The effects of layoffs and quits on wage growth of male household heads

Author: Emily Blank

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Emily Blank
Boston College

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Chapter I

Introduction

The prospect of job loss has always been an alarming one, both for individual workers and for society as a whole. Job loss can be devastating not only to a worker's ego and emotional stability, but also to family finances. The purpose of this thesis is to examine the claim that job separations lower workers' wages. In particular, we test the following hypotheses:

(1) Layoffs are more harmful to wages than quits. We expect layoffs to decrease future wages. Superficially, at least, it seems that quits would tend to increase wages. Since they are voluntary, they should not be undertaken unless they imply a move to a preferred state for the job changer. There are, however, forms of compensation other than monetary remuneration, e.g., job satisfaction, relationships with co-workers, etc. Therefore, a worker may be willing to change jobs even if it does not increase his earnings, provided that total psychic compensation increases.

Further, a quit may be prompted by dissatisfaction with the old job rather than by the promise of a new "better" job. In this case, the worker may not know, at the time of the quit, the conditions of his next job (and whether they will be better or worse than that of the old job). Some quits are not even easily distinguishable from layoffs. Conceivably a worker might quit because he knows he is about to be fired.

We conclude that the circumstances under which a worker quits determine the outcome of the quit. The theoretical effect of a quit on wages is positive, but the empirical effect of a quit on wages (with no information about these circumstances) is ambiguous.

On the other hand, we expect layoffs to have a negative impact on wage growth. By definition, layoffs are involuntary. If a worker expected a job change to be lucrative, he would have quit (setting aside non-pecuniary considerations). Of course, as stated above, a worker's expectations may be incorrect. Further, some workers are discharged for cause. (We shall refer to both discharges for cause and discharges due to shifts in demand for labor as layoffs). A discharge for cause, or firing, is a black mark on an individual's record and may lower his future wage rate.

(2) The less recent the turnover, the weaker its effect on current wages. In other words, individuals "recover" from any effects of turnover (e.g., loss of firm specific on-the-job training and negative signalling, both discussed below) given sufficient time.

(3) Some demographic groups are more vulnerable than others to the effects of turnover because they acquire more firm specific on-the-job training. The more firm specific training a worker has, the higher his current wage compared to his alternative wage with other firms, and the larger the wage loss expected following turnover.

(4) The more tenure a worker has on the current job just prior to a job change, the greater the amount of OJT accumulated specific to the current job, and thus the greater the potential loss from a job change.

Testing these hypotheses is of interest because of the importance of job mobility in American society. This is illustrated in Table I. This table demonstrates the percentages of males in the University of Michigan "Panel Study of Income Dynamics" data set who were laid off and quit at least once during the decade 1969-1979. (We shall discuss this data set in greater detail in Chapter 4.) Note that the layoff and quit rates both decline monotonically with age.

For the group as a whole, more than 3 out of 10 men in this survey experienced at least one layoff during the period and almost half experienced at least one quit. For good or for ill, a considerable proportion of males (particularly young males) experienced turnover at some point during the decade.

According to classical economic theory, labor mobility is necessary for efficient allocation in the job market. If, however, job changing proves to be harmful for certain groups, we may want to consider active measures to prevent these groups from the consequences of frequent turnover. For instance, if we find that older workers suffer heavy financial losses from layoffs, we may target income supports to this group.

There are several mechanisms by which quits and layoffs can decrease the future wage:

TABLE 1
Layoff and Quit Incidence by
Age for All Males
PSID Data

Age	14-23	24-33	34-43	44-53	54-63	All Ages
% with at least 1 layoff 1969-79	42.0%	37.4%	35.2%	31.0%	19.4%	31.5%
% with at least 1 quit 1969-79	73.7%	52.8%	48.6%	43.6%	32.6%	45.5%

First, the worker may have training which makes him highly productive on the current job but which is irrelevant to work with any other firm. This is what we mean by specific on-the-job-training (henceforth referred to as specific OJT or as specific training). The existence of specific OJT with an individual's current firm tends to increase his current wage relative to his potential wage with other firms.

Second, layoffs could be perceived by prospective employers as a sign of worker inferiority and thus lower the alternative wage offer to the job changer. Likewise frequent quitters may have lower wages than less mobile individuals. This effect is called "negative signalling".

Third, the worker will, in general, need to spend time and money in job search whenever he changes jobs. It presumably takes more time and money to find a high-paying job than a low-paying job. Each additional job change takes place at a later period in an individual's life. Therefore, each time job search takes place, the stream of potential benefits are smaller, cet. par., because there is less time until retirement. Therefore, each time a job change takes place, we expect the individual to invest less in job search and therefore gain less from the change. Further workers who tend to have frequent job changes would be expected to invest less in job search for each job change (and in less specific OJT) than less mobile individuals and therefore have lower wages.

In testing these proportions, we use a sample of males, 23-53 years old (in 1968) from the Michigan Panel Study of Income Dynamics. This study traces individuals' work histories from 1968 to 1981. It contains information on quits and layoffs between these two dates as well as 1968 levels of other relevant variables and changes in these variables between 1968 and 1980.

We restrict our sample to males because many females, particularly married females, tend to have fluctuations in labor force participation due to family responsibilities. This means that any study of effects of turnover on females requires a model of female labor force participation decisions since labor force exit is a more frequently used option for female workers. Such a study would be extremely interesting but is beyond the scope of this thesis.

The variable of interest in this thesis is the hourly wage rate rather than total yearly earnings. In focusing on the wage rate, we avoid the problem of labor supply determination. Hours of work is, to some extent, a choice variable for the worker. We wish to examine the effects of layoffs and quits on the wage faced by the worker in a future period apart from the labor supply decisions the worker makes in that period.

General Design of This Thesis

In Chapter II, we review the existing theoretical literature on human capital and OJT accumulation and turnover (Part A) and the empirical literature relating wage rates and growth in wage rates to past layoffs and quits (Part B).

Part A further divides into two sections. Section 1 includes models of OJT investment. Only one of these (Bartel-Borjas) considers the impact of firm specificity and layoff and quit probabilities on OJT. As we will see in the theoretical literature and in Chapter III, firms sometimes pay for part of firm specific OJT and therefore have some control over the quantity of an individual's specific OJT investment. However, the OJT models in Part A ignore the firm's role in the OJT decision. Section 2 (of Part A of Chapter II) reviews articles that model the layoff and quit decisions by firms and individuals, respectively. Each article considers the influence of specific OJT on these layoff and quit decisions and concludes that the returns to quits and layoffs are inversely related to specific OJT accumulated by the worker on the job.

In Part B of the literature review, we discuss the empirical literature on wages and job turnover. Many of these models fail to incorporate the existence of specific OJT into their analyses. Some, however, recognize not only the connection between job mobility and specific training loss, but also the connection between job tenure and specific training. Individuals who never acquire long tenure on a job because of frequent turnover should be those who acquire, cet. par., less specific OJT than immobile individuals. For such individuals, it is the lack of OJT that is the direct cause of low wages (if turnover is negatively related to low wages) rather than the job changes themselves. In fact, job changes may do little to harm those who acquire little specific training; those who acquire long job tenure, however, potentially acquire large amounts of specific training which increases vulnerability to turnover.

In Chapter III, we construct a model of OJT investment which incorporates both the literature on both individual OJT decisions and firm OJT decisions. We consider specific OJT investment decisions to be made jointly by both the worker and the firm. In particular, the relationship between specific OJT and likelihood of layoffs and quits is considered as a factor in the OJT model. The worker recognizes that an increase in specific OJT investment decreases his layoff probability as well as increasing his wage rate; the firm recognizes that an increase in specific OJT investment decreases the quit rate as well as increasing worker productivity. A unique feature of our model is that both the worker and the firm consider the decrease in turnover resulting from an increase in OJT investment as part of the marginal benefit from such investment. This decrease in layoff/quit probability will, therefore, be an argument in the worker/firm OJT investment function. After deriving a specific training investment function, we hypothesize that its arguments are functions of observable, measurable variables for the individual, e.g., tenure, age, education, race and occupation. Therefore, these variables are the ultimate determinants of specific OJT investment.

Since the quantity of this investment is positively related to loss from a layoff or quit, we conclude that this loss will be a function of tenure, age, education, occupation and race of the job changer.

In Chapter IV, we empirically test the proposition that the loss in wages from a layoff or quit depends on the variables that proxy OJT, i.e., tenure, age, education, occupation and race. This tests the third of the four hypotheses with which we began this chapter.

The dependent variable will be the log of 1980 average hourly earnings minus the log of 1968 average hourly earnings. We hypothesize that the dependent variable is a function of the proxy variables discussed above, turnover variables describing quit and layoff behavior and other control variables. To estimate the influence of the proxy variables on the effect of layoffs and quits on the dependent variables, we could interact the proxy and turnover variables. Alternatively, we disaggregate our regressions by the proxy variables which is equivalent to interacting them with each variable in the regression. The turnover variable will be geared as closely as possible to testing the other three hypotheses posed at the beginning of this Chapter. In other words, we differentiate job changes by whether:

(1) they are quits or layoffs

(2) they are before 1974 or after 1974

(3) amount of tenure prior to the job change.

The Chapter concludes with a discussion of the results.

In Chapter V, we summarize our findings and suggest further avenues of research.

Chapter II

Literature Review

In Section A of this Chapter, we summarize some of the theoretical literature on human capital/OJT investment. This literature is the basis for our model in the Theory Chapter which will show (1) that the gain from a job change is inversely related to amount of specific OJT a worker has on the current job, and (2) that the amount of OJT investment the worker accumulates is related to cost of OJT to both the individual and firm and to the expected increase in productivity and wages from another unit of investment. We will show that age, education, job tenure, occupation and race are proxies for these factors and therefore are good proxies for OJT.

In Section B of ths chapter, we shall discuss efforts in the literature to measure OJT empirically and to explain the effects of turnover on wages and on wage growth of various populations.

In our empirical work, we will extend the existing literature by demonstrating how the effects of layoffs and quits vary by age, education, race, job tenure and occupation. Our basic hypothesis is that those with personal characteristics associated with greatest specific OJT investment should lose the most, cet. par., from layoffs and quits. We will also try to discern how the layoffs and quits differ in the effect on wage growth and how timing of turnover influences wage growth.

We can separate the literature reviewed in Section A into that which models quantity of OJT investment from the point of view of the individual and that which discusses the relationship of specific OJT to quits and layoffs. Here, we briefly compare the articles in both groups.

Gary Becker examines the market an individual faces for human capital without regard to whether it is general or firm specific. His supply curve depends on the individual's ease of access to funds with which to purchase human capital and his demand curve depends on the individual's ability to learn. We will borrow his idea that the quantity of human capital investment is a function of ability.

Knapp and Hansen model K(t), the ratio of expenditure on OJT to potential earnings in time t. They suppose K(t) to be a decreasing function of work experience (t), with K(o) (ratio of OJT expenditure to potential earnings at start of work life) a function of one's personal characteristics. This is consistent with Becker's notion that a worker's characteristics affect the positions of demand and supply curves for human capital.

Knapp and Hansen's OJT function:

$$K(t) = K(o) - \frac{t\ K(o)}{T}$$

is somewhat restrictive. It implies that the OJT ratio, K(t), declines by exactly the same amount in each year, ignoring the possibility of job change and consequent commencement of new training programs.

Brown does not consider the possibility of job changes either, but his model of OJT investment is quite stylized. It specifies the marginal cost function of post school investments, and recognizes that the rate of return MG-1 grown over time and may depend on the individual's cohort.

These three authors model OJT investment, but they never consider how the prospect of a layoff or quit affects the investment decision or even recognize that some OJT is specific. Bartel and Borjas fill this gap to some extent. They suppose that a proportion, γ, of each unit of human capital investment is firm specific and find that γ is positively related to the expected remaining job duration. Further, their results imply that the amount of human capital investment is positively correlated with amount of time the worker expects to remain with the firm after the investment and therefore is negatively related to the likelihood of a layoff or quit. The structure of their model implies that the amount of general human capital investment as well as specific human capital investment increases with expected remaining duration of the job. Theoretically, there is no reason this assumption should be true. We can avoid it by allowing specific OJT investment and general investment to increase in different proportions, i.e., by allowing the specific and general OJT investment decisions to be made separately.

Our model will go even further in incorporating turnover into the OJT model than Bartel's and Borjas'. We show that the recognition of the effect of specific OJT on quit and layoff probabilities will influence the OJT decision. Decreased layoff probability is one of the benefits to a worker from additional OJT investment, and decreased quit probability is a benefit to the firm.

Becker, Hashimoto and Parsons deal explicitly with the relationship of specific OJT to layoffs and quits.

Becker lays the ground work. He argues that firms will be willing to pay for part of specific training only if they expect:

(a) that the worker will remain with the firm for at least some specified time period,

(b) that the worker's future marginal revenue product will be greater than the future wage. (Parsons refers to the gap between the two as firm-owned specific capital.)

If (b) holds, firms have an incentive to minimize layoffs and quits. In order to minimize quits, they may pay the worker a wage higher than his alternative wage. (Parsons refers to the gap between the two as worker owned specific capital.)

Hashimoto points out that the worker's post-training wage with the firm is often determined before post-training MRP and alternative wages are known to the firm and worker, respectively. If the post-training wage is rigid, non-optimal quits and layoffs may take place. We will borrow the idea that the post-training MRP and the alternative wage are unknown at time of the training and that the period 2 wage with the firm is set in period 1.

Parsons discusses the relationship of quits and layoffs to firm-owned and worker owned specific human capital.

Section A

Theoretical Literature

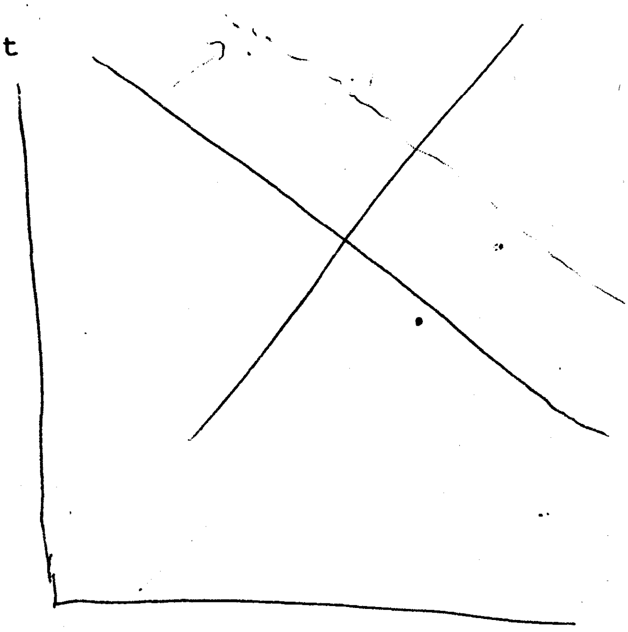
Part 1. Models of OJT

Becker[1] (1975) adapts the traditional models of investment in nonhuman capital to the determination of the amount invested in human capital by a "representative" person. He therefore posits a supply and demand curve for human capital. Further, he discusses how an individual's characteristics shift these curves. This discussion will be particularly relevant to our model of OJT investment which concludes with an equation that posits that the level of OJT accumulation is a (reduced form) function of an individual's characteristics.

The supply curve for human capital investment in Becker's model is upward sloping because investment (above a certain level) requires the individual to borrow at interest rates that increase with amount borrowed.

The demand curve is downward sloping because an individual's intellectual and physical capacities are limited so that eventually diminishing returns set in to human capital investment.

Obviously, a worker's supply curve for human capital depends on his family background, race, access to financing, etc. The worker's demand curve for OJT depends much more on his abilities, and more specifically, on his capacity to lear. The abler the worker is, the higher his increase in earnings given that he invests in an extra unit of human capital.



Graph 2.1 - Demand-Supply for Human Capital

The diagram shows that an increase in ability (to benefit from any level of human capital investment) will increase optimal investment. This supports our contention (in the next chapter) that the more able a worker, cet. par., the more OJT he will acquire.

Knapp and Hansen[2] (1976) explicitly take into account the tendency to concentrate human capital investment at the beginning of work life in their model. They also test empirically the hypothesis that OJT varies with education. Their basic model measures intensity of OJT investment in time t by

$$(2.1)\quad K(t) = \frac{C(t)}{E(t)} = 1 - \frac{Y(t)}{E(t)}$$

where C(t) = investment costs in time t

E(t) = potential earnings in time t

Y(t) = actual earnings in time t

Y(t)=E(t)-C(t)

t = years of work experience =

age - years school - 5

The OJT model is

$$(2.2)\quad K(t) = K(o) - (t)[K(o)/T]$$

where K(o) = investment ratio at the beginning of work life.

T is length of work life.

This model implies that K(t) declines linearly with time through work life until retirement (t=T)

with K(T) = 0

This investment function is rather restrictive. Although it appears reasonable that K(t) should, in general, decline with t, there is no reason it should decline by the same amount in each year. Also, other non-constant factors besides t should affect K(t). For instance, the individual may leave a job which involved no investment for one which requires much OJT, in which case there may be periods in which K(t) rises with t. Knapp and Hansen extend this model to hypothesize that K(o) for a particular individual is:

$$K(o)^i = K(\bar{o}) + K(o)^{i*}$$

where $K(\bar{o})$ is the mean of K(o) for the individual i's age/education group, and

$K(o)^{i*}$ is the deviation of $K(o)^i$ from the mean, with an expected value of 0,

$K(o)^{i*}$ is hypothesized to be a function of schooling and $K(\bar{o})$. In order to test this hypothesis empirically, Knapp and Hansen must estimate $K(o)^i$ for the members of their sample which is the Johns Hopkins Retrospective Life History Survey of males 30-39 years of age in 1968.

Their method[3] is as follows.

Assume $K(o)^i > 0$, and therefore $Y(o) < E(o)$, i.e., actual earnings at beginning of worklife are less than potential earnings. If we can find E(o), the level of income an individual would have had at the start of his work life if he had conducted no post school investment, we can find K(o) since Y(o) is available in the data set used.

Since K(t) declines with t and this model has no depreciation, there will be a value of $t > 0$, (call it $\hat{t}$) at which $Y(\hat{t}) = E(o)$, i.e., when actual earnings catch up with initial potential earnings. If it were true that C(t) was the same for all t, $\hat{t}$ could be found by the following:

(2.3) Let $Y(t_i) = E(o) + \left(r \sum_{t=1}^{t_i} C(t)\right) - C(t_i)$

where E(o) and C(t) are as defined above

$Y(t_i)$ is actual income in t_i (i=0...T)

r = the return to post-school investments

let $t_i = \hat{t}$

then

(2.4) $Y(\hat{t}) = E(o) + r \sum_{t=1}^{\hat{t}} C(t) - C(\hat{t})$

Since by definition, $Y(\hat{t}) = E(o)$,

(2.5) $r \sum_{t=1}^{\hat{t}} C(t) = C(\hat{t})$

Supposing (as suggested above) that C(t) is the same for all t, then

(2.6) $r \sum_{t=1}^{\hat{t}} C(t) = r\,\hat{t}\,C(\hat{t}) = C(\hat{t})$

and $\hat{t} = \frac{1}{r}$.

If we can somehow find r, the return on human capital, we can find $\hat{t}$. Then, from available data we can find $Y(\hat{t})$, which equals E(o). Finding Y(o) from the data, we can compute for each individual i,

(2.7) $C(o)^i = E(o)^i - Y(o)^i$

and thus

$$K(o)^i = \frac{C(o)^i}{E(o)^i}$$

Knapp and Hansen use estimates of r for different demographic groups from T. Johnson's[4] (1970) article. From this they find $\hat{t}$ for each group, $Y(\hat{t})^i$ for each individual i (reported income in time t), then $E(o)^i$ and finally $K(o)^i$ for each individual and $K(\overline{o})$ for each demographic group.

$K(o)^{i*}$ can be calculated from $K(o)^i$ and $K(\overline{o})$. Although it seems that $K(o)^{i*}$ must, on average be 0 within every demographic group, Knapp and Hansen hypothesize that $K(o)^{i*}$ is a function of $K(\overline{o})$ as well as education. OLS regressions are run for all demographic groups pooled with $K(o)^{i*}$ as the dependent variable, $K(\overline{o})$ and education as independent variables. The results show that $K(\overline{o})$ affects $K(o)^{i*}$ positively, and education affects $K(o)^{i*}$ negatively. Neither coefficient is significant at the 10% level. These results suggest that typical wage regressions give biased coefficients of education because education is actually picking up the effects of OJT on wages.

A problem with this analysis is that t equals 1/r only if C(t) is constant over time. There is no reason this should be true. In fact, it seems more likely that total post-school investment (and not just rate of investment) declines over time. In this case, $\hat{t} < 1/r$ (see Mincer, p. 17) and if income continues to grow past the true $\hat{t}$, income in t = 1/r will be an overestimate of E(o) and K(o) will be overestimated. Our assumptions will be less restrictive than Knapp and Hansen's regarding the timing of investment.

Charles Brown[5] (1976) presents an elaborate model of human capital investment. He actually specifies a cost function for human capital, and considers rate of growth in both returns to and costs of human capital over time and cohort effects on OJT determination. Finally, he attempts to estimate the parameters of his model.

In this model, the worker maximizes the present value of earnings.

$$(2.8)\quad V = \sum_{t=0}^{N} Y(t)(1+r)^{-t}$$

$Y(t)$ = net earnings at working at t

N is length of working life

r is rate of interest, and

(2.9) $Y(t) = R(1+g)^t K(t) - C(t)$ gives net earnings in time t where $K(t)$ is the stock of human capital at age t

R is the rental price of human capital at time t=0

g is the rate of growth in the rental price of human capital due to labor and human capital augmenting technical progress, price inflation, etc.

R and g are assumed independent of hours worked by the individual.

$C(t)$ is the cost of investment

Investment is $I(t) \equiv K(t+1)-K(t)$

$$(2.10)\quad C(t) = \frac{a}{B} I(t)^B (1+g)^t \qquad B > 1$$

Equation 2.8 can be rewritten substituting 2.9 and 2.10 and the resulting equation can be maximized with respect to I(t).

Given K(o), this maximization process yields an optimum series of I(t) which further implies an optimal path for Y(t). This is (see Brown for intermediate steps):

$$(2.11)\ Y(t) = (1-g)^{t}\{ R\ K(o)+C[\sum_{S=0}^{t-1} P(N-S)^{\alpha} - \frac{1}{B} P(N-t)^{B\ \alpha}]\}$$

where

P(N-t) is the present value of a dollar per year for N-t years

$\alpha \equiv 1/B-1$

$C = R(R/a)^{\alpha} = a(R/a)^{\alpha B}$

One more twist is added: K(o) is allowed to be a function of the individual's cohort (year he started work). Call the cohort v. Then

$R(v) = R(o)(1+g)^{v}$

$a(v) = a(o)(1+g)^{v}$

K(o,v) = human capital of cohort v in t=0

K(o,v) might increase over v, for example, if skills previously learned in the labor market came to be learned in school. On the other hand, in a sample selected by years of schooling, K(o,v) might decline with v, as average schooling levels increased throughout the economy, the "ability" range from which the typical high school graduate is drawn may decline.

Then

$$(2.12)\ Y(t,v)= (1+g)^{v+t}\{R\ K(o,v)+C(o)[\sum_{j=0}^{t-1} P(N-S)^{\alpha} - \frac{1}{B} P(N-t)^{\alpha B} \}$$

Using non-linear techniques, Brown estimates B, D, and C using a 5225 member sample of the civilian non-institutional male population age 14-24, originally interviewed in 1966, the sample members include only those who had completed exactly 12 years of schooling in 1966, were out of school in 1966 and who reported a wage in 1966 and each of 3 subsequent survey dates.

Three different alternative assumptions were made about g.

(1) g is .13, the rate of growth in consumer prices between 1966 and 1969.

(2) g = .19, the rate of growth in average gross hourly earnings in the private sector between 1966 and 1969.

(3) g = .32. This is based on the rate of increase of wages of sample members age 20-24 in 1969 over wages of sample members 20-24 in 1966.

The results are:

Table 2.1 - Estimates of Parameters
Using Different Assumptions About Inflation

	g =.13	g =.19	g =.32
B	1.792	1.468	1.149
D	1.010	1.010	1.010

In this model, OJT is completely determined by the parameters. No allowance is made in this model for job change and loss of specific human capital.[6] Our model will address this issue in detail.

Bartel and Borjas[7] (1977) are the first among these authors to recognize that the return to OJT depends on the extent to which it is firm specific. Their model incorporates the notion that benefits from specific OJT investment depend on expected remaining tenure on the job.

In order to derive the optimal quantity of OJT, they first model marginal cost and marginal revenue functions for OJT and the expected time remaining on the job at time of OJT accumulation. Total expenditure on OJT by the worker in time t is given by the cost function:

(2.13) $C_t = \frac{\alpha\lambda}{B} Q_t^B \qquad \alpha > 0,\ B > 0$

where Q_t = total number of units of OJT acquired by the workers in t.

λ is the fraction of total cost of OJT investment in time t paid for by the worker, $\lambda \leq 1$.

λ will be less than 1 if the firm pays for part of specific OJT.

All general OJT will be paid for by the worker (see discussion of firm investment in OJT below). If γ is the proportion of human capital investment which is specific and if σ is the employee's share in the cost of and returns to specific training,

$\lambda = 1-\gamma(1-\sigma)$

where σ is the percentage of specific OJT paid for by the worker.

Then the marginal cost of OJT to the worker is:

(2.14) $\alpha\lambda\ Q^{B-1}$

Let a_o = the rental value on each unit of human capital.

Then, marginal return on general human capital is:

$$(2.15)\quad a_o = \int_o^{T-t} e^{-rv}\, dv$$

where r is the discount rate

t is the year of investment

T is the year of retirement (assumed known).

Before expressing the marginal return on specific capital, define:

T_t^* = expected total duration of the current job as of time t

j = current job tenure in time t

So T_t^* - j is expected remaining job duration. Then the marginal return on specific OJT is:

$$(2.16)\quad a_o \int_o^{T^*_t-j} e^{-rv}\, dv$$

Since γ of each unit of human capital is specific OJT and $1-\gamma$ is general capital, the marginal return to an extra unit of human capital is:

$$(2.17)\quad MR_t = a_o(1-\gamma) \cdot \int_o^{T-t} e^{-rv} dv + a_o \gamma\sigma \int_o^{T_t^*-j} e^{-rv} dv$$

Next T_t^* is modelled

$$(2.18)\quad T_t^* = T_t^*\ (\gamma, j, \pi, \sigma)$$

π is the individual's total prior work experience in time t.

γ, j, σ are as defined above.

(2.19) $\frac{\partial T^*_t}{\partial \gamma} > 0 \quad \frac{\partial T^*_t}{\partial j} > 0, \quad \frac{\partial T^*_t}{\partial \pi} > 0 \quad \frac{\partial T^*_t}{\partial \sigma} \gtrless 0$

$\frac{\partial T^*_t}{\partial \gamma} > 0$ because likelihoods of quits and layoffs in any period are inversely related to proportion of human capital that is specific.

$\frac{\partial T^*_t}{\partial j} > 0$ because amount of firm specific OJT is positively related to tenure already completed on the job and expected remaining job duration is positively related to specific OJT already accumulated on the job. Therefore, total expected job duration is a positive function of already completed job duration.

$\frac{\partial T^*_t}{\pi} > 0$ (with some exceptions discussed below) because incentives to quit are greater, cet. par., the younger the individual. The reason is that the time span over which returns to mobility are collected is inversely related to age at the times of job change. So quits will be negatively related to prior work experience.

The sign of $\frac{\partial T^*_t}{\partial \sigma}$ is ambiguous. In this model, σ, the share of investment for which the individual pays is equal to his share of the returns, the greater the worker's share of the returns (argue Bartel and Borjas) the more incentive the worker has to avoid turnover and the less incentive the employer has to avoid turnover.

Finally, Bartel and Borjas derive Q_t (units human capital investment) and show some interesting partial derivatives.

Setting $MR_t = MC_t$

(2.20) $Q_t = MR_t^{1/B-1} (\alpha\lambda)^{-1(B-1)}$

Taking partial derivatives with respect to π, j yield implications relevant to this thesis:

$$(2.21)\ \frac{\partial Q_t}{\partial \pi} = G[\overset{-}{a_o(\gamma-1)\ e^{-r(T-t)}} + \overset{+}{\frac{\partial T_t^*}{\partial \pi}\ a_o\gamma}\ \sigma\ e^{-r(T_t^*-j)}]$$

where $G\ (\partial\lambda)^{-1/B-1}\ (\frac{1}{B-1})\ \cdot\ MR_t^{\exp}\ [(2-B)/B-1)]$

The first term in equation (5) is the effect of π on the returns to the general training portion of human capital investment. It is negative since the older the individual is at time t, the smaller payoff period to general training. The second term operates through the functional dependence of T_t^* on π. We have seen that T_t^* is likely to depend positively on π since the gains from mobility decline with age. This result, however, is limited by the finiteness of work life. Therefore, at younger ages the effect of π on Q_t via T_t^* is positive and the total effect of π on Q_t is ambiguous. At later stages of life, when $\frac{\partial T_t^*}{\partial \pi}$ approaches 0 increase in age will have a negative effect on Q_t.

$$(2.22)\ \frac{\partial Q_t}{\partial j} = G[\overset{-}{a_o(\gamma-1)\ e^{-r(T-t)}} + (\frac{\partial T_t^*}{\partial j} - 1)\ a_o\gamma\sigma\ e^{-r(T_t^*-j)}$$

Equation 2.22 shows that j also has two opposing effects on Q_t.

An increase in j, holding T_t^* constant, decreases T_t^*-j or expected remaining time on the job held in t. This, of course, decreases the marginal return to specific human capital. Further, an increase in j, holding age of retirement constant increases π which decreases the marginal return to human capital. This latter effect can be seen in the first term of 2.22 while the former is incorporated in the second term.

However j may also increase T*. Bartel and Borjas impose the assumption that for younger workers

$$\frac{\partial T_t^*}{\partial j} > 1, \text{ but } \frac{\partial T_t^*}{\partial j \partial \pi} < 0$$

(that is, $\frac{\partial T_t^*}{\partial j}$ declines as t approaches retirement age).

