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Chapter Author: Ann P. Bartel, George J. Borjas

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2 Wage Growth and Job Turnover: An Empirical Analysis

Ann P. Bartel and George J. Borjas

The question of why an individual's wages grow over and above economy-wide productivity growth is fundamental to the analysis of the earnings distribution. In fact, explanations of the earnings distribution such as human capital investments or random shock models are basically descriptions of the wage growth process for the individual.[1] Despite this importance, and mainly owing to the lack of longitudinal data for a given individual, the empirical analysis of wage growth has lagged behind the empirical analysis of wage levels.[2] This paper is a partial attempt to remedy this asymmetry. We focus on documenting how labor turnover systematically affects the rate of growth in wages both across jobs and within the job. It will be our working hypothesis to interpret wage growth to be the result of human capital investments, both general and specific to the job. We will also interpret wage growth across jobs as being due to changes in the individual's human capital stock resulting from "mobility" investments (e.g., search) and losses of specific training incurred when job separation takes place.

Given this framework, we tackle two important questions in labor economics.[3] The first is a variation of the old question of whether mobility "pays." Note that the cross-section comparison of movers and stayers (or in the migration literature, migrants and nonmigrants) does not necessarily provide an answer to the relevant question: does a person who moved during the time period under investigation do better than he would have done had he stayed? Of course, the fact that the alternative wage is not observed once the individual's decision has been made has

Ann P. Bartel is Associate Professor, Columbia University Graduate School of Business.

George J. Borjas is Associate Professor of Economics, University of California, Santa Barbara.

prevented researchers from answering this question. Recent econometric techniques dealing with selection bias in censored samples (Heckman 1979) provide one method of approaching this problem. In this paper, however, we pursue a somewhat simpler approach that utilizes the longitudinal nature of our data. In particular, we will analyze the on-the-job progress of a *given* individual before and after the move.

A second related question we will analyze is the effect of labor turnover on wage growth *within* the job. It is quite obvious that mobility shifts the earnings profile after each separation occurs. It is less obvious, but equally important, that an individual's intentions to separate from a firm will affect the rate of growth of his earnings in the current job. In particular, we hope to establish that job immobility (i.e., longer tenure) is associated with steeper wage growth than would occur otherwise for a given individual.[4] This finding should prove useful on several grounds. First of all, it establishes that indeed wages grow with tenure for a given individual. Although this may seem like a somewhat trivial empirical result, it should put to rest doubts about the interpretation of the observed positive relationship between wage levels and tenure. In particular, there exists the possibility that this positive correlation is entirely due to population heterogeneity. That is, there exist some unobserved individual characteristics which lead to low wages and high turnover rates for some persons, and to high wages and low turnover rates for other individuals. Then a cross-section correlation of wages and tenure would be positive even if wages did not grow at all in the job.[5]

More importantly, by establishing that wage growth on the job is related to the separation probability, we can obtain some estimates of the importance of specific training in the labor market. In particular, as long as specificity is an important component of human capital investments, the human capital hypothesis predicts a positive correlation between investment costs per year and *completed* job tenure. Since lower probabilities of separation are associated with larger incentives to invest, we should observe steeper earnings profiles in longer jobs. Note that the prediction implies not only that wages grow on the job for a given individual, but that they grow faster the better the match (i.e., the longer the tenure). Therefore, in a sense, the "gains to immobility" are due to the fact that job tenure "matters" over and above the accumulation of labor market exposure.

The purpose of this paper, therefore, is to provide a systematic empirical analysis of the relationship between wage growth and job turnover. We will use two data sets in the study: the National Longitudinal Surveys (NLS) of Young and Mature Men. Section 2.1 provides a systematic examination of the relationship between labor turnover and wage growth across jobs. Section 2.2 analyzes the effects of job immobility on wage growth. In section 2.3 we consider the implications of labor turnover for

lifetime wage growth. Section 2.4 briefly describes the effects of personal and labor market characteristics on individual wage growth. Finally, section 2.5 summarizes the results of the study.

2.1 Labor Turnover and the Wage Profile across Jobs

In this section we use the NLS Young and Mature Men samples to analyze the effects of labor turnover on wage growth across jobs. There are several important restrictions in our use of the data. First of all we define labor mobility to occur when an individual changes employers. Thus transfers within the same firm are viewed as part of the returns to staying in the job. Secondly, to simplify the empirical analysis we do not attempt to distinguish between local movers and individuals who change jobs and migrate simultaneously. In other words, we ignore the role of geographic mobility and its interaction effects with job turnover on wage growth.[6] Third, our sample is composed of individuals who either did not change jobs at all in the period under investigation or did not leave the labor force after the separation took place. Thus individuals who were either retired or in school at the beginning of the period or whose job separation was followed by either retirement or by a return to school are deleted from our sample.[7] For both data sets we concentrate on the interval between 1967 and 1973, and partition this long period into three two-year intervals, 1967–69, 1969–71, and 1971–73. We then pool the information in each of these intervals across the individuals in our sample, in effect tripling the number of observations.[8] The labor turnover variable is defined to equal unity if the employer at the end of the two-year period is not the same as the employer at the beginning of the two-year interval. Section 2.1.1 reports the results of comparing the two-year price-deflated wage growth of individuals who separated from their jobs during the period with the relevant wage increases reported by stayers. In section 2.1.2 we return to the question addressed earlier of whether mobility "pays" for a given individual.

2.1.1 Comparing Movers and Stayers

Table 2.1 contains coefficients on dummy variables that indicate the individual's mobility status over a two-year interval. These coefficients are taken from regressions using absolute or percentage wage growth over the two-year period as the dependent variable and holding constant a set of standardizing variables listed in the note to the table (an exact description of these variables is given in the appendix). It is important to note that these standardizing variables are measured as of the beginning of the two-year period.

The coefficients of the separation dummies may be broadly interpreted as estimates of the "gains" associated with mobility. Table 2.1 shows that

among the young men a quit is associated with an increase in earnings but for the older men a quit has either a negative or zero effect on wage growth. Thus, for example, young men who quit receive a wage increase of 11 cents an hour more than those who stayed, while for older men the wage increase is approximately minus 3 cents an hour.[9] On the other hand, in both samples, being laid off from a job leads to lower wage growth than staying, although in the young men's sample the difference is not very significant. For the older men, however, layoffs reduce wage

Table 2.1 **The Effects of Turnover on Wage Growth across Jobs Comparing Movers and Stayers (Dependent variable = ΔW or $\Delta \ln W$)**

	Absolute Growth			Percentage Growth		
	(1)	(2)	(3)	(4)	(5)	(6)
	A. NLS Young Men ($n = 3{,}665$)					
QUIT	.1139			.0184		
	(2.02)			(1.31)		
LAYOFF	−.0264	−.0397	−.0485	−.0253	−.0299	−.0322
	(−.35)	(−.53)	(−.64)	(−1.35)	(−1.60)	(−1.72)
JOBREL		.1800			.0382	
		(3.07)			(2.62)	
PERS		−.3545	−.3605		−.1269	−.1284
		(−3.14)	(−3.19)		(−4.53)	(−4.59)
PUSH			.0540			.0055
			(.72)			(.30)
PULL			.2984			.0688
			(4.09)			(3.81)
	B. NLS Mature Men ($n = 4{,}745$)					
QUIT	−.0259			−.0488		
	(−.29)			(−2.05)		
LAYOFF	−.1888	−.1907	−.1927	−.0972	−.0979	−.0982
	(−2.08)	(−2.10)	(−2.13)	(−4.00)	(−4.03)	(−4.04)
JOBREL		.1342			.0047	
		(1.31)			(.17)	
PERS		−.4641	−.4651		−.1951	−.1953
		(−2.81)	(−2.82)		(−4.42)	(−4.43)
PUSH			−.0973			−.0283
			(−.79)			(−.85)
PULL			.5999			.0711
			(3.46)			(1.53)

