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HUMAN CAPITAL INVESTMENT, SCHOOLING, AND EARNINGS: "THE ROLE OF EXPERIENCE"

W. Lee Hansen and Burton A. Weisbrod

UNIVERSITY OF WISCONSIN - MADISON

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ABSTRACT

While theoretical and empirical research on the economics of human capital is still in its relative youth, a substantial body of work has already accumulated on the variables determining worker earnings and on the importance of schooling as one of those determinants. The present paper focuses attention on one such variable that has received almost no attention in the literature, namely, experience. The concept of experience is explored, its various forms examined, and then a number of operational measures of experience in models of individuals' earnings are applied. The primary objective is to learn more about the quantitative importance of experience as one (or more than one) determinant of earnings. Also investigated is the quantitative importance of schooling as a determinant of earnings.

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W. Lee Hansen and Burton A. Weisbrod
University of Wisconsin

While theoretical and empirical research on the economics of human capital is still in its relative youth, a substantial body of work has already accumulated on the variables determining worker earnings and on the importance of schooling as one of those determinants. The present paper focuses attention on one such variable that has received almost no attention in the literature, namely, experience.[1] We explore the concept of experience, examine its various forms, and then apply a number of operational measures of experience in models of individuals' earnings.

Our primary objective is to learn more about the quantitative importance of experience as one (or more than one) determinant of earnings. We also investigate the quantitative importance of schooling as a determinant of earnings. The possible connection between schooling and experience exists because of the likelihood that empirical measures of those two variables may be correlated, and both may affect earnings; in this case the omission of experience from econometric models of earnings will produce biased estimates of the effect of schooling on earnings. That is, just as the omission of a student's "ability" is known to bias estimates of the effect on earnings of schooling, so the same may be true of the omission or improper specification of "experience." This possibility should be examined.

I. CONCEPTS OF EXPERIENCE

It is a gross oversimplification to regard experience as reflecting any single or simple process. Models of the determinants of earnings

will be strengthened by recognizing that experience is multidimensional. If we define "experience" conceptually as the knowledge and practical wisdom that (1) is gained independent of schooling and formal training and that (2) affects labor productivity and earnings (assuming that earnings reflect productivity), then several types of experience can be distinguished. There are, for example, the experiences of learning to get along with people, of learning the discipline required for succeeding in a particular socioeconomic milieu, and of learning from day-to-day associations with people, tools, and ideas. All of these are likely to affect one's success in the labor market.

While this appears obvious--that experience has multiple dimensions--what little empirical attention has been paid to experience in models of the determinants of earnings assumes implicitly that all earnings-relevant experiences occur simply as a function (usually linear or log-linear) of the passage of time. That is, the frequent use of the variable, age, can be interpreted to reflect a view that earnings-relevant experience occurs at a constant rate throughout life. Alternatively, experience might be interpreted as those earnings-relevant factors that operate only by virtue of time spent out of school, time spent in the labor market, or perhaps time spent in a particular job with a particular employer. The fact, however, is that "experience"--by any definition--is rarely mentioned until quite recently in the published literature on human capital, or in the empirical research on the determinants of earnings.[2] Interestingly, however, much of the labor-economics/collective-bargaining literature does recognize the importance of experience as related to job tenure and seniority, although it is generally not examined in relation to schooling (Rees and Shultz; Palmer et al.).

To provide for our subsequent examination of the quantitative impact of experience, we hypothesize the existence of five classes of experience:

Type I: Social experience. This is experience obtained through the passage of time. Reflecting exposure to the social system, this type is essentially a function of age.

Type II: Labor market experience. This is experience obtained through being in the labor market whether employed or unemployed. Whatever its precise mechanism, this type accrues to a person who is in the world of work. The importance of this type of experience is some function of duration of labor force participation.

Type III: On-a-job experience. This is experience obtained through being employed. People do not obtain this kind when they are unemployed or not in the labor force, for whatever the reason. Thus, the importance of this type of experience is a function of duration of actual employment.

