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JOB MOBILITY AND EARNINGS OVER THE LIFE CYCLE

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Abstract

The paper analyzes the effects of job mobility on earnings both at young and at older ages. The model takes into account the discontinuity of earnings across jobs, the decline of human capital investment within the job and over the life cycle, and the effects of mobility on the slope of the earnings profile. Careful attention to the functional form of the earnings equation indicates why the coefficient of the current segment is usually larger than the coefficient of the previous segments. Findings from the NLS data include:

1. Mobile individuals at all ages invest significantly less in on-the-job training.

2. Although job mobility is associated with significant wage gains (across jobs), there is a substantial wage differential between the mobile and the nonmobile at older ages.

3. The explanatory power of the earnings equation is significantly increased by accounting for the effects of job mobility; job mobility is an important determinant of the wage structure.

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JOB MOBILITY AND EARNINGS OVER THE LIFE CYCLE

George J. Borjas*

I. Introduction

The determinants of the earnings distribution have received widespread attention in recent years. The main innovation of this renewed interest in the determination of earnings has been the development of a human capital framework to explain the characteristics of the income distribution. Essentially, it is assumed that variations in earnings over time are caused by changes in the individual's net human capital stock, the embodied knowledge and skills useful in the labor market.

Many studies have shown that the pattern of earnings over the life cycle can be explained by the time profile of investment in human capital.[1] Mainly because of data limitations these studies have refrained from analyzing the effects of job mobility on the life cycle distribution and volume of human capital investments. The recent emergence of longitudinal data sets allows the researcher to study the relationship between the job history of the individual and the level of current earnings.

The objective of this paper is to analyze the effects of job mobility on the cross-sectional distribution of earnings. It will be argued that job mobility has two effects on earnings. The first effect is on the level of the earnings profile through wage gains due to job mobility. This effect has been

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[1]See Mincer (1974) for an application of the human capital model to the 1960 U.S. Census data. A recent survey of human capital models and of the empirical evidence is given in Rosen (1977).

documented in the literature and is usually strongly positive for quits and nonpositive for layoffs.[2] A second effect, that of mobility on the slope of the earnings profile, has been ignored in the literature. I will argue that by creating disincentives for investments in human capital due to the fact that some specificity exists in on-the-job training, job mobility will tend to flatten the slope of the earnings profile. This paper can be viewed as an attempt to empirically document this effect of job mobility on earnings. Part II of the paper presents the theoretical framework as well as an expansion of the human capital earnings function to allow for the estimation of this effect. Part III gives an extensive empirical analysis using the National Longitudinal Survey (NLS) of Mature Men. In Part IV, the empirical analysis is briefly replicated on the NLS of Young Men. Part V summarizes the empirical findings of the study.

II. The Specification of Work History in the Earnings Function

Mincer (1974) has shown that the relationship between the individual's earnings capacity and his stock of human capital can be written as:

$$\ln E_t = \ln E_s + \sum_{i=o}^{T} r_i k_i \qquad (1)$$

where:

E_t = earnings capacity at time t; defined as what the individual's earnings would be if he did not invest in human capital.

r_i = the rate of return to human capital investment.

E_s = earnings capacity after completion of s years of schooling; if direct costs of school and student earnings are largely offsetting then $\ln E_s = \ln E_o + r_s s$.

[2]For a recent analysis of this problem, see Bartel and Borjas (1977).

k_t = the ratio of dollar investment costs, C_t, to earnings capacity, E_t: i.e. a "time-equivalent" measure of investment at time t.

Note that in equation (1), the returns are summed over T years of labor force experience.

The main prediction of models of life cycle distributions of human capital investment is that C_t will be declining over time.[3] Dollar investment costs decline over time for two reasons: given a fixed lifetime, the returns from later investments are smaller; and investments that take place later in the life cycle are costlier since the price of time is increasing due to the accumulation of human capital investment. Since E_t is increasing over time, the ratio $k_t = C_t/E_t$ can be expected to decline even if dollar investment costs are constant or rise at a smaller rate than E_t. Thus the assumption that k_t will be declining over time is a more general implication of these models. A simple functional form is:[4]

$$k_t = k_o - \beta t \tag{2}$$

where k_o is the initial level of the investment ratio and β is the rate of decline of human capital investment. For simplicity, assume a constant rate of return for all post-school investment. Rewriting equation (1) in continuous terms, substituting (2) and integrating yields the simplest form of the earnings function:

$$\ln E_t = \ln E_s + r k_o T - \frac{r\beta}{2} T^2 \tag{3}$$

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[3]See Ben-Porath (1967) and Becker (1975).

[4]See Mincer (1974) for empirical testing of some alternative functional forms for the investment profile.