Note: Other variables held constant are EDUC, EXPER, JOB, ARMY, UNION, HLTH, MAR, WLFP, WW, WKSUN, SIZE, UN, D67, D69; t-statistics in parentheses.

growth over the two-year period by about 19 cents per hour. An interesting result is obtained by making a direct comparison of quits versus layoffs. In the case of young men, a quit is worth about 14 cents more than a layoff; while for the older men, a quit is worth 16.3 cents more than a layoff. Thus although who gains and loses relative to stayers varies over the life cycle, the gains to quitting as opposed to being laid off remain relatively constant with age.

Of course, it is not surprising that quitters do better than individuals who were laid off at all ages. What is puzzling is that quitters do not do better than stayers systematically over the life cycle. Further analysis of this result can be conducted with the information provided in the NLS on the *reasons* for the quit. Thus we decompose the variable QUIT (1 if change was voluntary, 0 otherwise) into two kinds of voluntary changes: job related or for personal reasons.[10] The reader should, of course, note that these reasons are reported *after* the separation took place, and hence there may be some element of rationalization on the worker's part which may contaminate the results we report. The coefficients of JOBREL (job-related quits) and PERS (personal quits) are shown in columns 2 and 5 of table 2.1. The results are quite striking. In both samples we now find that individuals who quit for personal reasons had significantly smaller wage growth than stayers, while men who had a job-related quit experienced higher wage growth than stayers. This latter effect is significant for the young men's sample, but less significant in the older men's NLS. The results, therefore, imply a very significant differential in the gains from quitting according to the type of quit. Moreover, it is also of interest to note that layoffs and quits for personal reasons have similar qualitative effects on wage growth. This might be due to the fact that both these types of separations have a large exogenous and unexpected component, so that these individuals would have had less search while on the job than individuals whose quit was premeditated.

A further decomposition of the variable QUIT may be examined in columns 3 and 6 where job-related quits have been segmented into quits due to dissatisfaction with the current job (PUSH) and quits occurring because the individual found a better job (PULL).[11] One may argue that it is irrelevant whether the change was due to a pull or a push since basically the voluntary separation occurred because the individual's opportunities were better in the new job. That is, it is irrelevant whether the quit was due to the fact that the present job was bad or to the fact that the new job was better. Either way, the new job improved the individual's situation *relative* to the old job. Although essentially correct, this line of argument ignores an empirical peculiarity of the data: most of the individuals who said they were pushed from the current job gave reasons relating to the nonwage aspects of the job. Thus there is no obvious reason to expect any kind of wage increase for this group. Indeed, table

2.1 shows that the effect of quits on wage growth differs significantly depending on whether the quit was a pull or a push. A pull always leads to significantly higher wage growth than that experienced by stayers, while a push does not seem to affect wage growth at all. In general, the results in table 2.1 suggest that the nature of a quit is a very important determinant of the gains to mobility. Moreover, the results obtained with the detailed decomposition of QUIT provide one explanation of the fact that the QUIT coefficient varies over the life cycle. In particular, a quit is more likely to be due to finding a better job at younger ages, while at older ages the quit is mainly due to dissatisfaction with the current job. These results, however, are not entirely consistent with the matching view of labor turnover since the matching process—and therefore quits due to dissatisfaction with the present employer—is more likely to take place early in the life cycle. The fact that our data show the opposite is somewhat puzzling.

Finally, one way of measuring the magnitude of the wage increase due to PULL is to calculate the present value of this increase assuming both that the individual works full time until his retirement and that the wage increase due to the quit is general in the sense that it remains with him throughout his working life.[12] From column 3 the observed wage increase is worth $2,940 for the young men and $570 for the older men. Obviously the longer payoff period for young men clearly increases the return on mobility investment.

2.1.2 Wage Growth prior to, during, and after the Move

In the previous section we conducted an analysis calculating the "gains" associated with mobility by comparing movers and stayers. As was pointed out earlier, this procedure could create problems if population heterogeneity is an important phenomenon in the labor market. The existence of heterogeneity raises two distinct types of problems. First, the separation dummies that compare movers and stayers can be proxying unobserved individual characteristics indicating both the propensity for turnover and the individual's ability to "grow" on the job. Since individuals with high propensities for turnover find it harder to "hold onto a job," population heterogeneity would create a negative correlation between wage growth and the separation probabilities. Moreover, if one reason that stayers stay in the job is their better progress (or prospects for progress), clearly this would give a further downward bias to the "gains" to mobility.

Thus unless we resort to somewhat more complicated statistical procedures, ordinary least-squares comparisons of movers and stayers will yield hopelessly biased estimates of the returns to moving. A correct answer to the question of whether the individual gained by moving can be obtained only by a comparison of the individual's new wage progress to

that which he would have obtained had he stayed at the previous job. Clearly the relevant alternative wage is unavailable once the individual's separation decision is taken. A simple approximation, however, exists if we utilize fully the longitudinal nature of our data. For example, suppose we have a sample of individuals who either did not change jobs between 1967 and 1973 or changed only between 1969 and 1971. Thus the basic difference between the two groups of men lies in their 1969–71 separation propensities. Suppose that we estimate wage growth equations similar to those given in columns 3 and 6 of table 2.1 for each of the subperiods 1967–69, 1969–71, and 1971–73 as a function of the 1969–71 separation probabilities. The coefficients on these dummies can then be studied to show how the mover's wages were growing *before* he changed jobs, *during* the period in which he changed jobs, and *after* the job change took place. If we are willing to assume that the effect of the 1969–71 mobility dummy on 1967–69 wage growth is indicative of how movers were doing in the job prior to separation, we can then determine conclusively whether a mover gained from moving by analyzing the behavior of the separation dummies over the six-year period. In particular, the individual improved his situation by moving if the mobility coefficient is more positive after the move than before the move. Thus by looking at *changes* in the mobility coefficient we are, in effect, controlling for population heterogeneity, since these unobserved individual characteristics are assumed to be constant over time.