Type IV: In-the-skill experience. This is experience accumulated while performing a particular kind of work for a sustained period. A worker who is continuously in a given occupation, using and developing a particular set of skills, obtains more of this kind of experience than does someone who shifts work activities. Thus, this experience is some function of the length of time a person has practiced particular skills. It is, perhaps, what has sometimes been discussed as "learning-by-doing." (Arrow 1962; Sen 1962; Hartley 1965)

Type V: With-the-employer experience. This is experience obtained with a particular employer. A worker who remains with a single employer obtains more of this type of experience than does a similar worker who changes employers, even if the latter worker performs the same type of work. Thus, this employer-specific experience[3] is some function of duration of employment with a particular employer.

In reality, people are generally obtaining several, and frequently all five, types of experience simultaneously. For example, a person employed by a particular employer for a lengthy period is accumulating all five types of experience, whereas someone who is unemployed and looking for work is accumulating experience of Types I and II only. Thus, in the empirical work, the challenge is to devise separate measures for each type of experience so that the effects of each on earnings can be estimated.

We do not suggest that every form of experience affecting earnings falls neatly into one of these five categories. Indeed, we can think of some that do not; travel, to the extent that it is "broadening," is a kind of experience outside the labor market which deserves recognition even though it escapes our typology. We believe, however, that the bulk of earnings-relevant experience is captured by our classification.

II. QUANTITATIVE IMPORTANCE OF HOW EXPERIENCE IS SPECIFIED

Even before attempting to operationalize these various types of earnings-relevant experience (in section III, below), we know from earlier work that the particular manner in which "experience" is measured exerts

(1) an effect on the coefficient of schooling in models of the influence of schooling on earnings and that it exerts (2) an effect on the estimated direct influence of experience on earnings. These are the two relationships pointed out above that we wish to consider.

Table 1 presents coefficient estimates obtained from linear least-squares regressions of annual earnings on years of schooling, "experience"--by each of four alternative measures--and a vector of "background" variables that are listed in the note to the table. This table presents previously published results, and so the details of the original studies are not presented here. Column 1 measures experience by age; the measures used in columns 2-4 assume that earnings-relevant experience begins only when schooling is completed (col. 2) but not before some minimum age is reached (cols. 3 and 4).[4] If, for example, an early school-leaver obtains no earnings-relevant experience until age 16 because child-labor laws effectively prevent his labor market participation, then, assuming that such participation is the only form of experience that counts, the experience measure in column 4 would be most suitable. The experience measures of columns 2-4 are, in effect, variants of our Type II experience, reflecting labor market experience. All of the four measures used in Table 1 imply that once experience begins, it continues at a constant rate through time and neither depreciates nor obsolesces through time, assumptions that are obviously questionable. These measures also imply that experience affects earnings independently of whether the person works or not, whether a working person works continuously in one occupation or shifts among many occupations, and whether a working person is employed regularly for one employer or works for many different employers. Our point, however, is certainly not to defend any of these measures--even though "age" was one that we actually

TABLE 1

Least-Squares Regression Estimates for Years of Schooling and Experience, in Dollars Per Year

Variable	Age	Years Since Leaving School	Years Since Leaving School After Age 14	Years Since Leaving School After Age 16
	(1)	(2)	(3)	(4)
Schooling (years completed)	$20 (1.54)	$204	$89 (6.08)	$42 (4.13)
Experience (years)	184 (12.09)	184	161 (11.10)	180 (11.90)

Sources: Col. 1, Hansen, Weisbrod, and Scanlon 1970.
Col. 2, calculated by Chiswick from data in Hansen, Weisbrod, and Scanlon 1970. He did not present t-statistics.
Cols. 3,4, Hansen, Weisbrod, and Scanlon 1972.

Note: t-values shown in parentheses. All estimates are for our Model IV in Hansen, Weisbrod, and Scanlon 1970, and, hence, control for the following variables: Armed Forces Qualification Test score (AFQT), training, color, marital status, family size, and region of residence. Only the direct effects of education are shown; the effect of education on "learning" (AFQT) and, thus, indirectly on earnings is not included in these estimates.

used in a previous paper--but to show the sensitivity of regression estimates to the specification and measurement of experience.