The specification of the earnings function given by (3) assumes a continuously declining investment profile. For some subgroups of the population--for example, married women--such an assumption is clearly untenable.[5] Less obviously, once specific training and job mobility are introduced in the analysis, the assumption of a continuously declining investment path must be modified since specific training and job mobility are likely to have additional implications concerning the optimal volume and allocation of investment activities over the life cycle. The major implications are:[6]

1. The earnings profile is likely to be discontinuous across jobs. There are two reasons for the discontinuity in earnings: First, job mobility will likely result in wage gains if the job switch has been voluntary. These gains, in a sense, represent the returns to investment in job search. Secondly, the <u>investment</u> profile is likely to be discontinuous across jobs. The basic reason for this discontinuity is that different jobs provide different learning options.[7] Indeed, job turnover might be directly related to the search by individuals for investment opportunities different from the ones offered in the current job. A more subtle reason for the discontinuity is the fact that towards the end of the job, incentives for investment by <u>both</u> employers and employees are diminished as long as some specificity exists in the job training. In the beginning of the new job, at least once some brief trial period has elapses, the incentives for investment are likely to increase. In fact, holding the marginal cost of

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[5]It should be clear that the discontinuity in labor force participation experienced by married women creates discontinuities in both their investment and earnings profiles. For a detailed analysis, see Mincer and Polachek (1974).

[6]A formal development of these predictions is given by Polachek (1975).

[7]This approach to the on-the-job learning process was first formalized by Rosen (1972).

investment constant across jobs, this would imply not only a discontinuous investment profile, but one that has an upward shift as well.[8]

2. If investment declines over the life cycle as the optimization models predict, two separate implications for the investment profile can be deduced when job mobility and specific training are introduced into the analysis. First, investment will probably decline within the job. This decline is more likely to hold for longer jobs, since at the beginning of the job, while the match is being investigated by both the individual and the employer, investment may increase or remain constant (even at a zero level). A second implication is that the level of investment in the job is likely to be higher the earlier the job occurs. This prediction, too, must be qualified by the search for a proper match, which is clearly most intensive at the early phase of the working life.

One method of introducing these effects into the earnings function is by incorporating the work history of the individual into the equation. Generally, suppose there are n jobs in the individual's working life up to time t. Then equation (1) can be generalized as:[9]

$$\ln E_t = \ln E_s + r_1 \sum_{i=o}^{e_1} k_{i1} + \ . \ . \ . + r_n \sum_{i=o}^{e_n} k_{in} \qquad (4)$$

where e_j is the duration of the j^{th} job and k_{tj} is the investment ratio in the t^{th} year of the j^{th} job. Note that the rates of return have been assumed constant within the segment, but have been allowed to vary across jobs.

The discontinuity in the earnings and investment profiles is reflected in (4) by the fact that the returns to on-the-job training have been broken up

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[8] These arguments, of course, depend on the trial or "matching" period being relatively short. A detailed model of the matching process is given in Jovanovic (1977).

[9] This method of segmentation, in a sense, resets the counter of experience at zero each time a new job is started. A detailed discussion of the relationship among the different forms of segmentation is given by Borjas (1975).

into n terms. Each of these terms depends on the investment path for the particular job. As was argued earlier, we would expect that the investment path be declining within the job. Thus an analogue of (2) is:

$$k_{ti} = k_{oi} - \beta_i t \qquad (i=1, \ldots ,n) \qquad (5)$$

We also expect the level of the investment profile to be affected by the timing of the job in the life cycle. That is, more investment is likely to take place the earlier the job occurs. This prediction, of course, follows from the fact that if some of the training is general (i.e., useful in other jobs) the payoff is greater the earlier it occurs. If the training is partly specific, however, a more important prediction for the slope of the investment (and hence the earnings) profile can be derived: the level of investment in any job is likely to be positively correlated with the completed duration of the job. In other words, the earnings profile will be steeper in longer jobs. For example, suppose only general training were produced on the job. Then dollar investment costs in a given job would not be correlated to the completed duration of the job since the only factor which can diminish the value of general training is depreciation. If we allow for the existence of specific training, dollar investment costs are positively correlated with job duration since higher levels of investment (due partly to the existence of specific training) imply lower turnover rates, ceteris paribus.[10]

The correlation between investment and job duration clearly holds in terms of dollar investment costs. However, the equations derived are in terms of "time-equivalent" investment costs. So that when using the log-linear equations, a strong assumption must be made: there is a positive correlation between dollar

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[10] If, as is likely, general and specific training are joint outputs, then longer jobs will be associated with larger volumes of both types of investment.

investment costs and the time spent investing. The reason for the assumption is that even though dollar investment costs and completed job duration are positively correlated, the same need not be true between time-equivalent costs and job duration. The assumption permits us to say that there is a positive correlation between time investment and completed experience, since those with longer job duration will have more investment, but by assumption they spend more time at it.

These hypotheses can be easily introduced into the earnings function if we assume the relationships to be linear. In particular, the level of investment in the i^{th} job (k_{oi}) is given by:

$$k_{oi} = \alpha_i + \rho_i \, t_i^* - \sigma_i \, \pi_i \qquad (i=1,\ldots,n) \qquad (6)$$

where t_i^* is the expected completed duration of the i^{th} job, and π_i is labor force experience prior to starting job i.[11] The parameter ρ_i measures the importance of specific training on investment behavior, while σ_i measures the effect of aging on the distribution of lifetime investments.[12]

A problem immediately arises since the t_i^* are not observed. For all previous jobs ($i=1,\ldots,n-1$), a first-order approximation is the actual completed job duration. For the current job, t_n^* is unobserved and no reasonable proxy exists. We do know, however, that $t_n^* \geq e_n$. Specifically, $t_n^* = e_n + R$, where R represents the years remaining on the current job. An implication of the existence of specific training is that how long an individual has already been at the job provides information on how long he will remain there. That is, those men who have been longer at the job and invested more in specific training, will have a

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[11] Of course, $\pi_1=0$ since at the beginning of the first job no previous experience has been accumulated.