The results of estimating these equations are presented in table 2.2. Panels A and B give the results for young and older men using the sample of men who either moved during 1969–71 only or did not move at all during the six-year period. To show how these results should be interpreted, let us consider in detail the effect of being "pushed" from the 1969 job on the wage profile of young men. We find that prior to the separation, individuals who were "pushed" from the job had significantly lower wage growth than individuals who stayed in that job subsequently. Two factors explain this result. Clearly, the movers were not progressing well on the job and eventually quit because of this. Secondly, if the job was a mismatch, as it eventually turned out to be, and if this information was known to both firm and workers, the incentives for investment in the job were weak, leading to smaller wage growth (see section 2.2, below). During the 1969–71 period, when the move actually occurred, we find that these *same* individuals had larger wage growth than stayers. Again, assuming that the difference between movers and stayers in the 1967–69 period is the correct comparison between the mover's old job and the stayers' job, clearly the positive coefficient of PUSH on 1969–71 wage growth provides very strong evidence that the movers improved their situation significantly through job mobility. Moreover, we find that these gains were not temporary since the comparison of movers to stayers in the 1971–73 period (after the move took place) yields the finding that there is

Table 2.2 **The Effects of 1969–71 Mobility on Wage Growth (Dependent variable = ΔW or $\Delta \ln W$)**

	Absolute Growth			Percentage Growth		
	67–69	69–71	71–73	67–69	69–71	71–73
			A. NLS Young Men ($n = 392$)			
LAYOFF	.0885	−.0391	.0579	.0785	.0201	.0575
	(.57)	(−.23)	(.47)	(1.24)	(.39)	(1.14)
PERS	−.1250	−.3029	.2169	−.0320	−.1223	.1347
	(−.59)	(−1.34)	(.80)	(−.37)	(−1.75)	(1.95)
PUSH	−.2455	.3083	−.0440	−.0693	.1105	.0153
	(−1.66)	(1.94)	(−.23)	(−1.15)	(2.26)	(.32)
PULL	−.1027	.6174	.3287	.0384	.1784	.0599
	(−.57)	(3.23)	(1.44)	(.53)	(3.02)	(1.03)
			B. NLS Mature Men ($n = 1{,}016$)			
LAYOFF	.2111	−.5501	.1534	.0802	−.1818	.0579
	(.99)	(−2.80)	(.69)	(1.75)	(−3.45)	(.95)
PERS	−.2156	−1.1024	−.1143	−.0301	−.3780	.0062
	(−.44)	(−2.46)	(−.23)	(−.29)	(−3.13)	(.04)
PUSH	.1202	−.0932	−.2345	.0129	−.0437	−.0098
	(.32)	(−.27)	(−.59)	(.16)	(−.47)	(−.09)
PULL	.1083	−.6126	−.7372	.0407	−.0656	−.1102
	(.22)	(−1.37)	(−1.45)	(.39)	(−.54)	(−.79)
			C. NLS Young Men ($n = 1{,}032$)			
LAYOFF	.0922	.1157	−.5305	.0515	.0163	−.0069
	(1.90)	(1.40)	(−.43)	(1.47)	(.60)	(−.22)
PERS	−.1040	−.1187	.0417	−.0223	−.0465	.0521
	(−.80)	(−.92)	(.22)	(−.41)	(−1.09)	(1.07)
PUSH	−.1801	.1637	−.0467	−.0363	.0535	−.0028
	(−1.91)	(1.75)	(−.34)	(−.91)	(1.74)	(−.08)
PULL	−.0033	.2202	−.0197	.0477	.0587	−.0144
	(−.03)	(2.01)	(−.12)	(1.02)	(1.62)	(−.35)
			D. NLS Mature Men ($n = 1{,}379$)			
LAYOFF	.1552	−.1687	−.1519	.0183	−.0455	−.0518
	(.89)	(−1.00)	(−.82)	(.47)	(−1.03)	(−1.08)
PERS	−.2006	−.3616	.4840	−.0096	−.1559	.1579
	(−.55)	(−1.03)	(1.24)	(−.12)	(−1.68)	(1.56)
PUSH	.0220	−.0223	−.1771	−.0340	.0327	−.0248
	(.08)	(−.08)	(−.58)	(−.53)	(.45)	(−.31)
PULL	−.0096	−.1769	.1511	.0294	−.0016	−.0453
	(−.03)	(−.44)	(.34)	(.32)	(.00)	(−.39)

Note: The variables (excluding JOB) held constant in table 2.1 are held constant here; t-statistics in parentheses.

no difference in the wage progress of the two groups. Therefore, we can safely conclude that individuals who moved used job mobility as a tool to achieve a better wage package.

The reader can easily verify that almost (qualitatively) identical results are obtained for the other types of voluntary separations in the NLS young men's sample. For the mature men, this exercise yields somewhat mixed results. The reason is probably due to the fact that the separation dummies have very low means. For example, the frequencies of PUSH, PULL and PERS are .0098, .0059, and .0059, respectively.

It may be argued that these findings are seriously biased by the existence of selectivity bias since our sample consists of individuals who either did not change jobs at all or who moved in only the 1969–71 period, so that the move was, in a sense, successful. In fact, the use of an unrestricted sample, where we include all individuals and relate their wage growth in all three periods to their 1969–71 separation behavior, barely affects our results as can be seen in panels C and D of table 2.2. If anything, we obtain somewhat more reasonable results for the mature men.

2.2 Labor Turnover and Wage Growth within the Job

In the previous section we have shown that labor turnover affects the wage profile *across* jobs. In this section we demonstrate how labor turnover also affects the earnings profile *within* the job. In section 2.2.1 we present a simple framework for analyzing the relationship between labor turnover and on-the-job wage growth, and in section 2.2.2 we document empirically that labor turnover systematically affects the slope of the earnings profile within the job.

2.2.1 A Framework for Analyzing On-the-Job Wage Growth

One way in which on-the-job wage growth can be studied is to interpret it as the result of human capital investment. If no mobility occurs during the period $t-1$ to t, then the absolute change in the individual's earnings capacity during that period can be written as:

$$\Delta E_t = E_t - E_{t-1} = r_n C_{t-1} \tag{1}$$

where E_t is earnings capacity at experience year t; C_t denotes dollar investment costs in t, and r_n is the rate of return to postschool investments on the current (nth) job. Note that C_t is composed of all investment costs borne by the individual. That is, it is composed of general investments as well as the share of specific training costs paid by the individual.

The change in earnings capacity given by equation (1) is unobserved. However, if all investment costs are foregone earnings, observed earnings, Y_t, are defined by $Y_t = E_t - C_t$. Thus equation (1) can be rewritten as:

$$\Delta Y_t = r_n C_{t-1} - (C_t - C_{t-1}) = r_n C_{t-1} + \beta_n \tag{2}$$

where $\beta_n = -(C_t - C_{t-1})$. Since, by assumption, no job change has occurred, observed wage growth on the job is composed of the returns to on-the-job training plus the change in investment costs from period to period. If the investment profile is assumed to be continuous and linearly declining (within the job), the change in investment costs is given by the constant rate of decline in investment in the current job, β_n. Thus observed wage growth incorporates the saving in investment costs as job tenure increases.

To convert equation (2) into observables, we hypothesize that investment costs are a negative function both of previous experience and of current job experience.[13] That is, more investment is undertaken the younger the individual was when he started the job and the shorter the tenure on the job. Of course, both these implications must be qualified by the fact that at low levels of tenure there is a considerable amount of learning taking place as both the individual and the firm consider whether the job match is worthwhile. Moreover, at younger ages, as the individual learns about the labor market, "job shopping" might lead to an initial increase in investment. Thus it is possible that human capital investments may be zero or rise initially both with age and with job tenure. We assume that these matching periods are reasonably short so that our linear approximations do not greatly distort reality. In particular, if π_n measures experience prior to the current job and e_n measures current job tenure, a simple relation determining investment costs would be:[14]

$$C_t = C_{0n} - \sigma_n \pi_n - \beta_n e_n \tag{3}$$

Note that C_{0n} measures the level of investment that would take place initially if the current job were the first job in the life cycle. Substituting (3) into (2) yields:

$$\Delta Y_t = (r_n C_{0n} + \beta_n + r_n \beta_n) - r_n \sigma_n \pi_n - r_n \beta_n e_n \tag{4}$$

Thus a simple regression of wage growth on previous and current experience gives coefficients that are proportional to the effect of aging both prior to the job and within the job.