III. ANOTHER LOOK AT EXPERIENCE: SOME NEW EVIDENCE AND MEASURES

We now turn to an entirely different body of data to help assess both the quantitative importance of the various types of experience and the effect of their inclusion on the estimated coefficient of schooling. This body of data is drawn from a national sample of 3,000 male veterans age 18-35, who were included in the 1964 Current Population Survey, as a part of the special study of the military draft undertaken for the Department of Defense by the National Opinion Research Center.[5] We used data for the 965 men for whom complete information was available on the variables of interest to us. A notable feature of these data is their inclusion of information on the duration of military experience as well as postservice schooling. We show here only a portion of our findings, namely, the regression coefficients for experience (defined in various ways) and for schooling, holding constant the other variables listed in the note below Table 3.

Our primary objective is to learn more about the effect on earnings of the various types of experience we identified above. Our secondary objective is to learn more about the effect on earnings of formal schooling, an effect which, as we have shown above, will be estimated differently depending on the manner in which experience is defined.

Table 2 portrays the kinds of information we have regarding (1) the duration of schooling and of work experiences for each man and (2) the timing of these activities. Data on timing are of particular interest because they permit us to distinguish between the effects of various

types of earnings-relevant experiences, depending on the stage at which they occurred.

Table 2 shows the sequence of schooling and experience of various types for the average person in the sample. It indicates that the mean amount of pre-service schooling is 12.0 years, completed at age 18; that this is followed by a period averaging 0.4 of a year prior to obtaining the first job; and that 2.6 years later, on average, the individual entered military service, where he remained for an average of 2.4 years, being discharged at age 23.4. And so on.

The data do not permit us to estimate the effects on earnings of all five types of experience, but we can estimate the effects of several types. Moreover, we can begin to test whether the work experience that occurs at different times has the same effect on earnings or whether the effects differ, possibly reflecting such factors as depreciation and obsolescence of experience, or the obtaining of experience that is more relevant to the kind of work the person is currently performing.

We next describe how the various experience measures are defined.

Type I experience--in the social system--is especially elusive in concept. Ideally, we would have information on the amount of time an individual was gaining earnings-relevant experience apart from his schooling and work-related activities. In practice, however, it is most difficult to distinguish between what a worker learns in school or on the job and what he learns in other ways during the years when he is in school or at work.

Our data permit a reasonable proxy, however, for Type I experience: the period of time that the worker is not in school and not in the labor market. Our assumption is that if a worker obtains any earnings-relevant

TABLE 2

Duration in Years of Various Components of Experience and Schooling for Average Individual in Sample

	Mean Duration	Age at Completion of Schooling or Experience Shown in Column 1
	(1)	(2)
Average age of entry into school		6.0
Average years of school completed	12.0	18.0
Average time in years between school completion and first job or entry into military service	0.4	18.4
Average time in years between time of taking first job and entry into military service	2.6	21.0
Average years of military service	2.4	23.4
Average years of added education	0.6	24.0
Average years of postservice experience after added schooling but prior to starting current job	2.0	26.0
Average years worked on current job	4.2	
Average calculated age at time of survey		30.2*

*The calculated average age of 30.2 at the time of survey exceeds the average reported age of the respondents, 29.7. Two factors account for the discrepancy. First, the age of entry into school was arbitrarily assumed to be age 6. Second, since some segments of experience are calculated on the basis of data in years (e.g., "age of discharge from service"), and some on data in months ("time in military service"), small errors are introduced into the measurement of several of the time segments.

experience during this period, he gains the type of experience that occurs simply through the passage of time. Our proxy for this type of experience is the period between the time at which a person completes pre-service schooling and the time at which he obtains his first job or enters military service. We recognize that a person may have learned something during this time through the process of applying for jobs, taking interviews, and so forth. On the other hand, the period following completion of school is often treated as a kind of extended vacation period during which job search is minimal, particularly if a person expects to enter military service in the near future. Our judgment is that, in general, most of the postschool, pre-work period is spent in the latter way, and so we treat this period as one in which only Type I experience is being obtained.[6]

This proxy for Type I experience is also imperfect in other ways, for it is limited to a particular time in one's life, and so there is danger in extrapolating findings about the value of this type of experience to other stages of life. Nevertheless, we believe that our proxy measure is useful at least as a beginning for the process of understanding the different ways in which people enhance their labor productivity and earnings.