[12] Thus β_i measures the effect of aging within the job for given levels of previous experience.

lower probability of quitting (and of layoff) than other individuals.[13] Thus:

$$R = \lambda + \delta e_n \tag{7}$$

Then:

$$t_i^* = \begin{cases} e_i & ,i < n \\ \lambda + \gamma e_n & ,i = n,\ \gamma = 1 + \delta \end{cases} \tag{8}$$

Converting (4) into continuous terms, using equations (5)-(8), and integrating yields:

$$\begin{aligned} \ln E_t = \ln E_s &+ \sum_{i=1}^{n-1} r_i \alpha_i e_i + r_n (\alpha_n + \rho_n \lambda) e_n \\ &+ \sum_{i=1}^{n-1} r_i (\rho_i - \frac{\beta_i}{2}) e_i^2 + r_n (\rho_n \gamma - \frac{\beta_i}{2}) e_n^2 \\ &- \sum_{i=2}^{n} r_i \sigma_i \pi_i e_i \end{aligned} \tag{9}$$

Equation (9) says that the i^{th} segment ($i=2,\ldots,n$) will have three variables associated with it in the earnings function:[14] linear and quadratic experience, and an interaction between experience in the i^{th} job and previous experience. Each interaction term is negative because the higher the starting age of the job the lower the volume of investment in that job.

An important implication of (9) is that the linear current job coefficient is likely to have a relatively stronger effect (when compared to the linear coefficients of the previous jobs). The reason is that the <u>total</u> duration of

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[13] The fact that the probability of separation strongly diminishes with tenure has been recently documented by Bartel and Borjas (1977).

[14] The first segment only has the linear and quadratic terms since previous experience at that time is zero.

the current job is unobserved, thus making it seem as if observed current experience matters more than previous experience. Note also that the linear coefficient of previous experience segments is given by $r_i \alpha_i$. It can be seen from (6) that α_i measures the investment ratio that would occur early in the life cycle at a very short job. Since little on-the-job training is likely to take place in short jobs, α_i will lie close to zero. Moreover, it can be shown that the negative depreciation rate enters the linear coefficients of job experience [see Mincer and Polachek (1974)]. Once depreciation is included in the analysis, (9) provides a partial explanation of why the coefficient of previous jobs has been found to be insignificantly different from zero (and sometimes even negative) in other studies.[15]

Clearly equation (9) cannot be estimated since the dependent variable is earnings capacity which is unobserved. Net earnings can be defined as $Y_t = E_t - C_t$, so that $\ln Y_t = \ln E_t + \ln (1 - k_t)$. Y_t is closer to the empirically observed earnings since most investment costs are likely to be forgone earnings. Assuming that k_t is a small number, $\ln (1 - k_t) \approx -k_t$. Equation (9) can then be written as:

$$\begin{aligned} \ln Y_t = {} & [\ln E_s - \alpha_n - \rho_n \lambda] + \sum_{i=1}^{n-1} (r_i \alpha_i + \sigma_n) e_i \\ & + [r_n (\alpha_n + \rho_n \lambda) + (\beta_n - \rho_n \gamma)] e_n \\ & + \sum_{i=1}^{n-1} r_i (\rho_i - \frac{\beta_i}{2}) e_i^2 + r_n (\rho_n \gamma - \frac{\beta_n}{2}) e_n^2 \\ & - \sum_{i=2}^{n} r_i \sigma_i \pi_i e_i \end{aligned} \qquad (10)$$

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[15] See, for example, Freeman (1974) and Malkiel and Malkiel (1973).

At this point it is perhaps appropriate to note an important problem with equation (10):[16] the parameters of interest are not identified.[17] In particular, for a given rate of return only σ_i can be identified; the parameter measuring the importance of specific training, ρ_i, cannot be estimated. Thus it is impossible to test directly whether the existence of specific training significantly affects the distribution of earnings.[18] However, it can be shown that if t_n^* were known, equation (10) becomes:

$$\begin{aligned} \ln Y_t = & (\ln E_s - \alpha_n) + \sum_{i=1}^{n-1} (r_i \alpha_i + \sigma_n) e_i \\ & + [r_n \alpha_n + (\beta_n - \rho_n)] e_n + \sum_{i=1}^{n} r_i (\rho_i - \frac{\beta_i}{2}) e_i^2 \\ & - \sum_{i=2}^{n} r_i \sigma_i \pi_i e_i + r_n \rho_n R e_n - \rho_n R \end{aligned} \tag{11}$$

Equation (11) adds in two variables that did not enter (10): R and an interaction term between R and e_n. The reason that R enters negatively into the

[16] Note also that the use of observed earnings instead of earnings capacity adds the parameter σ_n to all the linear previous job coefficients and $(\beta_n - \rho_n \gamma)$ to the linear current job coefficient. Generally, it is found that the quadratic of current job experience is negative, hence $[\rho_n \gamma - (\beta_n/2)] < 0$. This implies that the use of observed earnings biases upwards <u>all</u> the linear experience coefficients. The relative bias between the previous jobs and the current job cannot, however, be estimated.

[17] This is, of course, a general problem with this family of earnings functions. Recently, it was shown by Hanushek and Quigley (1977) that by using certain assumptions restricting the interactions between investment and labor supply some of the parameters may be identified.

