasing demands, the rate of return would rise, whereas improved capital markets, public subsidies, and consumption-motivated investment would tend to depress the rates.

The narrowing of income inequality over the first half of this century is consistent with apparent declines in rates of return;[17] with increased income, which permitted financing and increased consumption demands; and with the growth of publicly financed education, primarily at lower levels of schooling. In the past two decades the rate of return and inequality remained roughly stable, even though the trends in income and public financing continued to grow.[18] The suggestion is implicit that there was a countervailing growth of the demand for skills by industry.

Growth of schooling appears to be associated with a decline in the dispersion and in the skewness of the distribution of schooling. The latter is an arithmetic phenomenon due to a finite and often

[16] Time-equivalent units are basically not comparable over time unless there is no productivity growth in the creation of human capital. If productivity grows, a unit (say, one year of schooling) today represents a larger increment of skill than in the past.

If Δh is difference in skill and if w_2 and w_1 are the wage rates at higher and lower skill levels, rate of return is

$$r = \frac{lnw_2 - lnw_1}{\Delta h}$$

[17] For fragmentary evidence, see Becker (1964, pp. 131–135).

[18] The extension of public financing to higher levels of schooling, however, may widen inequality, as some recent research suggests.

legislated limit on years of schooling. The decreased dispersion in the distribution of schooling may well be a lagged effect of the narrowing inequality of parental income that was observed before 1950. It probably resulted also from governmental subsidies and the spread of compulsory schooling, child labor laws, and minimum wage laws, all of which shortened the lower tail of the schooling distribution. The distribution of earnings within age groups in current data reflects the effects of a mild secular narrowing in the dispersion of schooling and of a stronger reduction in its skewness.

Aside from the change in the shape of the schooling distribution, the continuing growth of education contributes to a reduced inequality of earnings.

The meaning of the upward trends in education is that the level of education is higher in young than in old age groups. This offsets, in part, the age variation in earnings, which is due to the growth of experience with age. Another consequence is that the relative numerical importance of the young and least-educated and the old and most-educated groups becomes smaller, the more rapid the upward educational trends. But these are precisely the groups within which the inequality in earnings is largest. Therefore, the stronger the upward trend in schooling, the smaller the aggregate inequality. It can be shown that if growth in schooling ceased and the distribution of schooling in each age group remained the same as among young earners with less than a decade of work experience, inequality in the cross section as measured by the logarithmic variance would increase by close to 10 percent.

Secular trends in education also affect the distribution of income indirectly via effects on the composition of the labor force and the resulting distribution of employment. The lengthening of schooling and increased enrollment produced a growing intermittent student labor force. The growth of education of women contributed to a growing female labor force whose participation is partial. The resulting cyclical and seasonal sensitivity of the labor force and the updrift in frictional unemployment have been commented upon by labor economists. As far as the distribution of income is concerned, the growing relative importance of the "secondary" labor force widens the dispersion of employment, a factor which tends to widen the inequality of annual earnings.

Although the inequality of *personal* earnings among all earners, including men, women, and teenagers, is of interest, attention to inequality among *family units* is prompted by considerations of

economic welfare and of consumption behavior. Effects of the education-induced changes in the labor force are best understood by considering the family context of earning activities. The greater the earning power of a family member, the greater the incentives to participate in the labor force. However, the greater the earnings of other family members and the greater the family nonemployment income, the weaker the tendency to work in the labor market.

The positive correlation between educational attainments of husband and wife is a force in the direction of greater inequality among families than among family heads. However, the "income effect" works in the opposite direction. It dominates particularly in families where the employment of the primary earner is unstable. It appears, on balance, that the existence and growth of a secondary labor force, which is partially induced by the growth of education, contributed not only to the widening of dollar dispersion but also to the narrowing of relative inequality among families.[19]

In conclusion, it is important to note that the secular growth in education, the narrowing of its distribution, and the growth of labor force participation of women have rather small effects on income inequality *insofar as they do not affect rates of return to investments in human capital.* If the secular upgrading of education continues at a steady rate, there are no effects: only acceleration of trends produces changes in inequality. At the same time, unless accompanied by similar reductions in the dispersion of all forms of human capital, even large reductions in the dispersion of schooling produce small changes in inequality. In contrast, changes in rates of return transmitted throughout the economy do affect income inequality almost proportionately.[20]

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[19] Unrelated individuals are here excluded from the definition of a family.

[20] These conclusions are based on research by Chiswick and myself (Chiswick & Mincer, 1972).

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