If $\frac{\partial T_t^*}{\partial j} > 1$, which is likely for younger workers, the second term of 2.22 is positive because j increases expected remaining job duration.

There are two major respects in which this model differs from ours.

(1) The proportion of specific to general human capital investment in any period is the same for every unit of investment. In our model, general and specific OJT investment may take place separately so that the worker can, in theory, increase specific OJT without any increase in general OJT and vice-versa. Thus, we do not have an increase in experience increasing general human capital through it's (usually) positive effect on T_t^* as T_t^* is, at least, in theory irrelevant to general human capital investment. In our model, if we were predicting the effect of

experience on general human capital investment, it would be unambiguously negatively. We do recognize that ageing may, in theory, increase investment in specific OJT.

It is true that, in practice, it is not always possible to provide specific OJT without general training and vice versa. However, it seems more unrealistic to impose the condition that each unit of training is exactly the same mix of general/specific than to assume they can be acquired separately.

(2) We will not assume that the worker's share of the return to OJT is the same as his share of the costs. The wage will depend only on total specific OJT. Therefore, an increase in total firm specific OJT will decrease the probability of both quits and layoffs in this thesis, but the division in costs between firm and worker is irrelevant. Firms may pay for instance wage premiums (in our model) above the share of the OJT cost borne by the worker. The rationale for this is that both workers and the firm include the probability of turnover as arguments in their respective objective functions, and thus regard decrease in turnover as one of the benefits of additional OJT investment.

Borjas and Bartel make one more important point: that specific OJT investment will be at a minimum in the last year of a job (assuming that at that time, the worker knows he is going to change jobs). At the start of the new job, γ may increase sharply. Therefore, specific OJT investment will not necessarily decline through life.

Part 2. Basis in the literature for the connection between OJT and turnover.

Most articles concerned with OJT are based on Becker's theory of general and specific on-the-job-training.[8]

General OJT increases the future marginal product of workers not only in the firm providing it, but in other firms as well. Therefore, if a worker only had general OJT, the firm would have to pay him at least his marginal revenue product in every period or lose him to other firms.

Therefore, the firm will be unwilling to pay for general training. Workers who acquire general training in t_o will either have to pay for it outright, or accept a wage in t_o below MP'_o, the t_o marginal product by C (the total cost of the training).

However, not all OJT is general. "Clearly, some kinds of training increase productivity more in firms providing it than in other firms."[9] Training that has no effect on the productivity of trainees with other firms is called specific training. Firms often provide OJT that is partly specific and partly genera. Firms will in general share the costs of specific OJT.

The effect of investment on productivity in other firms depends partly on regional market conditions. Very strong monopsonists would be able to regard much of their training as specific; since they do not compete with other firms for labor, workers cannot use training monopsonists provide with other firms without incurring moving costs.

If all training were general, turnover would be harmful neither to the firm or the worker. A worker with only general training who is laid off can, in theory, get an equally high wage elsewhere. A firm that has workers with only general training quit can, at no loss, hire equally competent workers.

However, the existence of specific training renders turnover less desirable. A worker, to the extent that he pays for specific training (by accepting initial wages below marginal product) gets "stuck" with useless firm specific OJT if he is laid off. A firm, to the extent that it pays for specific OJT gets "stuck" if a trainee quits, because it cannot replace the trainee without paying for more training. Employers recognize that the likelihood of a quit is not fixed, but depends on wages. Since it is in the employer's interest to reduce turnover if he pays for OJT, he might offer a worker, in whom he has invested, higher wages than the worker could get elsewhere. This is equivalent to offering the worker some of the returns from training. The offering of higher wages would, however, make the supply of trainees greater than the demand. To remedy this "the final step would be to shift some training costs as well as returns to employees, thereby bringing supply more in line with demand." Thus firms and workers will tend to share specific training costs <u>and</u> returns. Wages after the training period will be lower than the current productivity and higher than the worker's alternative wage, assuming that post-training productivity with the current job is greater than productivity on alternative jobs.

Therefore, the more specific OJT a worker has, the less likely, cet. par., he is to quit or be laid off and the higher his wage. This assumption will be incorporated in our OJT model.

In a two-period model by Hashimoto (1981), specific OJT investment is shared by worker and firm.[10] Also, he introduces the assumptions that in the period in which the investment is made, post-training (i.e., second period) productivity of worker with the firm and the worker's alternative wage are unknown. We shall use these assumptions below (in the Theory Chapter).

The actual value of the marginal product of the trainee, $\tilde{v}$, to the firm in the second period is:

(2.23) $\tilde{v} = H+(m+\eta)h = v+ h\eta$

where:

H is units of completely general human capital

m = the average (expected) value of a unit of specific OJT (done in t_1) to the firm

η is a random component with a density function $\phi(\eta)$

$E(\eta) = 0$

$m+\eta$ = actual value of a unit of OJT to the firm

h = units of specific OJT

v is the average value of the marginal product of the trainee in the second period.

The wage of the worker at alternative employment is given by

(2.24) $\hat{Y} = H+\varepsilon h$

where

ε is some random component with a density function of $\psi(\varepsilon)$

with $E(\varepsilon) = 0$, $\text{Cov}(\eta,\varepsilon) = 0$

It seems illogical that h (units of specific OJT) should affect earnings on alternative employment $\hat{Y}$. Possibly, Hashimoto is thinking that not all OJT that firms and workers suppose to be firm specific is useless with other firms. He does not, however, elaborate on this point.

The interpretation of a negative value of ε is also questionable. $\varepsilon < 0$ implies that the alternative wage is less than the value of general human capital by some fraction of h.

His model fails to take into account the possibility of random shocks in demand by other firms, for workers with general training (regardless of h). In our model, we allow the alternative wage to be a random variable even though specific OJT is constrained to be useful only to the firm with which it was acquired.

In Hashimoto's model, the wage of the worker who is still with the firm in period 2 is w, where:

(2.25) $w = H+\alpha R$ $\qquad\qquad 0 \leq \alpha \leq 1$

and $\quad R = mh$

In other words, the increase of the period 2 wage with the period 1 firm over the value of general training is some fraction (α) of the average value of the specific training to the firm or hm (where m and h are as defined above).

Before the second period, but after training, both the actual value of the marginal product of the worker to the firm ($v+\eta h$) and the true alternative wage of the worker ($\hat{Y} = H+\varepsilon h$)

become apparent to the firm and the worker, respectively. Prior to training (and when specific OJT decisions are made) only the average values of $\hat{v}$ and $\hat{Y}$ ($v = H+mh$ and $Y = H$) are known.

When the true values of ε and η (and therefore of $\hat{Y}$ and $\hat{v}$) become known, the worker knows the true alternative wage $\hat{Y}$, and the firm knows the employee's true contribution to profit $\tilde{v}$. The worker will quit if the alternative wage is higher than w (period 2 wage with the same firm) i.e., if $w-\hat{Y} < 0$,

or if

(2.26) $\varepsilon > \alpha m \equiv \varepsilon^*$

The employer will dismiss the worker when the worker's true MRP is less than w, i.e., if $\hat{v} - w < 0$,

or if

(2.27) $\eta < -(1-\alpha)m \equiv \eta^*$

These are both different from the jointly optimum separation rule[11] or

(2.28) $\hat{v} - \hat{Y} \leq 0$, i.e., $m \leq (\varepsilon-\eta)$.

$\hat{v} - \hat{Y}$ is the difference between the value of the trainee to the firm in period 2 and the trainee's value to alternative firms (in perfect competition, his alternative wage) in period 2.

So the parties may experience separations which would not occur if α could be costlessly adjusted after the values of ε and

η became apparent. Hashimoto remarks that there is a moral hazard problem if ε is known only to workers and η to firms; that is, workers have an incentive to overstate ε and firms to understate η. The parties may (since α cannot be costlessly adjusted) impose external effects on each other by unilaterally separating and cause a partial dissipation of the return from investment. They will in this model choose α to minimize the dissipation of the return. Hashimoto shows that the optimum value of α (worker's share of return to specifit OJT) is equal to workers share in the cost of specific OJT.

Parsons (1972) recognizes[12] that quit and layoff probabilities are inversely related to specific OJT accumulation. He estimates the relation between these probabilities and variables related to specific OJT. He hypothesizes:

(a) that both firm specific and general human capital are a function of a worker's characteristics

(b) that industry layoff rates are a negative function of employer owned firm specific human capital investment (i.e., gap between marginal revenue product and wages) and

(c) that industry quit rates are a negative function of employee owned specific human capital investment (i.e., net value of the sum of the difference between wages in each year with the current firm and the alternative wage).

The firm maximizes the present value of profit over two periods, although it exists before and after these two periods. It faces the constraint that once a trainee is laid off, any training benefits to the firm may be unrecoverable even should it be profitable to rehire the worker; only a certain percentage of the pool of laid off trainees, θ, will remain unemployed and available for rehiring in future periods.

The max problem for the firm is

$$(2.29) \quad \mathcal{L} = \sum_{t-1}^{2} (P_t Q_t - W_{1t} - W_{2t} S_{2t} - e \cdot l_{Y_t})^{t-1}$$

$$-\lambda \, (R_2 + D_2 - Z_2)$$

where: P_t = price of product in t

Q_t = output in t

W_{1t} = wage of trained workers in t_1

W_{2t} = wage of trainees in t

S_{1t} = number of trained workers in t

S_{2t} = number of trainees in t

e is the direct cost of each layoff to the firm (consisting of severence pay, increased contributions to unemployment insurance and processing costs of each layoff)

l_{yt} = number of layoffs in t

$\delta = \frac{1}{1+r}$ (r is the discount rate)

R_2 is the number of workers rehired in t_2 from the pool of laid off workers

D_2 is a non-negative slack variable

Z_2 is the rehire pool in t_2

(2.30) $Z_2 = \theta^2 Z_0 + \theta(l_{Y1} - R_1)$

where Z_0 is the pool of trainees available for rehire in time 0 and θ is the per period retention rate of workers in the pool. $\theta < 1$.

In other words, out of the original pool from time 0, Z_0, $\theta^2 Z_0$ are still unemployed in t_2. This is part of the rehire pool in t_2 (i.e., Z_2). Workers who were laid off in t_1 (if any) and who have not found other jobs are another part of the rehire pool in t_2. There are θl_{Y1} of these. On the other hand, if rehires rather than layoffs took place in t_1, Z_2 is decreased by θR_1.

Note that only laid off workers can be rehired. No one who quit can come back to this firm even if he is laid off by the new firm(s).

All t_1 trainees still with the firm in t_2 are considered trained workers in t_2 so:

(2.31) $S_{1t} = S_{1,\, t-1} + S_{2,t-1} - q_t - l_{Y_t} + R_t$

q_t = quits in time t

Parsons implicitly assumes all trainees are identical and all trained workers are identical; there are no discharges for cause, only layoffs due to "insufficient" demand. No mention is made of the decision of which particular trainees or trained workers to lay off.

The quit function for trainees in t is:

(2.32) $q_t = q(\overset{-}{w}_{2t}, \overset{+}{w}_{3t}, \overset{-}{w}_{1,\, t+1}, \overset{+}{w}_{3t+1}, \overset{+}{l}_{Y_{t+1}})$

where: w_{2t} is the wage paid to trainees in t

w_{3t} is the alternative wage in t

$w_{1,\ t+1}$ is the wage paid to trained workers in t+1 (by which time those who were trainees in time t are finished with training and considered trained workers)

$w_{3,\ t+1}$ is the alternative wage in t+1

(Assume $w_{1,\ t+1}$ and $w_{3,\ t+1}$ are known with certainty)

ly_{t+1} is the expected number of layoffs in period t+1. Industries in which workers believe there will be many future layoffs will have a high quit rate.

The signs over the variables denote the signs of the respective partial derivatives.

The supply schedule of trainees takes a similar form:

$$(2.33)\quad S_{2,t} = S(\overset{+}{w}_{2,t}, \overset{-}{w}_{3,t}, \overset{+}{w}_{1,t+1}, \overset{-}{w}_{3,t+1}, \overset{-}{l}_{Y_{t+1}})$$

w_{2t} = wage in t for trainees

The Lagrangian (2.29) is maximized substituting in equations (2.30) to (2.33).

The firm's choice variables are $w_{1,t}$, $w_{1,t+1}$, $w_{2,t}$, ly_t, ly_{t+1}, R_2, D_2. Since corner solutions for a number of these variables are possible (i.e., $D_2 = 0$, $ly_{t+1} = 0$), non-linear programming techniques are appropriate.

Parsons derives the Kuhn-Tucker necessary conditions for a profit maximum (not reproduced here). They imply that if the net marginal contribution of trained workers to profit in t_2 times the proportion of trained workers who would be lost forever if laid off (1-θ), is positive, layoffs in t_1 will not be non-zero unless the loss in t_1 profit from keeping a marginal worker on is negative and large enough in absolute value to offset future losses from current layoff.

After setting down this basic model, Parsons derives industry quit rates and layoff rates as a function of observable values in the following manner:

(2.34) $ly = f(S_f)$

where ly is the industry layoff rate

S_F is average industry quantity of firm owned specific OJT MP-W

$ly/\ S_f < 0$

(2.35) $q = q(S_W)$

where q is the industry quit rate

S_W is worker owned specifit OJT

$S_W = W - (W_A - T_C)$

W is the wage with the current firm

W_A is the highest wage with alternative firms

T_C is transfer costs of a job change to the individual

$\partial q/\ S_W < 0$

Parsons hypothesizes that:

(2.36) $W = a_1 G + a_2 S_W$

where G = general human capital of the worker

Rearrange terms:

$$S_w = \frac{W - a_1 G}{a_2}$$

Parsons assumes that $a_1 \approx a_2$, i.e., that general and specific human capital investments are about equally profitable. (This seems questionable, due to the extra risk involved in worker investment in specific capital, specific capital investors should require a premium, i.e., $a_2 > a_1$, unless they are risk lovers.)

If $a_1 \approx a_2$,

$$S_W = \frac{W}{a_2} - G \qquad \text{Further,}$$

$$G \equiv T - S$$

where T = total human capital and S = specific human capital

(2.37) So $$S_W = \frac{W}{a_2} - T + S$$

For a particular industry, T and S are hypothesized to have the following functions

(2.38) $S = S(\overset{+}{\text{mean wage}}, \overset{+}{\text{mean Education}}, \overset{+}{\text{\%managers in industry}}, \text{mean job}$

$\overset{+}{\text{tenure}}$, capital-labor $\overset{+}{\text{ratio}}$, $\overset{+}{\text{\%rural}}$, industry $\overset{+}{\text{unioni-}}$

zation index, industry concentration $\overset{+}{\text{ratio}}$, $\overset{-}{\text{\%young}}$,

$\overset{+}{\text{\%old}}$, $\overset{?}{\text{\%white}}$, $\overset{?}{\text{\%female}}$)

(2.38A) T = T(mean $\overset{+}{\text{education}}$, $\overset{+}{\text{\%professional}}$, $\overset{+}{\text{\%managers}}$, mean job

$\overset{+}{\text{tenure}}$, capital-labor $\overset{+}{\text{ratio}}$, $\overset{-}{\text{\%south}}$, union $\overset{+}{\text{index}}$, con-

centration $\overset{+}{\text{ratio}}$, $\overset{+}{\text{\%white}}$, $\overset{-}{\text{\%female}}$, $\overset{-}{\text{\%young}}$, $\overset{?}{\text{\%old}}$)

(2.39) Since $(MP-W) = S_F \equiv S - S_W$,

$$S_F = S - \frac{W}{a_2} + T - S = \frac{W}{a_2} + T$$

and $\dfrac{\partial S_f}{\partial X_C} = -\dfrac{1}{a_2} + \dfrac{\partial T}{\partial X}i$ if $X = W$

otherwise $\dfrac{\partial S_F}{\partial X_i} = \dfrac{\partial T}{\partial X_i}$

From (2.37)

$$(2.40) \qquad \frac{\partial q}{\partial X_i} = \frac{\partial q}{\partial S_W} - \left(\frac{\partial T}{\partial X_i} + \frac{\partial S}{\partial X_i}\right)$$

for all X_i but W

and from (2.39')

$$(2.41) \qquad \frac{d\ell}{dX_i)} = \frac{\ell}{S_W}\left(\frac{T}{X_C}\right)$$

Using 47 Census Bureau 3 digit manufacturing industries, Parsons regresses quit and layoff rates on these X_i variables and w. The dependent variables are quits per 100 workers and layoffs per 100 workers.

Table 2.2 - Regressions Results Effects of Personal Characteristics on Industry Quit & Layoff Rates

A. Quit Rate Regressions

	1959		1963	
	Coefficient	+ Value	Coefficient	+ Value
Constant	5.00	5.10	4.8290	4.17
Income	-.0004	-2.63		
Education	.0799	.80	-.0111	- .12
Capital/Worker			-.0179	-3.13
%Managers	-.0424	-1.70	-.0166	- .58
%Professionals	.0247	2.67	.0227	2.10
Tenure	.0258	1.09	.0368	1.33
%Younger	.0368	1.96	.0289	1.47
%South	-.0030	-1.40	-.0022	- .65
%Rural	-.0080	-1.76	-.0026	- .49
Concentration ratio	-.0135	-4.38	-.0152	-4.25
White	-.0268	-3.36	-.0181	-1.98
Female	-.0054	-1.34	-.0067	-1.68

B. Layoff Rate Regressions

	1959		1963	
	Coefficient	+ Value	Coefficient	+ Value
Constant	4.9360	1.19	1.5160	.44
Income	.0015	3.71		
%Production Workers			.0419	3.73
Education	-.8373	-2.60	-.6440	-2.63
%Professional	.1461	4.00	.1431	5.00
Capital/ Worker	-.00005	-1.97	-.0003	-2.26
%Younger	.0932	1.52	.0602	1.18
%Older	.1263	2.28	.1230	2.66
Tenure	.0896	1.09	.1610	2.37
%White	-.0579	-2.18	-.0266	-1.14
Union	.0146	1.17	.0041	.42
Concentration Ratio	-.0380	-3.06	-.0230	-2.44

The results for the quit regressions are as expected. An increase in earnings decreases the quit rate, but only very slightly (by .0004).

Industry quit rates in 1959 decline by .0424 for each increase in the proportion of workers who are managers and increase by .0247 for each increase in the proportion who are professionals. This suggests a strong correlation between percent managers and specific OJT and a correlation between percent professionals and general OJT. An increase in the percent rural workers decreases the quit rate by .008. As Parsons suggests, percent rural may have a negative coefficient because rural workers are isolated and have limited access to information about alternative jobs.

An increase in the concentration ratio decreases the quit rate by .0135 and an increase in percent white decreases the quit rate by .0268. Results for the 1963 regressions are similar except that the coefficients of percent managers and percent rural are insignificant.

For the 1959 layoff regressions an increase in earnings increases the layoff rate slightly by .0015 consistent with the hypothesis that earnings are positively related to worker owned specific OJT. An increase in mean education decreases the layoff rate by .8373. An increase in percent professionals increases l_{Yt} by .1461, but an increase in the capital worker ratio decreases the layoff rate. The industry layoff rate is positively related to the percentage older workers, possibly because "sunset industries" have a large proportion of older percent workers. An increase in the percent of older workers by 1, decreases the layoff rate by .1263 and a 1% increase in the concentration ratio decreases the layoff rate by .0380.

Parsons does not allow the future alternative wage or the post-training marginal revenue product to vary. (We will assume both are random variables.) His model, however, is very similar to ours in spirit. Layoff and quit rates are a function of specific capital which in turn is a function of individual characteristics. His interest is in the effect of average industry levels of various personal characteristics on industry layoff and quit rates, and it is layoffs and quits that are the decision variable for the firm rather than OJT investment.

Our contribution will be a model of specific OJT investment considering the interests of both the firm and the worker. In particular, we examine how theses interests are affected by the effect of specific OJT on layoffs and quits.

Section B. Empirical Literature

The relevant empirical literature can be divided into two parts: 1) articles presenting wage (or wage growth) regressions that include layoffs and quits among the independent variables; and 2) articles presenting empirical evidence on the relation of level of human capital investment to job tenure.

The first article in part 1 by Black, makes no distinction between workers by age, race or occupation. By including all sample members in each regression, he appears to assume that turnover affects workers of all ages, races and occupations equally. Cooke, on the other hand restricts his sample to a specific occupational group, scientists and engineers. In chapter 3, we will show that such a restriction should improve the results; how much one has to lose from a layoff or quit depends on one's occupation.

The Cooke article, however, is flawed in the use of level of yearly earnings as the dependent variable. It is possible that low earnings individuals get laid off more than high earnings individuals; if so, Cooke's results that those with past layoffs earn less than immobile individuals may be due to spurious correlation between earnings and layoffs.

Jacobsen also runs regressions with the level of yearly earnings as the dependent variable. His contribution is recognizing that loss from leaving an industry varies by:

a) how recent the departure was;

b) which industry the worker left.

The Blau and Kahn article uses the difference in the log wage between t_1 and t_2 as the dependent variable. This (unlike the methods used by Cooke and Jacobsen) takes into account differences in the individuals' wages prior to the layoff and can thus more closely estimate the true loss from a layoff.

Blau and Kahn also recognize that the effect of a layoff may differ between males and females and between whites and blacks; they disaggregate their sample accordingly. Further, they restrict their sample to workers age 14-24, recognizing that age may affect a worker's resiliency after a layoff.

In part 2, Borjas attempts to measure the OJT accumulated by older men on past jobs and to relate the quantity of the OJT to past job mobility.

Borjas and Bartel investigate the relationship between turnover and previous wage growth in order to shed light on the relationship between OJT and the tendency to change jobs. Lastly, Bartel regresses growth of earnings on the job and between job on dummies denoting job mobility patterns. This yields further information about the relationship of OJT and job mobility.

PART 1

Wage Regressions Using Turnover Variable

Matthew Black,[13] (1980) discusses the effects of quits on the ratio of log of 1973 wage rate to log of 1971 wage rate using the Panel Study of Income Dynamics from the University of Michigan. He hypothesizes that:

1. Returns to quitting are increased by prior on-the-job search, i.e., effort to find a new job while still employed on the old job.

2. Returns to quitting are limited by exploitable market wage opportunities specific to a worker's skills, i.e., by how much he is being underpaid on his current job relative to the average worker with his skills.

This is measured by $\Delta\hat{W}_t$ where:

$$\Delta\hat{W}_t = \frac{\hat{Wm}_t - W_t}{W_t}$$

$\hat{Wm}_t$ is the predicted value obtained from regressing the 1971 wage rate against human capital, local wages for unskilled labor, personal background characteristics and all of the above interacted with a race dummy, and W_t is the actual wage in 1981. $\hat{\Delta W}_t$ is a proxy for the opportunity cost of staying with one's 1971 job. Therefore gains from

quitting should be directly related to $\hat{\Delta W}_t$.
Unfortunately, $\hat{Wm}_t$ may be a flawed measure of what an individual is "worth" in the market; if W_t is $<\hat{Wm}_t$, it may be because of unmeasured characteristics rather than placement in the wrong job.

Returns to quitting are limited by the number of vacancies which is related to the local unemployment rate. Black's model is:

$$\ln\left(W_{t+2}/W_t\right) = B_1\, EXP_t + B_2\, \Delta\, HS_{t+2}$$

$$+ B_3\, \Delta U_{t+2} + B_4\, POP_t + B_5\, ED_t \qquad (2.42)$$

$$+ B_6\, IQ + B_7\, Z + \varepsilon$$

where:

$\ln\left(W_{t+2}/W_t\right)$ = log of ratio of wage rate in time t+2 to wage rate in time t.

EXP_t = years work experience in time t.

HS_t = health status in time t

ΔU_{t+2} = change in local unemployment rate between time t and time t+2.

POP_t = population in time t

ED_t = education in time t

IQ_t = IQ in time t

Z = is the product of a column vector which is equal to the transpose of [1, S, Q, S.Q] and a row vector

$[1, \Delta\hat{W}_t, U_t, \Delta\hat{W}_t \quad U_t]$

where

U_t = unemployment rate in time t in local labor market

S = 1 if person conducted on the job search but did not quit, 1971-1973

Q = 1 if person quit without prior job search, 1971-1973

S·Q = 1 if person conducted OJS and then quit, 1971-1973.

Those who quit after OJS are presumably better informed than those who quit without prior search, so we expect the coefficient of S.Q to be greater than that of Q. The higher the rate of unemployment in one's local labor market, the less the return from quitting, so the coefficient of Q.U should be less than that of Q. The higher $\Delta\hat{W}_t$, the higher should be the returns from quitting so $Q.\Delta\hat{W}_t$ should have a higher coefficient than Q.

Black uses a data source of 425 black and 1084 white males. Although he does not say he has eliminated workers who were laid off between 1971 and 1973, he calls workers who did not quit "immobile" which suggests those laid off were excluded from the sample.

Regressions are run using different combinations of Z,

$\Delta\hat{W}_t$ and U_t to denote quits and market opportunities.

The results for selected variables in 2 of the equations are.

Table 2.3: Regression REsults for Search and Quite Variables

I.	Variable	Coefficient (t ratio)
	Q	-.187 (4.64)
	S	-0.56 (2.09)
	Q x S	-.049 (.92)
II	Q	-.226 (4.96)
	S	-.092 (2.97)
	Q x S	-.166 (2.81)
	$\Delta\hat{W}$	.056 (2.46)
	S x $\Delta\hat{W}$	.170 (2.92)
	Q x $\Delta\hat{W}$	.123 (1.37)
	S x Q x $\Delta\hat{W}$	.478 (4.26)
	Q x U_t	.169 (1.63)
	S x U_t	.074 (1.19)
	S x Q x U_t	-.307 (.92)
	Q x ΔW x U_t	-.287 (-2.40)
	S x Q x $\Delta\hat{W}$ x U_t	.555 (1.43)

Equation I, suggests that those who only quit or only searched did significantly worse than those who did neither, while those who both quit and searched had wage growth which was not significantly different from immobile workers who conducted no job search. Black speculates that this bleak view for quitters was due to the slack labor markets in 1971-1973. It seems odd that those immobile workers who conducted on-the-job search did worse than immobile workers who did not. One possible explanation is that immobile searchers with few skills were induced to search by low wage growth, rather than hurt by the search per se. The low wage growth searcher who does not find a "better", higher paying job is stuck with the current, low wage growth job.

In equation II, $\Delta \hat{W}_t$ and U are added, both on their own and interactively with the search and quit variables. Q x S becomes negative and significant at the 1% level. This suggests that many people either quit for non-precuniary reasons or are ill-informed even after on-the-job search. The impact of quitting and searching seems to be heavily dependent on ΔW as can be seen from the relatively large and significant coefficient of $S \times Q \times \Delta \hat{W}$.

The interaction coeffcients of $S \times \Delta \hat{W} \times U$ and $Q \times \Delta W \times U$ are significant and negative with unreasonably large coefficients. The problem may be with the interactive inclusion of the unemployment rate, as this implies that each additional increment of a percentage point in unemployment decreases the gain to quit/search behavior equally, no matter whether the current unemployment rate is 3% or 20%. One possible solution to this would be to use dummies for different levels of unemployment.

Cooke,[14] (1980) has no formal model but hypothesizes that voluntary turnover leads to higher earnings as a result of rational investment decisions. Involuntary turnover, on the other hand, is presumed to lead to earnings loss because (a) the decision to change jobs is not that of the employee, (b) some discharges act as negative signals to prospective employers, and (c) permanent layoffs are a function of unfavorable market conditions which limit re-employment opportunities.

Cooke also attempts to test whether search unemployment results in increased earnings or weakens the worker's bargaining position with prospective employers. He hypothesizes that long periods of search unemployment are more likely to depict serious re-employment problems (i.e., structural unemployment) whereas short periods may depict normal search activities (i.e., frictional unemployment). Thus, long periods of search unemployment are expected to have a larger detrimental effect on wages than short periods.

His data came from the National Longitudinal Study of Scientists and Engineers (NLSSE) and from a 1% systematic survey of membership of some professional engineering societies, henceforth referred to as SEP.

The following model is tested.

2.43 $$\ln(E_j) = a + b_1 S + b_2 S^2 + b_3 EXP + b_4 EXP^2 + b_5 Q + b_6 Q/UI + b_7 Q/U2 + b_8 LO + b_9 LO/U1 + b_{10} LO/U_2 .$$

where:

$\ln(E_j)$ = natural log of gross salary in year j

j = 1972 in NLSSE sample, j=1976 in SEP sample

S = years schooling

EXP = years of professional experience

Q = 1 if quit previous job without experiencing search unemployment

Q/U1 = 1 if quit previous job followed by search unemployment up to 6 months

Q/U2 = if quit previous job with search unemployment greater than 6 months

LO = 1 if laid off from previous job without search unemployment

LO/U1 = 1 if laid off from previous job with up to 6 months search unemployment

LO/U2 = 1 if laid off from previous job with more than 6 months search unemployment.

The results for the turnover variables are

Table 2.4: Regression Results for Quit, Layoff and Unemployment Variables

	NLSSE		SEP	
	Coefficient	t value	coefficient	t value
Q	-.04	8.075	.006	.37
Q/U1	-0.21	10.3	-0.36	.565
Q/U2	-.33	8.44	-.27	2.45
LO	-.13	12.635	-.09	3.03
LO/U1	-.185	15.08	-.18	4.27
LO/U2	-.3934	15.21	-.26	4.47

Superficially these results seem to support the hypothesis that search employment, particularly of long duration, is harmful to wage prospects and that the effect of a layoff is worse than that of a quit.

One possible problem with this analysis is that those who reported some search unemployment may be more likely, than others to experience some unemployment (and, cet. par, a shorter working year than average) in 1972 (NLSSE) or 1976 (SEP). Those who worked fewer than average hours because of unemployment would be expected to have yearly lower salaries regardless of the effect of unemployment on the wage rate.

A second problem is that turnover/unemployment may be picking up unmeasured productivity differences between workers which would affect wages. In our work, as a partial solution to this problem, we shall use growth in log wage rate rather than level of log earnings. Since "unmeasured characteristics" that remain constant in every year should affect the log wage the same in every year, their effect should be cancelled out by subtracting log wage in one year form log wage in another year.