Type II experience--in the labor market--cannot be identified with our data because there is no information regarding duration of unemployment and job search. Without such information there is essentially no difference between Type II and Type III experience, and, therefore, no proxy for Type II is included in the regression analysis below.

Type III experience--on-the-job--can be examined in some detail with our data. We can investigate the separate effects on earnings of work

experiences occurring (1) prior to military service, (2) in military service, and (3) after military service. Our expectation is that the more recently the experience was obtained, the greater would be its impact on earnings.

Type IV experience--doing a particular kind of work--is not well-measured by our data, and no proxy for it is included in the regression analysis.

Type V experience--with a particular employer--is available in the form of years worked with the present employer.

To examine the relationships between a person's current annual earnings, his schooling, and his experiences of the various types, we estimated the following least-squares regression equation, where reported annual incomes is used as an approximation of earnings.[7]

$$Y = a + b_1E_1 + b_2E_{3A} + b_3E_{3B} + b_4E_{3C} + b_5E_5 + b_6S_B + b_7S_A + b_8Z + e,$$

where Y = annual income, in dollars;

E_1 = duration of time in years between completion of pre-service schooling and the taking of the first job (or of entry into military service, if this came before the first job);

E_{3A} = earlier postservice job experience, in years;

E_{3B} = duration of pre-service job experience, in years;

E_{3C} = duration of military service, in years;

E_5 = duration of current employment, in years;

S_B = years of schooling completed before military service;

S_A = added years of schooling completed subsequent to military service; and

Z = a vector of control variables including race, marital status, region of residence, and score on the Armed Forces Qualification Test (AFQT).

In addition to the linear model above, we also examined a model that reflected the hypothesis that schooling and work experience interact. This hypothesis holds that the more schooling one has, the better (more valuable) the work experience he is able to obtain. If this is true, then terms reflecting the interaction (product) of schooling and experience should have positive (and significant) regression coefficients. In fact, however, all of our experience measures, when entered interactively with schooling, had negative coefficients, although most were not significantly different from zero. Failing, then, to find evidence in support of the interaction model, we report here only the results for the non-interaction model.

Empirical Results

The regression estimates are presented in Table 3. Several results stand out. First, the time spent immediately after completing school but before taking a first regular job or entering military service, E_1, has no statistically significant effect on subsequent civilian earnings. The magnitude of the estimated coefficient--$102--however, is about as large as all but one of the experience coefficients; we cannot reject the hypothesis that E_1 experience is of considerable importance, even though we also cannot reject the hypothesis that E_1 experience is really of zero importance. Second, military service and whatever experience (and training) is associated with it, E_{3C}, is also not associated with a statistically significant effect on earnings, but this coefficient is substantially smaller than that of E_1. Finally, the effects of civilian work experiences E_{3A} and E_5

are large and highly significant. As expected, the magnitudes (and significance levels) of the work-experience regression coefficients (E_{3B}, E_{3A}, E_5) decline as the time elapsed increases since the experience took place. Thus, we note that job experience with the current employer, E_5, has a larger dollar impact than earlier postservice job experience, E_{3A}, which in turn has a larger dollar impact than does pre-service job experience, E_{3B}.

Table 3 also shows, for contrast, the estimated effect on earnings of a year of experience if experience is measured simply by age, rather than by the various measures we have been discussing. The lower panel of Table 3 (Model 2) shows that a year of age is associated with an additional $130 of annual income. This result masks the fact, which is brought out in our preferred Model 1 formulation, that some types of experience appear to contribute up to $246 per year, while other types contribute little or nothing.

