1-1-1993

Occupational mobility, interfirm mobility and subsequent wage profiles.

Young-il Park
University of Massachusetts Amherst

OCCUPATIONAL MOBILITY, INTERFIRM MOBILITY AND SUBSEQUENT WAGE PROFILES

A Dissertation Presented

by

YOUNG-IL PARK

Submitted to the Graduate School of the
University of Massachusetts in partial fulfillment
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 1993

School of Management

OCCUPATIONAL MOBILITY, INTERFIRM MOBILITY AND SUBSEQUENT WAGE PROFILES

A Dissertation Presented

by

YOUNG-IL PARK

Approved as to style and contents by:

Robert A. Nakosteen, Chair

Craig L. Moore, Member

Agha Iqbal Ali, Member

Stephen P. Coelen, Member

Ronald Karren,
Ph.D. Program Director,
School of Management

To My Parents,

Myoung-Hye,

Peter and Richard

With Love and Thanks

ACKNOWLEDGEMENTS

When I arrived at Amherst in 1985 to join MBA program, I had no idea how my life would be. Many things happened to me during my stay at Amherst. I met my wife, got married and brought up two beautiful sons.

First of all, I would like to gratefully acknowledge the guidance and support provided by my advisor Robert Nakosteen. I also thank other members of my dissertation committee for their time, comments and suggestions.

I would like to express my special gratitude to my parents who have given us all that they can. Without their support I could not have survived. I also thank my wife Myoung-Hye for her endless love, help and encouragement, who has been sharing the same struggle with me, since she has been under enormous amount of pressure as a student, wife and mother of two children. And I really want to thank my two adorable sons, Peter and Richard who have been so wonderful with their smiles and hugs. Peter has been so understanding in our responsibilities as students and parents. Richard has been so good-natured a baby too. His good manner made our life a lot easier. I think all my family who have already gone back to my country are really anxious to see all my work done, so I can play a usual role of a husband and father which has been postponed till now. Really I have waited for this moment for a long time.

Finally, special thanks and bye to my dissertation.

ABSTRACT

OCCUPATIONAL MOBILITY, INTERFIRM MOBILITY

AND SUBSEQUENT WAGE PROFILES

MAY 1993

YOUNG-IL PARK, B.S., HANKUK UNIVERSITY OF FOREIGN STUDIES

M.B.A., UNIVERSITY OF MASSACHUSETTS

Ph.D., UNIVERSITY OF MASSACHUSETTS

Directed by: Professor Robert A. Nakosteen

This study investigates the job dimension of migrant behavior. It presents a model of worker mobility among occupations and employers. It is assumed that workers behave as if they monitor their expected earnings from continued employment in their present positions. Earnings are presumed to be a function of variables that describe the worker's productivity and prospects for future wage growth.

Our model consists of six equations. The first two describe decisions to change occupations and employers. The dependent variables are binary, reflecting the dichotomous nature of the decisions. The remaining equations describe wage rates at the end of period. While we employ a common wage specification, we allow the coefficients of the explanatory variables to differ among the four decision regimes.

Each of the equations includes a random error term which captures factors that are known to the decision maker but not measured by our data, as well as inherent randomness in the

decision process. We permit nonzero correlation among the error terms in the decision equations and wage equations.

This framework gives rise to our three principal items of concern. First, we seek evidence on variables that influence mobility decisions. Second, we examine the post-mobility wage profiles, seeking evidence of discrepancies across migrant regimes. Finally, we look for evidence of self selection in the mobility decision process.

We estimate the model with the data collected from the University of Michigan's Panel Study of Income Dynamics (PSID). Based on the results from wage-gap calculations, it is found that within the category of occupational migrants, workers enjoy efficient economic returns, although they can be still better off by not changing employers than changing (intrafirm transfers and promotions). However, it is found that workers who end up with the same occupation with different employer suffer from wage discrepancy. The evidence of self selection is detected in occupational nonmigrants.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

This dissertation investigates the job dimension of migrant behavior. It presents a model of worker mobility among occupations and employers. My point of departure is to study both occupational mobility and employer mobility using human capital framework, hoping to get a better understanding of the relationship between labor mobility and subsequent earnings.