Louis Jacobsen [15] divided his sample [16] into those workers who changed industries between 1962 and 1964 and those who did not. Then, he divides industry leavers into those whose initial industry had grown in total employment in their SMSA of residence and those for whom this employment had shrunk. This first group of industry leavers is called rise leavers; most of them have presumably left due to quits, illness, retirement or firing for cause. Jacobsen refers to industry leaving voluntarily or by illness or firing for cause as attrition.

The group who left a shrinking industry is called fall leavers. Many of the workers in this group left the industry because of layoffs solely due to industry contraction. Such workers are, in Jacobsen's terms, subject to displacement. Similarly, those who did not change industry, (industry stayers) are divided into rise-stayers and fall-stayers. Using prime age males from the Social Security System's Leeds file and disaggregating by industry, Jacobsen regressed earnings in 1965 on:

1) earnings one year before leaving the industry
2) earnings two years before leaving the industry
3) earnings three years before leaving the industry
4) dummies denoting year worker left industry (1960-65)
5) race dummy
6) dummies for being a rise leaver, fall leaver and fall stayer.

A separate regression was run for each industry. From these regressions, Jacobsen calculates the loss in earnings due to displacement for each industry. It turns out that in industries where losses of fall-leavers were large, those of rise-leavers were too and vice-versa. In 8 out of 11 industries, rise leavers lost more than fall leavers which suggests that workers who quit or were fired for cause had lower alternative wages than those who were displaced. This is not altogether surprising as workers fired for cause are probably, as a rule, less able than the average displaced person, but it seems odd that quitters would ever do worse than displaced workers. Possibly, some voluntary industry leaving is self-selection out by less able workers.

Finally, correlations were calculated between percentage income losses of industry fall leavers and: the attrition rate in that industry, or ATTRITION (i.e., percentage of workers that leave that industry by attrition) percent prime age male employment in that industry (PRIMALE), and average earnings in that industry (EARNINGS).

The results are shown below:

Table 2.5: Correlation Between % Loss and Attrition Rates, Earnings and % Prime Age Miles

	% LOSS	ATTRITION	PRIMALE	EARNINGS
% LOSS	1.000			
ATTRITION	-.821	1.000		
PRIMALE	.774	-.760	1.000	
EARNINGS	.435	-.550	.598	1.000

% LOSS was positively correlated with PRIMALE. Jacobsen claims that industries in which a large percentage of employees are prime age males contain a large proportion of production workers and that production workers invest most heavily in specific training. If so, this positive correlation is consistent with the theory that loss from displacement is directly related to industry specific OJT investment.

% LOSS was negatively correlated with ATTRITION. Since it is well documented in theory that job attachment should be directly correlated with quantity of specific training, we would expect the industry attrition rate to be negatively related to specific training. This is consistent with a negative correlation between ATTRITION and % LOSS.

A drawback of this simple correlation is that nothing is held constant. Jacobsen also performs a multiple correlation of earnings, ATTRITION and PRIMALE with % LOSS. The results are not shown, but he reports that the correlation of EARNINGS and % LOSS become insignificant in the multiple correlation. Jacobsen speculates that this is evidence that loss of specific human capital is responsible for the earnings loss rather than an indication that workers displaced from a job with high earnings have difficulty finding another high wage job. It seems as likely, however, that multicollinearity is responsible.

Unlike the other authors mentioned, Jacobsen takes account of the year of the job separation. Also, the disaggregation by industry does take some account of specific capital differences of individuals since some industries provide more industry specific capital than others. The division of workers between industry stayers, displaced workers, and workers who had attrition is useful since it seems unlikely that displacement is a signal that a worker is incompetent. Displaced workers left their industry because of economic conditions although it is true that in hard times, poorer workers may be let go first, union rules permitting.

Unfortunately, nothing can be said from these results, about people who change job/occupation but not industry, differences between the effects of layoffs and quits, or how the number of job changes affects income loss. We shall address all of these issues in our empirical work.

Note that the dependent variable in the regressions is yearly earnings rather than hourly wage as in the other articles we examine here (except Cooke). This means that loss due to displacement includes not only loss in the hourly wage, but also loss due to decreased hours of work or to unemployment.

It is surprising that inclusions of earnings in all three years prior to leaving does not render all coefficients insignificant, since past income levels are bound to be correlated with each other. However, these lagged income variables do control for personal characteristics that may not be picked up by the other variables.

Blau and Kahn,[17] (1981) investigate the consequences of layoffs. They use the 1969-73 NLS for young men and young women (14-24 years old) and are interested not only in the effects of layoffs on current wages but also on long run income prospects.

model is $\ln W = g^1(Z, L)$

Their modellnsW.44g^1(Z, L)

2.44A $\Delta \ln Y\ OCC = g^2\ (Z, L)$

where Z is a vector of various exogenous characteristics (e.g., education, experience, tenure).

L = 1 if the person had a layoff between 1970 and the second survey date (which was in 1972-73)

$\Delta \ln W = \ln W_2 - \ln W_1$

W_1 = 1970 wage rate

W_2 = 1972 or 1973 wage rate

$\Delta \ln Y$ OCC = log of median 1970 earnings in the individual's t_2 occupation-log of median 1970 earnings in the individual's t_1 occupation.

According to search theory, the expected return to searching, net of search costs, is likely to be negative for those laid off, as otherwise the worker would have quit. However, it is possible that the absolute wage change is positive. So the regressions coefficient of L may not be negative.

Those who quit during the survey period are excluded from the sample as it was impossible to tell if they would have been laid off had they not quit.

The resulting coefficients [18] of the layoff dummies are:

Table 2.6: Effects of Layoffs by Sex and Race

Demographic Group	Coefficients	
	$\Delta \ln W$	$\Delta \ln Y$ OCC
white males	-.0981	-.0567
black males	-.0420	-.0341
white females	.0152	.0221
black females	-.0373	.1127

Both coefficients are significant at the 1% level for white males and the one for $\Delta \ln$ Y OCC is significant at the 5% level for black females. Thus we have evidence that layoffs hurt both short run and long run income prospects for white males, and long run income prospects for black females.

Having the change of ln W and ln YOCC as dependent variables eliminates one source of bias, i.e., wages being correlated with unmeasured characteristics that also may be related to layoffs (a problem with the Cooke article). If such characteristics exist but do not change between 1969 and 1973 for any individual and affect both the initial and end log wage equally, their effect will be cancelled when first differencing.

Also, these regressions are confined to a certain age group which controls somewhat for the effect of age on accumulation of specific human capital and remaining length of work life.

These regressions do not take into account the number of layoffs or examine the effects of quits on wage growth. Our study will include regressions with numbers of quits and layoffs.

PART 2

Empirical Evidence on Relation of Turnover To OJT Accumulation

George Borjas [19] (1978) examines how the pattern of lifetime mobility influences OJT accumulation. In particular, he attempts to show that individuals with many job changes tend to acquire less OJT than less mobile individuals.

He hypothesizes that men do not have OJT profiles that are continually declining through life even though most OJT is accumulated when young. This is because those who change jobs also may start on a new course of OJT as different jobs provide different training opportunities. Most training will be concentrated at the beginning of any particular job since the earlier training takes place, the more time the worker has on the job with enhanced productivity. Even if periodic retraining is necessary some time after, (when job tenure is already long) this retraining is unlikely to be as extensive as the initial training.

Borjas models K_{it}, the ratio of dollars of investment to potential earnings in year t of the ith job.

2.45 $K_{1t} = K_{oi} - B_i\ (t)$

where:

K_{oi} = proportion of potential earnings spent in investment activities on the first year of the ith job.

B_i = rate of decline per year (on the ith job) of the proportion of potential earnings spent on investment in new OJT.

K_{oi} measures the intensity of OJT investment on the ith job and B_i measures the tendency to decrease investment in OJT with each successive year on the ith job.

Borjas tries to estimate K_{oi} for workers with different patterns of job mobility. He hypothesizes that K_{oi} is a function of timing of the job in the life cycle (measured by amount of labor force experience prior to the ith job) and expected completed duration of the ith job (because some OJT is firm specific and not worth acquiring for short tenure workers). Specifically:

2.46 $$K_{oi} = \alpha_i + \rho_i t_i^* - \sigma_i \pi_i$$

where: α_i is a constant

t^* is expected completed duration of the ith job

π is labor force experience prior to starting the ith job.

So: for any time t on job i, ratio of investment in OJT to potential earnings is:

2.47 $$K_{it} = \alpha_i + \rho_i t_i^* - \sigma_i \pi_i - B_i t$$

So current OJT accumulation is a positive function of current tenure on the current job because current tenure is positively correlated with t_i^* and negatively with past work experience, including that on the current job.

The relationship of OJT to potential earnings is:

2.48 $$\ln E_t = \ln E_s + r \sum_{t=0}^{t} K_t$$

where:

E_t = earnings capacity at time t

r = rate of return on OJT

E_s = earnings capacity at t=0 (t=0 when the individual enters the labor force after completing s years of school)

K_t = ratio of OJT investment to potential earnings in time t.

Substituting 2.47 into 2.48 and integrating, Borjas gets an equation that suggests (see Borjas for mathematics) that earnings in time t are a function of:

(1) duration of each job in the life cycle, e_i, (because e_i is positively related to t_i^* which is positively related to K_{oi})

(2) the square of duration on each job e_i^2 (because as tenure increases prior work experience increases which decreases K_{oi})

(3) interaction of duration of ith job and experience prior to the ith job (because increases in experience prior to ith job decreases K_{oi})

When we adjusted the model to estimate actual rather than potential earnings [20] (see Borjas, p 368-69) we see that actual earnings in time t are a function of tenure (and tenure squared) on each job held up to and including time t and the interaction between tenure on each job and past work experience.

Further, Borjas's mathematics implies that when actual earnings in time t are regressed on the above variables (plus control variables, e.g. education) and values are assumed for B and r, the K_{oi} for different jobs can be calculated from the coefficients of the above tenure and experience variables (see Borjas for method).

The data are taken from the NLS Survey of Mature Men (45-59 years of age) and are restricted to white men who are working, but not self-employed, in 1966. Borjas divides the men into the following four mobility patterns. An individual followed either: **mobility pattern 1** if his first job after leaving school, his longest and his current jobs are all the same job, **pattern 2** if longest and current job are the same but first job was different, **pattern 3** if his first and longest job were the same but current job was different and **pattern 4** if all three jobs were difference.

The dependent variables are RATE = usual log wage rate in 1966 and the independent variables include:

EXPER = experience since completion of school, in years

FIRST = duration of first job after completion of school, in years, if first job is different from current one

GAPA = time between completion of first job and start of longest/current job

LONGEST = duration of longest job ever, if longest job is different from first and current job

GAPB = time between end of longest job and start of current job

INTER (i) = interaction term pertaining to the ith job; tenure on the ith job multiplied by experience prior to the ith job

and other personal characteristics

Regressions were run separately on each of the mobility groups and also pooled. From these, values of K_{oi} are calculated assuming r = .10 and rB/2 = .0010, .0015 and .0020. These estimates cover the range of those found in the literature of unsegmented earnings functions (see Mincer).

As expected, he find that the less mobile groups have higher K_{oi}

Table 2.7: Intensity of Investment by Mobility Pattern

Segment	rB/2 = .001	rB/2 = .0015	rB/2 = .002
Pattern 1	.180	.180	.180
Pattern 2			
First	.159	.175	.191
GAPA	.098	.159	.220
Current (same as longest)	.157	.198	.239
Pattern 3			
First (same as longest)	-.204	-.114	-.025
GAPA	.032	.069	.106
Current	.072	.045	.024
Pattern 4			
First	-.279	-.265	-.250
GAPA	-.096	-.046	.004
Longest	-.023	.038	.099
GAPB	-.086	-.009	-.034
Current	-.076	-.107	-.137

For every job, under every assumption about rB/2, K_{oi} is largest for pattern 1 individuals, next largest for pattern 2 individuals and least for pattern 4 individuals. From this, Borjas concludes that more mobile individuals invest the least in OJT. Recall that K_{oi} is an estimate of the proportion of potential earnings invested in OJT at the start of each job

It is unclear how to interpret negative values of K_{oi}. Borjas suggests that these arise because the ratio K_{oi} is net of depreciation, but there is insufficient information to determine this.

The most striking problem with this analysis is that it takes no account of the fact that firm specific OJT is lost when an individual changes jobs. Therefore, the regressions of the actual 1966 log wage rate on tenure and experience on past jobs fail to pick up specific OJT; consequently, most of the K_{oi} ratios are net of specific OJT. Remember that truly firm specific capital from past jobs will be completely irrelevant to the current wage rate. The fact that the K_{oi} are smallest for the most mobile is evidence only that the more mobile accumulate less general human capital, as the estimated values of K_{oi} are based on the 1966 log wage regression coefficients.

Tenure on a particular job should be correlated with the amount of specific OJT on that job, but it is not an exact measure. Other factors besides large stocks of firm specific OJT could keep a worker on one job for most of his life, such as inertia or attachment to co-workers. Also, there are factors other than tenure that affect specific OJT such as occupation and ability. Borjas does not take these into account. Still, he does consider the effect of a personal characteristic (i.e., job mobility) on OJT. He also recognizes the effect of age on OJT investment in restricting the sample to mature men.

Borjas' model of OJT assumes that K_{oi} decreases by the same amount each year on a job---an assumption that seems questionable. Also, it would be useful to know the timing of changes in jobs other than the three mentioned here (although that is not given in the NLS) as well as what went on in the gaps between the three jobs (employment, training, etc) and whether or not the job separations were voluntary. Further, since the data cover the life history of labor for older men, it perhaps should be recognized that some OJT in early years is subject to significant depreciation. This depreciation could, as Borjas suggested, have something to do with the negative value of K_{oi} for some jobs for the more mobile groups. Our work will include regressions of change in log wage on different measures of turnover (among other variables). This confronts loss of specific capital from a job change. In our OJT model, we have no such restrictive linear decline in OJT acquisition with each year on the job as Borjas does. We do not have data over the entire work cycle as in the NLS, but we do have approximate timing of job changes in our sample and we distinguish between layoffs and quits.

In an NBER working paper, Borjas and Bartel [21] do several tests of the proposition that mobility is inversely related to specific OJT and therefore to wage growth. Also, their data (NLS older and young men) allow them to analyze effect of quits by reason for quit.

Their theory of OJT accumulation is identical to that in the Borjas article reviewed earlier, but the empirical work is more solid. Their dependent variables are wage rate growth and growth in log wage rate rather than wage level, and they distinguish between quits and layoffs.

Their independent variables include

PER = 1 if the individual quit a job for personal reasons

PUSH = 1 if the individual quit because of dissatisfaction with current job

PULL =1 if the individual quit because he found a better job

LAYOFF = 1 if the individual changed jobs involuntarily

D67 = 1 if observation refers to 1967-69

D69 = 1 if observation refer to 1969-71

and other individual characteristics.

Bartel and Borjas focus on the time period 1967-73. The interval between 1967 and 1973 is partitioned into three two year intervals, 1967-69, 1969-71, and 1971-73.

In the first group of (table 2.8) regressions, information in each of these intervals is pooled across the intervals in their sample, tripling the number of observations. It is not obvious that this improves the quality of the results since labor market conditions were very different in the three periods. The regressions do, at least include dummies (D67 and D69) for the information from the 1967-69, 1969-71 periods.

Table 2.8: 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)
	A. NLS Young Men (n = 3,665)	
LAYOFF	-.0485	-.0322
	(-.64)	(-1.72)
PERS	-.3605	-.1284
	(-3.19)	(-4.59)
PUSH	.0540	.0055
	(.72)	(.30)
PULL	.2984	.0688
	(4.09)	(3.81)
	B. NLS Mature Men (n = 4.745)	
LAYOFF	-.1927	-.0982
	(-2.13)	(-4.04)
PERS	-.4651	-.1953
	(-2.82)	(-4.43)
PUSH	-.0973	-.0283
	(-.79)	(-.85)
PULL	.5999	.0711
	(3.46)	(1.53)

The values in parentheses are t statistics.

In regressions (1) and (2), there are three quit dummies, PUSH = 1 if the individual had a job-related quit that was motivated by dislike of the job, PULL = 1 if a job related quit was motivated by a higher wage offer from another firm, and PERS=1 if a quit occurred for personal rather than job related reasons

It is expected that PULL will have a positive coefficient.

These expectations are borne out by the regressions coefficients for both the younger group and the older group. LAYOFF has a negative, significant coefficient for the older workers, but is insignificant for the younger workers in equatin 1.

In the second group of regressions (table 2.9) for which coefficients of the turnover variables are shown in Table 2.2, wage growth is examined before and after a 1969-1971 job change. The purpose is to compare the wage progress on a new job with that a worker would have obtained had he stayed at the old job, for mobile and immobile individuals.

Table 2.9: The Effects of 1969-71 Mobility on Wage Growth (Dependent variable $= \Delta W$ 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)	(.144)	(.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)	(-.137)	(-1.45)	(.39)	(-.54)	(-.79)

t-statistics are in parentheses.

It is hoped that wage growth on the old "job" i.e. 1967-69 will proxy tendency to accumulate OJT investment on the old "job" which may be correlated with tendency to change jobs in 1969-71.

The samples in panel A and B of table 2.2 consist of respectively younger and older workers who either did not change jobs between 1967 and 1973 or changed only between 1969 and 1971. Wage growth equations similar to those is the first group (but excluding D67 and D69) are estimated for each of the subperiods 1967-69, 1969-71 and 1971-73. Presumably wage growth in 1967-69 is not directly affected by job changes 1969-71 but rather by the firm's and worker's expectations of the worker's total job duration and ability of the worker to benefit from OJT on that job. The only significant coefficient for the 1967-69 period is PUSH (=1, if individual quit because of job dissatisfaction 1969-71) for the younger group. Those younger workers with PUSH =1 apparently had lower wage growth in 1967-69 than the reference group, higher wage growth in 1969-71 and wage growth in 1971-73 that was not statistically different from that of the reference group.

This suggests that the 1969-71 quit (for PUSH=1 individuals) was precipitated by a poor job-worker match and resulted in a better wage package for the individual. Tentatively, we can conclude that for younger workers, PUSH = 1 indicates a poor job-worker match rather than a worker's lack of ability to assimilate OJT.

In the third group of regressions, (table 2.10) the sample is restricted to those who stayed on the job between 1967 and 1973. (This certainly could cause selection bias). The dependent variable is wage growth 1967 to 1969 and the independent variables are those used in the first group of regressions (excluding D67 and D69) plus: PREV = number of years job experience previous to current job and REMTEN = time remaining on the job measured as of 1967 (calculated in hindsight from eventual total job duration).

In table 2.10, the coefficients of PREV, REMTEN and JOB (= current job tenure in 1967) are shown for the young and older men.

Since REMTEN is an estimate of expected remaining job duration in 1967, its coefficient is supposed to measure the effect of expected remaining job duration on OJT investment. As Gulbert Chez remarks (in a comment included in the reprint of this working paper) actual remaining time on the job is not necessarily a perfect estimate of the expected remaining timing on the job.

Table 2.10: 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. NLS Mature Men (n = 747)	
PREV	-.0144	-.0045
	(-2.13)	(-1.62)
JOB	-.0195	-.0062
	(-2.90)	(-2.25)
REMTEN	.0245	.0013
	(1.26)	(.16)

The coefficients of REMTEN are not significant at the 10% level for either group. Bartel and Borjas however, estimate the increase in lifetime earnings from an increase in one year of remaining job tenure as follows: Over the 2 year period, an extra year of job tenure in the older men sample appears to increase the two year growth in hourly wage rate about 2.5 cents. Therefore, over a 1 year period, the extra year would increase the wage rate by 1.25%. So we multiple .0125 by 2000 (assuming 2000 hours a year of work) and find the increase in yearly income is $25.70. From an ex ante point of view, this implies staying an additional 20 years on the job is equal to an increase of $514 per year in earnings. Assuming an interest rate of 10%, the present value of this increase in annual earnings over the 20 year span is $4,446. Bartel and Borjas realize that this conclusion is tentative, particularly since the coefficients of REMTEN are insignificant. They calculate that the present value for young men of staying on the job 6.6 years (the largest tenure for the young men) is $2700.

Despite exclusion biases, these results are quite interesting. Ghez suggests that inclusion of effects of timing (when the layoff or quit took place) and the number of layoffs and quits could improve the analysis. Our empirical work will incorporate both of these suggestions.

In Earnings Growth on the Job and in Between Jobs,[22] (1980) Bartel breaks wage growth into earnings growth on-the-job (J) and earnings growth between jobs (M). Some portion of J and M is due to economy wide increases in labor productivity. The remaining growth is largely due to the individual's acquisition of human capital over time.

She hypothesizes that total on-the-job growth will be smaller for more mobile individuals. Such individuals tend to have less tenure, which makes specific OJT an unprofitable investment. Conversely, workers with little specific OJT have little incentive to avoid mobility. Therefore, the more mobile an individual, the less specific

OJT s/he acquires on each job and thus, the smaller J will be.

Bartel recognizes that timing is a factor in wage growth, i.e., that turnover close to time of entry into the labor market has a very different effect on J (and its effect on current earnings) than later turnover. If turnover only occurs very early in one's worklife, one still may have a job with long tenure, which is conducive to accumulation of large amounts of specific OJT (and large J). Moreover, none of this OJT will be lost due to job change.

Bartel used the Coleman-Rossi Retrospective Life History Study to study males who were age 30-39 in 1969. For different race/education groups she found average on-the-job earnings growth and average between-jobs earnings growth. It turned out that for the average white male, 26% of earnings gains took place between jobs when earnings gains were deflated for economy-wide productivity gains. For the average black male, 64% of earnings growth took place between jobs. This occurred despite the fact that blacks in the sample were only slightly more mobile than whites, having worked at 4.6 firms on average since labor force entry compared to the white average of 4 firms.

Next, Bartel ran regressions with total earnings gains, J and M as dependent variables, controlling for education, race, geographic mobility, wife's labor force characteristics, age, experience, tenure and job mobility.

She used 2 measures of job mobility. First, the number of firms with which an individual has worked (NFIRMS) and second, dummies for 3 mobility patterns (similar to Borjas') in which the individual could fall. These patterns are:

pattern 1: worker has had same job since start of working life (ONEFIRM = 1);

pattern 2: changed jobs at least once but current job is one held longest (CLONG = 1); and

pattern 3: current job is neither only job ever held or longest job.

Since specific training is positively correlated with tenure, J is hypothesized to be largest for individuals who fit pattern 1 and least for individuals that fit pattern 3.

It seems that actual tenure on each job would be more to the point than one's mobility pattern as labelled in this paper. It is possible to have the current job be the same as the longest job even if tenure on current job is very small (as long as tenures on other jobs are smaller).

In tables 2.11 and 2.12 selected regression coefficients are shown for whites and blacks with NFIRMS as the mobility variable. For whites, education has a positive effect on J but not on M, even holding constant NFIRMS. For black males, the effect is not as clear. Also, when earnings are deflated for productivity increases, J increases with experience, but less for blacks than for whites.

For white males, J is negatively related to NFIRMS (confirming the specific OJT/mobility hypothesis). For blacks, the coefficient of NFIRMS is positive (!). Bartel claims that it becomes negative when a quadratic is added, but it is strange that it is not negative on its own. Unfortunately, NFIRMS tells us little about OJT for each firm. It is conceivable that blacks (due to discrimination) have to invest more in job-shopping than whites do; that is, they must be willing to try various jobs and move until they find one that offers them OJT.

Table 2.11: Results for Whites

t values are in parentheses

Independent Variable	J undeflated for productivity	J deflated	M undeflated	M deflated
EDUC	492.21	189.88	-12.37	-18.26
	(6.77)	(3.28)	(-.23)	(-.34)
EXPER	493.22	110.76	53.52	48.28
	(3.38)	(.95)	(.49)	(.44)
$EXPER^2$	-8.65	-1.22	-3.13	-3.26
	(-1.68)	(-.30)	(-.80)	(-.84)
NFIRMS	-126.01	-85.64	164.66	153.50
	(-1.99)	(-1.70)	(3.45)	(3.24)

Table 2.12: Results for Blacks

Independent Variable	J (not deflated)	J (deflated)	M (not deflated)	M (deflated)
EDUC	127.69	29.65	-38.73	-55.26
	(2.88)	(.73)	(-.83)	(-1.18)
EXPER	166.89	34.50	-16.65	-37.77
	(1.48)	(.34)	(-.14)	(-.32)
$EXPER^2$	-5.23	-4.00	2.06	2.46
	(-1.36)	(-1.14)	(.51)	(-.61)
NFIRMS	71.92	84.08	-42.19	-52.00
	(1.74)	(2.24)	(-.98)	(-1.20)

Table 2.13 shows coefficients of mobility patterns ONEFIRM and CLONG in regressions in which the dependent variables were J, M and total earnings.

It seems strange to use M as a dependent variable and use ONEFIRM as an independent variable since M should be 0 for everyone who has only worked in one firm. As expected, ONEFIRM and CLONG have positive coefficients in regressions in which J is the dependent variable, ONEFIRM has a negative coefficient in the regressions using M. The negative coefficient of ONEFIRM in the M regression can be interpreted as the negative of the increase in M that would result if one moved, from having worked only in one firm (ONEFIRM = 1) to being in the reference group (current job is neither first or longest). Most coefficients are not, however, significant at the 10% level. Note that for whites, total earnings gains seem to be greater for those with some mobility, but with longest job as same as current one.

Bartel and Borjas have the advantage of using mobility data over the entire life cycle. Their disadvantage is that information on timing of turnover is unavailable.

Table 2.13: Effects of Mobility Pattern on Earnings on the Job and Earnings Between Jobs

	J (not deflated)	M (not deflated)	J (deflated)	M (deflated)
WHITES				
ONEFIRM	603.66	-634.78	333.46	-557.81
	(1.18)	(-1.64)	(.83)	(-1.45)
CLONG	605.04	146.25	341.95	131.37
	(1.58)	(.50)	(1.13)	(.46)
BLACKS				
CLONG	324.40	-146.63	162.49	-134.87
	(1.26)	(-.54)	(.69)	(-.50)
ONEFIRM	1014.37	-707.02	638.23	-603.68
	(2.21)	(-1.47)	(1.52)	(-1.25)

Some Problems with the Empirical Literature

The literature review uncovered a number of problems with existing research. First, some of the empirical literature about effect of layoffs and quits on financial status uses as the dependent variable the <u>level</u> of post-turnover earnings on wage rate (Cooke, Jacobsen). In order to find loss (or gain) in wages, the post-turnover wage must be compared to the pre-turnover wage for the job changers. Using levels implicitly assumes that pre-turnover wages are identical for changers and non-changers. The possible bias on coefficients of turnover variables is obvious: workers who move a lot collect little specific OJT, their pre-turnover wages are likely to be low and loss from a job change minimal. Our independent variable will be the difference in the log wage between t_1 and t_2 ($\ln w_2 - \ln w_1$). Another problem is that one author inputed a wage to individuals and then used some form of the difference between the imputed and actual wages as an estimate of "rent" to their current job (Black). While it is true that a worker may be in a job in which his marginal product is not as high as it could be on another job, there is a danger in assuming either that this is true or that he is paid less than his marginal revenue product merely because the actual wage is less than the imputed wage. It is not clear that an imputed wage measures a workers actual marginal revenue product. Possibly, the actual wage picks up a worker's unmeasured characteristics (e.g. energy level) and therefore is a better indication of productivity than the imputed wage.

Borjas, as mentioned in the review of his article, fails to measure specific OJT because his estimates of investment on past jobs are calculated from the regression of 1966 log wage on tenure on past jobs and previous work experience. By definition of firm specific OJT, specific training on previous jobs (which tenure and prior experience are supposed to proxy) is completely irrelevant to the 1966 wage. By using $\log w_2 - \log w_1$, as a dependent variable, we do relate specific OJT on the t_1 job to $\log w_1$.

Our empirical work will use log wage rate in 1980 - log wage rate 1968 as the dependent variables, thus avoiding the problems we discussed with using wage levels. Further, we shall disaggregate our wage regressions by age, education, race, and occupation to estimate the effect these variables have on loss from turnover. (The theoretical justification for this disaggregation is presented below in chapter 3). Finally, we shall, in different regressions, take into account not only the timing of the job change (following Jacobsen) and tenure prior to the job change, but numbers of quits and layoffs.

FOOTNOTES

[1] Gary Becker, Human Capital (New York: Columbia University Press, 1964), p 94-106.

[2] C. B. Knapp and Hansen, W. L., "Earnings and Individual Variations in Postschool Investment, JPE, 84(2) (April, 1976), p 351-58.

[3] Jacob Mincer, Schooling Experience and Earnings, (Columbia University Press, New York: 1974), p 17.

[4] T. Johnson, "Returns from Investment in Human Capital", American Economic Review, 60(30) (September, 1970), p 546-60.

[5] Charles Brown, "A Model of Optimal Human Capital Accumulation and the Wages of Young High School Graduates", Journal of Political Economy 84(2) (April 1976) p 299-316.

[6] This criticism can be made of most of this group of articles including some not reported such as one by Klevmarken and Quigley, "Age, Experience and Earnings in Human Capital Investment", Journal of Political Economy 84 (1) (February, 1976) p 41-72.

[7] Ann Bartel and Borjas, George, "Specific Training and its Effects of Human Capital Investment Profile", Southern Economic Journal 44(2) (October, 1977), p 333-41.

[8] op. cit., Becker, p 16-37.

[9] ibid, p 17.

10 M. Hashimoto, "Firm-Specific Human Capital: Shared Investment or Optimal Entrapment?" American Economic Review, 71(3) (June, 1981) p 474-481.

11 If $\hat{v} < \hat{y}$, the worker's productivity of the job is greater than that on alternative jobs. In this case, a shift in α rather than a job separation would be Paieto optimum. By shifting α the party who initiated the separation could be compensated for staying with the other party, who would lose less than he would from a job separation.

12 D. Parsons, "Specific Human Capital, An Application to Quit and Layoff Rates", Journal of Political Economy 80(6) (November/December 1972) p 1120-1142.

13 Matthew Black "Pecuniary Implications of On-the-Job-Search and Quit Activity", Review of Economics and Statistics 62(2) (May 1980), p 222-229.

14 W. N. Cooke, "Turnover and Earnings: The Scientist and Engineer Case", Journal of Human Resources 15(3) (Summer 1980) p 435-43.