These results indicate the importance of using more refined measures of experience than simply age. But they also point up the difficulty of estimating the separate effects of the various types of experience we posited in this paper. Our conceptualization of experience recognizes that different types of experience can and generally do occur simultaneously. The actual experience measures used, however, assumed that only one type of experience occurred at a time. Therefore, our estimates in Table 3 actually capture the effects of more than one type of experience, and so we must adjust them downward in order to obtain estimates of our conceptually identified types of experience.

We can illustrate this as follows. The variable E_3 (taken as an average of E_{3A}, E_{3B}, and E_{3C}) captures not only the effects of previous employment experience (Type III) but also the effects of nonschooling, nonemployment experience (Type I). To estimate the separate effect on earnings of Type III experience alone, we must subtract the coefficient of

TABLE 3

Regression Results for Experience Variables

Experience Measure	b	t-value
Model 1: (variables measured in years)		
Nonemployment, Nonschooling (E_1)	\$102/year	0.77
Military service experience (E_{3C})	57	0.99
Pre-service job experience (E_{3B})	69	1.66
Earlier postservice job experience (E_{3A})	105	4.33
Current job experience (E_5)	246	7.80
R^2 = .2576		
Model 2:		
Age as a measure of experience of all types	130	5.72
R^2 = .2388		

Note: The estimates of b's for Models 1 and 2 control for race, marital status, region of residence (South/Non-South), AFQT score, schooling before service, and added schooling after service.

E_1 from the coefficient of E_3. If we view the E_1 coefficient as being essentially zero (because of its low level of significance), then the net effect of Type III experience would be that shown for the E_3 variable in Table 3, which we take to be approximately $70. But if we regard the E_1 coefficient of $102 as the best estimate of nonschooling, nonemployment experience--even though that coefficient is not significantly different from zero--then the net effect of previous employment experience would be $102 less than is shown in Table 3; this would mean that military and pre-service work experience are of negative value. If these two periods of experience actually led to a "decay" in skills and attitudes, then individuals would, indeed, be worse off than if they had not been employed. We think such a result is unlikely, however, which leads us to believe that the true coefficient of E_1 may well be approximately zero.[8]

To continue the illustration, the variable E_5 reflects not only current employment experience (Type V) but also previous experience (Type III) and nonschooling, nonemployment experience (Type I). Therefore, we must subtract the E_3 coefficient--which encompasses Type III and Type I experience--from the E_5 coefficient to obtain the value of Type V experience. Thus, the effect of Type V experience would be $246 minus approximately $70, or $176.

We do not want to emphasize these empirical results. Because experience is multidimensional and more than one kind of experience can occur at a time, developing empirical estimates of the separate effects of the various types of experience is not easy; the procedures we employed can, and should be, improved upon. More important than our estimates is the evidence that experience takes a variety of forms which differ in their impacts on earnings. Specifically, it appears that age is a poor proxy for experience of an earnings-relevant type, contrary to what we and others have sometimes assumed (Hansen, Weisbrod, and Scanlan, 1970; Chiswick; and Mincer).

TABLE 4

Regressions Results for Schooling Variables, Using Experience Measures from Models 1 and 2

Schooling Measures	b	t-value
Model 1:		
Years completed before military service	$427/year	7.79
Added years completed after military service	339	5.02
$R^2 = .2576$		
Model 2:		
Years completed before military service	342	7.46
Added years completed after military service	205	3.15
$R^2 = .2388$		

Note: The estimates of b's for Models 1 and 2 control for race, marital status, region of residence (South/Non-South), AFQT Scores, and the experience measures cited in Table 3.

Experience and Schooling

Earlier in this paper we pointed out that the definition and measurement of experience was also important because of the correlation between many measures of experience and the amount of schooling completed by a person. Thus, we showed in Table 1 that the estimated coefficient of schooling was quite sensitive to the manner in which experience was specified. We are now in a position to examine this relationship once again, this time with our new body of data and with a considerably improved set of experience measures.