Most current studies on earnings and labor mobility treat only one dimension of mobility: either geographical, interfirm, or occupational mobility. There are several theoretical reasons that support the simultaneous occurrence of occupational and interfirm mobility.

Occupational mobility due to imperfect occupational matching may occur because workers have incomplete information about the nature of chosen occupations. Complete information may be revealed by actual work in that occupation. Alternatively, if the costs of entering the primary choice occupation are too high, some information may be gained by existence in a closely related occupation. Therefore, occupational mobility will be observed if there does not exist a good match between the worker and the occupation, and often such mobility will also involve interfirm mobility.

Exogenous changes in the market may cause both firm and occupation change. If, for example, a firm is going out of

business and workers are being laid off, some workers will find a job in a new firm, which may also involve working in a new occupation. This is likely to happen if the reason that forced the firm go out of business also caused a drop in the demand for skills specific to the occupation.

Individual worker's career plan can cause interaction between occupational and interfirm mobility. Individual workers can move along a career line which is divided into several stages during a career. Occupational mobility can be observed as a worker's career plan unfolds. This type of mobility can take place within the firm or among firms.

Most research on investment in human capital and labor mobility distinguishes between two types of human capital: general and firm-specific human capital. This distinction captures only one dimension of human capital specificity. Specificity has many dimensions. Skills are not always general or firm specific, but often times occupation specific. Analysis of occupational and interfirm mobility can introduce not only general and firm-specific human capital but also occupation-specific human capital.

This study is primarily concerned with simultaneous treatment of occupational mobility and interfirm mobility, and their effects on the subsequent earnings profile. It presents a model of worker mobility among occupations and employers. This study focuses on workers' decisions to relocate among occupations and employers. We assume that workers behave as if they monitor their expected earnings from continued employment in their present

positions. Earnings are presumed to be a function of variables that describe the worker's productivity and prospects for future wage growth. During each period the worker faced a pair of decisions: whether to remain in his present occupation and in his present firm. We observe the worker at the end of the period and record that he has changed both occupation and employer, changed either occupation or employer, or remained intact.

Our framework gives rise to three principal items of concern. First, we seek evidence on variables that influence relocation decisions. Second, we examine the post migration wage profiles, seeking evidence of discrepancies across migrant regimes. Finally, we look for evidence of self selection in the migrant decision process.

The organization of this study is: Chapter II provides the literature review which will present the theoretical background and empirical findings on labor mobility and earnings.

Chapter III describes the econometric model and estimation, data and specification. The chapter starts by suggesting some preliminary reasons for simultaneous treatment of occupational mobility and interfirm mobility. We present a model of six equations. The first two describe decisions to change occupations and employers. The dependent variables are binary, reflecting the dichotomous nature of the decisions. The remaining equations explain wage rates at the end of the period. While we employ a common wage specification, we allow the coefficients of the explanatory variables to differ among the four decision regimes.

Estimates of these profiles permit us to make inferences concerning the effect of migration decisions on wage rate subsequent to the move.

Each of the equations includes a random disturbance term which captures factors that are known to the decision maker but not measured by our data, as well as inherent randomness in the decision process. We do not restrict these unobservables to be independent of one another. Instead we permit nonzero correlation among the error terms in the decision equations and the wage equations. Evidence of significant covariation between errors in the decision and wage equations would be indicative of self selection in the migration process. This would suggest that individuals are characterized by unobservables which simultaneously affect both their propensities to migrate and their post migration wage rates.

We employ a two-stage estimation procedure to estimate the model. The first step is to estimate the two decision probit equations, from which we estimate appropriate selectivity terms for both occupational and interfirm mobility. In the second stage, we use OLS method to fit log wage equations with relevant explanatory variables and the calculated selectivity terms.