We can introduce the relationship between labor turnover and on-the-job wage growth by noting that C_{0n} will vary systematically with the probability of separation. That is, since a part of dollar investment costs is specific to the current job, there will be a positive correlation between the level of the investment profile (measured by C_{0n}) and expected completed job duration. In other words, the individual and the firm will invest more in longer jobs because they can both collect the returns to specific training over a longer period of time. Simultaneously, those individuals who have invested more on the job will have an incentive to stay longer.[15]

Denoting by t_n^* the expected completed tenure in the job as of the beginning of the job, this implies:

$$C_{0n} = \alpha_n + \rho_n t_n^* \tag{5}$$

If longitudinal data are used, information on t_n^* is generally available as long as actual events closely parallel expectations. If we make the simplifying assumption that *actual completed* tenure equals t_n^* as a first-order approximation, and if we observe a sample of individuals changing jobs at some point during the survey, then it is possible to estimate the parameter ρ_n (times a constant). In particular, rewrite t_n^* as:

$$t_n^* = e_n + R_n \tag{6}$$

where e_n is current job tenure and R_n is time remaining in the current job. Using equations 4–6 we can derive:

$$\Delta Y_t = (r_n\alpha_n + \beta_n + r_n\beta_n) - r_n\sigma_n\pi_n + r_n(\rho_n - \beta_n)\, e_n + r_n\rho_n R_n \tag{7}$$

The human capital hypothesis would predict that the coefficient on R_n is positive, i.e., wage growth is steeper in longer jobs. It is important to note that this relationship cannot be measured by observing the coefficient on current tenure, e_n. As equation 7 shows, the coefficient on e_n is ambiguous because longer observed tenure (as of the time of the survey) implies both that the individual is older (the aging effect β_n) and that more will be invested, since for given R_n the job will be longer (the investment effect ρ_n). The key to demonstrating that labor turnover and on-the-job wage growth are related is the availability of longitudinal data which enable us to observe an individual's *completed* tenure.[16]

It is important to note, however, that an alternative interpretaton can be given to the observation of a positive coefficient on R_n. One could simply argue that in jobs where an individual is progressing, i.e., where his wages are growing faster than they would elsewhere (perhaps because of better opportunities for investment), the individual will have an incentive to stay. Again, we would observe a positive correlation between on-the-job wage growth and *completed* job tenure. Actually, either interpretation highlights the importance of specific human capital in explaining labor turnover.

2.2.2 Empirical Results on Wage Growth within the Job

Table 2.3 presents the results of estimating equation 7 on both NLS samples. In both cases, we selected a group of individuals who had stayed on the job between 1967 and 1969 but who had changed jobs at any time during 1969 and 1973. Thus we have a sample of individuals for whom time remaining on the job is observed.[17] The equations in table 2.3 relate

Table 2.3 **Effects of "Time Remaining on the Job" on 1967–69 Wage Growth**

	(1) Absolute Growth	(2) Percentage Growth
	$Y_{69} - Y_{67}$	$\ln Y_{69} - \ln Y_{67}$
	A. NLS Young Men ($n = 156$)	
PREV	−.0120	−.0109
	(−.56)	(−1.53)
JOB	−.0500	−.0225
	(−1.47)	(−2.00)
REMTEN	.0837	.0238
	(.87)	(.76)
	B. Mature Men ($n = 747$)	
PREV	−.0144	−.0045
	(−2.13)	(−1.62)
JOB	−.0195	−.0062
	(−2.90)	(−2.25)
REMTEN	.0245	.0013
	(1.26)	(.16)

Note: The variables held constant in table 2.1 (except D67 and D69) are also held constant here.
The sample is restricted to individuals who stayed on the job between 1967 and 1969 but left that job between 1969 and 1973.

wage growth in 1967–69 to previous experience (PREV), current job tenure (JOB), time remaining on the job measured as of 1967 (REMTEN), and a set of standardizing variables listed in the note to table 2.1. As before, the wage growth equations are estimated in two alternative ways: in column 1, the absolute change in wages over the 1967–69 period is the dependent variable, while in column 2, the percentage change in wages is analyzed.

Although the results are not statistically very strong, the coefficient of time remaining on the job, REMTEN, has the right sign and seems to be more significant for the older men sample.[18] For example, an extra year of job tenure in the older men sample increases the hourly wage rate by about 2.5 cents more over the 2-year time period under investigation. An interesting exercise that can be carried out is to ask how much does the positive correlation between completed tenure and wage growth contribute to total wage gains on the job? This calculation can be done roughly in the following way. First of all, in terms of yearly earnings (i.e., 2,000 hours supplied to the labor market), we obtain the increase in annual earnings of expecting to stay *one* additional year on the job by multiplying .0125 by 2,000;[19] this amount is $25.70. The individuals in our sample, in

fact, stayed 20 years on the job (15 years prior to the survey and 5 after the survey). Therefore, from an ex ante point of view, staying an additional 20 years on the job is equivalent to an increase in annual earnings of $514. The present value of this increase in annual earnings over the completed job span (20 years of tenure) is $4,446. Thus there is substantial wage growth on the job over and above that obtained if there were no positive correlation between wage growth and completed job tenure. In the case of young men, even though the coefficient of REMTEN is 8.4 cents, the completed tenure is significantly smaller, only 6.6 years (2.9 years before the survey, 3.7 years after the survey). Thus the present value of the wage gains due to the correlation between completed job tenure and wage growth is $2,700.[20] Of course, we recognize that the insignificance of REMTEN in our equations indicates the need for further research on this question.

2.3 Labor Turnover and Lifetime Wage Growth

Parts 2.1 and 2.2 have shown the role that labor turnover plays in determining wage growth both across jobs and within the job. We have observed that individuals who change jobs voluntarily experience wage gains while individuals who stay on the job appear to experience steeper wage growth within the job. Thus one cannot predict a priori whether turnover leads to smaller or larger lifetime wage growth. In this section we suggest how this question can be answered.

It might seem appropriate to estimate an earnings function of the form:

$$Y_t = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \alpha_3 e + \alpha_4 e^2 \tag{8}$$

where t is total labor force experience and e denotes current job tenure. This type of earnings function is essentially based on the argument that on-the-job training is composed both of general and specific training. The coefficients of t capture the earnings growth of the individual over the life cycle, while the coefficients of e measure any growth which is specific to the current job *over and above* the growth which would have occurred due to general labor force experience. Thus, in principle, the estimation of (8) would provide some insight into the importance of job-specific skills in determining the observed wage structure. Unfortunately, a problem with this interpretation arises when (8) is applied to a cross-section of individuals. In particular, consider an extreme case in which there is no specific training, and thus α_3 and α_4 are truly zero. If individuals self-select themselves into different types of jobs because they differ in their propensities to separate—in other words, there is population heterogeneity—it may be that individuals who match into a "good" job receive high wages and therefore show low propensities to separate and individuals with "bad" matches receive low wages and are therefore observed

to have high propensities to separate.[21] In this case, in the cross-section, α_3 may turn out to be positive *artificially*! Thus the cross-section estimates of (8) may not be very meaningful in analyzing the relationship between turnover and lifetime wage growth.