[18] In the empirical section below, however, the investment ratios k_{oi} will be estimated for several values of $r_i \beta_i/2$ (which allows us to identify $r_i \rho_i$ for $i<n$ and $r_n \rho_n \gamma$). Thus for a given value of the rate of return the investment ratio can be calculated.

equation is because of the existence of a positive correlation between investment and job duration: the higher the remaining time in the current job, the higher the incentive to invest more in the current time period t (since the payoff period to that part of investment which is specific is longer), therefore the lower current earnings. The interaction between R and e_n is positive because the theory suggest more investment in longer jobs: the longer e_n, the more investment that occurred on the job, therefore the higher the returns the individual is collecting at time t. Thus the specific training hypothesis can be tested by taking advantage of the nature of panel data. If individuals can be observed over a relatively long period of time, then we can obtain (at least for a subset of the sample) completed time in the current job.

III. The Earnings of Older Men

A. The Sample

The National Longitudinal Survey was started in the year 1966 for men aged 45-59 during the original survey. This data provides us with a longitudinal (though retrospective) working life history of older men.[19] Because of the structure of the questionnaire, it is possible to get, at most, the duration of three jobs in the individual's working life: the first full-time job ever held after completion of schooling, the longest job ever, and the current job. Since two or three of these jobs might refer to the same job (that is, the first job was also the longest job, etc.) we have different numbers of jobs across individuals. The data also allows us to determine the time elapsed between jobs--e.g., time elapsed between the first and longest job, or a "residual."

The earnings functions derived earlier require the same number of jobs across individuals. To do this, the sample was broken up into four job mobility patterns:

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[19] See The Pre-Retirement Years, Volume I, Manpower Research Monograph No. 15, United States Department of Labor, for an extensive discussion of the survey and of the techniques employed in collecting the data.

Pattern 1--only one job has been held since the completion of schooling. Obviously, this pattern is composed of the most non-mobile individuals.

Pattern 2--the first job after the completion of schooling is different from the current job, which is also the longest job ever. We can also identify the time elapsed between the first and current jobs, or a residual. This pattern, therefore, is characterized by three segments.

Pattern 3--the first job was the longest job ever, and is different from the current job. Again we can identify a residual: the time elapsed between the first and current jobs. This pattern, too, is characterized by three segments.

Pattern 4--the first, longest, and current jobs are all different. Two residuals can be estimated for these individuals: the time elapsed between the first and longest jobs, and the time elapsed between the longest and current jobs. This mobility pattern clearly contains the most mobile individuals and is characterized by five segments.

In order to pool the samples a simple method is used throughout. All individuals are assumed to have a current job. Define FIRST as the first job after completion of schooling, if different from the current job; RESID1 as the residual following the first job; LONGEST as the longest job ever, if different from both the first and current jobs; RESID2 as the residual following the longest job; and CURRENT as the current job. If a job does not exist for a given individual, a zero is coded as his experience for that particular job.[20]

The sample was restricted to white, salaried men who were working in 1966 and who had valid data for wages, working life histories and the other key variables in the analysis. These restrictions reduced the sample size to 1976 observations of which about 90 percent are in mobility patterns 2 or 4.

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[20] For example, in mobility pattern 2--where the first job is different from the current (longest) job--FIRST, RESID1, and CURRENT would exist, but LONGEST and RESID2 would be coded as zero.

Table 1 gives the list of variables used in the study. Table 2 gives summary statistics for each of the mobility patterns and for the pooled sample. It shows systematic variations in the characteristics of these individuals across mobility patterns. The least mobile men (Pattern 1) have wage rates 33.8 percent higher than the most mobile (Pattern 4) men. The same finding holds when we compare Pattern 2 (where the current job is the longest job ever) to Pattern 4: those men who have been longest at the current job have wage rates 17.6 percent higher. Moreover, it can also be seen in Table 2 that in comparing the two largest mobility patterns, differences in personal characteristics such as education, health, etc., are too small to explain the sizable wage differential.

B. Estimates of the Human Capital Earnings Function

Table 3 gives the unsegmented earnings function derived in equation (3) for the pooled sample and across mobility patterns using the natural logarithm of the wage rate as the dependent variable. The explanatory power of the equation is small. The estimated investment ratios are larger and more significant for the less mobile, Patterns 1 and 2. For the most mobile men in Pattern 4, the estimate of the investment ratio is negative. This result might be caused by two factors: this sample might have an average earnings profile that has already peaked and/or mobile men invested significantly less than the non-mobile men in on-the-job training, and once the depreciation rate is taken into account net investment becomes zero or negative. Thus even at this level, the basic hypothesis of this paper, namely that job mobility affects the rate of growth of earnings adversely, is confirmed.

The individuals in Pattern 1 have only had one job. Therefore the analysis of their earnings profile does not require any further segmentation of the investment path. The coefficient of experience can be used to calculate an estimate of the investment ratio. If the rate of return is assumed to be 10 percent, the initial investment ratio is .18.