The model will be estimated with data from the University of Michigan's Panel Study of Income Dynamics (PSID). The sample contains 3,087 heads of households who were employed for money during the 1986 survey and 1987 survey. The operational definition of employer mobility is that employer in 1986 is

different from the employer in 1987. Occupational mobility is defined as a change in two-digit PSID occupation classification code in the survey of 1986 from the one reported for the 1987 survey.

Chapter IV presents analysis of sample data and the results of model estimation. In the first section, we analyze the patterns of worker's mobility to look for possible interactions between occupational mobility and employer mobility. In addition, we analyze descriptive statistics to have a clear picture of sample data. In the second section, we present the results and explanation of all model estimations.

Finally, Chapter V includes an overview and the conclusions of this study.

CHAPTER II

LITERATURE REVIEW ON LABOR MOBILITY AND EARNINGS

Recent studies in labor economics have generated a sizable literature on the determinants and consequences of labor mobility. Labor mobility has been defined from different perspectives such as geographical relocation,[1] interfirm mobility, interindustry mobility and occupational switching. In this chapter, I will restrict my review of previous studies of labor mobility to interfirm mobility and occupational mobility.

Section one will deal with interfirm mobility and earnings and section two with occupational mobility.

A. Studies on Interfirm Mobility and Earnings

It is not simple to categorize the literature on employer mobility and earnings due to the wide variety of methodologies applied to a number of different populations. Indeed, throughout this literature, there is no consistent characterization of mobility. While many of the studies distinguish between voluntary mobility (quit) and involuntary mobility (layoff), this is not universally true. Regardless, I have chosen the type of model employed in the studies as my basis for categorizing this broad literature.

---

[1]For geographical mobility, refer to the literature review in Greenwood (1975, 1985).

Perhaps the most frequently used model in this literature is the log wage regression with mobility probit. Another frequently used model is a wage regression with a mobility dummy variable. Finally, a number of studies perform two separate regressions of wage and mobility, assuming that each is independent of the other. This section is divided into subsections according to these primary types of models used in the study of earnings and interfirm mobility.

1. Models of Log Wage Regression with Mobility Probit

Borjas and Rosen (1980) view labor turnover as a sorting process which occurs as a result of mismatches in the existing allocation of workers to firms. These mismatches can be attributed, in part, to imperfect information and mobility costs. Accordingly, they view labor turnover as necessary and productive, since it serves to increase the efficiency of the labor market, and thereby increases labor productivity, total wage income, and the total value of output. Recognizing that a worker's past investment decisions affect that worker's separation decision, while at the same time the worker's likelihood of separation has a feedback effect on his or her incentive to invest, Borjas and Rosen use a three-stage estimation procedure to estimate log of the wage change equation.

Using The National Longitudinal Survey (NLS) of Young Men for the 1971-75 period, their first stage is a reduced form probit estimation of observable employee characteristics, such as

education, tenure, experience, geographic location, industrial sector, and socioeconomic indicators. Among these estimates, prior job tenure has the strongest effect on the probability of separating from the current job; it has a strong negative and decreasing effect. Education is also found to have a significant effect on interfirm mobility, while the effect of general labor market experience is insignificant.

Borjas and Rosen then test their hypothesis by obtaining selectivity corrected imputations of the gains from staying and moving, and showing that the probability of separation depends on the expected gains from mobility. By performing log wage growth regressions on their selectivity bias calculated from reduced probit estimates, they find that prior job tenure has a negative effect on subsequent wage growth. The authors attribute this effect to the fact that longer tenure with a previous job results in higher wage levels in that previous job, thereby reducing the effect of the prior job in determining the initial earnings after a job change. Experience and education is not significant at a conventional level of significance. In addition, they find that job changers, on average, experience a larger gain from employer separation than stayers would have obtained had they moved. Similarly, stayers experience larger gains from staying on their jobs than changers would have obtained had they stayed.