Table 4 shows the least-squares estimates of the change in income associated with more years of schooling when experience is measured in the multidimensional manner described above (Model 1), and, alternatively, when it is measured simply by years of age (Model 2). The results are again striking. When age is used, the two variables--years of schooling completed before military service and added years of schooling completed after military service--have estimated coefficients of $342 and $205 per year, respectively (and at high levels of statistical significance). However, when we use the model we prefer, Model I, the coefficient of schooling before service increases by about 25 percent, to $427 per year, and that for schooling after service by 66 percent, to $339 per year. The use of age as a proxy for income-relevant experience seriously understates the impact of schooling on income because of the higher correlation between age and years of schooling than between the experience variables and years of schooling.[9]

Comparing the results for Model I in Tables 3 and 4, we note that a year of postservice schooling is considerably more valuable--apparently adding $339 per year to earnings--than its substitute, a year of work experience. The experience that occurs during the period in which the

veteran might return to school, perhaps best proxied by the variable E_{3A} (earlier postservice job experience), adds only $105 per year to earnings.

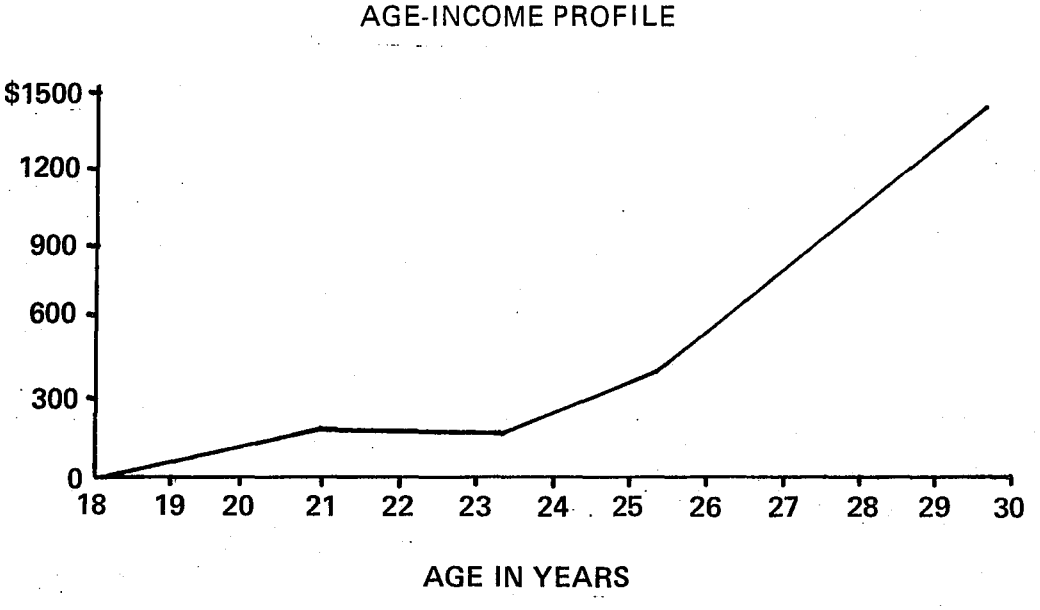
The comparative effect on earnings of pre-service schooling and experience is even more dramatic. While pre-service job experience is shown in Table 3 to be worth only $69 per year in earnings (and even this is not different from zero at a high level of statistical significance), a year of pre-service schooling is worth $427 per year.

IV. SOME SPECULATION ON FUTURE RESEARCH

What do these results suggest for the directions that should be taken in future research?