TABLE 1

List of Variables

RATE	=	Wage rate in 1966
ANNUAL	=	Annual earnings in 1965
EDUC	=	Completed years of education
EXPER	=	Experience since completion of schooling
FIRST	=	Duration of first job after completion of school--if different from the current job
RESID1	=	Residual experience following FIRST
LONGEST	=	Duration of longest job ever--if different from first and current jobs
RESID2	=	Residual experience following LONGEST
CURRENT	=	Current job experience
FIRST2	=	FIRST squared, etc.
INTER(i)	=	Interaction term pertaining to the i^{th} job; experience in i^{th} job times experience prior to the i^{th} job
HLTH	=	1 if health is good or excellent; 0 otherwise
TRAIN	=	Number of years of formal post-school training
MAR	=	1 if married spouse present; 0 otherwise

TABLE 2

Summary Statistics

Variable	Pattern 1	Pattern 2	Pattern 3	Pattern 4	Pooled Sample
EDUC	12.38	10.48	9.95	10.22	10.48
AGE	50.39	51.15	51.80	51.13	51.14
ANNUAL	9997.6	8286.4	6103.2	6863.7	7814.1
RATE	4.38	3.71	2.77	3.19	3.53
FIRST	-	3.20	17.91	2.98	3.79
RESID1	-	12.16	7.36	10.00	10.53
LONGEST	-	-	-	12.16	3.79
RESID2	-	-	-	5.21	1.62
CURRENT	25.36	18.21	5.75	3.99	13.46
HLTH	.86	.81	.80	.82	.81
TRAIN	.96	.82	.85	.83	.83
MAR	.93	.93	.89	.89	.92
Number of Observations	111	1136	113	616	1976

TABLE 3

Unsegmented Earnings Functions*
All Samples Dependent = Ln(RATE)

Variable	Pattern 1	Pattern 2	Pattern 3	Pattern 4	Pooled Sample
C	.541	.171	-.0006	.716	.247
EDUC	.038 (2.8)	.069 (15.3)	.072 (5.1)	.059 (8.1)	.067 (18.6)
EXPER	.030 (1.6)	.016 (1.0)	-.0009 (-.04)	-.017 (-.7)	.010 (1.3)
EXPER2	-.0006 (-1.4)	-.0002 (-.9)	.0002 (.4)	.0002 (.6)	-.0001 (-1.1)
R^2	.120	.208	.211	.140	.181

*The t-ratios are given in parentheses.

The segmented earnings function (with and without interaction terms) is presented in Table 4 for the pooled sample. As can be seen, the interaction terms are mostly negative, and in fact the addition of the interaction terms to the simpler segmentation in Column 1 significantly increases the explanatory power of the equation (the F statistic is 2.21, significant at the 10 percent level). Note also that the coefficients of previous experience are significantly weaker than the effect of current experience and that the coefficient of the longest job prior to the current job is by far the largest and most significant of all the previous job coefficients.

By estimating the segmented earnings function within each mobility pattern, it is possible to calculate the investment ratios for the different jobs in each mobility pattern. These regressions are shown in Table A-1 of the Appendix. As can be seen, the estimates are generally not very significant but this is mainly due to the large amount of multicollinearity among the variables. Table 5 presents the initial investment ratios for several values of $r\beta/2$ (assumed to be the same across all jobs in the individual's life cycle):[21] .0010, .0015, and .0020. The estimates are presented assuming $r = .10$, since varying the rate of return did not affect the qualitative results of the analysis. Table 5 also presents estimates of the "projected" investment ratio, $\bar{k}_{oi}$, defined as what investment would have been if the particular job had been the first job in the life cycle.[22]

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[21]These estimates of $r\beta/2$ cover the range of those found in the literature on unsegmented earnings functions. For example, Mincer (1974) has an estimated $r\beta/2 = .0012$.

[22]Mathematically, $\bar{k}_{oi} = k_{oi} + \sigma_i \pi_i$. This measure is useful since by assuming the β_i to be constant across jobs, the difference in $\bar{k}_{oi}$ from one job to another measures the change in investment from the last time period in the old job to the first time period in the new job.

TABLE 4

Segmented Earnings Functions
Pooled Sample, Dependent = Ln(RATE)

Variable	b	t	b	t
C	.421		.223	
EDUC	.061	(18.1)	.061	(18.0)
FIRST	-.014	(-2.8)	-.0004	(-.05)
RESID1	-.003	(-.7)	.011	(1.5)
LONGEST	-.002	(-.3)	.018	(1.8)
RESID2	.004	(.5)	-.009	(-.6)
CURRENT	.014	(3.4)	.028	(3.4)
FIRST2	.0003	(1.3)	.0007	(.3)
RESID12	.00009	(.7)	-.0001	(-.8)
LONGEST2	.000004	(.02)	-.0004	(-1.3)
RESID22	-.0004	(-1.2)	-.0003	(-.07)
CURRENT2	-.0002	(-1.6)	-.0004	(-2.5)
INTER2			-.0005	(-1.4)
INTER3			-.0007	(-2.4)
INTER4			.0005	(.9)
INTER5			-.0005	(-2.2)
R^2	.230		.233	