While most studies of longitudinal data are limited to estimates of short-run wage changes, **Blau and Kahn (1981)** attempt to determine whether mobility-induced wage changes are transitory

or lasting. Using data from 1970-1972 NLS data for young women and 1969-1971 NLS data for young men, the authors create four further subsamples - white male, white female, black male, and black female. The additional subsamples allow them to focus on the differential effect of sex and race on voluntary mobility.

For each group, the Blau and Kahn estimate a probit model for quit probabilities. The estimated effects of earnings variables such as long-run earnings opportunities, current wage, and a dummy variable for industry group are large, negative, and significant for all four groups. While coverage by a collective bargaining agreement is large, and negative for all groups, this estimate is not significant for black females. Similarly, the quit probability declines significantly with tenure for all four groups. However, white males in white-collar jobs and black males in the basic industries are more likely to quit than their counterparts. For white females, relatively more education and being married are associated with higher quit probabilities.

By fitting change in log earnings regressions, Blau and Kahn analyze the returns to quitting. Recognizing the endogeneity of quits, they use instruments calculated from the first-stage probit estimations, and report only the quit coefficients. When this instrumental variables approach is used to account for sample heterogeneity, Blau and Kahn find that quitting improved both the current wages as well as the long-term earnings prospects for all groups, with the improvement in long-term earnings prospects exceeding the gain in the current earnings.

In his study of mobility wage effects, **Antel (1986)** criticizes the approach of Bartel and Borjas (1981) and Blau and Kahn (1981), by arguing that their simple comparison of mover wage profiles with stayer wage profiles incorrectly assumes that quitting is exogenous. Rather, Antel states that firm-specific skills are costly and since employees cannot transfer these skills to new employers, employees specialize in firm-specific training. Consequently, the false assumption that quits are exogenous produces a downward bias on mobility wage effects. Citing the small or insignificant positive wage effects for young males found by both Bartel and Borjas (1981) and Blau and Kahn (1981), Antel hypothesizes that a simultaneous estimation structure with job change as an endogenous variable will produce significantly larger mobility wage effects.

Antel performs maximum likelihood estimates of log wage change with reduced form probit estimates of quits using employee characteristics such as wage, tenure, experience, education, health status, union status, and industrial sector on 1969-1970 NLS data for young men. Using this revised methodology, the typical and expected negative effect of wage, tenure, union status, and health coefficients on the probability of quit; the insignificant effect of experience and education on the probability of quit; and, the positive relationship part-time status and the probability of quit are all confirmed.

In addition, the coefficient of the quit-tenure interaction indicates that tenured quitters do not exhibit wage gains below

the gains of less tenured job changers. Experience shows a significant negative effect on wage growth while change in experience between wage observations is significant and positive.

However, in contrast to most previous research, Antel's estimate of wage growth after a voluntary job change is large and significant; voluntary mobility significantly increased wages. Antel attributes this notable mobility effect on wages to his endogenous treatment of voluntary mobility. Furthermore, to test the endogeneity of quits and sample selection, Antel performs a single equation OLS regression on quit. By comparing this result with his simultaneous equation maximum likelihood estimation of the quit coefficient, Antel concludes that treating quit as an exogenous variable underestimated mobility wage gains by about half.

Criticizing OLS log wage regressions, **Marshall and Zarkin (1987)** specify a model for the joint determination of firm's wage offer and the employees mobility decision. This joint determination is based upon their model of the employee-firm relationship as a contract in which the firm is repeatedly making a specific wage offer in the current time period to the employee for the next time period's wage. Whenever the offer falls below the worker's reservation wage, the employee makes an employer-separation decision.

Specifically, Marshall and Zarkin use the 1970-1971 NLS for young men. They model the log wage offer for period t as a function of worker characteristics in period t-1. The log

reservation wage is specified as a function of worker characteristics and search and mobility costs in period t-1. It is assumed that the disturbances in these equations are jointly normally distributed. Consequently, this leads directly to a first-stage probit specification for the mobility decision. These results are then used to calculate selectivity correction terms that are included in second-stage offer equations for stayers and new hires.