Using longitudinal data, however, we can provide a solution to this problem. In particular, consider the equation:

$$Y_t - Y_0 = \gamma_1 t + \gamma_2 t^2 + \gamma_3 e + \gamma_4 e^2 \tag{9}$$

where Y_0 gives earnings in the first year of the life cycle. Thus by looking at wage growth we net out any individual differences that are unobserved but affect the individual's earnings throughout the working life. The coefficients γ_i $(i = 1, \ldots, 4)$ can be interpreted as the effects of experience and job tenure on total life cycle wage progress. In particular, consider the extreme case in which there is no specific training. Clearly the coefficients γ_1 and γ_2 simply capture scale effects and are expected to be positive and negative respectively. If there is only general training, there is no obvious reason why length of current job tenure should provide any additional information on total life cycle wage growth. In fact, if mobility "pays" (that is, if there are nonnegative gains associated with changing jobs), longer tenure implies a smaller propensity for separation. If there is serial correlation in this propensity over the individual's life cycle, this implies less turnover in the individual's previous experience $t-e$. But under the assumption that mobility pays, the net effect of current tenure should then be negative! On the other hand, if wage progress over the life cycle is a function not only of total experience but of current job tenure, we would expect γ_3 and γ_4 to be positive and negative respectively in equation 9. If this is the case, however, the results can be interpreted as an indication of the fact that specific training is an important component of wage determination.[22] In other words, job tenure matters over and above the passage of labor market exposure.

Unfortunately, the two data sets we use in this paper do not contain any information on initial earnings in the life cycle. Moreover, in the young men's NLS the individuals are much too young and both labor market experience and job tenure too short to get any robust estimates of the parameters. However, in the older men's NLS we do have a measure of labor market progress made by the individual over the life cycle, since we are given the Duncan scale for the initial and current occupations. One distinct advantage of using the Duncan scale is that the measure of "earnings" is of a more permanent nature.[23] Table 2.4 presents the lifetime earnings growth regression estimated for the older men's NLS. The linear job tenure coefficient is positive and significant, indicating that holding total labor force experience constant, longer job tenure is associated with higher levels of total life cycle wage growth. Therefore, the results unambiguously show that while mobility that takes place early in

Table 2.4 **Effects of Job Tenure on Lifetime Wage Growth, NLS Mature Men (Dependent Variable = $Y_t - Y_0$)**

Variable	Coefficient	t
Constant	−24.1973	
EDUC	.4470	(2.13)
EXPER	1.8399	(2.04)
EXPER^2	−.0284	(−2.23)
JOB	.4860	(3.29)
JOB^2	−.0077	(−1.78)
R^2	.028	

the life cycle may pay, individuals who have finally settled in a firm experience larger lifetime wage growth than individuals who are still changing jobs.

2.4 Effects of Other Variables

In the previous sections we have documented that turnover is an important determinant of wage growth. In this section we explore in more detail the other determinants of wage growth for both the young men's and the mature men's NLS samples. The basic results are presented in table 2.5 where wage growth regressions are estimated separately for stayers, quitters, and layoffs in both age samples. In order to conserve space we present only the results using arithmetic wage growth.

The effects of the other variables are interesting. For example, education has a strong positive effect on the wage growth of young men. Moreover, within the young men's sample, education affects the wage growth of men who separated from the job much more strongly than that of stayers. In the older men sample, however, education has a significant effect only for those who quit. Therefore the results seem to suggest that education helps to increase the gains from mobility for young men and the gains from quitting at older ages.

The coefficients of experience are quite interesting in the young men's sample. In particular, as predicted in section 2.2, experience has a negative effect on the wage growth of stayers. Note, however, that experience is *positive* (though very weak) for both quitters and layoffs, indicating that the accumulation of labor market experience may be helpful in creating the gains from mobility. A similar pattern is found for older men: experience has a negative effect on the wage growth of stayers, a positive effect on the wage growth of quitters and a zero effect on the wage growth of people who were laid off.

Other variables of some interest include a union coefficient which seems to have a zero or negative effect on the wage growth of stayers. Marital status and the labor force participation status of the wife have

significantly positive and negative effects respectively on the wage growth of the young men stayers. These effects can be interpreted by arguing that marriage increases the labor market investment incentives of males (perhaps due to the household division of labor), while if the wife works these incentives are diminished.

Finally, one of the most significant variables in the regression is the size of the local labor market. This variable has a strong positive effect on the wage growth of stayers. Surprisingly, it has a negative effect on the wage growth of older men who were laid off from their jobs.

Table 2.5 **Effects of Other Variables on Wage Growth (Dependent variable = ΔY_i)**

	Stayers		Quitters		Layoffs	
	Coeff.	t	Coeff.	t	Coeff.	t
			A. Young Men			
D67	.0020	(.03)	.0927	(.54)	.2099	(1.12)
D69	−.0467	(−.40)	−.0331	(−.08)	−.0806	(−.23)
EDUC	.0250	(2.69)	.0710	(2.35)	.0796	(2.71)
EXPER	−.0094	(−1.40)	.0123	(.53)	.0103	(.49)
JOB	−.0068	(−.94)	−.0488	(−1.40)	.0209	(.59)
ARMY	−.0018	(−1.27)	−.0028	(−.57)	−.0005	(−.11)
UNION	−.0713	(−1.80)	−.1051	(−.66)	−.0766	(−.55)
HLTH	−.0684	(−1.02)	−.2184	(−1.08)	−.0959	(−.53)
MAR	.0934	(1.90)	−.0883	(−.53)	−.2598	(−1.61)
WLFP	−.1032	(−1.83)	.0855	(.44)	.5517	(2.51)
WINC	.0014	(1.06)	.0033	(.75)	−.0057	(−.98)
WKSUN	−.0023	(−.51)	−.0027	(−.26)	.0054	(.96)
SIZE	.0057	(3.09)	.0140	(2.12)	.0020	(.31)
UN	−.0086	(−.75)	.0010	(.03)	.0381	(1.01)
R^2	.029		.021		.049	
n	2145		1046		474	
			B. Mature Men			
D67	.0531	(.97)	1.124	(2.24)	.7686	(3.68)
D69	−.0078	(−.14)	.6508	(1.28)	.5883	(2.86)
EDUC	.0033	(.41)	.1082	(1.71)	−.0061	(−.19)
EXPER	−.0081	(−1.68)	.0731	(1.83)	.0105	(.54)
JOB	.0011	(.60)	−.0266	(−1.36)	−.0019	(−.25)
UNION	−.0146	(−.35)	.0773	(.17)	.5189	(3.49)
HLTH	−.0210	(−.43)	.2883	(.81)	.1391	(.78)
MAR	.0022	(.03)	.2708	(.46)	−.5184	(−2.14)
WLFP	.0116	(.28)	.5285	(1.36)	.0370	(.23)
WW	.0046	(.93)	−.1899	(−1.01)	−.0005	(−.29)
WKSUN	−.0064	(−1.29)	.0027	(.14)	−.0037	(−.87)
SIZE	.0025	(1.48)	.0032	(.23)	−.0177	(−2.61)
UN	−.0011	(−.10)	.0224	(.21)	.0234	(.57)
R^2	.004		.060		.130	
n	4213		252		280	

2.5 Summary

In this paper we have presented a systematic empirical analysis of wage growth in the National Longitudinal Surveys of Young and Mature Men. We have demonstrated that labor turnover is a significant factor in understanding wage growth since it affects both wage growth *across* jobs and wage growth *within* the job. Some specific findings are summarized below.