TABLE 5

Investment Ratios

Segment	$r\beta/2=.0010$ k_{oi}	$r\beta/2=.0010$ $\bar{k}_{oi}$	$r\beta/2=.0015$ k_{oi}	$r\beta/2=.0015$ $\bar{k}_{oi}$	$r\beta/2=.0020$ k_{oi}	$r\beta/2=.0020$ $\bar{k}_{oi}$
Pattern 2						
FIRST	.159	.159	.175	.175	.191	.191
RESID1	.098	.162	.159	.255	.220	.348
CURRENT	.157	.464	.198	.659	.239	.853
Pattern 3						
FIRST	-.204	-.204	-.114	-.114	-.025	-.025
RESID1	.032	.390	.069	.606	.106	.822
CURRENT	.072	.577	.045	.803	.024	1.035
Pattern 4						
FIRST	-.279	-.279	-.265	-.265	-.250	-.250
RESID1	-.096	-.036	-.046	.043	.004	.123
LONGEST	-.023	.237	.038	.427	.099	.618
RESID2	-.086	.417	-.060	.694	-.034	.972
CURRENT	-.076	.531	-.107	.804	-.137	1.077

The results presented earlier for those individuals who were least mobile (Pattern 1) indicated they invested heavily on the job as expected since these men currently receive returns on all training ever acquired (net of depreciation), and since they had more incentive to invest larger amounts in their only job.

For the individuals in Pattern 2--where the first job was a short job different from the current (longest) job--investment was also extensive. The estimate of k_{oi} for the current job is higher than the estimates for previous jobs, despite the fact that the current job started 15.4 years after the beginning of labor force experience.

The estimates for individuals in Pattern 3--where the longest job was the first job--are highly dependent on the functional form of the earnings function. One reason for the instability of the coefficients might be the small size of this mobility pattern (113 observations). The results do indicate little investment in all jobs.

The results for the most mobile individuals--Pattern 4--show that little investment occurred in all jobs except the longest. Both the first and current jobs yield estimated k_{oi}'s which are negative even though in the actual regression the current job coefficient was significantly higher than all the other coefficients. The fact that these estimates are negative might be because these are ratios net of depreciation.

The projected $\bar{k}_{oi}$'s shown in Table 5 yield two important empirical findings. Note that since we have assumed the same rate of decline within all jobs, the difference between $\bar{k}_{oi}$ across jobs gives the shift in the level of the investment profile from one job to the other. The estimates in Table 5 show consistently higher $\bar{k}_{oi}$ the later the job. This finding indicates that there is an upward shift in the level of the investment profile after changing jobs. A second finding given by the $\bar{k}_{oi}$ of Patterns 2 and 4 is that the size of the jump in investment across jobs is highest when individuals switch to the longest job.

Summarizing, two important conclusions can be inferred from the analysis of investment ratios across jobs: First, the results indicate that the non-mobile invest in time units more than the mobile. This, of course, depresses current earnings of mobile men, ceteris paribus; thus providing an explanation as to why the current earnings of mobile individuals are lower than the earnings of the non-mobile. Secondly, the findings show that longer duration of jobs is associated with higher growth in earnings.

As shown earlier, a more direct test of the specific training hypothesis can be obtained if t_n^*, the total duration of the current job, is observed. The results using equation (11) are shown in Table 6, using a small sample of individuals who left the job they held in 1966 before 1969. The coefficient of the interaction term (REM x CURRENT) is positive and significant as expected, thus $r_n \rho_n = .0087$. The coefficient of time remaining (REM) is negative and approaching statistical significance, thus $\rho_n = .0620$. The implied estimate of r_n is about 14 percent.[23] The results unambiguously suggest that the correlation between job duration and investment is a significant determinant of the distribution of earnings. The addition of these two variables increases the explanatory power of the equation (the F statistic is 2.55, significant at the 10 percent level). The negative effect of REM on current earnings can only be explained by referring to the effects of specific training and job mobility on the investment profile. If training were totally general, then time remaining in the current job would

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[23] Though the signs are as theoretically predicted, the magnitudes are not reasonable. They are several times higher than the ones used earlier to calculate investment ratios. This is probably due to the fact that the sample is small and REM has little variation.

TABLE 6

Earnings Functions When Completed Duration of Current Job is Known

Dependent = Ln (Rate), n = 350

Variable	b	t	b	t
C	.087		.164	
EDUC	.057	(5.9)	.055	(5.7)
FIRST	.002	(.1)	-.0009	(-.04)
RESID1	.028	(1.3)	.028	(1.3)
LONGEST	.012	(.4)	.014	(.5)
RESID2	.016	(.4)	.018	(.5)
CURRENT	.011	(.5)	.004	(.2)
FIRST2	.0002	(.3)	.0003	(.5)
RESID12	-.0004	(-.9)	-.0004	(-.9)
LONGEST2	.0002	(.3)	.0002	(.2)
RESID22	-.0004	(-.5)	-.0005	(-.5)
CURRENT2	.0002	(.3)	.0001	(.2)
INTER2	-.0008	(-.8)	-.0008	(-.8)
INTER3	-.0008	(-.8)	-.0008	(-.8)
INTER4	-.0002	(-.2)	-.0003	(-.2)
INTER5	-.0003	(-.4)	-.0003	(-.5)
REMxCURRENT			.0087	(2.3)
REM			-.0620	(-1.3)
R^2	.157		.170	

have no effect on the investment profile or on the earnings distribution. Once specific training is introduced, the payoff period to that portion of the training which is firm-specific becomes the time remaining in the current job. The longer the time remaining, the higher the marginal revenue of investment, so that more investment takes place in the current period. This, of course, implies lower earnings now. Similarly, the positive interaction term says that the negative effect of REM on current earnings is balanced by the fact that longer REM and longer CURRENT would imply a longer job, so that more would have been invested on the job prior to the current time period, leading to higher current earnings.