15 Louis S. Jacobsen, Earnings Losses of Workers Displaced From Manufacturing Industries (Public Research Institute, 1976).

[16] His sample consists of individuals from the Leeds file who:

a) were employed at least three consecutive quarters in one industry and at least four quarters during the period 1962-65.
b) were employed in one of 22 selected SMSA's defined in 1967
c) were males, age 23-53 in 1967
d) reported earnings in each year 1960-70.

[17] F. D. Blau and Kahn, L. M., "Causes and Consequences of Layoffs", Economic Inquiry 19(2) (April 1981), p 270-290.

[18] A Heckman-type adjustment is made to take into account the exclusion of those who quit. See Blau and Kahn p 294-295.

[19] George Borjas, "Job Mobility and Earnings over the Life Cycle", Industrial Labor Relations Review (1978), p 365-376.

[20] Note that $\ln Y_t = \ln E_t + \ln (1-K_t)$ and assume $\ln (1 - K_t) \approx K_t$.

[21] Anne P. Bartel, "Earnings Growth on the Job and Between Jobs", Economic Inquiry (January, 1980), p 123-137.

[22] Anne P. Bartel and Borjas, George, "Wage Growth and Turnover, an Empirical Analysis" (NBER Reprint, #321, September, 1982.

Chapter III

Theory Chapter

A. Introduction

In chapter 1, we hypothesized that the gain from a job change is inversely related to specific OJT accumulated on the current job. In this chapter, we will construct a model of specific OJT accumulation incorporating determinants of both firm and individual desires for training, and including the effect of OJT on quit probabilities and layoff probabilities. Although we do not have the kind of data required to measure OJT directly, our model will suggest appropriate proxies for OJT based on measurable, available variables. The purpose of the theoretical model is to develop testable hypotheses about the relationship between the effect of layoff and quit experiences and these proxy variables. Variables positively related to expenditure on specific OJT should be inversely related to gains from job changing. In chapter 4, we will present an empirical test of this proposition.

B. Model of OJT Accumulation

Throughout this chapter, we will assume the following:

(1) the worker is in the labor force for two periods, t_1 and t_2.

(2) In t_1, he accumulates C units of firm specific training (i.e., OJT that raises productivity only within the firm with which the worker is employed in t_1). This specific OJT acquired in t_1 does not affect the worker's wage rate until t_2.

(3) In t_1, the wage rate is a constant, w_1, and in t_2, the wage rate is $w_2(C)$ $(\frac{\partial w_2(C)}{\partial (C)} > 0)$ <u>if</u> the worker is still with the t_1 firm in t_2. If the worker leaves this firm, his wage will be $\tilde{w}_j$ the highest available wage rate with an alternative firm; $\tilde{w}_j$ is a random variable and is independent of C.

Since OJT makes employees more productive, it may benefit the firm as well as the employee. Therefore, both the employer and the employee may be willing to pay for part of OJT. In general, specific OJT is paid for partly by the worker (through fees and foregone wages in t_1) and partly by the firm (through hire of instructors and foregone output in t_1). For the purpose of this model, we view OJT as a good that the worker and firm jointly purchase from a vendor for $1 a unit, a portion of which is paid by the individual and a portion of which is paid by the firm.

Since we want to show that an individual's OJT investment is dependent on his personal characteristics (e.g., age, education, occupation), we now divide workers into n groups, each of which represents a unique combination of these characteristics (e.g., 32 year old high school graduates with 2 years of job tenure.

Each group p bargains individually with the firm to determine C_p, i.e., the amount of OJT (C) per worker in group p, and P_f^p which is the proportion of group p's OJT paid by the firm ($0 < P_f^p < 1$). The firm therefore pays a total of $\$P_f^p C_p$ per group p worker for OJT and the worker pays $\$(1-P_f^p)C_p$. Both firm and worker must agree on the amount of OJT investment C_p.

The optimum specific training investment, C_p, from the firm's perspective is that which maximizes profits given P_f^p.

The optimum specific training investment, C_p, from the point of view of the individual in group p, is that which maximizes utility given $1-P_f^p$.

The model presented below has two parts:

(1) a model of profit maximization for the firm, and

(2) a model of utility maximization for the individual.

The profit maximization model can be solved for a schedule relating the quantity of specific OJT firms are willing to supply group p to each possible value of P_f^p. Similarly, the individual utility maximization yields a schedule relating the amount of OJT a worker from group p wishes to purchase to each value of $(1-P_f^p)$. Assuming the market for OJT is competitive, each schedule could, in principle, be aggregated to determine equilibrium values of C_p and P_f^p. It will turn out that the equilibrium value of C_p, for any group p, depends on the characteristics of that group. Since (as we will show below) the effect of job change on wage growth depends on C_p, we expect the effect of job change to depend on the personal characteristics that affect C_p.

1. The Firm

We make the following assumptions about the firm.

(a) The firm exists for periods t_1 and t_2. Its aim is to maximize the present discounted value of profits over these two periods. It is a price-taker in the market for its output, for factors of production and for OJT.

(b) In t_1, the firm decides how many workers to hire from each group, and how much OJT to provide workers in each group p given $(P_F^1 \ldots P_F^p \ldots P_F^n)$. Each worker in group p gets the same amount of OJT.

(c) There is a lag of one period between a worker's acquisition of OJT and the resulting increase in his productivity; that is, OJT does not affect production until t_2. Since this is only a two period model, the firm is only interested in subsidizing OJT that takes place in t_1.

(d) The screening process for hiring workers in t_1 guarantees that all workers in group p are equally productive in t_1, but the firm cannot determine in advance the t_2 (post-training) productivity of a given hiree.

(e) Each worker hired by the firm works $\bar{H}$ hours in t_1 (fixed by custom. The t_1 wage, w, is different for each group. The t_1 wage is w_p for group p. At this wage, the firm can hire as many group p trainees as it wants.

(f) In t_1, the firm promises that each group p worker still with the firm in t_2 will work $\bar{H}$ hours in t_2, and receive a wage rate $w_2^p(C_p)$. The function $w_2^p(C_p)$ is predetermined and known by both firm and worker $\frac{\partial w_2^p}{\partial C^p} > 0$.

(g) By t_2, the firm can observe whether each worker has adequately absorbed his training. Any workers that have not will be dismissed.[1] Let the firm, from observing the workers, assign each worker a competence score of α. α is a function of C, X(C). Workers are fired who have a score less than $\bar{\alpha}$. Then the probability of a dismissal is

$$l(C) = \int_{\alpha\,\min}^{\bar{\alpha}} f(\alpha)\big|_c \, d\alpha$$

Let $f(\alpha,C)$ be a normal distribution with

$\mu=\mu(C)$ $\quad\quad\quad\quad \mu'(C)>0$

$\sigma=\bar{\sigma}$

$l(C)=\text{prob}(\alpha<\bar{\alpha})$

$l(C)$ can be found by transforming X into Z the standard normal distribution

$$l(C)=\text{prob}\left(Z<\frac{\bar{\alpha}-\mu(C)}{\bar{\sigma}}\right)$$

$\frac{\bar{\alpha}-\mu(C)}{\bar{\sigma}}$ is the "Z score" of $\bar{\alpha}$, or the distance (in standard deviations) between $\bar{\alpha}$ and $\mu(C)$.

Clearly, since an increase in C increases $\mu(C)$, it decreases the Z score of $\bar{\alpha}$ and therefore the probability of an individual having a score $<\bar{\alpha}$. Therefore,

$$\frac{\partial l(C)}{\partial C} < 0.$$

(h) Between t_1 and t_2, trainees may conduct job search and therefore receive information about other job opportunities and possibly receive job offers from other firms. If the highest wage rate offer a trainee receives is greater than $w_2^p(C_p)$, the worker will quit. (This assumes no fixed costs associated with a job change.) Hours of work per period are fixed at $\bar{H}$, even for job changers, so the wage rate is the sole criterion by which a worker judges job offers. (Non-pecuniary advantages or disadvantages are disregarded in this model.)

(i) The firm's production function in t_2 is

$$f(A^1(C_1)\cdot X_1 \ldots A^p(C_p)\cdot X_p \ldots A^n(C_n)\cdot X_n, K)$$

where: $X_p = (1-l^p)(1-q^p)$

l^p=layoff rate for group p

q^p=quit rate for group p

K = units of physical capital.

In other words, X^p is the total number of trainees from group p still with the firm in t_2, i.e., that have not quit or been laid off.[2]

$X_p \cdot A^p(C_p)$ can be thought of as the quantity of "augmented labor" from group p available to the firm in time t_2. We use the function $X_p \cdot A^p(C_p)$ to emphasize that the benefit of OJT to the firm in t_2 is contingent on the number of trainees from each group still with the firm in t_2 as the skill is embodied in the trainees. $A^p(C_p)$ is the average augmentation of the X^p workers from group p still with the firm in t_2.

$$\left(A^p(0)=1\right) \frac{\partial A^p(C_p)}{\partial C} > 0.$$

(j) The expected value (in t_1) of the present discounted profits is

(3.1) $\underset{t_1 \text{ revenue}}{P_1 f(L_1 \ldots L_p \ldots L_n, K)} - \underset{t_1 \text{ wage bill}}{\sum_{p=1}^{p} w_p L_p \bar{H}}$

$\underset{t_1 \text{ training costs}}{- \sum_{p=1}^{n} P_F^p C_p L_p} \quad \underset{\text{non-human capital bill}}{- \quad P_K K}$

$+ \frac{1}{1+r} [\underset{t_2 \text{ revenue}}{P_2 f(A^1 (C_1) X_1^E \ldots A^p(C_p) X_p^E \ldots A^n(C_n) X_n^E, K)}$

$\underset{t_2 \text{ wage bill}}{- \sum_{p=1}^{n} w_2^p (C_p) \bar{H} X_p^E} \quad \underset{\text{non-human capital bill}}{- \quad P_K K}\ ]$

where

P_1 = price of product in t_1

$f(L_1 \ldots L_p \ldots L_n, K)$ is t_1 production function

L_p = number of workers from group p hired in t_1

K = unit of physical capital (fixed for t_1, t_2)

P_K = rental price of physical capital (fixed for t_1, t_2)

w_p = t_1 wage of group p

$\bar{H}$ = hours worked by each worker each period (fixed for all individuals)

P_F^p = firm's contribution to OJT expenditures for group P

C_p = specific OJT accumulated by each member of group p in t_1

r is the discount rate

P_2 = firm's product price in t_2

$f(A^1(C)X_1^E, \ldots A^n(C)X_n^E, K)$ is the firm's production function in t_2.

$A^p(C)$ is expected average labor augmentation for each individual in group P remaining with the firm in t_2.

X_p^E is the number of workers the firm expects to retain in t_2 from group p.

$$X_p^E = (1 - l_p^E(C))\,(1 - q_p^E(C)) \cdot L_p$$

where $l_p^E(C)$ is the expected layoff rate for group p (as perceived by both the worker and the firm). Both parties derive $l^E(C)$ from observing firms similar to the one in question.

$q_p^E(C)$ is the expected quit rate for group p.

$w_2^p(C_p)$ is the wage rate paid to each worker in group p who remains with the firm in t_2.

In order to save space, we will drop the subscripts when taking first order conditions. In other words, L_p will be referred to simply as L, C_p as C, etc.

First order conditions for a short-run maximum are:

$$(3.2)\quad \frac{\partial\pi}{\partial L} = P_1 \frac{\partial f}{\partial L} - w\bar{H} - P_F C$$

$$+ \frac{1}{1+r}[\, P_2 \frac{\partial f}{\partial B} A(C)((1-l^E(C))(1-q^E(C)))$$

$$- w_2(C)\bar{H}((1-l^E(C)(1-q^E(C))]$$

$$(3.3)\quad \frac{\partial\pi}{\partial C} = -P_F$$

$$+ \frac{1}{1+r}[(P_2 \frac{\partial f}{\partial B}\ (X^E A'(C) - LA(C)((1-l^E)\frac{\partial q^E}{\partial C} + (1-q^E)\frac{\partial l^E}{\partial C}))$$

$$- w_2'(C)\bar{H}X^E + w_2(C)(\bar{H}L(1-l^E)\frac{\partial q^E}{\partial C} + (1-q^E)\frac{\partial l^E}{\partial C})] - P_F L$$

with $B=A(C)\cdot X$

The first full line of equation (3.3) represents additional revenue from an increase of 1 unit in C. $X^E A'(c)$ represents a function of the increase in production of each retained worker in t_2 times the number of workers expected to be employed in t_2.

$$-L\ A(C)((1-l)\frac{dq}{dc} + (1-q)\frac{dl}{dc})$$

is the increase in proportion of workers who stay with the firm in t_2 $(-(1-l)\frac{dq}{dc} - (1-q)\frac{dl}{dc})$ times some measure of the productivity of workers before the last unit of OJT was accumulated.

The second line of equation (3.3) represents additional costs of increasing C by another unit. These include:

a) the extra wage bill because workers are more skilled or

$\frac{\partial w_2(c)}{\partial c} \bar{H}X^E$.

b) the additional wages that must be paid because fewer workers will quit or be laid off after the additional unit of OJT is accumulated, or

$$-w_2(C)(\bar{H}L(1-l^E)\frac{\partial q^E}{\partial C} + (1-q^E)\frac{\partial l^E}{\partial C}$$

c) the additional OJT costs in t_1, or $P_F \cdot L$.

At this point, it seems advisable to distinguish our firm profit model from that of Parsons (1972) since they are very similar in their treatment of optimal layoffs and specific on-the-job training.

First, the decision variables are different in the two models. For Parsons, they are number of layoffs and the wage for trainees and trained workers in each period. In our model, the number of trainees in each group, and the amount of OJT given to each worker are the decision variables; the functional forms of $w_e^P(C)$, $q_P^E(C)$ and $l_P^E(C)$ are determined outside of the model. We are interested in determination of C_P (which Parsons regards as given) because of its effect on an individual's financial loss from a job change. Parsons is more interested in explaining industry quit and layoff rates.

Secondly, Parsons allows the firm to rehire laid off workers in period 2. Instead, we assume that the firm commits itself to each worker hired for at least one period. Workers laid off just prior to t_2 are not rehired. Parsons has to recognize that rehires may be desirable because he is explaining (among other things) layoff behavior of the firm. However, in our model, it is sufficient to point out that the expected loss to the firm from a layoff increases with C.

Third, we, unlike Parsons, take account of the fact that post-training alternative wage rates and marginal products (with the firm that supplied the specific training) differ among individuals. This heterogeneity avoids two problems: (1) why it should be profitable for one worker to quit if it is not for all the workers, and (2) if layoffs are necessary, why is one worker laid off rather than another.

Fourth, Parsons explicitly divides specific OJT into worker owned and firm owned OJT. Our way of dealing with this is the function $w_2(C)$. The greater $\frac{\partial w_2(C)}{\partial (C)}$, the more OJT is worker owned, the more workers are willing to pay for OJT (cet. par.) and the less firms are willing to pay.

2. The Worker

We make the following assumptions about the individual worker.

(a) The individual works for two periods, t_1 and t_2. He knows that the t_1 wage will be w and that hours of work in both periods will be $\bar{H}$.

(b) Consistent with the firm model, the worker acquires, in t_1, C units of OJT and pays $(1-$P_F$) for each of these units. (Since we are discussing only one worker in this section, we drop the p subscript and superscript whenever possible.) The worker knows that if he is still with the t_1 firm in t_2, his t_2 wage rate will be $w_2(C)$; he is also aware of the possibility that he will not be with this same firm in t_2 because of a layoff or quit.

(c) An individual takes his layoff probability to be $l_p^E(C_p)$, i.e., the firm's anticipated layoff rate for his group. Recall that $\frac{\partial l_p^E}{\partial C_p} < 0$.

(d) The worker i perceives his probability of quitting prior to t_2 as $q^i(C)$. A worker will quit to take another job in t_2 if he receives a job offer for t_2 with a wage rate $\tilde{w}$ higher than $w_2(C)$. The probability of such a job offer increases if the worker makes an investment in some job search. However, in this model, we are not interested in the job search decision per se. Therefore, the level of job search investment is taken to be exogenous at $\bar{S}$ dollars for t_1.

The probability distribution for the maximum alternative wage offer ($\tilde{w}$) the worker i receives for t_2 is[3]

$$f_1(\tilde{w}(\bar{S},Z^i))$$

where $\bar{S}$ = dollar equivalent of resources spent on search.

Z^i is a vector of personal characteristics for worker i.

$\tilde{w}$ is the maximum wage offer from other firms.

The quit probability of a representative individual is therefore

$$(3.4)\quad q^i(C) = \int_{w_2(C)}^{\infty} f_1(\tilde{w}(S,Z^i)d\tilde{w}\ (\bar{S},Z^i)$$

$$(3.5)\quad \frac{\partial q^i(C)}{\partial C} = - f_1(w_2(C)) \frac{\partial w_2(C)}{\partial C} < 0$$

The timing of all these actions and decisions is assumed to be as follows:

(1) At the very beginning of t_1, the individual decides on a level of C, given $1-P_F$ and implements it. Simultaneously, the individual invests $\bar{S}$ in on-the-job search.

(2) After OJT investment is obtained, the employer observes its effect on each trainee and by t_2 can tell the true effect of the training on a worker's productivity. Those with competency score of less than $\bar{\alpha}$ (see section above on firm) are not profitable to rehire in t_2 and will therefore be dismissed regardless of the firm's prior expenditures on the worker's training, as discussed above.

(3) After they find out whether or not they will be laid off, workers receive job offers for t_2 from other firms as a result of their prior job search. The workers who are going to

be laid off accept the highest wage offer, which, we will say, has an expected value of w_L. Any worker who does not get a layoff notice compares the best alternative wage offer $\tilde{w}$, with $w_2(C)$. If the best offer $\tilde{w}$ is higher than $w_2(C)$, the worker will quit. Otherwise, he will stay with the firm.

The expected value of the wage rate in t_2 from a quit is (holding S and Z constant)

$$(3.6) \quad \int_{w_2(C)}^{\infty} \tilde{w} f_1(\tilde{w}) dw$$

Recall that $f_1(\tilde{w})$ describes the probability distribution of the maximum alternative wage offer $\tilde{w}$ to the individual who has not been laid off.

Assume $\int_{w_2(C)}^{\infty} \tilde{w} f_1(\tilde{w}) > w_L$.

This assumption is based on two factors.

(1) The wage rate from a quit will never be below $w_2(C)$.

(2) If a layoff is viewed as a more negative signal than a quit, the signalling effect may cause the wage distribution for those laid off to be lower than for those who quit.

We are now prepared to evaluate the t_2 wage the individual expects in time t_1.

$$(3.7) \quad E(w_2) = (1-1^E(C))(1-q^i(C))w_2(C) + 1^E(C)w_L$$

$$+ (1-1^E(C)) \int_{w_2(C)}^{\infty} \tilde{w} f_1(\tilde{w}) d\tilde{w}$$

The first term is the wage from staying, $w_2(C)$, times the probability that the individual remains with the firm in t_2.

The second term is the expected wage from a layoff w_L times the probability of a layoff $1^E(C)$.

The third term is the sum of all the products for each m:[4] (probability that the maximum wage offer will be $\tilde{w}_m$) times ($\tilde{w}_m$) for all $\tilde{w}_m > w_2(C)$

Note that all the $f(\tilde{w}_m)d\tilde{w}_m$(for $w_m > w_2(C)$ sum to $q^i(C)$. So this last term "incorporates" $(1-1^E(C))q(C)$ and the probabilities of the possible events in 3.7 sum to 1.

Since $q(C) = \int_{w_2(C)}^{\infty} f_1(\hat{w}) d\hat{w}$ we can rewrite 3.7 as

$$(3.8)\quad E(w_2) = (1-1^E(C))[1-\int_{w_2(C)}^{\infty} f_1(\hat{w}) d\hat{w}] w_2(C)$$

$$+ 1^E(C) w_L + (1-1^E(C)) \int_{w_2(C)}^{\infty} f_1(\hat{w}) d\hat{w}.$$

Finally, we are ready to model the individual's decision to purchase specific OJT. His objective is to maximize lifetime (two period) utility with respect to the budget constraint or to maximize the Lagrangian:

$$(3.9)\quad \mathcal{L} =$$

$$U(X_1, X_2, L_1, L_2)$$

$$+ \lambda[X_1 + \frac{1}{1+r} X_2 - ((\bar{H}w_1 - (1-P_F)C - \bar{S})$$

$$+ \frac{1}{1+r} \bar{H} \ ((1-1^E(C))(1-q^i(C))w_2(C) + 1^E(C)w_L$$

$$+ (1-1^E(C)) \int_{w_2(C)}^{\infty} \tilde{w}f(\tilde{w})d\tilde{w}))]$$

where:

X_1 = all consumer expenditures in t_1 other than on specific OJT

X_2 = all consumer expenditures in t_2 other than on specific OJT

L_1 = leisure in t_1 { exogenous since hours of work

L_2 = leisure in t_2 { are fixed in both periods

λ is the Lagrangian multiplier

r is the discount rate

$\bar{H} = T-L_1=T-L_2=$ hours worked in t_1 and t_2

$(1-P_F)C$ = worker expenditure in t_1 on specific OJT

w = t_1 wage rate, assumed exogenous

$\bar{S}$ = search expenditures

The expression in brackets is, as discussed above, the expected value of the wage rate in t_2. Note that C only affects the budget constraint in this model.

First order conditions for utility maximization with respect to C are

$$(3.10)\quad \lambda \cdot \frac{1}{1+r} \bar{H}[- \frac{\partial l^E}{\partial C}(1-q^i(C))w_2(C)+(1-q^i(C))(1-l^E(C)) \frac{\partial w_2(C)}{\partial C}$$

$$+ (1-l^E(C))f_1(w_2(C)) \frac{\partial w_2(C)}{\partial C} \cdot w_2(C) + \frac{\partial l^E}{\partial C} w_L$$

$$- \frac{\partial l^E}{\partial C} \int_{w_2(C)}^{\infty} \tilde{w} f_1(\tilde{w})d\tilde{w}$$

$$- (1-l^E(C))f(w_2(C))w_2(C) \frac{\partial w_2(C)}{\partial C}] + (1-P_F) = 0$$

Collecting terms and assuming $\lambda \neq 0$ yields:

$$(3.10')\quad - \frac{1}{1+r} \bar{H} [\frac{\partial l^E}{\partial C} (w_L - \int_{w_2(C)}^{\infty} \tilde{w} f(\tilde{w})d\tilde{w} - (1-q^i(C))w_2(C))$$

$$+(1-q^i(C))(1-l^E(C)) \frac{\partial w_2(C)}{\partial C}] + (1-P_F) = 0$$

The first term in parentheses $w_1 - \int_{w_2(C)}^{\infty} \tilde{w} f(\tilde{w})d\tilde{w} -$ $(1-q^i(C))w_2(C)$ can be interpreted as the expected decrease in wages from a layoff.

So this first term in parentheses multiplied by $\frac{\partial l^E}{\partial C}$ (the decrease in expected layoff probability given an increase in C) gives the (positive) expected increase in earnings due to a decrease in layoff probability that results from a small increase in C.

The first term on the second line

$\bar{H}(1-q^i(C))(1-l^E(C))\ \frac{\partial w_2(C)}{\partial C}$ is also positive. This is the increase in earnings from a marginal increase in C (given no job change) times the probability of remaining with the t_1 firm. The sum of the terms just discussed is the marginal benefit to the worker from an extra unit of C. For the optimal amount of C to be purchased, a necessary condition is that the sum equals the marginal cost of C or $1-P_F$.

From the first order conditions in sections A and B, we derived the two key equations in this model (equations 3.2 and 3.10).

$$(3.2)\quad \frac{\partial \pi}{\partial C} = -P_F +$$

$$\frac{1}{1+r}[P_2 \frac{\partial f}{\partial B} (X^E A'(C)-LA(C)\ ((1-l^E)\frac{\partial q^E}{\partial C} \quad + (1-q^E)\ \frac{\partial l^E}{\partial C}\ ))$$

$$-w_2'(\bar{C})HX^E + w_2(C)L((1-l^E)\ \frac{\partial q^E}{\partial C} \quad + (1-q^E)\ \frac{\partial l^E}{\partial C} \quad)\ ]$$

$$= 0$$

with $B = A(C)\cdot X$

and

$$\frac{\partial U}{\partial C} =$$

$$(3.10)\quad -\frac{1}{1+r}\quad \bar{H}[\frac{\partial l^E}{\partial C}\ (w_1 - \int_{w_2(C)}^{\infty} \tilde{w}\ f(\tilde{w})d\tilde{w} - (1-q^i(C))w_2(C))$$

$$+ (1-q^i(C))(1-l^E(C))\ \frac{\partial w_2(C)}{\partial C}\ ] + (1-P_F) = 0$$

From these equations, we can derive the firm's willingness to supply OJT and the worker's demand for OJT given P_F. (Actually, it is a joint willingness to purchase OJT at prices P_F and $1-P_F$).

Summing OJT demand for all workers and firms will determine aggregate demand and supply of OJT for any particular group p and presumably, equilibrium values of C and P_F for each group.

In the next two sections, we will show that these two main equations imply that the equilibrium quantity of C_p is a function of various parameters assumed exogenous to the model (i.e., certain characteristics common to everyone in group p). The empirical work focuses on the role of these exogenous parameters in relating observed wage changes to job changes.

3. Implications for Empirical Work

1. OJT Functions

The first order conditions in sections A and B of this chapter (equations 3.2 and 3.10) implicitly define equations of the following form for group p.

$$(3.11)\quad C_p^{Dfirm} = C_p^F(\overset{-}{P_F^p}; A'_p(\overset{+}{C_p}), A_p(\overset{+}{C_p}), \overset{-}{\frac{\partial w_2^p}{\partial C_p}}, \overset{-}{w_2^p}(C_p), q'\overset{-}{p}^E(C_p), \overset{-}{q_p^E}(C_p),$$

$$\frac{\partial \ell_p^E}{\partial C_p},\ \bar{\ell}_p^E(C),\ L_p,\ \frac{\partial f}{\partial B},\bar{i})$$

$$(3.11A)\quad C_p^{Dworker} = C_p^w(1-\bar{P}_F^p;\ \frac{\bar{\partial q_i}}{\partial C_p}\ \bar{q}^i,\ \frac{\partial w_2^p(C_p)}{\partial C_p},w_2^p(\overset{+}{C_p}),\ \frac{\bar{\partial \ell^E}}{\partial C_p},\bar{\ell}_p^E(C_p),\bar{r})$$

These two equations yield supply and demand schedules for C_p versus P_f^p, holding other arguments constant. These other arguments are shift parameters. The signs above each argument are expected partial derivatives.

There is also the reduced form at equilibrium P_f^p for which

$$(3.11B)\quad C_p^E = C_p^E(A_p'(C_p),A_p(C_p),\frac{\partial w_2^p(C)}{\partial C_p},\ w_2^p(C_p),q_p'^E(C_p),q_p^E(C_p),$$

$$\frac{\partial \ell_p^E}{\partial C_p},\ell_p^E(C),L_p,\frac{\alpha f}{\alpha B},r,\frac{\partial q^i}{\partial C_p},q^i)$$

Unfortunately, most of the arguments in (3.11B) are not directly observable. We will estimate C_p^E by substituting the proxies age, education, tenure, and occupation and race to get

$$(3.11C)\quad C^p = g(AGE^p,EDUCATION^p,TENURE^p,OCC,RACE)$$

Let all the members of a particular group be identical as to their age cohort, education and job tenure. We have divided our sample into 2 age groups, 4 education groups and 3 tenure groups. So in each occupation, there are potentially 2 x 4 x 3 = 24 different groups of workers and therefore 24 different OJT markets.

We use age, education, tenure and occupation to proxy the above shift parameters by the following reasoning.

EDUCATION should be positively correlated with A(C) and A'(C) because education increases an individual's ability to learn (at least in theory) and therefore to benefit from training. Education should also be positively correlated with $w_2(C)$ (part of the return to C). It must be noted that education increases the return to general OJT as well as to specific OJT (C). Given limited resources, specific and general OJT are competing uses of the resources, and whether education increases C or not depends on how much an increase in education increases the returns to general OJT relative to returns to specific OJT. Therefore, the effect of education on specific OJT accumulation is ambiguous. We shall find the same is true with other variables.

AGE decreases an individual's tendency to quit because the closer he is to retirement, the fewer years he has on the "new" job and therefore the less gain from the quit.[5]

After a certain point, we expect further aging to decrease a worker's capacity for further training and therefore to decrease A(C) and A'(C).

TENURE is inversely related to $l^E(C)$, $q^E(C)$, $l^{E'}(C)$ and $q^{E'}(C)$ and positively related to $w_2(C)$ holding C constant. Union rules often require that earnings and job security be directly related to seniority. Even non-unionized firms may relate wages and immunity from layoffs to tenure for the sake of morale.

Occupations differ in their requirements for specific OJT. In other words, we expect A(C) and A'(C) to be particularly high in occupations which require much technical skill.

However, in the empirical literature the wage differences between blacks and whites are not entirely explainable by differences in general human capital variables. Part of the wage differences could be due to "crowding" of minorities into occupations and industries that are relatively low paying and/or unskilled. It is beyond the scope of this thesis to disaggregate on the basis of three-digit occupation and industry; but we hypothesize that blacks accumulate, on the whole, less specific OJT than whites.

2. Wage Model

Now we offer a more detailed model of the wage rates in t_1 and t_2.