1. Although the gains to quitting appear to be positive for young men and zero or negative for older men, this was clarified by distinguishing among three types of quits: quits due to finding a better job, quits due to being dissatisfied with the current job, and quits due to personal reasons. It was then shown that in both age groups, individuals who quit because they said they found a better job experienced significant wage gains. At older ages a quit is mainly due to dissatisfaction with the current job and these types of quits do not in general significantly increase earnings. The change in the nature of a quit over the life cycle is the reason for the age differences in the impacts of quits on wages.

2. We extended our analysis of the wage gains from mobility by comparing not only movers and stayers but individuals to themselves in the sense that we analyzed the individual's wage profile before, during, and after the move to determine whether it had been significantly affected by mobility. It was shown that at least for the young men, this type of exercise led to the conclusion that a mover significantly gained from his actions.

3. Labor turnover and wage growth within the job are related through a weak positive correlation between wage growth and *completed* job tenure. Individuals who expected to remain on the job an additional year experienced steeper wage growth in the current period, ceteris paribus.

4. Since labor turnover was found to have offsetting effects on wage growth, i.e., to lead to wage gains across jobs but flatter growth in shorter jobs, its effect on lifetime wage growth could not be predicted. Our empirical analysis showed, however, that, even when total labor force experience is held constant, there exists a strong positive correlation between length of current tenure and total life-cycle wage growth. Thus, while early mobility may pay, individuals who are still changing jobs later in life experience lower overall wage growth.

In summary, this paper has tried to show that labor turnover affects not only the growth of wages across jobs but also the rate at which wages grow on the job. It is therefore an important factor that must be taken into account in any study of the earnings distribution.

Appendix

List of Variables

QUIT	= 1 if individual changed jobs voluntarily
LAYOFF	= 1 if the individual changed jobs involuntarily
JOBREL	= 1 if individual quit for job-related reasons (see note 10)
PERS	= 1 if individual quit for personal reasons (see note 10)
PUSH	= 1 if individual quit because of dissatisfaction with current job (see note 11)
PULL	= 1 if individual quit because he found better job (see note 11)
EDUC	= years of education
EXPER	= potential experience since date of completion of schooling
JOB	= years of job tenure
ARMY	= years in the military (Young Men only)
UNION	= 1 if individual was a member of a union
HLTH	= 1 if individual's health limits kind or amount of work
MAR	= 1 if individual married with spouse present
WLFP	= 1 if individual's wife was employed
WW	= wife's wage rate (Older Men)
WINC	= wife's earnings (Young Men)
WKSUN	= weeks unemployed during the two-year interval
SIZE	= size of labor force in 1960 of area in which individual lives
UN	= unemployment rate in area in which individual lives
D67	= 1 if observation refers to 1967–69
D69	= 1 if observation refers to 1969–71

Notes

1. See Mincer (1970) and Sahota (1978) for surveys of alternative explanations of the determinants of the earnings distribution.

2. Some exceptions are found in the papers by Lazear (1976) and Wise (1975).

3. In previous work (Bartel and Borjas 1977) we have analyzed the problem of *why* people move. Here we concentrate on establishing the consequences of labor turnover for the individual's wage-experience profile.

4. Jovanovic (1979) provides a model that predicts wage growth on the job based on the matching process between the individual and the firm.

5. An extensive discussion of the role and effects of heterogeneity in the labor market is given in Heckman, chapter 3, below. Further analysis of the problem, with labor turnover used as the focus, is provided by Jovanovic and Mincer, chapter 1, above.

6. See Bartel (1979) for a detailed analysis of the relationship between job turnover and migration.

7. These sample selection rules are far more serious than they appear to be. In particular, in the extreme age groups sampled in the NLS, a significant portion of turnover may be due to either retirement or school enrollment changes.

8. There are two important qualifications to be noted here. First, in the young men's NLS, many individuals were enrolled in school in the early years of the survey. Since we concentrate on the labor market behavior of men permanently attached to the labor force, we do not have observations for these individuals in the early years, so that pooling cross-section and time series less than triples the number of observations. Secondly, the efficiency of ordinary least squares can be improved upon by utilizing one of the many methods now available for pooling cross-section and time series. We do not pursue this refinement in this paper.

9. Recall that these numbers refer to the gains made over the two-year period. To obtain annual effects of labor mobility, simply divide the coefficients by two.

10. A job-related quit is one that occurred because the individual (a) was dissatisfied with wages, hours, working conditions, and/or location of his job; (b) disliked his fellow employees; or (c) found a better job. A personal quit is one that occurred because of (a) health problems or (b) family reasons. For young men, 85 percent of the quits were job related while for the older men 73 percent were job related.

11. PUSH is defined as a quit that occurred because the individual (a) was dissatisfied with wages, hours, working conditions or location of his job; or (b) disliked his fellow employees. PULL is a quit where the individual reports that he found a better job. Among the young men, 50 percent of job-related quits were "pulls," while for the older men only 35 percent of these quits were "pulls."

12. The calculation uses the formula:

$$\mathrm{PV} - 2{,}000 \cdot (\Delta W) \int_0^{T-1969} e^{-rt}\, dt$$

where ΔW is the absolute wage increase, 2,000 is the number of hours worked each year, and T is the year of retirement. For young men, $T - 1969$ is 43 years while for older men it is 10 years. We assume r equals 10 percent.

13. These implications follow easily from life cycle optimization models developed by Ben-Porath (1967), Becker (1975) and Heckman (1976).

14. The implications of this investment function for the wage level equation are derived in Borjas (1975, 1981).

15. If firm and individual investments are positively correlated, then clearly the firm too has a smaller incentive to lay off the worker, further lowering the probability of separation.

16. Although the derivations in this section are in terms of absolute wage growth, similar equations can be derived for percentage wage growth. In particular, the analysis would then be conducted in terms of time-equivalent investment ratios. These ratios, in turn, would then be expected to decline both over the life cycle and within the job. Moreover, if higher levels of investment can take place only by spending a larger portion of work time investing, one would expect a positive correlation between these investment ratios and completed job tenure. Thus the analysis may carry over to percentage wage growth.

17. These sample restrictions, of course, raise the possibility of sample selection bias; see Heckman (1979) for a thorough discussion of this problem.

18. There are two possible reasons for the insignificance of REMTEN in the young men's NLS. First, these men are in the very early years of their jobs when investment may not be taking place. Second, the usable sample is very small because during 1967–69 approximately half of the individuals were enrolled in school and are deleted from the sample; among the remaining 50 percent, the job separation rate is very high thus resulting in further deletions. It is interesting to note that by enlarging the young men's sample to include individuals who did not leave the job by 1973 and assigning an arbitrary value of 10 for REMTEN for these individuals, the REMTEN coefficient becomes positive and significant.

19. We use .0125 rather than .025 because the wage growth equations refer to two-year intervals.

20. Note that the coefficient of REMTEN is never significant in column 2 when we deal with percentage wage growth. In principle, the correlation between investment and completed tenure need hold only in terms of dollar investment costs and not in terms of time-equivalent investment ratios since it is not clear a priori how initial earnings capacities are correlated with completed job tenure.