One last piece of evidence on the validity of the specific training hypothesis is given by measuring the gain of the fine degree of segmentation used in this paper to the unsegmented earnings function or to a function which combines all previous jobs into one segment, PREVIOUS. These two-segment earnings functions are shown in Table 7 for the pooled sample and for the mobility patterns. When the results are compared to the full segmentation in the pooled sample (Table 4) the simpler two-segment earnings function does not fare badly. The R^2 in the simpler equation is .223, while the explanatory power of the full segmentation is only slightly higher, .233.

Within mobility patterns, however, there are significant differences between the simple segmentation shown in Table 7 and the full segmentation in Appendix Table A-1. For example, no significant differences in explanatory power can be detected in the equations for Pattern 2 (where the current job is the longest). The R^2 for the unsegmented equation is .208; it increases to .232 with the two-job breakdown, and to .234 with the full segmentation. Thus the introduction of the current job, where most investment took place, is the factor behind the increase in explanatory power. In Pattern 4, the results are quite different. The full segmentation gives a much better fit to the earnings profile in this

TABLE 7

Earnings Functions Using Two Segments*
Dependent = Ln(RATE), All Samples

Variable	Pooled Sample	Pattern 2	Pattern 3	Pattern 4
C	.264	.280	-.077	.715
EDUC	.061	.065	.072	.058
	(17.3)	(14.3)	(5.2)	(7.8)
PREVIOUS	.004	.006	-.020	-.018
	(.5)	(.4)	(-.9)	(-.7)
CURRENT	.023	.016	.128	-.002
	(2.6)	(1.0)	(2.6)	(-.1)
PREVIOUS2	-.0001	-.0002	.0007	.0002
	(-.4)	(-.6)	(1.5)	(.6)
CURRENT2	-.0003	-.0002	-.0030	-.0001
	(-1.9)	(-.5)	(-2.0)	(-.1)
INTER	-.0003	-.0002	-.0023	.0003
	(-1.0)	(-.4)	(-1.5)	(.3)
R^2	.223	.232	.276	.142

*The t-ratios are given in parentheses.

mobility pattern: the R^2 for the full segmentation is .184, while the explanatory power of the simpler equation is only .142, and that of the unsegmented function is .140. Thus the increase in R^2 comes when we segment previous experience. This finding suggests that the more "homogeneous" previous experience, the better the fit of the simpler (two-job) segmentation. That is, in Pattern 4 we are combining the longest job and a series of short jobs into one segment of previous experience. The results discussed earlier indicated that some investment took place in the longest job, but little investment took place in the other previous jobs. If we combine these jobs into a single category of previous experience, we lose the information given by the relationship between job duration and the rate of growth in wages. Therefore the results point out the importance of the longest job (regardless of when it occurred) in the determination of earnings.[24]

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[24] Note that the analysis has concentrated on the effect of job experience on earnings; very little attempt has been made to include other variables in the equation. This was done to avoid the "kitchen-sink" tendency of many recent analyses using the earnings function. A more detailed specification of the equation can be found in Borjas (1975), and does not change any of the qualitative results. Secondly, the analysis has focused on documenting the effect of job mobility on the slope of the earnings profile. As was mentioned in the introduction, mobility also affects the level of the profile. A simple way of estimating this effect is to hold some measure of total on-the-job training constant, and then inserting variables that measure the extent of mobility. This can be done easily by adding mobility pattern dummies to the regression presented in the second column of Table 4. The coefficients of interest were:

Pattern	Coefficient	t-ratio
2	.050	(.9)
3	-.043	(-.5)
4	.160	(1.8)

Thus the results indicate a shifting of the level of the earnings profile of about 16 percent for the most mobile individuals in the sample. A more detailed analysis of the level effects of job mobility can be found in Bartel and Borjas (1977).

IV. The Earnings of Young Men

The sample used to study the effects of mobility on earnings at younger ages is the National Longitudinal Survey of Young Men (aged 14-24 during 1966, the original survey year).[25] Due to the young age range of the individuals being analyzed and the short duration of the jobs, the analysis is conducted with two segments of post-school experience:[26] duration of all previous jobs and current job experience. The non-mobile individuals are defined as those men who have always been in the current job. The data shows that the non-mobile individuals are younger. This is because of a selectivity bias inherent in the data: younger men have had less labor force experience, therefore they have had less opportunity to leave the current job, and are thus classified as non-mobile.

The average (1969) wage of the non-mobile is $3.207; while that of the mobile men is $3.372. Thus the more mobile have wage rates 5.7 percent higher than the non-mobile. This can, of course, be due to the fact that the mobile have had, on the average, more labor force experience. The estimated earnings function for the two mobility patterns is given in Table 8. Using the experience coefficients in the regressions, the investment ratios, k_{oi}, can be estimated. Given a rate of return of 10 percent, the non-mobile invested .162 of their time in their only job. The mobile men had an investment ratio of .12 in their previous job and .29 in the current job. Thus the volume of investment for the non-mobile is higher than investment for the previous job of the mobile but lower than investment in the mobile's current job. However, it is important to realize that due to the selectivity bias inherent in the non-mobile sample (younger men

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[25] An analysis of earnings for this sample is also given in Griliches (1976); however, his emphasis is on the bias in the schooling coefficient due to omitted ability variables. The sample is described in U.S. Department of Labor, <u>Career Thresholds</u>.