1. Effects of depreciation, timing, and specificity of experience. Figure 1 shows the age-income profile for the average sample, using the estimated regression coefficients and assuming the average number of years of each type of experience following completion of schooling before military service. The convexity (from below) is interesting, given the common finding of concavity in cross-sectional age-income profiles. Our data cover only persons up to age 35, however, and the curve might well behave differently for older persons. What can we say about the apparent convexity of the estimated experience-income profile? We might speculate that experience depreciates and obsolesces over time; our finding that the partial regression coefficients of $E_5 > E_{3A} > E_{3B}$ is consistent with this hypothesis (Ben-Porath). It might also be hypothesized that more recent experience has a higher payoff because individuals have been searching successfully for jobs that best suit their interests and talents; thus, our findings are also consistent with the hypothesis that people move to jobs having better earnings opportunities (Rees and Shultz). Still

Figure 1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AGE IN YEARS

another hypothesis is that workers acquire on-the-job training which, though possibly viewed as specific training by the employer, is partly general in its effect on employee earning power as workers move to accept new jobs (Becker). These three hypotheses are not mutually exclusive; there may be some validity to each. It would be useful, as a next step, to develop tests of them.

2. Experience as a human capital investment process. Apart from Type I experience, which depends only on the passage of time, all of the other types depend partly upon worker decisions--such as, to enter in the labor force, to take a job, to shift jobs, to change occupations. Because the gaining and losing of the various types of experience occurs as a result of personal decisions, we can view experience as an investment process. For example, a rational person contemplating a temporary withdrawal from a job and from the labor market would consider not only the loss of experience (of Types II, III, IV, and V) but also depreciation of previous experience, as such depreciation affects future earnings. Similarly, individuals choose whether or not to shift occupations or employers, and such choices imply recognition of the investment value of experience gained, just as worker decisions to accept lower-paying jobs that provide on-the-job training programs imply an investment decision.

The acquisition of different types of experiences has associated costs and benefits, depending upon the particular type of experience under scrutiny. As more complete models of the human-capital acquisition process are developed, they should explicitly recognize investment in various types of experience, in addition to investments in schooling, on-the-job training, health, migration, and so forth.

FOOTNOTES

[1]We wish to acknowledge our intellectual debt to Barry Chiswick. His comments on an earlier paper of ours stimulated us to give careful attention to the meaning and measurement of "experience." Thus, although we disagree with the measure that he proposed, we are grateful to him.

[2]Thurow, for example, does discuss the variable "years of experience" in his work but never defines what he means by it. Friedman and Kuznets, Tolles et al., and Tolles and Melichar are more specific in defining and measuring experience. Recent work by Cain, Hansen, and Freeman; Mincer; Maton; and Stoikov do consider in more systematic fashion the role of experience. Most books in the labor and human capital area do not even have the term, "experience," in their indexes.

[3]It appears that this may be similar to the notion of employer-specific training, as analyzed by Becker, although he did not define training operationally.

[4]Because the sum of years of school completed plus years since completing school is almost perfectly correlated with age, the experience measure used in column 2, and previously used by Mincer and Chiswick, causes the coefficient ascribed to age (column 1) to be reflected in the coefficient the sum of the two figures in column 1. The following discussion explains why this is so.

Our original model (for which column 1 presents some of the results), was

$$(1)\quad Y = a + b_1 S = b_2 A + b_3 AFQT + b_4 T + b_5 Z,$$

where S is years of school completed, A is age, AFQT is Armed Forces Qualification Test score, T is a dummy variable reflecting the presence of training, and Z is a vector of control variables.

But as Chiswick suggests, "Estimates of the effect of schooling on earnings holding experience constant can be obtained from the data presented by HWS (Hansen, Weisbrod, and Scanlon) if it is assumed age has no effect independent of schooling and experience, and that experience

4(cont.) (E) is measured as age minus schooling minus 5 (italics added). Substituting $A = E + S + 5$ into equation (1) results in:

$$(2)\quad Y = (b_0 + 5b_2) + (b_1 + b_2)S + (b_2)E + b_3AFQT + b_4T + b_5Z$$

and the direct effect of schooling on earnings is the sum of the slope coefficients of schooling and age from equation (1)."

[5]These data are described fully by Klassen and have been analyzed by Griliches and Mason.

[6]If it is the case, however, that the period is spent in job search, then this becomes a proxy for one dimension of Type II experience.