21. The problem of heterogeneity versus state dependence is discussed in detail in Heckman (chapter 3, below) and Jovanovic and Mincer (chapter 1, above).

22. Of course, the results could also be consistent with the hypothesis that wages grow on the job because of a successful "match" between employer and employee. In other words, an individual's mobility ultimately led to his finding a firm in which he was able to "move up the ladder."

23. The Duncan index is described in Reiss (1961). It is very highly correlated with earnings in the occupation.

Comment Gilbert R. Ghez

The paper by Ann Bartel and George Borjas is an interesting investigation of the relationship between wage growth and turnover. It seeks to shed light on this relationship using the theory of human capital. The authors succeed in showing some important empirical regularities characterizing job mobility. It is precisely the soundness of many of their findings which prompts me to take a more careful look at their methods.

I begin with four general comments on the model, followed by a number of shorter comments on empirical implementation.

1. My first observation is that the wage path of movers is surely a function of their whole history of job turnover. Repeat job losers presumably will fair worse than nonrepeaters not only because each successive job loss pushes them into worse options but also because a repeater may come to acquire a poor reputation. Employers tend to screen applicants on the basis not only of education but also on their work history. This feature is not recognized in the Bartel-Borjas paper, or for that matter in the voluminous literature on screening that has emerged in recent years. Even for job quitters, a series of former quits may be regarded adversely by prospective employers in that they may believe that this applicant's probability of quitting soon is higher than that of other comparable workers. This would reduce the market options of the repeat quitter. Repeat quits may of course also have a beneficial effect: in so far as search effort is more intense around the time of quitting, a repeat quitter may well have acquired more information about labor market options than other workers and thereby may be able to secure a more rewarding job.

Gilbert R. Ghez is Associate Professor of Management and Economics, Roosevelt University, Walter E. Heller College of Business Administration.

The direction of net impact of repeat quits on wage growth is thus an empirical question.

Because of these lagged effects, the error terms in the Bartel-Borjas empirical investigation are temporarily correlated. Repeat job changes over a given span of time are a more likely occurrence for young men than for mature ones. (Although to be sure the total number of job changes is a nondecreasing function of age.) The neglected lags are therefore more damaging to the regressions in the sample of young men. This may help explain why the effects of current layoffs are less significant there: current layoffs are a less perfect measure of total recent layoffs for young men than for older men. The neglected lags may also help explain why in both samples the effect of quits due to dissatisfaction with the current job (PUSH) does not have a statistically significant effect.

It would be most welcome if in future empirical work more attention was paid to this problem. There would be several ways to proceed. A natural and simple way would be to run regressions of wage growth on current separation, given that the individual had the same employer for, say, the previous five years and compare it to the wage growth of current movers who also changed jobs in the previous five years, as well as to the wage growth of those who did not change jobs over the five-year span. Presumably job separations in the very distant past carry no weight currently. A more complex procedure would allow for differential weights to past separations depending on exactly how far in the past they occurred.

2. My second comment pertains to modeling the effect of expected completed tenure on current investment costs. Bartel and Borjas assume in equation 5 that expected tenure t^* affects investment costs C independently of years of experience. However, a moment of reflection should convince the reader that optimizing theory predicts that a lengthening of expected tenure should have a larger effect on investments the closer the worker is to that expected date, for then the returns from longer tenure are discounted less heavily. Take for instance the Ben Porath neutral model of investment planning, modified to account for tenure on the current job until t^* and for tenure in a subsequent job from t^* to t^{**} (we could introduce more jobs without altering the gist of the argument). The discounted value of returns $b(t)$ from a unit of investment undertaken at time t is:

$$b(t) = \int_{t}^{t^*} a^* \, e^{-(i+\delta)(s-t)} ds + \int_{t^*}^{t^{**}} a^{**} \, e^{-(i+\delta)(s-t)} ds \tag{1}$$

where a^* is the return per period from a unit of human capital when the worker works in the firm where the training is undertaken, a^{**} is the return per period in the subsequent job from a unit of human capital acquired in the current job, i is the opportunity cost of funds, and δ is the

constant rate of depreciation. If we assume that a^* and a^{**} are constant within each job spell, then $b(t)$ can be written more compactly as:

$$b(t) = \frac{a^*}{i+\delta}[1 - e^{-(i+\delta)(t^* - t)}] + \frac{a^{**}}{i+\delta}[e^{-(i+\delta)(t^* - t)} - e^{-(i+\delta)(t^{**} - t)}]$$

$$= \frac{a^*}{i+\delta} - \frac{(a^* - a^{**})}{i+\delta} e^{-(i+\delta)(t^* - t)} - \frac{a^{**}}{i+\delta} e^{-(i+\delta)(t^{**} - t)}$$

Presumably $a^{**} < a^*$ if the current investment contains a specific component. So long as the worker is still investing, he equates marginal cost of investing to its marginal benefit. Total investment cost per period in the current job, denoted by C, is then simply (assuming that the production function of human capital does not shift over time):

$$C(t) = C[b(t)] \text{ with } \frac{dC}{db} > 0$$

The effect on marginal benefits of a change in expected completed tenure on this job, holding constant the total expected work length, is:

$$\frac{\partial b(t)}{\partial t^*} = (a^* - a^{**})\, e^{-(i+\delta)(t^* - t)} > 0 \tag{2}$$

This effect is larger the closer t is to t^*, as long as $i + \delta > 0$:

$$\frac{\partial^2 b(t)}{\partial t^*\, \partial t} = (a^* - a^{**})(i+\delta) e^{-(i+\delta)(t^* - t)} > 0 \tag{3}$$

Hence[1]:

$$\frac{\partial^2 C(t)}{\partial t^*\, \partial t} > 0$$

when $i + \delta > 0$ and $a^* > a^{**}$.

To avoid excessive notation here, assume that the current job is the first job. The empirical function used by Bartel-Borjas is:

$$C_t = \alpha + \rho t^* - \beta t$$

(I use t where they use e in their notation, since my discussion is centered on the first job in order to get at the main point). This linear function allows t^* to affect levels of investments but not slopes. A more appropriate specification which conserves much simplicity for the purpose of estimation is:[2]

$$C_t = \alpha' + \rho'(t^* - t) + \rho''(t^* - t)^2 + \gamma'(t^{**} - t) + \gamma''(t^{**} - t)^2 \tag{4}$$

where the prediction is that $\rho' > 0$, $\rho'' < 0$, $\gamma' > 0$, $\gamma'' < 0$. Viewed in this framework, Bartel-Borjas are implicitly assuming that $\rho'' = 0$ and $\gamma'' = 0$. It is useful to point out that if t^{**} is the same for all individuals in the sample, this equation can be implemented with data on expected completed tenure and experience (past and current experience). The earnings growth equation would be:

$$\Delta Y_t = rC_{t-1} - (C_t - C_{t-1})$$

$$\begin{aligned} \Delta Y_t = r[\alpha' + \rho'(t^* - t - 1) + \rho''(t^* - t - 1)^2] \\ + \gamma'(t^{**} - t) + \gamma''(t^{**} - t)^2 - (\rho' + \gamma') \\ + (\rho'' + \gamma'') + 2\rho''(t^* - t) + 2\gamma''(t^{**} - t) \end{aligned} \tag{5}$$