(3.12) wage in $t_1 = w_1 = e^{a_o + a_1 Z + \mu_1}$

(3.12A) wage in $t_2 = w_2 = e^{a_{o1} + a_1(Z+\Delta Z) + a_2(LO1) + a_3 Q1 + a_4 SC + \mu_2}$

where

e = base of natural log

a_o = constant term in t_1

Z = vector of personal characteristics unaffected by job change in t_1

μ_1 = error term in t_1 $\mu_1 \sim N(0,\sigma_{\mu 1})$

a_{o1} = constant term in t_2

$Z+\Delta Z$ = vector of personal characteristics in t_1

L01 = 1 if worker had at least one layoff between t_1 and t_2

Q1 = 1 if worker had at least one quit between t_1 and t_2

a_2 and a_3 measure effects of layoffs and quits aside from loss of OJT (e.g., negative signalling effects)[6]

C = amount of specific OJT accumulated in t_1

S is a dummy variable which = 1 if the individual is with the same firm in t_2 as in t_1 (in which case $w_2=w_2(C)$) and S=0 otherwise

$\mu_2 \sim E(0,\sigma_{\mu 2})$

Taking logs of w_1 and w_2

(3.13) $\ln w_1 = a_o + a_1 Z + \mu_1$

(3.14) $\ln w_2 = a_{o1} + a_1(Z+\Delta Z) + a_2 L01 + a_3 Q1 + \mu_2$

Subtracting

(3.15) $\ln w_2 - \ln w_1 = a_{o1} - a_o + a_1 \Delta Z + a_2 L01 + a_3 Q1 + \mu_2 - \mu_1$

So besides change in the constant term and in white "noise", $\ln w_2 - \ln w_1$ is a linear function of changes in personal characteristics layoffs, quits, and quantity of specific OJT accumulated in t_1. This OJT is, however, irrelevant unless S=1, i.e., unless the worker has not changed firms between t_1 and t_2.

Before putting our equation into final form, let us transform a_4SC as follows:

Let $S = (1-LO_F)(1-Q_F)$

where

$LO_F = 1$ if worker left t_1 job by a layoff before t_2

and

$Q_F = 1$ if left by a quit before t_2.

If $LO_F=1$, $Q_F=0$ and vice-versa, then:

$$(3.16)\quad a_4SC=a_4(1-LO_F)(1-Q_F)C$$

$$= a_4C(1-LO_F-Q_F+LO_F \cdot Q_F)$$

$$= a_4C(1-LO_F-Q_F)$$

since $LO_F \cdot Q_F=0$.

Then we can transform equation 3.15 to read

$$(3.17)\quad \ln w_2-\ln w_1=b_o+b_1\Delta Z+b_2L01+b_3Q1+\mu$$

where

$b_o= \Delta a_o+a_4C$

$b_1= a_1,$

$b_2 = -a_4C + a_2$

$b_3= -a_4C+a_3$

We expect $b_2 < 0$, $b_3 > 0$.

Note that b_2 and b_3 are dependent on C. Therefore, b_2 and b_3 will vary among the different groups since each will have its own equilibrium value of C. In particular, we wish to know how the characteristics of each group that affect C (i.e., education, age, occupation and race) affect b_2 and b_3.

Below, in Chapter IV we estimate these effects by regressing $\ln w_2 - \ln w_1$ on layoff variables, quit variables and control variables, disaggregating by age, education, race and occupation. (Tenure is interacted with turnover variables in the equations.) Regressions are also run with the pooled (non-stratified) sample.

Footnotes

1. In practice, many dismissals reflect demand conditions in the firm's labor market. In such cases, dismissals may have nothing to do with the individual's competence. Such dismissals are called layoffs rather than discharges for cause. (Layoffs generally occur in order of seniority rather than of competence.) We shall refer to all dismissals as layoffs. In theory, the likelihood of being laid off due to demand conditions is inversely related to specific training, (Oi, 1962). We show here that probability of discharge for cause is also inversely related to C.

2. Since this is only a two period model, we asume the firm makes no attempt to replace workers who are laid off or who quit in period one with new trainees in period two.

3. If the individual receives a sample of n job offers, $\tilde{w}$, the highest of these wage offers is a random variable at least pro ante. $\tilde{w}$ can be thought of as a sample statistic with distribution $f_1(\tilde{w})$.

4. The third term includes (1-l(C)) because in our model it is only possible to quit <u>after</u> a worker discovers he will <u>not</u> be laid off. This assumption is made purely for the sake of mathematical tractability.

5. We are relaxing the assumption that each individual has the same amount of work time ahead in t_1, and also that a quit involves no costs beyond on-the-job search. If job change was costless the magnitude of the gain from quit would be irrelevant to the quit decision as long as that magnitude was greater than 0.

6. A layoff may cause a decrease in wage growth not only because it deprives the worker of firm specific OJT, but because in some cases it may deprive a worker of monopoly "rents" that accrue to employment in certain industries or occupations. This type of wage mobility is shown in the empirical work of Jacobsen. Laid off auto workers suffer a 40% loss in earnings after two years. Displaced apparel workers show almost no loss and a gain over non-laid off workers after six years. The reason may be that there is rent to being employed in the auto industry but not in the apparel industry.

Chapter IV

Empirical Work

A. Introduction

The aim of this chapter is to investigate empirically the effect that quits and layoffs have on wage growth.

In Chapter III, we discussed one theory with implications for this effect, i.e., the theory of general and specific on-the-job training. General OJT raises a worker's productivity with a number of firms; specific OJT raises a worker's productivity only with the firm that provided it. Consequently, any individual with large investments in specific OJT on the current job will earn more, cet. par., at that current job than he could with other firms and hence will experience proportionately more loss from a job change than workers with small investments in specific OJT. In the previous chapter, we discussed the effect of age, education, race and occupation on accumulation of specific OJT.[1]

If age, race, education and occupation influence specific OJT, they should also, cet. par., make a difference in loss or gain from a job change.

We predict that the loss from a job change will be particularly acute if the job separation results from a layoff rather than a quit because:

(1) If the net gain from a prospective job change is posi-

tive, a worker will quit to take the higher wage job.[2] In contrast, if one changes jobs involuntarily, potential new jobs are likely to be inferior to the old one.

(2) Some workers suffer a dismissal because they are incompetent. Therefore, potential employers may view some workers who have experienced a non-temporary involuntary separation as suspect and even more so workers with multiple non-temporary layoffs. On the other hand, quits may in some cases reflect self-selection out by incompetent workers. Employers may regard those who have quit frequently as likely to continue this pattern and thus as poor candidates for specific OJT. In such cases, the loss from quits could be as large as that from layoffs.

In the theory chapter, we assumed that each worker has two periods of work life remaining. In practice, at any point in time, individuals vary in the length of remaining work life. The greater the time until retirement, the more time a job changer has (potentially) on the new job. This implies that:

(1) Younger workers accumulate more OJT immediately after a job change than older workers since they have more years to retirement and potentially longer tenure on the new job. This means that we should observe, cet.par., greater wage growth for younger job changers than for older job changers.

(2) Younger workers invest more in on-the-job search than older workers, again because they have more time remaining to receive the returns to search. (We are relaxing the assumption

in the previous chapter that $\bar{S}$, quantity of on-the-job search, is fixed.)

Together (1) and (2) suggest that the gain (loss) from a job change will be, on average, smallest (largest) for older workers.

Also employers may be reluctant to hire older workers, due either to their shorter potential job tenure or to pure age discrimination. This further decreases the gain from turnover for older workers.

One proxy for specific human capital is job tenure. OJT theorists agree that the longer an individual expects to be on a job, the greater benefit specific training should be to himself and his employer. Further, as we saw in the theory chapter, the likelihood of quits and layoffs in a given period is decreased by an increase in specific OJT. Therefore, an individual's job attachment (and job tenure) should be directly related to specific OJT and to loss from a job change. Therefore, a correlation between age and tenure contributes to the case for greater loss from turnover by older workers.

If we use 1968 (first year of data) job tenure as a measure of specific OJT acquired on 1968 job prior to the survey, we should expect the loss from turnover to be directly related to 1968 tenure.

In summary, we expect the loss from a layoff to be greater than that for a quit, and that financial loss from a job change should be positively related to one's age and job tenure as well as to other variables discussed in the OJT model in chapter 2.

In other words, if w_2 is the wage in the second period and LO is the number of layoffs and Q is the number of quits we expect that

(1) $\frac{\partial w_2}{\partial LO} < 0$, $\frac{\partial w_2}{\partial Q}$ is of ambiguous sign

(2) $\left|\frac{\partial w_2}{\partial LO}\right|$ is greater for older workers

and

(3) $\left|\frac{\partial w_2}{\partial LO}\right|$ is greater for high tenure workers.

Note that if (3) is true, this may reflect employees' tendency to stay longest on jobs that have economic "rent," i.e., that are in industries in which wages are high due to the monopoly positions of firms rather than to large OJT investments. If this tendency exists, those workers laid off with long job tenure may be losing economic "rent" rather than firm specific OJT.

B. Empirical Methodology

A. Basic Regressions Model

In the theory chapter, we showed that the change in the log wage, ($\ln w_2 - \ln w_1$) (which equals $\ln (\frac{w_2}{w_1})$), with respect to a layoff or quit is dependent on C, the quantity of specific OJT accumulated on the t_1 job.

We also demonstrated that C is a function of certain personal characteristics of the worker, e.g., tenure, education, age, race and occupation. Let X_1 be the vector of levels of these characteristics. It follows that the change in wage growth that results from a quit or layoff is a function of X_1.

More formally:

$\ln w_2 - \ln w_1 = f^W(X_1, X_2, X_3)$

where

X_1 is the above-mentioned vector of characteristics that affect C

X_2 is a vector of key (turnover) variables, i.e., variables describing quits and layoffs, and

X_3 = a vector of other control variables. (X_2 and X_3 will be discussed below in greater detail.)

Let $C = g(X_1)$.

Recall from Chapter 3 that

ΔZ = change in personal characteristics between t_1) and t_2

LO1 = 1 if there were any layoffs

Q1 = 1 if there were any quits

From equation (3.17):

4.1 $\ln w_2 - \ln w_1 = b_o + b_1\Delta Z + b_2 LO1 + b_3 Q1 + \mu$

with

$b_2 = -a_4 C + a_2$ (a_2, a_3 and a_4 are coefficients

$b_3 = -a_4C + a_3$ from equation 3.15)

a_2 and a_3 are effects of layoffs and quits on growth in the log wage aside from OJT effects.

or substituting, $C=g(X_1)$ where X_1 is a vector of personal characteristics (i.e., age, education, race, occupation, tenure):

$b_2 = -a_4g(X_1) + a_2$

$b_3 = -a_4g(X_1) + a_3$

So we hypothesize that b_2 and b_3 are functions of X_1. We shall test this hypothesis plus the hypothesis that b_o and b_1 are functions of X_1. This could be accomplished by interacting all the other independent variables with X_1. Equivalently, we will stratify our equations by each variable included in X_1, i.e., by age, then by education, then race, then by one-digit occupation. Each of the two age groups will be further stratified by education and then by race. We shall also run unstratified regressions that include our entire sample.

C. The Data

The data for this empirical test are from the Panel Study of Income Dynamics conducted by the Institute for Social Research Center of the University of Michigan. Since this is a panel study, it follows each family from 1968 to 1981, interviewing the family head in each year. The original 1968 survey consists of

4802 families. Of these families, 1872 were drawn from the 1967 Survey of Economic Opportunity, of which half the individuals lived in predominantly non-white Census Tracts. All of the families taken from the SEO had 1966 income equal to or below twice the federal poverty line at that time.[3]

Since the individuals we are examining are family heads, and most variables refer to the characteristics of the head of a particular family at a particular point in time, it is important to restrict the sample to families for which the head was constant over the entire survey period.[4]

One major problem with these data is that it is impossible to tell exactly when a particular layoff or quit took place. Turnover was reported as follows. The head was asked in each year what his tenure was on the current job. In all relevant years, if tenure was less than 12 months or if the head was unemployed at the survey date, the head was asked: "What happened to your last job?" Following is an example of the problem with this scheme of reporting. Suppose in the year 1972, the head reported less than 12 months tenure on the current job and, on further questioning, reported that he lost the last job by a layoff. It is unclear whether the layoff took place in 1972 or in 1971 even if the head was employed at the time of the 1971 interview.[5]

In fact, if a layoff from the last job was reported in both 1972 and 1971 and the head was unemployed in 1971 at the time of the survey, it is possible that the 1972 and 1971 layoffs actually represent the same event. In other words, the worker may have been laid off prior to the 1971 interview, been unemployed until after the 1971 interview and become re-employed less than a year before the 1972 interview. In this case, the 1971 layoff would be reported both in 1971 and in 1972, since in 1972 the individual had less than a year of job tenure and lost the last job by a layoff. Therefore, anyone who reported having lost the last job by a layoff in two consecutive years (or a quit in two consecutive years) and did not work after the survey date in the earlier of these years was dropped from the sample. This ensures that quits and layoffs are not double counted.[6]

There are some additional problems. When heads were asked: "What happened to your last job?" the possible responses were coded as follows:

(1) company folded, changed hands, moved out of town, went out of business, employer died,

(2) strike or lockout,

(3) laid off or fired permanently,

(4) quit, resigned, retired or pregnant (or promoted if response was obtained during 1969-74 or still had old job in addition to new (main) job if response was obtained during 1969-1975),

(5) first full time or permanent job ever had, wasn't working before this,

(6) self-employed on the last job and unemployed at the time of the survey. (From 1975 on, employed workers received code (6) if they changed jobs by a promotion and received code (4) if they were self-employed on the last job); for 1969-1974, workers employed at the time of survey, and self-employed on the last job received code (6),

(7) other, including being drafted,

(8) job was temporary,

(9) not available,

(10) inapplicable question.

There are two major problems with this coding for the purpose of this thesis.

(a) Those who reported a voluntary job separation during the period 1969-1974 are indistinguishable from those who reported a promotion during 1969-74 as both kinds of workers are assigned code (4) in the year in which the quit or promotion is recorded. For 1969-1975, those who quit were indistinguishable from those who kept the old job in addition to a new (main) job for the same reason, i.e., both are coded as (4).

(b) Genuine layoffs (due to the firm's demand conditions rather than incompetence on the part of the worker) are indistinguishable from discharges for cause. Both are coded as (3), despite the fact that the two kinds of discharges have very different implications for signalling.

In the remainder of this thesis, we shall for convenience refer to codings of (1) or (3) in any year as "layoffs", and codings of (4) as "quits".

Unfortunately, even with the best designed questionnaires, the difference between quits and layoffs may sometimes be blurred. For example, a worker who knows he is about to be fired may resign instead. Sometimes the desire to terminate a firm-worker relationship is mutual; the worker wishes to leave the firm and the firm wants to be rid of the worker. Which party actually initiates the termination (i.e., whether it is regarded as a layoff or quit) is arbitrary in such cases. A third example occurs when a worker who has a new job lined up for some future time volunteers to be "laid off" from the old job knowing that in the period between the old job and the new he can collect unemployment benefits.

Further, quits as well as layoffs may result in negative signalling. From the point of view of a prospective employer, a worker who demonstrates, by frequent quits, an unwillingness to commit himself to one job may be less desirable than a worker who experienced a layoff due to poor luck.

Many quits are for non-pecuniary reasons, e.g., dislike of the job. Ideally, we would consider effects of turnover on non-monetary benefits as well as on the money wage rate. Unfortunately, the data do not allow estimation of psychic benefits of a job. Quits for purely non-money reasons would not be expected to raise one's wage rate. The possibilities of quits with non-pecuniary motivation, of "quits" that are not entirely voluntary, and of over-optimistic quitters (who have a lower alternative wage than they believe) cause us to conclude that the expected change in wage from quits is ambiguous.

D. Sample

Our sample is restricted to individuals who:

(1) are male family heads in the years 1968-1980,

(2) are without severe health limitations in 1968 and 1980,

(3) are in the labor force at the time of both the 1968 and 1980 interviews,

(4) are 23-53 years of age in 1968,

(5) have non-zero average hourly wage in 1968 and 1980,

(6) are not self-employed proprietors, farmers, in the armed forces or police or of unknown or miscellaneous occupation in 1968 or 1980,

(7) are not among those deleted because of ambiguity in the number of quits and layoffs (as explained above),

(8) do not have missing data on any of the variables used in the regression.

The resulting sample size is 830 out of a data set of 6,620.

E. Regressions Variables

1.A. The Dependent Variable

Our dependent variable is:

$\ln w_2 - \ln w_1$

where

$\ln w_2$ = log of average hourly 1980 earnings

$\ln w_1$ = log of average hourly 1968 earnings.

The log specification follows treatment of Jacob Mincer (1973).

In our chapter 3 wage model (eqn. 3.14),

$$\ln w_2 = a_o + a_1(Z+\Delta Z) + a_2 LO1 + a_3 Q1 + a_4 SC + \mu_2$$

Recall that S = 1 if there was no turnover 1969-79. C is specific OJT.

The coefficients can be interpreted as the percent change in w_2 with respect to changes in the independent variables. Rather than simply using $\ln w_2$ as the dependent variable, we use $\ln w_2 - \ln w_1$ for the following reasons:

(1) The log wage rate at any period is a function of some individual characteristics that we can measure and others that are unobservable (such as the individual's fundamental personality which includes his intelligence, emotional stability and energy level). If the unmeasurable variables are important and correlated with included variables, their exclusion could bias

the regressions coefficients. Assuming (as discussed above) that the log wage is a linear function of all characteristics and that the unobserved variables and their true coefficients are constant over time, subtracting ln w_1 from ln w_2 will cause their effect to be cancelled out.

(2) ln w_1 is a function of, among other investments, specific OJT investment as of t_1 on the t_1 job. This specific OJT investment is part of the opportunity cost of changing jobs, either by a quit or by a layoff. Therefore ln w_2-ln w_1 is a measure of the net gain from a job change.

If X is some independent variable in the regression, its coefficient can be interpreted as $\frac{\partial \ln \left(\frac{w_2}{w_1}\right)}{\partial X}$. This, in turn, can be interpreted as the rate of change of $\frac{w_2}{w_1}$ that results from a marginal change in X. Call this interpretation "a." Unfortunately, most of our independent variables are dummies which cannot change marginally, so care must be taken in using this interpretation. This interpretation is equivalent to interpreting the coefficients as the change in rate of wage growth.

Another possible interpretation of the independent variables follows from the functional form of the regression:

$$\ln w_2 - \ln w_1 = b_o + b_1 \Delta Z + b_2 LO + b_3 Q + \mu$$

Is equivalent to:

$$\ln w_2 = \ln w_1 + b_o + b_1 \Delta Z + b_2 LO + b_3 Q + \mu$$

Our regression is equivalent to including $\ln w_1$ as an independent variable in determining $\ln w_2$ and constraining the coefficient of $\ln w_1$ to be 1 (Leigh, 1978). In this case, the coefficient on any independent variable X is the percentage change in w_2 (the 1980 wage rate) that results from a change in X. Call this interpretation "b."

This interpretation has some dangers as well. The main danger is that X and $\ln w_1$ will be correlated. For instance, those with UNI68=1 (who belonged to a union in 1968) can be expected to have relatively high values of $\ln w_1$. We will see that those who were union members in 1968, but not in 1980 (CUNIN=1) have $\ln w_2 - \ln w_1$ that is less than those who belonged to a union in neither year. 1980 wages could be just as high for union leavers as for those who never joined a union, but $\ln w_1$ is higher so CUNIN causes a decline in $\ln w_2 - \ln w_1$.

We will use both of these interpretations. Sometimes, in the text, we will assume that the coefficient of X is the percentage change in w_2 that results from a change in X (interpretation b). However, we shall also, in presenting the results, interpret the coefficient of X as the expected rate of change in the ratio w_2/w_1.

2B. The Independent Variables

a. The Turnover Variables

Our chief independent variables in the regressions will be those describing the individual's layoff and quit incidence, although control variables will, of course, be included. The turnover variables are designed to answer the following questions:

(1) Are quits less financially damaging than layoffs?

(2) Do the number of layoffs and quits make a difference or is only the fact of having any layoffs/quits important?

(3) Does the proximity to t_2 of the year in which the layoff/quit occurred matter in its effect on $\ln w_2 - \ln w_1$?

(4) Does tenure prior to the layoff/quit matter in the effect of the layoff/quit on $\ln w_2 - \ln w_1$?

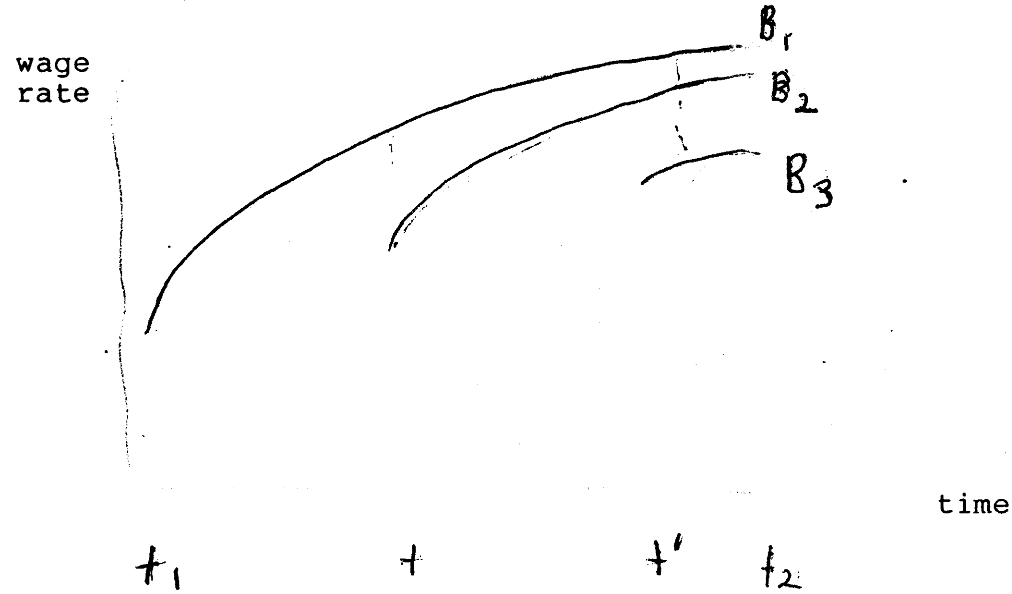
Before presenting the precise forms of the turnover variables, we discuss these questions in detail.

Question (1) was mentioned in the introduction to this chapter. We expect that layoffs will have a negative effect on $\ln w_2 - \ln w_1$ because they may result in negative signalling and because an involuntary job change suggests that the worker's alternatives are inferior to the job from which he was laid off as well as because of loss of OJT. The expected effect of quits on financial compensation is ambiguous. A quit between t_1 and t_2 may be a move to a higher paying job (in which case it would increase $\ln w_2 - \ln w_1$) or it may occur for non-pecuniary reasons or it may be a face-saving move by an employee who is about to be fired. Recall that the distinction between quits and layoffs may be blurred. At any rate, we expect that if quits decrease $\ln w_2 - \ln w_1$, they do so less than layoffs.

(2) Is the number of quits and layoffs important or merely the fact of any quit or layoff activity? An individual with a history of many layoffs or many quits may be perceived as unreliable by employers. Therefore, we wish to examine how the number of layoffs and number of quits affects $\ln w_2 - \ln w_1$. On the other hand, only one job change is required to deprive an individual of all the firm specific OJT acquired as of t_1. Thus, we also want to test the hypothesis that the existence of at least one layoff or of at least one quit affects $\ln w_2 - \ln w_1$.

(3) Is the timing of the layoff/quit important? We hypothesize that the worker will, to some extent, recover from the effects of layoffs and quits, but that such a recovery takes time. Jacobsen (1976) illustrates this with the following diagram.

Table 4.1



Graph 4.1 - Effects of Layoffs on Wage Growth by Timing of Layoffs

B_1 is the wage profile of an individual with no layoffs between t_1 and t_2.

B_2 is the wage profile of an individual with a layoff in time t only. Note that the individual described by B_2 has almost fully "recovered" his wage rate by t_2. In other words, by t_2, his wage rate is nearly the same as it would have been had the layoff never happened.

B_3 is the wage profile of an individual who was laid off in t', a time prior to t_2 but after t. The individual described by B_3 may also eventually recover from the layoff, but when we observe him in t_2, his wage rate will be much farther below the wage rate of someone without a layoff (described by B_1 than will be the wage rate of someone with a less recent layoff (described by B_2). We thus expect $\ln w_2 - \ln w_1$ to be less for workers with a recent layoff than for workers with a less recent layoff.

One rationale for eventual "recovery" from a job change is that a worker who loses the wage benefit from specific OJT after a job change may, in a few years, have a substantial amount of new specific OJT. Another, is that the individual's employer immediately following a layoff/quit may initially take the job change as a negative signal but regard it as irrelevant after employing the individual for several years and observing his work first-hand.

(4) Does job tenure prior to turnover matter? Various authors (e.g., Bartel and Borjas) have suggested that job tenure be used as proxy for specific OJT. The reason is that specific OJT is relatively useless for individuals with short job tenure and that (as modelled in chapter 3) the larger quantity of specific OJT a worker accumulates with a firm, the less likely he is to be laid off or to quit, and therefore the longer he will be on the job. It is unlikely, however, that the correlation between job tenure and OJT is exact. Job attachments may be due to non-pecuniary benefits rather than to possession of large amounts of OJT.

To investigate these issues, five alternative specifications of the turnover variables were used. In the following section, we discuss each of them in turn:

I. LO (= total number of layoffs reported 1969-1979)

Q (= total number of quits reported 1969-1979)

In the first set of regressions. LO and Q are included as independent variables. Unfortunately, as can be seen in the data section, at most one layoff or quit is reported in any given year. (The only information we have in any year on job changes is the answer to the question: "What happened to your last job?") So multiple layoffs or quits within a year are not recorded. With this caveat in mind, LO and Q are still useful variables; providing one measure of the frequency of quits and layoffs. We expect the coefficient of LO to be negative, but the sign of the coefficient of Q is ambiguous.

II. LO1 (= 1 if reported at least one layoff 1969-1979)

Q1 (= 1 if reported at least one quit 1969-1979)

In the second set of regressions, we substitute the dichotomous variables LO1 and Q1 for LO and Q. The regressions in I and II together are an empirical test of question (2): "Do number of quits/layoffs matter or merely the existence of any quits/layoffs?" We expect the coefficient of LO1 to be negative and have no a priori expectation about Q1.

III. LOE (= number of layoffs reported, 1969-1973)

LOL (= number of layoffs reported, 1974-1979)

QE (= number of quits reported, 1969-1973)

QL (= number of quits reported, 1974-1979)

In the third set of regressions, LO1 and Q1 are removed and

LOE, LOL, QE, and QL (denoting early or late) are inserted. These regressions address question (3): "Does the number of recent layoffs/quits (those in 1974-1979) affect the wage in 1980, and thus $\ln w_2 - \ln w_1$ more than number of earlier layoffs/quits (1969-1973)?" We hypothesize that LOE and LOL will both have negative coefficients, with the coefficient of LOL larger in absolute value than that of LOE. Again quits have an ambiguous effect and we do not have an a priori notion of the signs of QE and QL.

IV. LOE1 (= 1 if at least one layoff reported 1969-1973)

LOL1 (= 1 if at least one layoff reported 1974-1979)

QE1 (= 1 if at least one quit reported 1969-1973)

QL1 (= 1 if at least one quit reported 1974-1979)

As in set III, LOE1, LOL1, QE1, QL1 denote timing of layoffs and quits.

V. LO1S = interaction term between LO1 and dummy denoting 1968 job tenure less than two years

LO1MED = interaction between LO1 and 1968 job tenure of 2-3 years

LO1LG = interaction between LO1 and 1968 job tenure of four or more years

Q1S = interaction between Q1 and 1968 job tenure of less than 2 years

Q1MED = interaction between Q1 and 1968 job tenure of 2-3 years

Q1LG = interaction between Q1 and 1968 job tenure of 4 or more years.

In the fifth set of regressions, these interaction terms are used. This set of regressions addresses question (4): What is the influence of tenure prior to a layoff or quit on the effect of the layoff or quit on $\ln w_2 - \ln w_1$? Ideally, we would have completed job tenure at time of the layoff or quit as a proxy for total OJT accumulated on the 1968 job. Data problems prevent us from retrieving this information. On the positive side, these dummies, which incorporate 1968 job tenure are an indication of specific OJT in 1968 which would be a factor in explaining the 1968 wage rate and thus $\ln w_1$.

b. Control Variables

We want to test the effect layoffs and quits have on $\ln w_2 - \ln w_1$ controlling for as many other factors as possible. The control variables can change between 1968 and 1980. Recalling (from the theory section) that on average

$$\ln w_2 - \ln w_1 = b_o + b_1 \Delta Z + b_2 LO + b_3 Q$$

Where Z is a vector of control variables, we see that including <u>changes</u> in the control variables in the regressions is desirable. We also include the 1968 level of each control variable.

The control variables are:

H.S. = 1 if had exactly 12 years of school in 1968

H.S.P. = 1 if had more than 12 years of school in 1968 but less than 16

COLL = 1 if had 16 or more years of school in 1968

EDUP = 1 if individual increased his educational level between 1968 and 1980.

YOUNG = 1 if individual was 23-37 years old in 1968

WHITE = 1 if individual is white

UNI68 =1 if was a union member in 1968

CUNIY = 1 if was not a union member in 1968 but was in 1980

CUNIN = 1 if was a union member in 1968 but not in 1980

REG68 = 1 if worker was a resident of the South in 1968

CREGS = 1 if the worker moved to the South between 1968 and 1980

CREGNS = 1 if the worker moved out of the South between 1968 and 1980

HLIM68 = 1 if the worker had a health limitation in 1968

HEALTHB = 1 if the worker had a health limitation in 1968 but not in 1980

HEALTHW =1 if the worker had no health limitation in 1968 but had one in 1980

MARRY68 = 1 if worker was married in 1968

MARRY = 1 if worker was unmarried in 1968 but was married in 1980

UNMARRY = 1 if worker was married in 1968 but unmarried in 1980

Explanation of "Control" Variables

1. Dummies for education completed by 1968 and for increase in education 1968-1980 (H.S., H.S.P., COLL and EDUP). There are several mechanisms through which education could influence $\ln w_2 - \ln w_1$. First, education is a form of human capital investment; part of the return on this investment will be an increase in both $\ln w_1$ and $\ln w_2$ over the log wage rates a worker would receive without the investment. The effect this has on $\ln w_2 - \ln w_1$ depends on whether education increases $\ln w_1$ more than $\ln w_2$ or vice versa. Also, an individual's 1968 educational level may be correlated with quantity of OJT and other investment between 1968 and 1980. Education can be used as a proxy for ability to the extent that highly educated individuals tend to assimilate new information well; those with the most education will benefit most from OJT. Employers may therefore use education as a screening device to help decide in whom to invest OJT. Further, the education itself may increase one's learning potential and thus be a complement to OJT. These factors imply that human capital investment between 1968 and 1980 (and therefore, cet. par., $\ln w_2 - \ln w_1$) is a positive function of education. Therefore, we expect positive coefficients for H.S., H.S.P., and COLL with the coefficients increasing from H.S. to COLL.