Marshall and Zarkin find that the probability of a separation decreases at a decreasing rate with tenure, decreases with education, and increases with prior mobility. The probability of separation is also significantly lower for married workers. However, after controlling for marital status, the level of a wife's income has a negligible effect on the separation probability.

The second-stage wage results attribute all wage growth to experience. The coefficient for tenure, though very imprecise, is actually negative, while the experience effect is essentially linear with a 3.7-3.8 percent increase in wages per year for both new job and current job offers. The large and positive coefficients for the selectivity terms suggest that employee behavior is consistent with income-maximizing search.

To examine the effect on subsequent earnings of an worker's separation from either their employer or their industry, **Nakosteen and Zimmer (1988)** estimate a model of two dimensional mobility.

With a consideration of self selection, the model estimates two mobility decision probits and a log wage regression using the Social Security Administration's One Percent Continuous Work History Sample (CWHS) data set.

Among the estimates from reduced bivariate probit, they find that both the duration of the employees experience with the current employer and the tenure of residence were both strong deterrents to separation. As age increases, they find that industry separation decreases at an increasingly moderate rate. While older workers are more likely to separate from their employers and women are less likely to separate from either their employer or their industry, race does not have a significant effect on employer separation.

The results from second-stage wage equations selectivity terms draw attention. Within a category of double movers, workers who possess unmeasured tendencies to move industries also enjoy unmeasured earnings advantages to be exploited by moving. Based on their further analysis, Nakosteen and Zimmer conclude that employer nonmigrants enjoy more efficient returns on their predetermined earnings. Workers who separate from both their employers and their industries generally suffered the largest earnings losses.

Antel (1991) uses the 1979-81 NLS data set of young men to investigate the relationship between the length of the unemployment spell and the new wages of employer changers.

Specifically, Antel tests the hypothesis that the search and mobility costs associated with unemployment between jobs are compensated by the increased wage gains that result from a more intensive job search.

Using a reduced-form mobility choice equation to estimate mobility, the probit coefficient estimates are consistent with the results of previous studies (Antel, 1986). For example, Antel finds that high-wage, tenured, union, and health limited workers are less likely to quit; education and experience do not have a significant effect on an employee's quit probability, while part-time workers are more likely to quit. Among wage change estimates, schooling has an insignificant effect on wage change, while wages increase at a decreasing rate as experience increases.

Antel concludes that firms do not seem to view unemployed workers as less fit for hiring than currently employed workers. Accordingly, the cause of separation, either a voluntary quit or an involuntary layoff, did not appear to affect an employer's likelihood to hire an unemployed applicant. The major finding from this study is that an unemployment spell between jobs is associated with wage gains higher than those obtained when the job change was made with no intervening unemployment, thereby supporting the theory that a worker's mobility decision is a cost-benefit optimization behavior.

2. Models of Wage Regression or Mobility Regression

Mincer and Jovanovic (1981) use panel data on mobility and wages to ascertain the extent to which human capital investments are linked to either general labor market experience or current tenure. They define current tenure as the tenure with the current firm, or firm-specific tenure. To control for heterogeneity, they introduce two measures of previous mobility: the number of previous job changes, and the number of years in which the job changes occur. While specific job tenure remains an important determinant of mobility, supporting the specific human capital argument, its influence is much smaller if these two measures are introduced. A similar argument, with similar empirical results, is also applied to the observed positive relationship between wage and specific job tenure. These results are particularly interesting since the addition of the mobility term to the OLS log-wage regression produces a result that is not consistent with the specific human capital theory. To explain their surprising results, the authors tentatively conclude that general human capital investments account for only one half of the total positive effect of specific job tenure on wages, that specific investments account for about one fourth of this effect, and that the remaining effect can be explained through interfirm mobility acting as arbitrage activity.