That is, the wage growth equation is a quadratic function of t and t^*:

$$\Delta Y_t = k_0 + k_1 t + k_2 t^2 + k_3 t^* + k_4 (t^*)^2 + k_5 t t^* \tag{6}$$

where the coefficients are:

$$\begin{aligned} k_0 &= r\alpha' - (1+r)(\rho' + \gamma') + (1+r)(\rho'' + \gamma'') \\ &\quad + [r\gamma' - 2(1+r)\gamma'')]\, t^{**} + r\gamma''(t^{**})^2 \\ k_1 &= -r(\rho' + \gamma') + 2(1+r)(\rho'' + \gamma'') - 2r\gamma'' t^{**} \\ k_2 &= r(\rho'' + \gamma'') < 0 \\ k_3 &= r\rho' - 2(1+r)\rho'' > 0 \\ k_4 &= r\rho'' < 0 \\ k_5 &= -2r\rho'' > 0 \end{aligned}$$

3. This brings me to another comment. The assumption made by Bartel-Borjas that actual completed tenure is a good estimate of expected completed tenure is a dubious one. The assumption of perfect cohort expectations was introduced in my NBER study on life cycle consumption (Ghez and Becker 1975, chapter 2) and is embedded in all studies using rational expectations, but the assumption of perfect predictions is a poor choice at the level of the individual. Moreover although the assumption of rational expectations makes sense in the context of variables that are moving with some regularity, I think it is improper to use it in the context of turnover where chance events bulk large and where it is difficult to extract information from the past.

At the least, I would suggest breaking up the sample by variables that strongly influence completed tenure: characteristics of workers such as their level of education, and characteristics of firms (perhaps an industry

classification). Then make the assumption that for any individual his completed tenure is equal to the average tenure of the group plus a random term. In this way, by constructing a synthetic group, estimates of completed tenure effects are less likely to be biased.

In a more complete framework, expected completed separation from the current job is likely to vary over time for the worker. In this case, the change in income would partly reflect these changed expectations: a revised prospect that separation will occur sooner than had been anticipated earlier will reduce the incentive to invest currently. In practice I grant that it is difficult to come up with empirical counterparts to these expectation variables.

4. An equally fundamental problem with the Bartel-Borjas model is the assumption that job separations are exogenous. Rather than using ordinary least squares, they would have done better to construct and estimate a turnover equation also. Many of the standardizing variables used by Bartel-Borjas in their wage growth equations are also good controls for turnover. Such a turnover equation would depend also on anticipated returns from job mobility. The point is not simply that a simultaneous equation format would have been more appropriate, but also that predicted turnover could have been used as a more correct expected tenure variable. It might then also have been possible to estimate separately the contribution of anticipated turnover and that of turnover shocks (less fully anticipated separations) on wage growth.

I will make a few more brief comments. Their brevity is conditioned by the desire to conserve on space.

5. The 1967–73 period is composed of two distinct periods: 1967–69 is a period of full employment; 1970–73 is characterized by considerably more unemployment, recession in 1970–71, followed by a mild recovery in 1972–73. Bartel-Borjas analyze the effects of 1969–71 separations on 1967–69 wage growth. To the extent that the downturn in 1970 was unanticipated, it would make sense to compare the effect of 1969–71 separations on 1967–69 wage growth with the effect of 1971–73 separations on 1969–71 wage growth.

6. Presumably much turnover occurs immediately or soon after leaving school. The Bartel-Borjas sample contains only continuous labor force participants: those young men (aged 15–25 in 1967) in school full time who take summer jobs are excluded from the sample, whereas those in school holding continuous part-time jobs are included. Since people are likely to change jobs abruptly upon completion of school, it might be appropriate to include at least a dummy variable indicating whether or not the respondent is in school. This in itself does not solve the sample selection problem, but does provide some standardization.

7. Some additional standardization would have been appropriate. In particular the length of the workweek is an obvious candidate.

8. Another standardizing variable which might have been included is whether job mobility was accompanied by geographic mobility. These effects are important, as shown in previous work by Bartel. Why not include at least a dummy for geographic mobility on the slope coefficients of quits and layoffs?

9. Bartel-Borjas control for unemployment. I presume this reflects unemployment prior to job separation. Why not also control for unemployment at the place of destination?

10. Bartel-Borjas find that the size of the local labor market has a stronger effect on the wage growth of young quitters than on that of young stayers. This finding makes sense in the context of search theory, and could have been emphasized.

The virtual absence of effects of the size of local labor markets on the wage growth of mature quitters is puzzling. Perhaps if the regressions were standardized by geographic mobility, a stronger positive effect would be borne out.

11. Clearly a more appropriate measure of rewards from work would include nonpecuniary benefits on the one hand and fringe benefits in the form of paid vacations, health insurance plans, pensions, and bonuses on the other hand. It is remarkable that Bartel-Borjas get so much mileage from their less inclusive wage variable. Eventually, of course, human capital models with more comprehensive measures of rewards from work will have to be tested, when data sets suitable for that purpose become available.

Notes

1. These results generalize to the case of nonneutral investments using the methods developed in my unpublished paper "A Note on the Earnings Function When Human Capital Is Biased toward Earnings" (1973).

2. The Mincer-Polachek (1974) equation is different: it makes investment ratios decline with years of experience within work spells, but holds constant the anticipated duration of work in the current (and future) job.

References

Bartel, A. P. "The Migration Decision: What Role Does Job Mobility Play?" *American Economic Review*, December 1979.

Bartel, A. P., and Borjas, G. J. "Middle-Age Job Mobility: Its Determinants and Consequences," in S. Wolfbein, ed., *Men in the Pre-Retirement Years*. Philadelphia: Temple University, 1977.

Becker, G. S. *Human Capital*. 2nd Ed. N.Y.; Columbia University Press, 1975.

Ben-Porath, Y. "The Production of Human Capital and the Life Cycle of Earnings." *Journal of Political Economy*, August 1967.

Borjas, G. J. "Job Investment, Labor Mobility, and Earnings." Ph.D. Thesis, Columbia University, 1975.

_____. "Job Mobility and Earnings over the Life Cycle." *Industrial and Labor Relations Review*, April 1981.

Ghez, G. R., and Becker, G. S. *The Allocation of Time and Goods over the Life Cycle*. N.Y.: Columbia University Press, 1975.

Heckman, J. J. "Life-Cycle Model of Earnings, Learning and Consumption." *Journal of Political Economy*, August 1976.

_____. "Sample Selection Bias as a Specification Error." *Econometrica*, January 1979.

Jovanovic, B. "Job Matching and the Theory of Labor Turnover." *Journal of Political Economy*, December 1979.

Lazear, E. "Age, Experience and Wage Growth." *American Economic Review*, September 1976.

Mincer, J. "The Distribution of Labor Earnings." *Journal of Economic Literature*, October 1970.

Mincer, J., and Polachek, S. "Family Investments in Human Capital: Earnings of Women." *Journal* of *Political Economy*, March-April 1974.

Reiss, A. J., et al. *Occupations and Social Status*. N.Y.: Free Press, 1961.

Rosen, S. "Learning and Experience in the Labor Market." *Journal of Human Resources*, Summer 1972.

Sahota, G. "Theories of Personal Income Distribution: A Survey." *Journal of Economic Literature*, March 1978.

Wise, D. "Academic Achievement and Job Performance." *American Economic Review*, June 1975.