The dummy for increase in education 1968-1980, EDUP, should also have a positive coefficient since the increase in education is a human capital investment and since the increase in education may increase one's ability to benefit from post-school investments.

2. Age dummy - YOUNG (=1 if less than 38 years old). As discussed above, we expect younger workers to acquire relatively large amounts of OJT, and the same should apply for other kinds of human capital as well. Thus, the fastest growth in log wages should accrue to younger workers, and we expect a positive coefficient on YOUNG.

3. Race dummy WHITE. This dummy measures labor market racial discrimination in wage growth after controlling for other variables. It may also measure discrimination in the market for OJT. On both counts, we expect the coefficient of WHITE to be positive.

4. Dummies for 1968 union status and change in union states (UNI68, CUNIY, CUNIN). Unions are able to bargain monopolistically for wage increases. Therefore, 1968 union membership should, cet. par., increase $\ln w_1$; its effect on $\ln w_2 - \ln w_1$ is ambiguous. We expect CUNIY (=1 if became a union member over the survey period) to have a positive sign and CUNIN (=1 if ceased being a union member over the period) to have a negative sign.

5. Dummies for 1968 Southern residence and for movement in and out of the South (REG68, CREGS, CREGNS). Since the Sunbelt has been the most rapidly growing sector of the country in recent years, we expect the sign of REG68 (=1 if lived in the South in

1968) to be positive. However, in most of the South, wage levels are lower than in the other regions. So we expect movement out of the South (CREGNS=1) to increase $\ln w_2 - \ln w_1$ and movement to the South (CREGS=1) to decrease wage growth. This result for CREGS is mitigated by the fact that any regional mobility is an investment which should bring a positive return.[7]

6. Dummies for health limitation and changes in health limitation (HLIM68, HEALTHB, HEALTHW). A health limitation in time t should, cet. par., decrease $\ln w_t$. If a worker has a health limitation in 1968 and in 1980, then the health limitation would adversely affect both $\ln w_2$ and $\ln w_1$ and perhaps have no direct effect on $\ln w_2 - \ln w_1$. However, a health limitation that persists throughout the period t_1 to t_2 may discourage human capital investment over the period which would decrease $\ln w_2 - \ln w_1$. So we expect the sign of HLIM68 to be negative.

Improvement in a 1968 health limitation by 1980 has no effect on w_1 (the 1968 wage). However, the 1980 wage, w_2, should be higher for the improvers. So HEALTHB is expected to have a positive coefficient.

On the other hand, those with no health limitation in 1968 but a health deterioration by 1980 should have lower 1980 wages than workers with no deterioration. Therefore, we expect HEALTHW to have a negative coefficient.

7. Dummies for marital status and changes in marital status (MARRY68, MARRY, UNMARRY). Married men tend to have more finan-

cial responsibilities than single men. Consequently, we would expect those who marry to be those with the highest earnings (growth) potential. We therefore can regard marriage as a proxy for unmeasured characteristics (such as energy level) that increase wage growth. MARRY68 should have a positive coefficient.

F. Results

In this section, we will present, for the most part, regresions coefficients and t values only for the key variables. (The appendix will contain all regressions coefficients for selected regressions.) However, to give the reader an overview of the equations as a whole, we present and discuss all the coefficients (including key and control variables) of SET I regressions for the following groups:

1. the entire sample (ALL)
2. the YOUNG sample (all workers 23-37 years old in 1968)
3. the OLD sample (all workers 38-53 years old in 1968)
4. all WHITE workers
5. all BLACK workers

The Pooled Regression (ALL)

None of the education dummies or the increase in education dummy or WHITE are significant at even the 10% level.

Table 4.1

A. Pooled Sample

Dependent Variable = $\ln w_{1980} - \ln w_{1968}$

n = 830

VAR	COEF (t value)	VAR	COEF (t value)
H.S.	-.043 (-1.008)	HEALTH W	-.089 (-1.191)
H.S.P.	.086 (1.595)	MARRY 68	.189 (1.409)
COLL	-.024 (-.453)	MARRY	.189 (1.409)
EDUP	-.043 (-.789)	UNMARRY	-.252 (-3.876)***
YOUNG	.107 (3.181)***	LO	-.032 (-1.449)
WHITE	.007 (.168)	Q	-.018 (-1.012)
UNI68	.106 (2.441)***	CONSTANT	.836 (7.928)***
CUNIY	.110 (1.886)*	R^2 = .09	
CUNIN	-.309 (-4.715)***		
REG68	.087 (2.280)**		
CREGS	.009 (.071)		
CREGNS	.037 (.244)		
HLIM68	.176 (1.497)		
HEALTHB	-.009 (-.060)		

* = 10% level significance
** = 5% level significance
*** = 1% level significance

B. Young Sample
Dependent Variable = $w_{1980} - w_{1968}$
n = 421

VAR	COEF (t value)
E3	-.024 (-.385)
E4	.095 (1.259)
COLL	.010 (.130)
EDUP	-.009 (-.121)
RA	-.032 (-.532)
UNI68	.077 (1.136)
CUNIY	.052 (.642)
CUNIN	-.360 (-3.891)***
REG68	.072 (1.310)
CREGS	.173 (1.100)
CREGNS	.143 (.690)
HLIM68	.075 (.403)
HEALTHB	.165 (.654)
HEALTHW	-.109 (-.914)
MARRY68	.448 (2.945)***
MARRY	.545 (2.780)***
UNMARRY	-.255 (-2.824)***
CONST	.621 (3.652)***

R^2 = .1079

LO	-.026 (-.760)
Q	-.029 (-1.267)

C. Older Sample
Dependent Variable = $w_{1980} - w_{1968}$
n = 409

VAR	COEF (t value)	VAR	COEF (t value)
H.S.	-.065 (-1.083)	HEALTHW	-.074 (-.764)
H.S.P.	.052 (.661)	MARRY68	-.221 (-1.770)*
COLL	-.045 (-.638)	MARRY	-.137 (-.703)
EDUP	-.070 (-.828)	UNMARRY	-.237 (-2.468)***
		LO	-.048 (-1.599)
WHITE	.052 (.842)	Q	.011 (.327)
UNI68	.127** (2.212)	CONST	1.090 (7.955)
CUNIY	.162 (1.887)*	R^2 =	.103
CUNIN	-.233 (-2.420)***		
REG68	.094 (1.764)*		
CREGS	-.469 (-2.048)**		
CREGNS	-.085 (-.367)		
HLIM68	.246 (1.622)		
HEALTHB	-.140 (-.749)		

D. Whites

Dependent Variable = $w_{1980} - w_{1968}$

n = 614

VAR	COEF	(t value)
H.S.	-.034	(-.710)
H.S.P.	.117	(1.984)**
COLL	-.023	(-.407)
EDUP	-.026	(-.450)
YOUNG	.092	(2.439)***
UNI68	.064	(1.270)
CUNIY	.124	(1.784)*
CUNIN	-.278	(-3.875)**
REG68	.077	(1.769)*
CREGS	.033	(.262)
CREGNS	.021	(.135)
HLIM68	.065	(.516)
HEALTHB	.097	(.580)

VAR	COEF	(t value)
HEALTHW	-.021	(-.227)
MARRY68	.162	(1.455)
MARRY	.240	(1.521)
UNMARRY	-.175	(-2.092)**
LO	-.049	(-1.902)*
Q	-.012	(-.572)
CONST	.770	(6.374)***

R^2 = .072

E. Blacks

Dependent Variable = $w_{1980} - w_{1968}$

n = 193

VAR	COEF (t value)
H.S.	-.090 (-.860)
H.S.P.	-.204 (-1.230)
COLL	.052 (.189)
EDUP	-.144 (-.860)
YOUNG	.220 (2.521)***
UNI68	.236 (2.338)***
CUNIY	.095 (.766)
CUNIN	-.399 (-2.242)**
REG68	.133 (1.341)
CREGS	---
CREGNS	---
HLIM68	.467 (1.460)
HEALTHB	-.224 (-.609)

VAR	COEF (t value)
HEALTHW	---
MARRY68	-.150 (-.731)
MARRY	.010 (.034)
UNMARRY	-.352 (-2.816)***
LO	-.008 (-.148)
Q	-.041 (-.929)
CONST	.964 (4.312)***

R^2 = .1549

YOUNG, UNI68 and CUNIY all have coefficients that are of the expected positive sign and significant at the 10% level. Being less than 37 years old in 1968 increased w_2/w_1 by slightly more than 10%. The same is true of union membership in 1968. Leaving the union, however, decreased w_2/w_1 by almost 31%. The coefficients of UNI68 and CUNIN together imply that $\ln w_2 - \ln w_1$ was less for union leavers than for those who belonged to a union in neither year (the reference group) by .309-.106=.203.[8]

As expected, REG68 is positive. Southern residence in 1968 increases w_2/w_1 by 8.7%. This coefficient does not necessarily reflect a higher 1980 wage for Southerners. Since money wages in the South have in the past been lower than in other areas of the country, this result reflects in part low 1968 wages in the South. As discussed above, the South has experienced a recent boom so that regional wage differentials have narrowed.

Movement in and out of the South has little apparent effect on the dependent variable. This may be because the number of movers is small--only 14 individuals moved to the South and only 10 moved out between 1968 and 1980. Neither does health or changes in health. Recall that no one with more than a moderate health limitation was included in our sample, so we would expect any health problems to have, at most, a mild effect.

Marital status in 1968 and marriage during the survey period have no apparent effect on the dependent variable. Death or divorce of a spouse, on the other hand, decrease $\ln w_2 - \ln w_1$ by

.252.[9]

LO and Q are not significant at even the 10% level. It will turn out when all regression sets are presented that the number of layoffs and quits reported 1969-79 is not the best measure of turnover activity. Although regression SET I using LO and Q provides some interesting information, SETS II through V gradually refine our turnover variables. SETS IV and V will yield the most intriguing results.

YOUNG

For workers less than 37 years of age, UNI68 and CUNIY are no longer significant, but CUNIN is still negative and is significant at the 1% level. Insignificance of the UNI68 coefficient is not evidence that union membership in 1968 does not increase wage growth. According to statistical theory, the null hypothesis can, in general, not be accepted just because we fail to reject it.

Southern residence and geographical mobility have no apparent effect for this group, nor do health limitations. Marital status does appear to affect wage growth. Being married in 1968 increases $\ln w_2 - \ln w_1$ by .448.

The negative coefficient for UNMARRY on the other hand seems to indicate that loss of a spouse decreases 1980 earnings by 25.5%.

OLD

Union status and change in union status dummies are significant at the 10% level (at least) for middle aged workers. 1968 union membership increases w_2/w_1 by 12.7%. Joining a union during the survey period increases it by 16.2% and leaving the union decreases w_2/w_1 by 23.3%. Growth in the log wage is smaller for 1968 union members who left than for those who belonged to a union in neither period by .233-.127=.106 (coefficient of UNI68 minus coefficient of CUNIN). Here we cannot interpret this result (i.e., use interpretation "b") to mean that the 1980 wage rate is 10.6% less for union leavers than for the reference group. Since these union leavers belonged to a union in 1968, their wage rates in 1968 were, all else equal, greater than that of the reference group. So $\ln w_2 - \ln w_1$ should be smaller for the union leavers even if their 1980 wage is the same as those who never belonged to a union.

Southern residence in 1968 (REG68=1) has a positive and significant (at the 10% level) coefficient as expected. Movement into the South, however, seems to lower wage growth. Movement by middle aged and older individuals to the South may be preparatory to retirement and accompanied by a shift to an easier (and less high-paying) job.

Being married in 1968 actually decreases $\ln w_2 - \ln w_1$ by .221 for the middle aged workers. Those married in 1968 but unmarried by 1980 suffer a further loss as UNMARRY has a negative coefficient that is significant at the 1% level. Given w_1, an individual married in 1968 but not in 1980 has a 1980 wage that is 22.1%+23.7%=45.8% less than that of the reference group! LO is close to being significant at the 10% level; Q is completely insignificant.

WHITES

For whites, it does pay to increase education over the survey period. Holding w_1 constant, the increase (EDUP=1) raises the 1980 wage by 11.7% (by interpretation "b" under which the coefficient gives the percentage change in 1980 wage). Being under 37 in 1968 (YOUNG=1) increases w_2/w_1 by 9.2%. Younger workers, as expected, have the fastest wage growth.

Joining a union increases w_2/w_1 by 27.8%. Union leavers have w_2/w_1 that is 21.4% less (21.4% = 27.8% - 6.4%) than workers who belonged to a union in neither year.

REG68 is positive (.077) and significant at the 10% level. We saw that in the regression for ALL workers and for older workers that REG68 is also significant at the 10% level. However, whites in particular would be likely to receive a premium for being Southern residents if racial discrimination was most strongly operative in the wage determination of Southern firms.

For whites, number of layoffs (LO) has a negative coefficient that is significant at the 10% level. This coefficient suggests that if w_1 and LO are unrelated, each additional layoff decreases w_2 for whites by 4.9%. This magnitude is quite close to that of LO for older workers (-.048). This may mean that it is older white workers who suffer from layoffs.

BLACKS

For blacks, w_2/w_1 is larger for younger workers by 22.0%. The coefficient of YOUNG is larger for blacks than for whites but not significantly different at the 10% level. The same is true for the coefficients of UNI68 and CUNIN. As expected, union membership increases $\ln w_2 - \ln w_1$ and leaving the union decreases $\ln w_2 - \ln w_1$. UNMARRY is negative and significant at the 1% level. Holding w_1 constant, becoming single lowers a black worker's wage by 35.2%. LO and Q are both insignificant.

Chow tests were performed to test whether the YOUNG/OLD division and the WHITE/BLACK division improved the regressions fit.

For the YOUNG/OLD division,

$$F(409,401) = 1.130$$

which is below the cutoff point for significance at the 5% level. Disaggregation by age is not shown to improve the sum of squared errors significantly.

For the BLACK/WHITE divisions,

$F(594,193) = 1.38$

which is greater than the cutoff point for 1% level significance (1.33). This suggests that disaggregation by race does improve the regression results.

Further Disaggregation of Regression Results

Below we present and discuss key regression coefficients for all regression sets. We have the following prior expectations about our regressions results.

1. Layoff variables should have negative coefficients.

2. Variables denoting recent layoffs should have coefficients that are higher in absolute value than those denoting less recent layoffs.

3. Coefficients of layoff dummies interacted with 1968 tenure should increase in absolute value with amount of tenure. The more 1968 tenure a worker has, the greater should be the loss from a layoff.

4. Loss from turnover should increase with age; quit and layoff variable should have coefficients that are smaller (algebraically) for the older group.

5. The effect of education on loss from turnover is ambiguous. On the one hand, the more educated one is, the easier it will be to "learn" OJT; this encourages specific OJT investment for college graduates. On the other hand, the best educated workers have large amounts of general human capital which could be

substitutable for specific OJT. A priori, we would hypothesize that workers with an average amount of education acquire the most specific OJT and therefore suffer the most from turnover.[10]

6. We expect loss from turnover to be greater for whites than for blacks. Assuming racial prejudice and "crowding" of blacks into low wage industries, blacks have less to lose from turnover than whites.

7. We expect skilled operatives, people who work with heavy machines to have more specific on-the-job training than workers in other occupations. The skills they use are not easily taught in classrooms and vary from firm to firm. We hypothesize that firms in heavy industry also tend to be monopolistic so that their employees may have few alternative firms that use their skills. If this is the case, skilled laborers should be relatively vulnerable to turnover.

For each set of regressions, the key coefficients will be displayed in the following order:

The first page of the set (page A) will contain:

in column 1: the results for the entire sample (ALL)

in column 2: the results for all the younger workers (YOUNG)

in column 3: the results for all the older workers (OLD)

in column 4: the results for all workers with less than 12 years of schooling (< H.S.)

in column 5: the results for all workers with exactly 12 years of schooling (H.S.)

in column 6: the results for all workers with 13-15 years of schooling (H.S.P.)

in column 7: the results for all workers with at least 16 years of schooling (COLL)

in column 8: the results for all whites (WHITE)

in column 9: the results for all blacks (BLACK)

The second page of the set (B) will contain results for younger workers disaggregated first by education and then by race:

in column 1: the results (repeated) for all the younger workers (YOUNG)

in column 2: the results for younger workers with less than 12 years of school (YOUNG WITH < H.S.)

in column 3: the results for younger workers with exactly 12 years of school (YOUNG WITH H.S.)

in column 4: the results for younger workers with at least 16 years of schooling (YOUNG WITH COLL)

in column 5: the results for younger whites (YOUNG WHITES)

in column 6: the results for younger blacks (YOUNG BLACKS)

The third page of the set C will contain results for older workers disaggregated first by education and then by race:

in column 1: the results for all older workers (OLD)

in column 2: the results for older workers with less than 12 years of schooling (OLD WITH < H.S.)

in column 3: the results for older workers with exactly 12 years of schooling (OLD WITH H.S.)

in column 4: the results for older workers with at least 16 years of schooling (OLD WITH COLL)

in column 5: the results for older whites (OLD WHITES)

in column 6: the results for older blacks (OLD BLACKS)

Page D of regressions sets II, IV and V will aid us in interpreting the dummy regression coefficients that are significant at the 10% level. Column (3) gives the expected 1980 wage rate for a worker with the mean 1968 wage for his group, a value of 0 for the appropriate turnover dummy, and average values for all other characteristics. Column (4) gives the expected 1980 wage rate for a worker with the mean 1968 wage for his group, a value of 1 for the turnover dummy and average values for all other characteristics. In other words, the figure in Column (3) is the expected wage for an individual without the layoff (or quit) and (4) is the expected wage with the layoff or quit.

There are no special regressions for individuals who are neither black or white. Neither were regressions run separately for young workers with 13-15 years education and old workers with 13-15 years education due to the small sample sizes.

After the results and discussions of the five sets of regressions, some further results are presented for regressions disaggregating by 1968 one-digit occupation.

Regressions Analysis

Regression Set I

key variables {LO=number of layoffs 1969-79
are { Q=number of quits 1969-79

Of the 21 LO coefficients in set I, 17 are negative.[10] However, LO is never significant at the 5% level and is significant at the 10% level in only three regressions:

WHITES (page A, column 8)

OLDER WORKERS with exactly 12 years of education (page C, column 3)

and

OLDER WHITE WORKERS (page C, column 5)

In each of these three cases, LO is negative as is consistent with our prior expectations. Further, as we expected, it is older workers, whites, and those with a middle level of education are are harmed by layoffs.

If, using interpretation "b," we assume the coefficient of LO is equal to the percentage change in w_2 with respect to LO, we can interpret these coefficients as implying:

(1) that each additional layoff decreases the 1980 wage of whites by 5%

(2) that each additional layoff decreases the 1980 wage of older white workers by 5.5%

(3) that each additional layoff decreases the 1980 wage of

REGRESSION SET I PAGE A

Table 4.2
Results for Turnover Variables

TURNOVER VARIABLE		AGE		EDUCATION LEVEL				RACE	
	(1) ALL n=830	(2) YOUNG n=421	(3) OLD n=409	(4) <H.S. n=322	(5) H.S. n=238	(6) H.S.P. n=117	(7) COLL n=153	(8) WHITE n=614	(9) BLACK n=193
LO	-.032 (-1.449)	-.026 (-.760)	-.048 (-1.599)	-.036 (-1.087)	-.009 (-.204)	.016 (.250)	-.085 (-1.104)	-.049 (-1.902)*	-.008 (-.148)
Q	-.018 (-1.012)	-.029 (-1.267)	.011 (.327)	-.011 (-.344)	-.040 (-1.315)	.008 (.151)	-.003 (-.058)	-.012 (-.572)	-.041 (-.929)

REGRESSION SET I PAGE B

	(1)	(2)	(3)	(4)	(5)	(6)
		EDUCATION LEVEL			RACE	
	YOUNG n=421	YOUNG <H.S. n=136	YOUNG WITH H.S. n=135	YOUNG WITH COLL n=81	YOUNG WHITES n=307	YOUNG BLACKS n=100
LO	-.026 (-.760)	-.007 (-.134)	.008 (.157)	-.217 (-1.514)	-.048 (-1.158)	.015 (.219)
Q	-.029 (-1.267)	-.017 (-.422)	-.047 (-1.301)	.007 (.086)	-.032 (-1.200)	-.020 (-.413)

REGRESSION SET I PAGE C

		EDUCATION LEVEL			RACE	
	(1) OLD n=409	(2) OLD <H.S. n=186	(3) OLD WITH H.S. n=103	(4) OLD WITH COLL n=72	(5) OLD WHITES n=307	(6) OLD BLACKS n=93
LO	-.048 (-1.599)	-.054 (-1.244)	-.144 (-1.891)*	.003 (.034)	-.055 (-1.711)*	-.033 (-.424)
Q	.011 (.327)	-.004 (-.080)	-.092 (-1.447)	.005 (.059)	.033 (.960)	-.163 (-1.515)

older high school graduates by 14.4%.

There is less evidence about Q's effects although most of the Q coefficients are negative.

Regression Set II

LO1 (=1 if worker had at least one layoff)

Q1 (=1 if worker had at least one quit)

In regression set II, we test whether the presence of any layoffs or quits is harmful for workers. The specification in set I was more conducive to testing for negative signalling; any employers who have doubts about job changers should be particularly wary of those who frequently quit or lose their jobs. LO1 and Q1 are more representative of loss of specific OJT from 1968 job.

LO1 is significant at the 10% level for:

ALL (page A, column 1)

OLDER WORKERS (page A, column 3)

WHITES (page A, column 8)

The WHITE coefficient is significant at the 5% level.

Given ln w_1, at least one layoff:

(1) decreases the 1980 wage for a worker in the pooled sample by 7.4%

(2) decreases the 1980 wage for older workers by 9.3%

(3) decreases the 1980 wage for whites by 9.1%

Table 4.2 (continued)

SET II PAGE A

	AGE			EDUCATION LEVEL				RACE	
	(1) ALL	(2) YOUNG	(3) OLD	(4) <H.S.	(5) H.S.	(6) H.S.P.	(7) COLL	(8) WHITE	(9) BLACK
LO1	-.074 (-1.895)*	-.055 (-1.024)	-.093 (-1.645)*	-.088 (-1.483)	-.037 (-.540)	-.029 (-.246)	-.057 (-.514)	-.091 (-2.044)**	-.044 (-.498)
Q1	.022 (.617)	.037 (.723)	.016 (.296)	.048 (.760)	-.052 (-.853)	.267 (2.63)***	-.081 (-.891)	-.002 (-.038)	.101 (1.094)

SET II PAGE B

	(1)	(2)	(3)	(4)	(5)	(6)
		EDUCATION LEVEL			RACE	
	YOUNG	YOUNG <H.S.	YOUNG WITH H.S.	YOUNG WITH COLL	YOUNG WHITES	YOUNG BLACKS
LO1	-.055	-.058	-.005	-.123	-.088	-.011
	(-1.024)	(-.674)	(-.051)	(-.711)	(-1.375)	(-.100)
Q1	.037	.063	-.032	-.151	-.024	.254
	(.723)	(.695)	(-.378)	(-1.081)	(-.405)	(2.177)**

SET II PAGE C

	EDUCATION LEVEL				RACE	
	(1) OLD	(2) OLD <H.S.	(3) OLD WITH H.S.	(4) OLD WITH COLL	(5) OLD WHITES	(6) OLD BLACKS
LO1	-.093 (-1.645)*	-.114 (-1.344)	-.150 (-1.382)	.029 (.181)	-.096 (-1.560)	-.117 (-.821)
Q1	.016 (.296)	.050 (.545)	-.108 (-1.225)	-.004 (-.031)	.030 (.531)	-.134 (-.820)

REGRESSION SET II
PAGE D

(1) GROUP	(2) TYPE OF TURNOVER	(3) 1980 WAGE RATE WITH DUMMY = 0	(4) 1980 WAGE RATE WITH DUMMY = 1	(5) Δ[c]	(6) %Δ[d,e]
ALL	LO1[a]	$10.50	$10.30	-$.20	-2.0%
YOUNG	"	N.S.[b]	N.S.	N.S.	N.S.
OLD	"	$10.89	$ 9.93	-$.96	-8.8%
<H.S.	"	N.S.	N.S.	N.S.	N.S.
H.S.	"	"	"	"	"
COLL.	"	"	"	"	"
WHITE	"	$11.53	$10.55	-$.98	-8.5%
BLACK	"	N.S.	N.S.	N.S.	N.S.

[a] LO1 = 1 if individual had at least one layoff, 1969-1979

[b] coefficient not significant at 10% level

[c] quantity in column (3) minus quantity in column (4)

[d] quantity in column (5) divided by quantity in column (3)

[e] this would actually be equivalent to the regression coefficient of the appropriate due if we were dividing the quantity in column 5 by the midpoint between the quantities in column (3) and column (4)

REGRESSION SET II
PAGE D, continued

(1) GROUP	(2) TYPE OF URNOVER	(3) 1980 WAGE RATE WITH DUMMY = 0	(4) 1980 WAGE RATE WITH DUMMY = 1	(5)	(6)
YOUNG <H.S.	LO1	N.S.	N.S.	N.S.	N.S.
YOUNG W HS	"	"	"	"	"
YOUNG W COLL	"	"	"	"	"
OLD < H.S.	"	"	"	"	"
OLD W H.S.	LO1	$10.77	$9.33	-$1.44	-13.4%

LO1 not significant for any age race group, Q1 only significant for YOUNG BLACKS.

YOUNG BLACKS	Q1	$6.57	$7.67	$1.10	16.7%

Out of 21 LO1 coefficients, all are negative except for older workers who have at least a college degree.

Page D of regression set II shows the effect of at least one layoff on the 1980 wage of members of each of these groups using interpretation "a," that is, using the fact that $\ln w_2 - \ln w_1$ for a given individual is the log of (w_2/w_1). According to Page D, the loss in the 1980 hourly wage is

$.20 for ALL (2%)

$.96 for OLDER WORKERS (8.8%)

$.98 for WHITES (8.5%).

Q1 is positive and significant at the 5% level for workers with some college (H.S.P.) on page A, column 6 and for young blacks, page B, column 6. The H.S.P. group is difficult to fit into any pattern either a priori or with regard to regressions coefficients. It includes workers who have schooling past high school that qualifies them for some trade as well as college dropouts (workers who "quit" college). The non-academic schooling received by some workers in this category could be close to OJT.

The result for young blacks is intriguing. Having at least one quit over the period increases (from Page D) the 1980 hourly wage by $1.10 for young blacks. No such result was evident for Q (number of quits) from SET I. This is consistent with the hypothesis that too frequent quits can be a negative signal. It is also consistent with the presumed connection between tenure and specific OJT. An individual who changes jobs too often will have short job tenure on each job and therefore accumulate limited quantities of specific OJT.

The finding that young blacks in particular benefit from quits is consistent with Ann Bartel's curious findings that for blacks, earnings growth on the job was a positive function of number of employers. One possible explanation is that specific OJT is limited for blacks, by institutional and other factors so that gains from quitting (especially for young blacks with least specific training) are not offset by loss of OJT. A second possible explanation is that institutional limitations on OJT for blacks can be circumvented at certain firms. This implies that blacks particularly benefit from "job-shopping", that is, changing jobs until they find one which will provide them with opportunities for OJT investment.

As we progress from regression set III to set V, we shall see a dramatic increase in the number of significant coefficients. This improvement is a result of distinguishing job changes by timing and tenure prior to turnover.

SET III

Key variables are:

LOE = # layoffs 1969-1974

LOL = # layoffs 1974-1979

QE = # quits 1969-1974

SET III PAGE A

	AGE			EDUCATION LEVEL				RACE	
	(1) ALL	(2) YOUNG	(3) OLD	(4) <H.S.	(5) H.S.	(6) H.S.P.	(7) COLL	(8) WHITE	(9) BLACK
LOE	.027	.062	-.034	.013	.108	.150	-.098	-.001	.077
	(.754)	(1.269)	(-.644)	(.229)	(1.660)*	(1.282)	(-1.081)	(-.027)	(1.060)
LOL	-.076 ***	-.116 ***	-.058	-.061	-.107	-.069	-.051	-.079 ***	-.106
	(-2.520)	(-2.346)	(-1.498)	(-1.469)	(-1.577)	(-.829)	(-.369)	(-2.329)	(-1.351)
QE	-.005	-.029	.075	-.042	.015	.042	.006	.005	-.025
	(-.201)	(-.905)	(1.642)	(-.995)	(.324)	(.602)	(.084)	(.181)	(-.371)
QL	-.034	-.015	-.089	.049	-.088	-.036	-.009	-.033	-.051
	(-1.106)	(-.394)	(-1.519)	(.829)	(-1.818)*	(-.398)	(-.107)	(-.987)	(-.588)

SET III PAGE B

		EDUCATION LEVEL			RACE	
	(1)	(2)	(3)	(4)	(5)	(6)
	YOUNG	YOUNG WITH <H.S.	YOUNG WITH H.S.	YOUNG WITH COLL	YOUNG WHITES	YOUNG BLACKS
LOE	.062	.070	.194	-.341	.031	.162
	(1.269)	(.867)	(2.477)***	(-1.627)	(.537)	(1.494)
LOL	-.116	-.065	-.205	-.118	-.139	-.087
	(-2.346)	(-.957)	(-2.177)**	(-.632)	(-2.213)**	(-.903)
QE	-.029	-.096	.001	.028	-.025	-.054
	(-.905)	(-1.789)*	(.206)	(.246)	(-.678)	(-.700)
QL	-.015	.165	-.088	.025	-.031	.078
	(-.394)	(2.013)**	(-1.607)	(.185)	(-.722)	(.740)

SET III PAGE C

		EDUCATION LEVEL			RACE	
	(1) OLD	(2) OLD WITH <H.S.	(3) OLD WITH H.S.	(4) OLD WITH COLL	(5) OLD WHITES	(6) OLD BLACKS
LOE	-.034 (-.644)	-.050 (-.580)	-.102 (-.825)	-.008 (-.086)	-.075 (-1.165)	.017 (.152)
LOL	-.058 (-1.498)	-.060 (-1.089)	-.136 (-1.353)	.200 (.649)	-.046 (-1.176)	-.124 (-.924)
QE	.075 (1.642)	.047 (.611)	-.029 (-.299)	.055 (.524)	.087 (1.855)*	-.077 (-.518)
QL	-.089 (-1.519)	-.077 (-.842)	-.182 (-1.518)	-.062 (-.485)	-.050 (-.829)	-.301 (-1.802)*

QL = # quits 1974-1979

Recalling the Jacobsen diagram that accompanied the introduction of these variables, we see that recovery from early layoffs may be almost complete by 1980. In fact, LOE (number of early layoffs) has a positive, significant coefficient for high school graduates as a whole and for young high school graduates (with magnitudes of .108 and .194, respectively). Apparently, early layoffs give young high school graduates some impetus for improvement that eventually results in a higher paying job. On the other hand, LOE is negative (although insignificant) for every regression using older workers (on page C) except for older blacks.