[26] The sample is restricted to white, working young men who reported the key variables, and who are not enrolled in school in 1969, the year used in Table 8.

TABLE 8

Young Men Earnings Functions

Dependent = Ln (Rate)*

Variable	Non-Mobile Sample b	Non-Mobile Sample t	Mobile Sample b	Mobile Sample t
C	-.093		-.082	
EDUC	.076	(8.9)	.078	(8.8)
EXPER	.110	(4.9)	-	-
EXPER2	-.0078	(-2.6)	-	-
PREVIOUS			.071	(3.9)
CURRENT			.085	(2.8)
PREVIOUS2			-.0021	(-1.2)
CURRENT2			-.0031	(-.7)
INTER			-.0057	(-1.3)
R^2	.258		.189	

*Holds constant time worked prior to the completion of schooling and years in the army.

are more likely not to have changed jobs since they have not sampled the labor market very long) this group is likely to include individuals who will soon be mobile. Thus the average investment ratio is under-estimated for this group. A more conclusive finding that the volume of investment is positively correlated with job duration is given by using equation (11), where the completed duration of the current job is known. The dependent variable in this case is the log of the wage rate in 1966. The equation was estimated for a sample of individuals who left the 1966 job before 1969. The estimated equation was:[27]

$$\ln Y_t = \underset{(-2.5)}{-.0636\ \text{REM}} + \underset{(3.0)}{.0367\ \text{REM} \times \text{CURRENT}}$$

$$n=560, \qquad R^2 = .176$$

Since the coefficient of REM is negative, and the interaction term is positive (and both are statistically significant) we find that there is a strong positive correlation between job duration and on-the-job training.

In order to study the wage differential between the mobile and the non-mobile groups, a dummy variable set equal to one if the individual has not been in the current job since the beginning of labor force experience was included in the equation. Its effect on earnings was insignificantly different from zero. Thus we find that there is no wage differential by mobility patterns in this age group. Therefore even though the calculated investment ratios suggested more on-the-job investment for the non-mobile, the gains from job mobility are partly compensating the mobile at young ages. As the individuals age, and less mobility is undertaken (both in absolute terms, and in terms of the proportion that is voluntary) the accumulation of on-the-job training begins

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[27]Years of schooling, years in the army, and experience in each of the jobs (plus quadratics and interactions) were held constant in the equation.

to outweigh the gains from job mobility. This process results in significant wage differentials by the time the men reach age 50 as shown earlier.

V. Summary

This paper has analyzed the effects of job mobility on earnings both at young and at older ages. The discussion in Part II developed an earnings function which took into account: the discontinuity of earnings across jobs, the decline of human capital investment within the job and over the life cycle, and the effects of mobility on the slope of the earnings profile. It was shown that careful attention to the functional form of the equation led to an understanding of why the coefficient of the current segment is usually larger than the coefficient of the previous segments. Using the expanded equation on the NLS surveys led to several major empirical findings:

1. Mobile individuals at all ages invest significantly less in on-the-job training: longer job duration is associated with steeper growth in earnings.

2. Although job mobility is associated with significant wage gains (across jobs), there is a substantial wage differential between the mobile and the non-mobile at older ages. At young ages, however, no wage differential was detected, thus the gains from mobility plus the lower costs of investment are compensating the lower returns accruing to the mobile from their lower on-the-job training. As the men age, less mobility is undertaken so that the gains from mobility fall, and the non-mobile begin collecting returns on a large volume of training, leading to higher earnings.

3. The explanatory power of the equation was significantly increased by accounting for the effects of job mobility; this increase occurred when the longest job ever (regardless of when it occurred) was introduced in the equation. This is due to the fact that most of the human capital investment takes place in the longest job. The increase in explanatory power, therefore, points out that job mobility is an important determinant of the wage structure.

TABLE A-1

Interaction Model
Across Patterns, Dependent = Ln(RATE)

Variable	Pattern 2 b	Pattern 2 t	Pattern 3 b	Pattern 3 t	Pattern 4 b	Pattern 4 t
C	.426		-.185		.505	
EDUC	.064	(4.3)	.071	(5.4)	.061	(8.6)
FIRST	.007	(.4)	-.032	(-1.4)	-.025	(-1.2)
RESID1	-.006	(-.4)	.042	(1.2)	-.013	(-.7)
LONGEST	-	-	-	-	-.007	(-.3)
RESID2	-	-	-	-	-.024	(-1.0)
CURRENT	.007	(.4)	.153	(3.1)	.057	(2.5)
FIRST2	-.0006	(-1.2)	.0010	(2.3)	-.0000	(-.0)
RESID12	.0001	(.5)	-.0010	(-1.2)	.0005	(1.3)
LONGEST2	-	-	-	-	.0002	(.4)
RESID22	-	-	-	-	.0002	(.4)
CURRENT2	-.00003	(-.1)	-.0030	(-2.2)	-.0009	(-1.9)
INTER2	-.0005	(-.8)	-.00002	(-.00)	.0003	(.2)
INTER3	.0001	(.3)	-.0033	(-2.2)	.0002	(.3)
INTER4	-	-	-	-	.0010	(1.4)
INTER5	-	-	-	-	-.0015	(-2.5)
R^2	.234		.313		.184	

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