Bartel and Borjas (1981) conduct an analysis of wage growth and the wage gains from mobility job mobility. Consistent with

human capital theory, they attribute wage growth across jobs to individual search and mobility investments less the loss of specific training caused by employer separation. Similarly, wage growth within a job is attributed to both general and specific human capital investments. Two effects of job mobility are examined: the effect on differential life cycle wage growth between jobs of origin and destination; and the influence on life cycle wage growth in any given job. Bartel and Borjas's analysis of the 1969-1973 NLS data set for younger and older men produces a number of interesting results. First, they find that mobility has a significantly different effect on the wage growth of young men versus older men. The greater gains associated with the mobility of young men reflect the differential role of turnover between these two groups: the search investment aspect of turnover in discovering a career, as well as the relatively greater value that younger men place in finding a conformable job. In comparison, the mobility of adult workers typically has a greater element of surprise, such as an unanticipated plant closing. While the latter selectivity effect is not precisely modeled by Bartel and Borjas, they conduct some simple tests of the panel data which strongly suggests that the selectivity effect is not the most important source of variation. Instead, the effects of turnover on wage growth vary with the cause of turnover, with layoffs tending to reduce subsequent wage growth and quits tending to have either a positive or a smaller negative effect on the subsequent wage growth.

Second, the authors examine wage growth within a given job spell, predicting that greater expected tenure should result in greater investment and therefore greater wage growth. Their results suggest that employees with longer job spells exhibit greater life cycle wage growth.

Finally, the time series aspect of the panel data set allows Bartel and Borjas to distinguish between the general and firm specific experiences of the employees identified in the cross-section data set. The results show that specific training is an important component of life cycle wage determination, since individuals with greater specific-firm experience had greater life-time wage growth.

To determine the returns to interfirm job changes, **Mincer(1986)** estimates not only the short-run wage change, but also performs a separate estimation of longer-run wage changes. Mincer defines the short-run wage change as the difference between the starting wage on the new job and the wage earned on the old job one year earlier, while the longer-run wage change is the difference in the wage between the two jobs at the same tenure level, controlling for experience. By distinguishing between short-run and longer-run wage changes, Mincer measures the extent of any shift in the tenure-wage profile that results from an interfirm job change.

In his samples of white male nonstudent workers of age 60 or less, Mincer distinguishes experienced workers from young workers,

defined as those with less than 10 years of experience. In addition, according to their type of separation, Mincer further divides those workers who experience interfirm mobility into the quitter and the laid-off. Other employee characteristics included as independent variables are education, marital status, and union membership.

Across both experienced and young workers, Mincer finds that wage growth decreases at a decreasing rate with experience and tenure. In addition, changes in the adult male unemployment rate significantly affects the change in the real wage, with recent changes in the unemployment having a much stronger affect than less recent changes in the unemployment rate.

The estimation of shorter-run wage gains to interfirm job changes shows that for the average separation the wage gain after a job change does not exceed the wage gain resulted from staying with the same firm. Moreover, the wage gain for experienced workers whose interfirm mobility is caused by a layoff is even less than the wage growth of comparable stayers. Across all workers, the wage gains of quitters exceed the small or even negative wage gains of laid-off movers. Finally, the gains from separations for all workers decline with age (experience).

The results of long-run estimations are quantitatively similar to the short-run gains. For younger movers, the long-run gains are numerically larger than the short-run gains, which suggests that these employees move onto a higher wage growth path with their new firm.

Unlike most previous research which examined the average and transitory change in earnings between male employer stayers and employer changers during the first one or two years after an employer change, **Ruhm (1987)** examines the variance in earnings changes for both men and women in the five-year period following an employer change.

Ruhm finds that separation has a more clear and definitive impact on men's earnings than on women's earnings. Men who voluntarily left their employers enjoy a 10.5 percent faster wage growth than stayers, while men who involuntarily left suffer a 13.6 percent slower wage growth. Although the losses resulting from involuntary job turnover are transitory for various groups of employer changers, such as longer-tenured men, much of the wage loss persists for several years. Conversely, the wage decline for quits is quite large and lasting, typically persists for several periods.