This is evidence, although admittedly weak, that older workers tend not to recover from early layoffs.

We have much stronger evidence that LOL, the number of recent layoffs, is financially damaging. The coefficient of LOL is significant at the 5% level for:

ALL

YOUNG WORKERS

WHITE WORKERS

YOUNG, HIGH SCHOOL GRADUATES

and

YOUNG WHITES

For the first time, we have evidence that layoffs hurt younger workers as a group. Surprisingly, LOL is not significant for any group of older workers. Apparently, the number of late layoffs makes no more difference for older workers than the number of early layoffs. It is true that LOL is negative for all groups of older workers (SET III, page C) except for older college graduates. In fact, every regression in SET III except older college graduates has a negative coefficient of LOL. (In SET IV, we will see evidence that the existence of late layoffs hurts older workers.)

Every additional layoff decreases w_2/w_1 by:

7.6% for the pooled sample

11.6% for YOUNG

7.9% for WHITE

20.5% for YOUNG WITH HIGH SCHOOL

13.9% for YOUNG WHITES

The QE coefficients yield no observable pattern. QL does follow one tentative pattern; QL has a negative coefficient for every regression on page C. This suggests that recent layoffs decrease wage growth for older workers. Possibly, some of these recent quits are moves to easier jobs (a form of semi-retirement).

SET IV

LOE1 = 1 if had at least one early layoff

LOL1 = 1 if had at least one late layoff

QE1 = 1 if had at least one early quit

Table 4.2 (continued)

SET IV PAGE A

	AGE			EDUCATION LEVEL				RACE	
	(1) ALL	(2) YOUNG	(3) OLD	(4) <H.S.	(5) H.S.	(6) H.S.P.	(7) COLL	(8) WHITE	(9) BLACK
LOE1	.033	.079	-.045	.032	.082	.189	-.125	.002	.095
	(.684)	(1.269)	(-.587)	(.410)	(1.027)	(1.231)	(-.869)	(.043)	(.902)
LOL1	-.138 ***	-.162 ***	-.131 *	-.132 *	-.123	-.290 *	-.091	-.148 **	-.157
	(-2.869)	(-2.365)	(-1.925)	(-1.896)	(-1.309)	(-1.895)	(-.580)	(-2.688)	(-1.417)
QE1	.047	.009	.134 **	.039	.041	.245 **	-.047	.030	.126
	(1.186)	(.178)	(2.154)	(.544)	(.606)	(2.143)	(-.461)	(.678)	(1.207)
QL1	-.042	.015	-.139 **	.021	-.106	.060	-.060	-.047	-.028
	(-.952)	(.251)	(-2.011)	(.267)	(-1.390)	(.488)	(-.544)	(-.977)	(-.239)

SET IV PAGE B

	EDUCATION LEVEL				RACE	
	(1) YOUNG	(2) YOUNG WITH <H.S.	(3) YOUNG WITH H.S.	(4) YOUNG WITH COLL	(5) YOUNG WHITES	(6) YOUNG BLACKS
LOE1	.079	.098	.190	-.248	.038	.196
	(1.269)	(.956)	(1.870)*	(-1.010)	(.516)	(1.489)
LOL1	-.162 ***	-.120	-.254 **	-.167	-.200 ***	-.135
	(-2.365)	(-1.185)	(-2.007)	(-.771)	(-2.385)	(-1.000)
QE1	.009	-.045	.014	-.070	-.020	.119
	(.178)	(-.466)	(.154)	(-.456)	(-.317)	(.967)
QL1	.015	.166	-.025	-.065	-.025	.190
	(.251)	(1.520)	(-.253)	(-.387)	(-.380)	(1.282)

SET IV PAGE C

		EDUCATION LEVEL			RACE	
	(1) OLD	(2) OLD WITH <H.S.	(3) OLD WITH H.S.	(4) OLD WITH COLL	(5) OLD WHITES	(6) OLD BLACKS
LOE1	-.045 (-.587)	-.090 (-.707)	-.109 (-.740)	-.029 (-.162)	-.077 (-.859)	-.047 (-.262)
LOL1	-.131 (-1.925)*	-.164 (-1.671)*	-.095 (-.641)	.230 (.742)	-.107 (-1.468)	-.236 (-1.222)
QE1	.134 (2.154)**	.182 (1.649)*	-.001 (-.009)	.125 (.768)	.119 (1.859)*	.060 (.290)
QL1	-.139 (-2.011)**	-.178 (-1.539)	-.193 (-1.552)	-.115 (-.627)	-.093 (-1.304)	-.390 (-1.716)*

REGRESSION SET IV
PAGE D

(1) GROUP	(2) TYPE OF TURNOVER	(3) 1980 WAGE DUMMY = 0	(4) 1980 WAGE DUMMY = 1	(5) Δ[c]	(6) %Δ[d]
ALL	[a]LOL1	$10.50	$9.15	-$1.35	-12.9%
YOUNG	LOL1	$10.15	$8.63	-$1.52	-15.0%
OLD	LOL1	$10.89	$9.51	-$1.34	-12.4%
<H.S.	LOL1	$ 8.52	$6.90	-$1.62	-19.0%
H.S.	LOL1	N.S.[b]	N.S.	N.S.	N.S.
COLL	LOL1	N.S.	N.S.	N.S.	N.S.
WHITE	LOL1	$11.53	$9.95	-$1.58	-13.7%
BLACK	LOL1	N.S.	N.S.	N.S.	N.S.
YOUNG	LOE1	N.S.	N.S.	N.S.	N.S.
< HS	LOL1				
YOUNG	LOE1	$ 9.02	$10.46	$ 1.44	16.0%
W HS	LOL1	$ 9.64	$7.48	-$2.16	-22.4%
YOUNG	LOE1	N.S.	N.S.	N.S.	N.S.
W COLL	LOL1				
OLD W	LOE1	N.S.	N.S.	N.S.	N.S.
< HS	LOL1	$ 8.10	$6.89	-$1.21	-15.0%
OLD	LOE1	N.S.	N.S.	N.S.	N.S.
W HS	LOL1				
OLD W	LOE1	N.S.	N.S.	N.S.	N.S.
COLL	LOL1				

[a]LOE1=1 if individual had at least one layoff 1969-1973
LOL1= if individual had at least one layoff 1974-1979
[b]coefficient not significant at the 10% level
[c] (4)-(3)
[d] quantity in column (5) divided by quantity in column (3)

REGRESSION SET IV
PAGE D continued

(1) GROUP	(2) TYPE OF URNOVER	(3) 1980 WAGE DUMMY = 0	(4) 1980 WAGE DUMMY = 1	(5)	(6)
YOUNG WHITES	LOE1	N.S.	N.S.	N.S.	N.S.
	LOL1	$11.04	$8.70	-$2.34	-21.2%
	QE1	N.S.	N.S.	N.S.	N.S.
	QL1	N.S.	N.S.	N.S.	N.S.
OLD WHITES	LOE1	N.S.	N.S.	N.S.	N.S.
	LOL1	N.S.	N.S.	N.S.	N.S.
	QE1	$11.55	$13.00	$1.45	12.6%
	QL1	N.S.	N.S.	N.S.	N.S.
YOUNG BLACKS		Nothing Significant			
OLD BLACKS	LOE1	N.S.	N.S.	N.S.	N.S.
	LOL1	N.S.	N.S.	N.S.	N.S.
	QE1	N.S.	N.S.	N.S.	N.S.
	QL1	$6.80	$4.62	-$2.18	-32.1%

QL1 = 1 if had at least one late quit.

We believe that the key variables for this set are far superior to those of the previous sets; the existence of any recent layoffs is what lowers wage growth for many groups.

The existence of early layoffs (LOE1=1) appears to increase $\ln w_2 - \ln w_1$ for YOUNG high school graduates as LOE does. LOE1 is negative for every group of older workers. LOL1 is negative and significant at the 5% level for:

ALL

YOUNG

OLD

HIGH SCHOOL DROPOUTS

WORKERS WITH MORE THAN HIGH SCHOOL BUT NO COLLEGE DEGREE

YOUNG WHITE HIGH SCHOOL GRADUATES

YOUNG WHITES

OLD HIGH SCHOOL DROPOUTS

Before we distinguished turnover by when it occurred, we found no evidence that younger groups suffered from turnover. In SET III, when we started to distinguish layoffs and quits by timing, we found no evidence for older workers. A new pattern emerges when we consider existence rather than number of early/late quits and layoffs. For each age group, loss from a recent layoff appears to be a function of one's education. Among the younger workers, the high school graduates are vulnerable to recent layoffs. Among the older workers, it is the high school dropouts who suffer. It must be noted that we are not observing (in the young and old groups) the same group of workers at different points in their life cycle, but two entirely different cohorts. In other words, our young groups in this sample will not necessarily have the same experience when they reach middle age as the old group did at the time of this survey. For instance, when the older group was in school, dropping out of high school carried less of a stigma than when the young group was in school. This suggests that the older high school dropouts had the opportunity to invest more in all types of human capital (relative to other individuals in their cohort) than the younger high school dropouts. So older dropouts may have substantial specific OJT investments which are lost if the worker is laid off. Younger workers, on the other hand, will not have jobs requiring specific OJT unless they have graduated from high school. This explains why LOL1 is negative and significant for young workers with high school diplomas but not for young dropouts. We would expect LOL1 to also be negative and significant for older high school graduates, but it is not. We shall find additional evidence regarding this group in the fifth regression set.

Given w_1, and interpreting the coefficients as the percentage change in the 1980 wage, a recent layoff decreases the 1980 wage:

(1) 13.8% for ALL

(2) 16.2% for YOUNG

(3) 13% for OLD

(4) 13.2% for HIGH SCHOOL DROPOUTS

(5) 29% for those with some college, no degree

(6) 14.8% for WHITES

(7) 25% for YOUNG HIGH SCHOOL GRADUATES

(8) 20% for YOUNG WHITES

(9) 16.4% for OLD HIGH SCHOOL DROPOUTS

From Table D, a recent layoff decreases the 1980 hourly wage by

$1.35 for ALL (12.9%)

$1.52 for YOUNGER WORKERS (15%)

$1.34 for OLDER WORKERS (12.4%)

$1.62 for HIGH SCHOOL DROPOUTS (19%)

$1.58 for WHITES (13.7%)

$2.16 for YOUNG HIGH SCHOOL GRADUATES (22.4%)

$2.34 for YOUNG WHITES (21.2%), and

$1.21 for OLD HIGH SCHOOL DROPOUTS (15.0%)

QE1 is positive and significant at the 10% level for older workers as a whole, old high school dropouts and old whites. This suggests that older workers may be experienced at turning quits to long run advantage. QL1 is negative for every older group although it is never significant except for older workers as a whole and old blacks.

SET V

LO1S =(1 if laid off and 1968 tenure $<$ 2 years)

LO1MED =(1 if laid off and 1968 tenure 2-3 years)

LO1LG = (1 if laid off and 1968 tenure $\geq$ 4 years)

Q1S = (1 if quit and 1968 tenure $<$ 2 years)

Q1MED =(1 if quit and 1968 tenure 2-3 years)

Q1LG = (1 if quit and 1968 tenure $\geq$ 4 years)

When we interact layoffs and quits with 1968 tenure, we find interesting results only for LO1LG (being laid off with 4 or more years tenure in 1968).

LO1LG is negative and significant for:

ALL

YOUNG

OLD

HIGH SCHOOL GRADUATES

COLLEGE GRADUATES

WHITES

YOUNG HIGH SCHOOL GRADUATES

YOUNG COLLEGE GRADUATES

YOUNG WHITES

OLD HIGH SCHOOL GRADUATES

For high school dropouts (who seemed to suffer from layoffs undifferentiated by 1968 tenure) and blacks, tenure seems to make no difference in loss from layoffs. It is only relatively "privileged" individuals, i.e., whites and those with a high school education or better who are hurt by layoffs after at least

Table 4.2 (continued)

SET V PAGE A

		AGE		EDUCATION LEVEL				RACE	
	(1) ALL	(2) YOUNG	(3) OLD	(4) <H.S.	(5) H.S.	(6) H.S.P.	(7) COLL	(8) WHITE	(9) BLACK
LO1S	-.034	-.061	.043	-.082	-.047	-.281	.244	-.091	.062
	(-.520)	(-.736)	(.404)	(-.831)	(-.392)	(-1.369)	(1.389)	(-1.191)	(.459
LO1MED	.007	.048	-.058	.018	.129	-.062	-.124	-.001	.015
	(.091)	(.523)	(-.448)	(.144)	(1.123)	(-.263)	(-.601)	(-.007)	(.091
LO1LG	-.155 ***	-.164 *	-.130 *	-.119	-.208 *	.158	-.295 *	-.145 **	-.194
	(-2.613)	(-1.800)	(-1.655)	(-1.404)	(-1.856)	(.678)	(-1.661)	(-2.167)	(-1.408
Q1S	.039	.102	-.109	.076	-.022	.520 ***	-.077	.027	.114
	(.657)	(1.365)	(-.991)	(.706)	(-.231)	(2.55)	(-.519)	(.406)	(.803
Q1MED	-.043	.019	-.119	-.081	-.037	.315 *	-.237	-.096	.123
	(-.658)	(.225)	(-1.033)	(-.759)	(-.334)	(1.660)	(-1.232)	(-1.313)	(.75
Q1LG	.039	-.003	.099	.114	-.081	.173	-.032	.022	.044
	(.799)	(-.043)	(1.473)	(1.292)	(-.972)	(1.319)	(-.277)	(.415)	(.291

SET V PAGE B

		EDUCATION LEVEL			RACE	
	(1) YOUNG	(2) YOUNG WITH <H.S.	(3) YOUNG WITH H.S.	(4) YOUNG WITH COLL	(5) YOUNG WHITES	(6) YOUNG BLACKS
LO1S	-.061 (-.736)	-.112 (-.829)	-.130 (-.954)	.386 (1.480)	-.111 (-1.091)	-.047 (-.278)
LO1MED	.048 (.523)	-.033 (-.217)	.314 ** (2.257)	-.218 (-.791)	.024 (.218)	.213 (1.085)
LO1LG	-.164 (-1.800)*	-.025 (-.184)	-.268 (-1.663)*	-.700 (-2.192)**	-.183 (-1.683)*	-.112 (-.567)
Q1S	.102 (1.365)	.159 (1.104)	-.020 (-.181)	-.072 (-.362)	.038 (.432)	.357 (2.100)**
Q1MED	.019 (.225)	.054 (.378)	-.022 (-.167)	-.339 (-1.153)	-.060 (-.605)	.245 (1.292)
Q1LG	-.003 (-.043)	-.010 (-.073)	.012 (.095)	.011 (.056)	-.047 (-.584)	.133 (.570)

SET V PAGE C

		EDUCATION LEVEL			RACE	
	(1) OLD	(2) OLD WITH <H.S.	(3) OLD WITH H.S.	(4) OLD WITH COLL	(5) OLD WHITES	(6) OLD BLACKS
LO1S	.043 (.404)	-.035 (-.227)	.549 (1.927)*	.227 (.838)	-.007 (-.057)	.067 (.277)
LO1MED	-.058 (-.448)	.126 (.556)	-.263 (-1.357)	.130 (.249)	-.069 (-.477)	.038 (.103)
LO1LG	-.130 (-1.655)*	-.183 (-1.635)	-.305 (-2.030)*	-.028 (-.114)	-.102 (-1.228)	-.347 (-1.593)
Q1S	-.109 (-.991)	-.078 (-.438)	-.281 (-1.480)	-.285 (-.887)	-.059 (-.490)	-.204 (-.677)
Q1MED	-.119 (-1.033)	-.207 (-1.164)	-.268 (-1.120)	-.196 (-.586)	-.183 (-1.515)	-.173 (-.475)
Q1LG	.099 (1.473)	.192 (1.599)	-.146 (-1.361)	.119 (.722)	.120 (1.775)*	-.108 (-.469)

REGRESSION SET V
PAGE D

(1) GROUP	(2) TYPE OF TURNOVER	(3) 1980 WAGE DUMMY = 0	(4) 1980 WAGE DUMMY = 1	(5) Δ (4)-(3)	(6) %Δ $\frac{(4)-(3)}{(3)} = \frac{(5)}{(3)}$
ALL	LO1LG	$10.49	$8.98	-$1.51	-14.4%
YOUNG	LO1LG	$10.05	$8.38	-$1.67	-16.6%
OLD	LO1LG	$10.85	$9.51	-$1.34	-12.4%
< HS	LO1LG	N.S.	N.S.	N.S.	N.S.
H.S.	LO1LG	$10.06	$8.18	-$1.88	-18.7%
COLL	LO1LG	$15.49	$11.66	-$3.83	-24.7%
WHITE	LO1LG	$11.49	$10.03	-$1.46	-12.7%
BLACK	LO1LG	N.S.	N.S.	N.S.	N.S.
YOUNG < HS	LO1LG	N.S.	N.S.	N.S.	N.S.
YOUNG W HS	LO1LG	$ 9.50	$7.46	-$2.04	-21.5%
YOUNG W COLL	LO1LG	$14.72	$7.49	-$7.23	-49.1%
OLD < HS	LO1LG	N.S.	N.S.	N.S.	N.S.
OLD W HS	LO1LG	$10.73	$8.02	-$2.71	-25.3%
OLD W COLL	LO1LG	N.S.	N.S.	N.S.	N.S.
YOUNG WHITES	LO1LG	$10.88	$8.97	-$1.91	-17.5%
OLD WHITES	LO1LG	N.S.	N.S.	N.S.	N.S.
YOUNG BLACKS	LO1LG	N.S.	N.S.	N.S.	N.S.
OLD BLACKS	LO1LG	N.S.	N.S.	N.S.	N.S.

4 years of tenure. (Older high school dropouts do have a LO1LG coefficient that is nearly significant at the 10% level (+ = -1.635)). As with LOL1 (SET IV), the effect of LO1LG depends on the worker's age and education. LO1LG affects ln w_2 -ln w_1 for young workers with high school (or college) and old workers with less than high or a high school diploma.

A layoff after at least 4 years of tenure decreases w_2/w_1 by:

(1) 15.5% for the pooled sample

(2) 16.4% for YOUNG WORKERS

(3) 13% for OLDER WORKERS

(4) 20.8% for HIGH SCHOOL GRADUATES

(5) 29.5% for COLLEGE GRADUATES

(6) 14.5% for WWHITES

(7) 26.8% for YOUNG HIGH SCHOOL GRADUATES

(8) 70.0% for YOUNG COLLEGE GRADUATES

(9) 18.3% for YOUNG WHITES

(10) 30.5% for OLD HIGH SCHOOL GRADUATES

The magnitude of the LO1LG (-.70) for the young college graduates is particularly striking. It is different at the 5% level from that for young high school graduates. A 95% confidence interval for the true coefficient of LO1LG for younger college graduates is

$$-.70 - .6257066 \quad \text{to} \quad -.70 + .6257066$$

or

$$-1.326 \quad \text{to} \quad -.074$$

A 99% confidence interval for the true coefficient of LO1LG is

-.70 - .8220381 to -.70 + .8220381

or

-1.522 to .122.

This shows that the unusual magnitude of this estimated coefficient may be a statistical artifact. From Page D we see that a layoff with at least 4 years of tenure decreases the 1980 hourly wage by

$1.67 for YOUNGER WORKERS (16.6%)

$1.34 for OLDER WORKERS (12.4%)

$1.88 for HIGH SCHOOL GRADUATES (18.7%)

$3.83 for COLLEGE GRADUATES (24.7%)

$1.46 for WHITES (12.7%)

$2.04 for YOUNG HIGH SCHOOL GRADUATES (21.5%)

$7.23 for YOUNG COLLEGE GRADUATES (49.1%)

$2.71 for OLD HIGH SCHOOL GRADUATES (25.3%)

$1.91 for YOUNG WHITES (17.5%).

Results for Disaggregation by Occupation

We expect that the quantity of specific OJT investment (and therefore of potential loss from a layoff) depends on the nature of one's job. We only have one digit occupation for 1968, and no estimate of OJT required for particular occupations, but we

Table 4.4

Disaggregation by Occupation

A. Turnover Variables
Distinguish Job Changes by Timing

	Pro-fessionals n=164	Managers n=88	Sales and Clerical n=89	Crafts-men n=189	Opera-tives n=184	Unskilled labor n=116
LOE1	-.176	-.074	.093	.146	.069	-.031
	(-1.371)	(-.311)	(.574)	(1.373)	(.872)	(-.217)
LOL1	-.198	.022	-.546	.036	-.187	-.234
	(-1.595)	(.109)	(-2.743)***	(.311)	(-2.400)***	(-1.74)*
QE1	-.080	.014	.138	.042	.039	.044
	(-.850)	(.105)	(1.089)	(.458)	(.569)	(.334)
QL1	-.007	-.077	.118	-.295	.108	.134
	(-.068)	(-.510)	(1.697)*	(-2.883)***	(1.353)	(.832)

B. Turnover Variables
Distinguish Job Changes by Amount of Job Tenure in 1968

	Professionals	Managers	Sales and Clerical	Craftsmen	Operatives	Unskilled labor
LO1S	.024	.306	-.343	-.175	-.051	-.289
	(.153)	(1.108)	(-1.699)*	-(1.049)	(-.433)	(-1.656)*
LO1MED	-.320	.078	.042	.252	-.055	-.055
	(-1.443)	(.290)	(.115)	(1.318)	(-.503)	(-.263)
LO1LG	-.243	-.389	-.142	-.077	-.194	-.235
	(-1.613)	(-1.196)	(-.602)	(-.637)	(-2.091)**	(-1.191)
Q1S	-.069	-.333	.310	.006	.160	.148
	(-.522)	(-1.518)	(1.494)	(.042)	(1.469)	(.822)
Q1MED	-.114	-.286	.370	-.167	.045	-.196
	(-.634)	(-.980)	(1.312)	(-.974)	(.431)	(-.927)
Q1LG	-.078	.050	.026	-.136	.075	.368
	(-.684)	(.338)	(.153)	(-1.267)	(.819)	(1.982)*

hypothesized that skilled laborers will have the most specific OJT. As expected, operatives have coefficients of both LOL1 and LO1LG that are negative and significant. Recent layoffs decrease w_2 by 18.7%. A layoff after four or more years of tenure for this group decreases the dependent variable by .194.

LOL1 is significant for two other occupational categories--sales and clerical and unskilled labor. Unfortunately, the sales and clerical category is too broad for us to be able to interpret the LOL1 coefficient as it includes jobs that range from sales of sophisticated computer technology to file clerks. The result for the unskilled workers is surprising. By definition, unskilled workers have little firm specific OJT. Loss from layoffs cannot be due to loss of specific training. It is possible that layoffs cause negative signalling and loss of job "rents" for this group.

Years of tenure are positively related to loss from a layoff for operatives as expected. Operatives with at least four years of tenure have $\ln w_2 - \ln w_1$ decreased by .194 by a layoff.

G. Summary of Results

We have found that:

(1) Layoffs do decrease wage growth for most workers. Exceptions are young high school dropouts, older college graduates and blacks. We would expect young high school dropouts to have menial jobs and very little to lose by a layoff. Most

blacks in our sample (71% in our sample) had not finished high school. Some blacks are probably mired in dead-end jobs throughout their career. Older college graduates have presumably made their mark in their careers; they seem impervious to layoffs. Besides only 3 workers in this group had recent layoffs and 4 had a layoff after at least 4 years of tenure.

(2) Recent layoffs (since 1974) have a more serious effect on the 1980 wage than layoffs prior to 1974, particularly for the younger workers. There are hints (although the evidence is weak) that older workers are less resilient. Not only do the LOE and LOE1 coefficients tend to be negative for older groups, but LO and LO1 (variables for layoffs undifferentiated by when they happened) are negative and significant for (at least subsets of) older workers.

(3) For many workers, $\ln w_2 - \ln w_1$ is decreased most by layoffs if the worker had at least 4 years of tenure on the 1968 job (as of 1968). This is consistent with the hypothesis that job tenure and specific OJT investment are highly correlated. There is an alternative explanation for these results. This is that long job tenure is a result of some monopoly advantage to holding a particular job or a "rent". A layoff from such a job would certainly be disastrous, but not necessarily as a result of OJT loss.

The estimated LO1LG coefficient for young college graduates (-.70) is particularly striking. Although this suggests that either this group accumulates enormous amounts of OJT or its members tend to work at jobs with high "rent," our 95% confidence interval for the true interval includes more moderate values.

(4) The younger workers who suffer from layoffs tend to be better educated than the older workers hurt by layoffs. Recent layoffs hurt (among the young) high school graduates and (among the old) high school dropouts. Layoffs after at least four years of tenure hurt (among the young) high school <u>and</u> college graduates and (among the old) high school dropouts and high school graduates. This may be a cohort effect. Younger high school dropouts probably are more "inferior" compared to the average member of their cohort than older high school dropout are in relation to theirs.

(5) There is not much evidence on the effect of quits. They seem to help young blacks. Recent quits appear to decrease $\ln w_2 - \ln w_1$ for older workers but the evidence is rather weak.

Footnotes

1. These variables should likewise affect accumulation of general OJT investment. Our model in the theory chapter, in fact, can be applied to general OJT with the following three restrictions:

(1) The proportion of general OJT for which the firm pays is 0.

(2) General OJT may increase the wage rate by the same amount whether or not the worker changes jobs.

(3) An increase in general OJT does not alter the worker's turnover probabilities. If C_G is quantity of general training

$$\frac{\partial q}{\partial C_G} = \frac{\partial l}{\partial C_G} = 0$$

2. In practice, a worker may quit without knowing the conditions of his next job or even whether he will be able to find a new job. The quit is prompted by an expectation of a subsequent gain. The actual gain may be negative. So in practice, we expect the effect of quits on wage growth to be ambiguous.

3. This over-sampling of poor families and blacks ensures that these groups can be studied. However, it may cause bias on our turnover coefficients if poor people are affected differently by quits and layoffs than the non-poor.

4. If a married man left home forever, his wife was (if she had been part of the original 1968 sample) interviewed as the new head of the original family and the husband was considered head of a new family. If this same wife remarried, her new husband was interviewed as head of the original family. Thus, I must eliminate from my sample all individuals for which the 1968 family head died or left the family between 1968 and 1981 (the year in which the 1980 wage was reported).

5. If we had exact job tenure on current job in 1972 (at date on 1972 interview) and the date of the 1972 interview, we would be able to determine whether the individual was already at the 1972 job in 1971. However, we do not have the exact date of the interview in any year. Moreover, from all interviews until the 1976 questionnaire, the only information we have about current job tenure is whether it is (a) less than a year, (b) 1-1½ years, (c) 2-3 years, (d) 4-9 years, (e) 10-19 years, or (f) more than 20 years.

6. In most cases, the surveys were completed before the 40th week of the year so we assumed that anyone who worked more than

40 weeks in any year worked after the survey date. So individuals were deleted from the sample who had reported a quit or layoff in two consecutive years, were unemployed in the first of these years, and worked less than 40 weeks in the first year as they had ambiguity in the number of quits and layoffs reported. A total of 21 observations were deleted in this fashion.

7. Specifically, since the cost of living is lower in the South, real wages may be higher there even if money wages are lower. In this case, moving to the South could cause a real income gain.

8. This was calculated by subtracting the coefficient of UNI68 (.106) from that of CUNIN (-.309) and taking the absolute value. Individuals with UNI68=1, CUNIN=1 belonged to a union in 1968 but not in 1980.

9. Using the approximation

$$\ln w_2 - \ln w_1 = \ln\left(\frac{w_2}{w_1}\right)$$

and the constant term in the pooled regression .836,

we see that the reference worker has

$\frac{w_2}{w_1} \approx e^{.836} \approx 2.31$. This means that in 1980 the wage was 2.3 times the 1968 wage.

So the ratio of 1980 wage to 1968 wage for the reference worker (someone with less than 12 years education, 38-53 in 1968, black, belonging to a union neither in 1968 or in 1980, living in the South in neither period, married in neither period with no layoffs or quits 1968-1979) is 2.31. An individual identical to the reference worker except for being married in 1968 and unmarried in 1980 would have $\frac{w_2}{w_1}$ that was 25.2-18.9 or 6.3% less than the reference individual if the approximation

$$\left[\frac{(\ln w_2 - \ln w_1)}{\Delta X} \approx \text{\% change in } \frac{w_2}{w_1} \text{ with change in X}\right]$$

were correct for non-marginal changes in X.

10. Average number of years of school is 11.69 for older workers and 12.19 for young workers.

11. If the true coefficient of LO is 0 in every equation, the probability of any regression coefficient being negative is .5. If the regressions were independent of each other, the number of negative coefficients out of 21, Y, would be a binomial random variable with probability distribution

$$p(Y) = \frac{21!}{(21-Y)!Y!} \; (.5)^{Y}(.5)^{21-Y} \text{ and } p(17) = \frac{21!}{17!4!} \; (.5)^{21}$$

$$\approx 0$$

So the probability of getting 17 negative values of LO is almost impossible if the true coefficients are all 0.

12. If X (the number of negative coefficients of LOE on page C) is a true binomial random variable, the probability of 5 out of these 6 coefficients being negative is .094 if the true LO coefficient is always 0.

Chapter V

Summary and Conclusions

We began this dissertation by reviewing the theoretical and empirical literature dealing with on-the-job-training and its relation to layoffs and quits. None of the articles that modelled on-the-job-training dealt with the firm's decision to invest in worker on-the-job-training. We attempted to fill this gap with our OJT model.