[7]The data provided a choice between "annual income" and "last week's earnings." We chose the former for our dependent variable, our judgment being that it is a better measure of annual earnings than is last week's earnings multiplied by 50 or 52 weeks.

[8]It is possible that the apparent zero effect of E_1 experience is the net effect of two offsetting forces. The depreciation and obsolescence of knowledge previously gained may not be fully captured by the variables measuring schooling and previous experience. Hence, such depreciation and obsolescence--insofar as they occur as a function of the passage of time--may be offsetting the Type I experience that also occurs through the passage of time. Ideally, E_1 would be a measure of the gross effect of this social experience; in fact, however, it may measure the effect net of depreciation and obsolescence.

[9]The simple correlations are as follows:

	Total Schooling
Age	.038
E_1	-.096
E_{3A}	-.169
E_{3B}	-.501
E_{3C}	.012
E_5	-.033

References

Arrow, Kenneth J., "The Economic Implications of Learning by Doing," Review of Economic Studies, June 1962, 29A, 155-73.

Becker, Gary S., Human Capital, New York, National Bureau of Economic Research, 1964, Chapter 2.

Ben-Porath, Yoram, "The Production of Human Capital and the Life Cycle of Earnings," Journal of Political Economy, August 1967, 75, 352-65.

Cain, Glen G., Richard B. Freeman, and W. Lee Hansen, Labor Market Analysis of Engineers and Technical Workers, Baltimore, Md., Johns Hopkins Press, 1973, Chapter 5.

Chiswick, Barry R., "Schooling and Earnings of Low Achievers: Comment," American Economic Review, September 1972, 62, 752-54.

Friedman, Milton and Simon Kuznets, Income from Independent Professional Practice,

Griliches, Zvi and William Mason, "Education, Income, and Ability," Journal of Political Economy, Supplement, May 1972, 80.

Hansen, W. Lee, Burton A. Weisbrod, and William J. Scanlon, "Schooling and Earnings of Low Achievers," American Economic Review, June 1970, 60, 409-18.

Hansen, W. Lee, Burton A. Weisbrod, and William J. Scanlon, "Schooling and Earnings of Low Achievers: Reply," American Economic Review, September 1972, 62, 760-62.

Hartley, Keith, "The Learning Curve and Its Application to the Aircraft Industry," Journal of Industrial Economics, March 1965, 13, 122-28.

Klassen, A. D., Military Service in American Life Since World War II: An Overview, Report No. 117, National Opinion Research Center, University of Chicago, Chicago, Illinois, 1968.

References (cont'd)

Maton, J., "Experience on the Job and Formal Training or Alternative Means of Skill Acquisition: An Empirical Theory," International Labour Review, September 1969, 239-55.

Mincer, Jacob, "Schooling, Experience, and Earnings," New York, National Bureau of Economic Research, February 1973 (mimeo).

Palmer, Gladys L. et al., The Reluctant Job Changer, Philadelphia, University of Pennsylvania Press, 1962, 7-42.

Rees, Albert and George P. Shultz, Workers and Wages in an Urban Labor Market, Chicago, University of Chicago Press, 1970, 147-75.

Sen, Amartya K., "Education, Vintage, and Learning by Doing" Journal of Human Resources, Fall 1966, 1, 3-21.

Stoikov, Vladimir , "The Structure of Earnings in Japanese Manufacturing Industries: A Human-Capital Approach," Journal of Political Economy, March/April 1973, 81, 340-55.

Thurow, Lester, Investment in Human Capital, Belmont, California, Wadsworth Publishing Company, 1970, Chapter 4; also, see his "The Occupational Distribution of the Returns to Education and Experience of Whites and Negroes," in Proceedings of the Social Science Section of the American Statistical Association, Washington, D.C. 1968.

Tolles, N. Arnold et al., "The Structure of Economists' Employment and Salaries, 1964," American Economic Review, Supplement, December 1965, 55.

Tolles, N. Arnold and E. Melichar, "Studies of the Structure of Economists' Salaries and Income," American Economic Review, Supplement, December 1968, 58.