Although various authors recognized that OJT investment is related to age (Borjas and Bartel), tenure (Borjas, Bartel), race (Bartel) and education (Knapp and Hansen), none brought all these variables together as arguments in an OJT investment function. Further none made the transition from the effects of these variables on specific OJT accumulation to investigation of their effects on returns to layoffs and quits.

In Chapter III, we derived the equilibrium quantity of specific OJT purchased jointly by the individual and firm given profit maximization behavior of the firm and utility maximization behavior of the individual. It was demonstrated that the equilibrium quantity of firm specific training depended on the individual's age, education, race, tenure and occupation. We then developed a wage model which demonstrated that potential financial loss from a layoff or quit is related to the individual's specific OJT investment and therefore to the variables that affect this investment.

In Chapter IV, we tested the hypothesis that an individual's age, education, tenure, race and occupation affect loss from job changes. Our method was disaggregation of the wage regressions by these variables. Various specifications of the turnover variables were tried in order to determine:

(a) Is loss in wage growth greater from layoffs than from quits?

(b) Is loss from recent turnover greater than that from early turnover?

(c) Is there a relationship between tenure on the current job and loss from turnover?

Below, we summarize our findings.

Quits

We have little evidence that quits affect the wage growth of younger workers. One intriguing exception to this generalization is the evidence for young blacks. For this group, having at least one quit increases wage growth (Regression Set II). A young black who earned the mean wage for young blacks in 1968 increased his 1980 hourly wage by $1.10 if he had any quits between 1968 and 1980 (page D of the Regressions Sets in Table 4.3). When we differentiate quits by tenure (Regression Set V) we see evidence that quits increase wage growth for blacks with less than two years of tenure on the 1968 job. The implication is that "job-shopping", (i.e., voluntary investment in mobility to improve the job worker match) pays for young blacks, particularly those with little job tenure.

The paucity of significant results for other young workers is not terribly surprising considering the variety of situations that might prompt an individual to quit. Unfortunately, our data provides no information on reason for quit.

For the older workers as a group, recent quits appear to have consistently negative effects on wage growth although very few quit coefficients are significant at the 10% level. Bartel and Borjas also found that a quit reduced wage growth for older workers. As discussed above, their data (the NLS) allowed decomposition of quits by reason for quit--personal reasons, dissatisfaction with the job or receiving a superior job offer. They found that of older workers, those who quit for personal reasons were hurt more than those who were immobile. Further, they found that a quit is more likely to be due to finding a better job at younger ages while at older ages, quits are mainly due to dissatisfaction with the current job. (Considering that unemployment benefits are generally unavailable to workers who quit, the dissatisfaction must be extreme.) If this is the case for the older men in our sample, the negative coefficients on recent quits seem reasonable. The insignificance of these coefficients may result from the fact that the sample includes those who quit to take a better job and those who quit due to job dissatisfaction. Note that for older workers the loss from quits does not appear to be proportional to tenure prior to quit. In fact, all the coefficients denoting a quit with less than 2 years tenure in 1968 or a quit with 2-3 years tenure are negative for older workers but there is no pattern for the coefficients denoting a quit with at least four years of tenure. This suggests that for older workers, quits affect wages more adversely if they occur after a short time on the job than after at least four years tenure. This is mild evidence that older workers who quit frequently tend to suffer decreased wage growth because they never accumulate much OJT.

Layoffs

Layoffs reported six years previously have no negative and statistically significant effects on wage growth measured over the period (Regression Sets III and IV). This suggests that for most people any damage done by layoffs is overcome within 6 years. There is some weak evidence to the contrary for the older workers in Regression Sets III and IV as LOE1 (=1 if had at least one layoff prior to 1974) is negative (although insignificant) for all groups of older workers and LOE (number of layoffs prior to 1974) is negative for all older groups except older blacks. Those with a high school education, especially young high school educated workers actually appear to benefit from early layoffs. Workers in this last group who earned the average 1968 wage for the group ($3.43) and experienced at least one layoff up to 1974 had a 1980 wage rate (on average) that was $1.44 (16%) higher than that of the control group. Perhaps an early layoff forces a young worker to invest in job search and in finding a more appropriate job match.

As expected, recent layoffs never seem to benefit workers. Both young workers as a whole and older workers as a whole appear to suffer substantially from a recent layoff. The average younger worker loses $1.52 (15% from Table D) from the 1980 wage if he had any recent layoffs and the average older worker loses $1.34 (12.4%). For younger workers, those with exactly 12 years of education appear to lose the most from a recent layoff. They lose (from Table II) $2.16 (22.4%) from the 1980 wage if they had recent layoffs.

For older workers, those with less than a high school education appear to forfeit earnings growth as a result of layoffs. A likely explanation is that the average worker from the older cohort has less than 12 years education (as discussed in Chapter IV) while the average worker from the younger cohort has slightly more than 12 years of education. For the older cohort, high school dropouts are not necessarily below average in education and are therefore considered potentially trainable by employers. The specific component of their training is lost if they are laid off. Those with a high school education or above are somewhat above average and thus may have the flexibility to acquire general training that renders them less vulnerable to layoffs. Education itself is a form of general human capital which presumably boosts the worker's productivity on a number of jobs.

Younger high school dropouts, on the other hand, are somewhat below average in education and employers may consider them poor risks for training. Younger workers with a high school diploma have an opportunity to invest in specific OJT and therefore to bear the risks of losing it if laid off.

The specificiations which denote the existence of at least one layoff or quit in each period provide a better fit than the specification in which the turnover variables are number of quits and layoffs in each period. The reason may be that few individuals had more than one layoff or quit and fewer had more than two.

In turn, the turnover variables that distinguish layoffs and quits by when they happened provide a much better fit than quits and layoffs that are undifferentiated by time of job change. This suggests that the effect of a layoff on the current wage rate depends on when it occurs.

When we interact turnover dummies with dummies for 1968 tenure (Regression Set V), we find that young workers lose substantially from a layoff after at least 4 years of tenure if they have a high school diploma or even a college degree. The average worker from the younger cohort with a high school degree had his 1980 wage rate decreased by $2.04 (21.5%) if he had a layoff after at least 4 years of tenure. The loss for young workers with a college degree is even more striking.

Although these findings are interesting in themselves, they also suggest which groups accumulate the most specific OJT. They should be the ones that lose most from a layoff since loss from a layoff should be directly related to firm specific training. It must be cautioned, however, that financial loss from a layoff may reflect not only loss of specific on-the-job-training but loss of "economic rent" that accrued to the individual from belonging to a high wage industry or occupation.

Our results do not seem to show that older workers as a whole have more firm specific OJT than younger workers. They do suggest that certain educational groups within each age cohort specialize in specific OJT, e.g., young workers of high school age and older high school dropouts. Tenure seems to be highly correlated with firm specific OJT investment for high school graduates in both age groups and young college graduates. Whites seem to acquire more specific OJT than blacks.

Possibilities for Future Work

There would appear to be five possible extensions of this research:

(1) Investigation of tenure effects on the psychic wage (including non-pecuniary components).

We were only able to measure effects of job turnover on the monetary wage rate. However, the quit decision ordinarily takes into account all changes in job benefits some of which are non-monetary, e.g., working conditions. Bluestone has constructed meaningful estimates of non-pecuniary job factors from available information about working conditions in each occupation. Since we only have 1-digit occupation for the 1968 job, we could not do that in this dissertation.

(2) Investigation of the relationship between hours worked per period and OJT investment.

The wage rate may be a function of hours worked for two reasons. First, OJT requires time-on-the-job as an input. Secondly, the benefit of OJT is positively related to expected hours of work in the future which may be related to hours worked today. One possible line of research would be to estimate the relationship between the current wage rate and past yearly hours or weeks of work.

(3) Investigation of the effect of firm characteristics on OJT accumulation and worker loss from turnover.

As discussed above, firms in some industries pass on some monopoly profits to workers in higher-than-competitive wages. This suggests that some workers in these industries receive "rents" that are lost if the worker leaves the industry.

One possible extension of Jacobsen's work is to model movement between high wage and low wage industries after a job change.

(4) Investigation into the relationship of turnover to consequent unemployment.

The coding of our data makes it impossible to know exactly when turnover occurred and therefore its relationship to weeks unemployed in a given year. To make matters worse, weeks unemployed per year are indistinguishable in our data from weeks on strike (until the 1974 survey). The NLS (Parnes) survey does not have these problems and could be used to study the effect of layoffs on earnings through its effect on unemployment.

(5) Investigation of the effects of quits and layoffs on the wage rates for women.

Repeating this study for females would no doubt be interesting and useful. There would be an additional complicating factor which is the effect of childcare responsibilities on the female labor supply. Any study on the effects of turnover on women's wages should include modelling of their labor force participation.

Two distinct policy conclusions follow from the results of this research. First, the regressions indicate that mobility is good for young blacks and high school graduates under some circumstances. Hence, it might well be useful to improve the job information available to them and to aid their search for the best possible job. Moreover, if quits are beneficial to young blacks in part because early jobs turn out to place them in racist environments, then efforts to improve employer attitudes would be appropriate. This latter point is, of course, highly speculative.

Secondly, we found that older high school dropouts and young high school graduates appear to be hurt by recent layoffs. If the layoff is after four years of tenure, young college graduates and older high school graduates suffer. This indicates that job retraining programs could be helpful. If this appears too unwieldy, an alternative would be to subsidize those who wish to acquire formal training in the private sector.

BIBLIOGRAPHY

Alexander, A. J., "Income, Experience and the Structure of Internal Labor Markets" Quarterly Journal of Economics, 88, (February, 1974).

Barron, J., "Search in the Labor Market and Duration of Unemployment", American Economic Review, 65, (December, 1975).

Bartel, Ann, "Earnings Growth on-the-Job and Between Jobs", Economic Inquiry, 18, (January, 1980).

Bartel, Ann and Borjas, George, "Specific Training and its Effect on the Human Capital Investment Profile", Southern Economic Journal, 44, (October, 1977).

Bartel, Ann and Borjas, George, "Wage Growth and Turnover, an Empirical Analysis", National Bureau of Economic Research Reprint #321 (September 1982, Cambridge).

Becker, Gary, Human Capital, New York: Columbia University Press, 1964.

Becker, Gary and Chiswick, Barry, "Education and the Distribution of Earnings", American Economic Review, 56, (May, 1966).

Becker, Brian and Hills, Stephen, "Teenage Unemployment: Some Evidence of its Long-Run Effects on Wages", Journal of Human Resources, 15, (Summer, 1980).

Black, Matthew, "Pecuniary Implications of On-The-Job-Search and Quit Activity", Review of Economics and Statistics, 62, (May, 1980).

Blau, F. D. and Kahn, L. M., "Causes and Consequences of Layoffs", Economic Inquiry, 19, (April, 1981).

Bloch, Farrel, "Labor Turnover in U.S. Manufacturing Industries", Journal of Human Resources, 11, (Spring, 1976).

Bluestone, Barry, The Personal Earnings Distribution: Individual and Institutional Determinants, Chestnut Hill: SWRRI, (November, 1974).

Borjas, George, "Job Mobility and Earnings Over the Life Cycle", Industrial Labor Relations Review, (1978).

Brown, Charles, "A Model of Optimal Human Capital Accumulation and the Wages of Young High School Graduates," Journal of Political Economy, 84, (April, 1976).

Burdett, K, "A Theory of Employee Job Search and Quit Rates", American Economic Review, 68, (March, 1978).

Cline, Harold, Job Mobility and Wage Growth, unpublished disseration abstract, Princeton University, 1980.

Cooke, W. N., "Turnover and Earnings: the Scientist and Engineer Case", Journal of Human Resources, 15, (Summer, 1980).

__________, "Turnover and Earnings: Some Empirical Evidence", Industrial Relations, 18, (Spring, 1979).

Director, S. M. and Doctors, S. I., "Racial Differences in Blue-Collar Turnover Rates", Industrial Relations, 15, (October, 1976).

Fernberg, Robert, "On the Empirical Importance of the Job Search Theory", Southern Economic Journal, 45, (October, 1978).

Flanagan, Robert, "Discrimination Theory, Labor Turnover and Racial Unemployment Differentials", Journal of Human Resources, 13, (Spring, 1978).

Flanagan, Robert, "Labor Force Experience, Turnover and Racial Wage Differentials", Review of Economics and Statistics, 56, (November, 1974).

Gilroy, C., "Investment in Human Capital and Black and White Unemployment", Monthly Labor Review, 18, (July, 1975).

Hall, Robert, "Turnover in the Labor Force", Brookings Papers on Economic Activity, (Summer, 1972).

Hashimoto, M., "Firm Specific Human Capital: Shared Investment or Optimal Entrapment?", American Economic Review, 71, (June, 1981).

Hashimoto, M., "Wage Reduction, Unemployment and Specific Human Capital", Economic Inquiry, 13, (December, 1975).

Henderson, James and Quandt, Richard, Microeconomic Theory: A Mathematical Approach, New York: McGraw Hill Book Company, 1971.

Holtmann, A. G. and Smith, V. Kerry, "Uncertainty and Durability of On-The-Job Training", Southern Economic Journal, 44, (July, 1977).

Jacobsen, Louis, Earnings Losses of Workers Displaced From Manufacturing Industries, Public Research Institute, 1976.

Johnston, T., "Returns from Investment in Human Capital" American Economic Review, 60, (September, 1970).

Johnston, T., Economic Methods, New York: McGraw Hill, Inc., 1972.

Kahn, Lawrence, "The Returns to Job Search: A Test of 2 Models", Economics and Statistics, 60, (November, 1978).

Klevmarken, Anders and Quigley, John, "Age, Experience and Earnings in Human Capital Investment", Journal of Political Economy, 84, (February, 1976).

Knapp, C. B. and Hansen, M. L., "Earnings and Individual Variations in Post-School Investment", Journal of Political Economy, 84, (April, 1976).

Leigh, Duane, An Analysis of the Determinants of Occupational Upgrading, New York: Academic Press, 1978.

Lippman and McCall, "The Economics of Job Search, A Survey", Economic Inquiry, 15, (June, 1976).

Lippman and McCall, "The Economics of Job Search: A Survey, Part 2", Economic Inquiry, 15, (September, 1976).

Lutz, Mark, "Quit Rates and the Quality of the Industrial Wage Structure", Industrial Relations, 16, (February, 1977).

Mincer, Jacob, Schooling, Experience and Earnings, New York: Columbia University Press, 1974.

__________, "The Distribution of Labor Incomes: A Survey", Journal of Economic Literature, 8, (March, 1970).

Mincer, Jacob and Jovanovic, Boyan, Labor Mobility and Wages, NBER Working Paper #357, (June 1979, Cambridge).

Oi, Walter, "Labor as a Quasi-Fixed Factor", Journal of Political Economy, 70, (December, 1962).

Parsons, D., "Specific Human Capital, An Application to Quit and Layoff Rates", Journal of Political Economy, 80, (November/December, 1972).

Piore, Michael, "Notes for a Theory of Labor Market Stratification", in Edwards et al, Labor Market Segmentation, Lexington, Mass., D.C. Heath, 1975.

Schiller, Bradley, "Relative Earnings Mobility in the United States", American Economic Review, 67, (December, 1977).

Seatear, John, "Job Search and Vacancy Contracts", American Economic Review, 69, (June, 1979).

Sleeper, R. D., "Labor Mobility Over the Life Cycle", British Journal of Industrial Relations, 13, (July, 1975).

Slifman, L., "Job Mobility and Labor Demand", Industrial Relations, 15, (May, 1976).

Spence, A. Michael, Market Signalling: Informational Transfer in Hiring and Related Screening Processes, Cambridge: Harvard Unversity Press, 1974.

Steinberg, Edward, "Upward Mobility in Internal Labor Markets", Industrial Relations, 14, (May, 1975).

Stiglitz, Joseph, "The Theory of Screening: Education and the Distribution of Income", American Economic Review, 65, (June, 1975).

Wash, Patrick, "Occupational Mobility of Health Workers", Monthly Labor Review, 100, (May, 1977).

Means of Control Variables
and Dependent Variable

When variable is a dummy, the mean refers to fraction of the sample for which the variable equals 1.

	ALL n=830	YOUNG n=421	OLD n=409
DLW	.982	1.026	.937
H.S.	.287	.321	.252
H.S.P.	.141	.164	.117
COLL	.184	.192	.176
EDUP	.100	.124	.076
YOUNG	.507	1.000	.000
WHITE	.740	.729	.751
UNI68	.308	.295	.323
CUNIY	.092	.107	.076
CUNIN	.086	.097	.073
REG68	.390	.423	.357
CREGS	.017	.024	.010
CREGNS	.012	.014	.010
HLIM68	.048	.036	.061
HEALTHB	.049	.019	.039
HEALTHW	.029	.043	.056
MARRY68	.941	.938	.944
MARRY	.029	.036	.022
UNMARRY	.069	.078	.059

Means of Turnover Variables

	ALL	YOUNG	OLD
LO	.364	.399	.328
Q	.563	.767	.352
LO1	.242	.280	.203
Q1	.345	.435	.252
LOE	.170	.211	.127
LOL	.194	.188	.200
QE	.329	.449	.205
QL	.234	.318	.147
LOE1	.139	.181	.095
LOL1	.139	.145	.132
QE1	.242	.318	.164
QL1	.182	.233	.130
LO1S	.088	.114	.061
LO1MED	.061	.081	.042
LO1LG	.090	.086	.095
Q1S	.114	.171	.056
Q1MED	.083	.112	.054
Q1LG	.145	.152	.137

	<H.S. n=322	H.S. n=238	H.S.P. n=117	COLL n=153
DLW	.993	.946	1.067	.950
EDUP	.078	.101	.094	.150
YOUNG	.422	.567	.590	.529
WHITE	.537	.828	.872	.928
UNI68	.398	.399	.214	.052
CUNIY	.081	.122	.103	.059
CUNIN	.087	.139	.068	.013
REG68	.562	.303	.256	.268
CREGS	.003	.034	.009	.026
CREGNS	.000	.008	.009	.046
HLIM68	.053	.029	.077	.046
HEALTHB	.034	.017	.051	.020
HEALTHW	.075	.042	.026	.026
MARRY68	.944	.962	.923	.915
MARRY	.028	.029	.034	.026
UNMARRY	.075	.046	.094	.072

	<H.S.	H.S.	H.S.P.	COLL
LO	.478	.311	.333	.229
Q	.531	.580	.615	.562
LO1	.314	.210	.205	.170
Q1	.320	.349	.385	.359
LOE	.189	.172	.145	.144
LOL	.289	.139	.188	.085
QE	.323	.319	.385	.314
QL	.208	.261	.231	.248
LOE1	.155	.151	.120	.098
LOL1	.202	.105	.111	.078
QE1	.224	.248	.274	.248
QL1	.171	.189	.179	.196
LO1S	.102	.071	.111	.065
LO1MED	.068	.067	.051	.046
LO1LG	.140	.067	.043	.059
Q1S	.093	.126	.128	.131
Q1MED	.096	.080	.094	.052
Q1LG	.127	.139	.162	.176

	WHITE n=614	BLACK n=193
DLW	.973	1.013
H.S.	.321	.202
H.S.P.	.166	.067
COLL	.231	.021
EDUP	.114	.052
YOUNG	.500	.518
UNI68	.305	.342
CUNIY	.078	.140
CUNIN	.094	.062
REG68	.279	.751
CREGS	.021	.065
CREGNS	.015	.000
HLIM68	.047	.057
HEALTHB	.026	.041
HEALTHW	.042	.078
MARRY68	.946	.922
MARRY	.026	.036
UNMARRY	.050	.119

	WHITE	BLACK
LO	.345	.435
Q	.606	.456
LO1	.230	.295
Q1	.370	.285
LOE	.155	.233
LOL	.191	.202
QE	.347	.285
QL	.259	.171
LOE1	.127	.187
LOL1	.134	.155
QE1	.257	.207
QL1	.202	.135
LO1S	.080	.119
LO1MED	.060	.073
LO1LG	.088	.104
Q1S	.114	.124
Q1MED	.090	.073
Q1LG	.163	.088

YOUNG WITH LESS THAN 12 YEARS EDUCATION

VAR	COEF (t value)	VAR	COEF (t value)
		HEALTHW	-.142 (-.963)
		MARRY68	.379 (1.090)
		MARRY	.492 (1.188)
EDUP	-.173 (-1.209)	UNMARRY	-.320 (-2.058)**
		LOE1	.098 (.956)
WHITE	-.038 (-.409)	LOL1	-.120 (-1.185)
UNI68	.088 (.757)	QE1	-.045 (-.466)
CUNIY	.192 (1.397)	QL1	.166 (1.520)
CUNIN	-.468 (-3.016)***	CONSTANT	.660 (1.814)*
REG68	.073 (.703)	R^2 =	.252
CREGS	---		
CREGNS	---		
HLIM68	-.103 (-.203)		
HEALTHB	---		

YOUNG WITH LESS THAN HIGH SCHOOL

VAR	COEF (t value)	VAR	COEF (t value)
		HEALTHW	-.146 (-.964)
		MARRY68	.535 (1.482)
		MARRY	.692 (1.628)
EDUP	-.152 (-1.023)	UNMARRY	-.255 (-1.653)*
		LO1S	-.112 (-.829)
WHITE	-.005 (-.054)	LO1MED	-.033 (-.217)
UNI68	.092 (.771)	LO1LG	-.025 (-.184)
CUNIY	.185 (1.329)	Q1S	.159 (1.104)
CUNIN	-.429 (-2.664)***	Q1MED	.054 (.378)
REG68	.067 (.634)	Q1LG	-.010 (-.073)
CREGS	---	CONSTANT	.487 (1.297)
CREGNS	---	R^2 =	.180
HLIM68	-.113 (-.218)		
HEALTHB	---		

YOUNG WITH HIGH SCHOOL DIPLOMA

VAR	COEF (t value)	VAR	COEF (t value)
		HEALTHW	-.226 (-.837)
		MARRY68	.192 (-1.079)
		MARRY	.174 (.632)
EDUP	.249 (1.939)*	UNMARRY	---
		LOE1	.190 (1.870)
WHITE	-.156 (-1.542)	LOL1	-.254 (-2.007)**
UNI68	.126 (1.256)	QE1	.014 (.154)
CUNIY	-.017 (-.144)	QL1	-.025 (-.253)
CUNIN	-.281 (-2.174)**	CONSTANT	1.133 (9.401)***
REG68	-.080 (-.907)	R^2 =	.172
CREGS	-.156 (-.734)		
CREGNS	-.345 (-.779)		
HLIM68	.171 (.547)		
HEALTHB	-.150 (-.359)		

YOUNG WITH HIGH SCHOOL

VAR	COEF (t value)	VAR	COEF (t value)
		HEALTHW	-.235 (-.875)
		MARRY68	-.223 (-1.247)
		MARRY	.152 (.553)
EDUP	.260 (2.052)**	UNMARRY	---
		LO1S	-.130 (-.954)
WHITE	-.126 (-1.237)	LO1MED	.314 (2.257)**
UNI68	.143 (1.427)	LO1LG	-.268 (-1.663)*
CUNIY	.036 (.299)	Q1S	-.020 (-.181)
CUNIN	-.336 (-2.635)**	Q1MED	-.022 (-.167)
REG68	-.052 (-.610)	Q1LG	.012 (.095)
CREGS	-.058 (-.270)	CONSTANT	1.104 (9.292)***
CREGNS	-.335 (-.753)	R^2 =	.201
HLIM68	.149 (.482)		
HEALTHB	-.120 (-.295)		

YOUNG WITH COLLEGE

VAR	COEF (t value)	VAR	COEF (t value)
		HEALTHW	-.018 (.040)
		MARRY68	.343 (1.445)
		MARRY	.429 (.924)
EDUP	-.130 (-.764)	UNMARRY	-.241 (-.843)
		LOE1	-.248 (-1.010)
WHITE	-.010 (-.036)	LOL1	-.167 (-.771)
UNI68	-.019 (-.064)	QE1	-.070 (-.456)
CUNIY	-.278 (-.689)	QL1	-.065 (-.387)
CUNIN	-.032 (-.044)	CONSTANT	.741 (2.063)**
REG68	.225 (1.210)	R^2 =	.2126
CREGS	.498 (1.544)		
CREGNS	.230 (.600)		
HLIM68	-.034 (-.072)		
HEALTHB	-.200 (-.283)		

YOUNG WITH COLLEGE

VAR	COEF (t value)	VAR	COEF (t value)
		HEALTHW	.100 (.234)
		MARRY68	.549 (2.288)**
		MARRY	.565 (1.226)
EDUP	-.178 (-1.077)	UNMARRY	-.137 (-.498)
		LO1S	.386 (1.480)
WHITE	.059 (.222)	LO1MED	-.218 (-.791)
UNI68	.043 (.146)	LO1LG	-.700 (-2.192)**
CUNIY	-.290 (-.751)	Q1S	-.072 (-.362)
CUNIN	-.003 (.005)	Q1MED	-.340 (-1.153)
REG68	.109 (.602)	Q1LG	.011 (.056)
CREGS	.564 (1.857)*	CONSTANT	.478 (1.359)
CREGNS	.454 (1.187)	R^2 =	.301
HLIM68	.147 (.330)		
HEALTHB	-.332 (-.492)		

OLD WITH LESS THAN HIGH SCHOOL

VAR	COEF (t value)
EDUP	-.122 (-.772)
WHITE	.019 (.226)
UNI68	.108 (1.229)
CUNIY	-.243 (-1.541)
CUNIN	-.032 (-.044)
REG68	.089 (1.058)
CREGS	---
CREGNS	---
HLIM68	.451 (2.138)**
HEALTHB	-.218 (-.830)
HEALTHW	-.207 (-1.372)
MARRY68	-.227 (-1.148)
MARRY	-.152 (-.484)
UNMARRY	-.131 (-.814)
LOE1	-.090 (-.707)
LOL1	-.164 (-1.671)*
QE1	.182 (1.649)*
QL1	-.178 (-1.539)
CONSTANT	1.143 (5.405)***

R^2 = .141

OLD WITH < H.S.

VAR	COEF (t value)
EDUP	-.140 (-.661)
WHITE	.029 (.344)
UNI68	.142 (1.614)
CUNIY	.017 (.103)
CUNIN	-.355 (-2.244)*
REG68	.121 (1.424)
CREGS	---
CREGNS	---
HLIM68	.462 (2.192)**
HEALTHB	-.227 (-.846)

VAR	COEF (t value)
HEALTHW	-.154 (-1.000)
MARRY68	-.192 (-.956)
MARRY	.006 (.019)
UNMARRY	-.153 (-.954)
LO1S	-.035 (-.227)
LO1MED	.126 (.556)
LO1LG	-.183 (-1.635)
Q1S	-.078 (-.438)
Q1MED	-.208 (-1.164)
Q1LG	.193 (1.599)
CONSTANT	1.054 (4.951)***

R^2 = .135

OLD WITH HIGH SCHOOL

VAR	COEF (t value)	VAR	COEF (t value)
		HEALTHW	.270 (1.778)*
		MARRY68	-.289 (-.991)
		MARRY	-.364 (-1.021)
EDUP	-.130 (-1.007)	UNMARRY	-.834 (-4.198)*
		LOE1	-.109 (-.740)
WHITE	.100 (.727)	LOL1	-.095 (-.641)
UNI68	.133 (1.487)	QE1	-.001 (-.009)
CUNIY	.396 (2.804)***	QL1	-.193 (-1.552)
CUNIN	-.082 (-.596)	CONSTANT	1.061 (3.325)***
REG68	.062 (.609)	R^2 =	.363
CREGS	-.552 (-2.343)		
CREGNS	-.025 (-.064)		
HLIM68	.356 (.950)		
HEALTHB	-.609 (-1.027)		

OLD WITH HIGH SCHOOL

VAR	COEF (t value)
EDUP	-.132 (-1.049)
WHITE	.124 (.955)
UNI68	.186 (2.111)**
CUNIY	.537 (3.806)***
CUNIN	-.126 (-.923)*
REG68	.043 (.434)
CREGS	-.573 (-2.562)***
CREGNS	-.004 (-.010)
HLIM68	.358 (.985)
HEALTHB	-.216 (-.360)
HEALTHW	.280 (1.879)*
MARRY68	-.280 (-.996)
MARRY	-.302 (-.871)
UNMARRY	-.865 (-4.491)*
LO1S	.549 (1.927)*
LO1MED	-.263 (-1.351)
LO1LG	-.305 (-2.030)
Q1S	-.281 (-1.480)
Q1MED	-.268 (-1.120)
Q1LG	-.146 (-1.361)

OLD WITH COLLEGE

VAR	COEF (t value)	VAR	COEF (t value)
		HEALTHW	---
		MARRY68	.928 (1.250)
		MARRY	.928 (1.250)
EDUP	.137 (.725)	UNMARRY	-.223 (-1.106)
		LOE1	-.030 (-.162)
WHITE	.202 (.999)	LOL1	.231 (.742)
UNI68	.246 (.767)	QE1	.125 (.768)
CUNIY	.142 (.806)	QL1	-.115 (-.627)
CUNIN	-.572 (-1.046)	CONSTANT	.079 (1.138)
REG68	.181 (1.314)	R^2 =	.1621
CREGS	---		
CREGNS	-.265 (-.978)		
HLIM68	-.047 (-.213)		
HEALTHB	---		

OLD WITH COLLEGE

VAR	COEF (t value)	VAR	COEF (t value)
		HEALTHW	---
		MARRY68	.480 (.706)
		MARRY	.741 (.902)
EDUP	.147 (.746)	UNMARRY	-.865 (-1.345)
		LO1S	.227 (.838)
WHITE	.192 (.928)	LO1MED	.130 (.249)
UNI68	.247 (.747)	LO1LG	-.028 (-.114)
CUNIY	.162 (.883)	Q1S	-.285 (-.887)
CUNIN	-.155 (-.250)	Q1MED	-.196 (-.586)
REG68	.203 (1.399)	Q1LG	.119 (.722)
CREGS	---	CONSTANT	.168 (.235)
CREGNS	-.280 (-1.008)	R^2 =	.173
HLIM68	-.002 (-.008)		
HEALTHB	---		