Based on panel data from Denver (DIME) and Seattle Income Maintenance Experiments (SIME), **Mortensen and Neumann (1989)** provide empirical evidence on the returns to interfirm mobility by examining the effects of various forms of job-specific investment[2]. In their descriptive analysis of the data, Mortensen and Neumann find that about 60 percent of all job changes occurred without an intervening spell of either unemployment or labor force

---

[2]Three specific versions of job-specific investment focused in the theoretical literature on mobility are job search, job matching, and on-the-job training.

withdrawal, while about 50 percent of the employer changes by women involved no spell of nonemployment.

On average, both male and female employer changers receive a higher wage on the new job. However, a surprisingly large fraction of the employer changers actually receive a wage cut. For example, 37 percent of the male and 36 percent of the female employer changers in Denver experience a wage cut. In addition, 34 percent of males and 32 percent of females experience wage cuts. Overall, a substantial fraction of individuals who moved directly to a new employer experience a wage cut. In Denver, 32 percent of the male workers and 30 percent of the female workers changing their employers without any intervening period of unemployment experience a wage cut, while the comparable percentages in Seattle sample are 29 percent of the men and 25 percent of the women. Based on this somewhat surprising information, the Mortensen and Neumann conclude that the simple view of the prevailing on-the-job search models are not adequate for underlying assumptions for labor turnover. To explain the large numbers of employees experiencing wage cuts, they suggest that job matching and/or specific human capital acquisition are important factors in the labor turnover process.

One conspicuous empirical pattern that emerged in both their raw data and regression analysis is that job transitions involving a spell of unemployment or nonparticipation result in wage that, on average, is about 5-6 percent less than the wage of individuals who moved directly to a new a job. Finally, through regression of

current wage on demographic characteristics, previous earnings, and the existence or non-existence of an intervening period of unemployment, Mortensen and Neumann find that very little of the variance in wages can be explained by personal characteristics such as age, education, or the level of previous earnings. More specifically, length of time on the previous job has no effect on subsequent earnings.

3. Summary

There appear conflicting results on the mobility-earnings profiles. Some studies show small or insignificant positive or even negative wage effects (Bartel and Borjas, 1981; Blau and Kahn, 1981; Mortensen and Neumann, 1989), other studies present significant positive wage effects (Antel, 1986). In their descriptive analysis of data where a large fraction of job changers actually received a wage cut, Mortensen and Neumann (1989) even suggest that job matching and/or specific human capital frameworks are better fit for turnover process.

When the effects of job change on wage are analyzed in both the short-run and long-run, short-run wage gains to interfirm job changes show that the wage gain after a job change does not exceed the wage gain resulted from staying with the same firm. The wage gain for experienced workers whose interfirm mobility is caused by a layoff is even less than the wage growth of comparable stayers. (Mincer, 1986). In comparison of short-run gains with long-run gains, the long-run gains are either numerically greater than

short-run gains (Blau and Kahn, 1981) or quantitatively similar to the short-run gains (Mincer, 1986).

In the studies of quitting and earnings, it is generally found that quitting induces a large and positive gain in earnings This gain has been most notable in young male quitters (Antel, 1986). However, when a distinction is made between quitting and layoff as the cause of the job mobility, the absolute magnitude of the net positive gains from quitting exceeds even the absolute size of the net negative loss from layoffs. In general, layoff tends to reduce subsequent wage growth and quitting tends to have either a positive or a smaller negative effect on wage growth.

The employee's tenure on the previous job had a negative affect on the likelihood of separation from the subsequent employer, and also had a negative or insignificant effect on the subsequent wage growth of movers. In addition, as current tenure increased, the wages of stayers within a firm increased and interfirm mobility decreased. This result supports the theory of specific capital investments.

Amongst the employee characteristics most frequently used in the literature, the overall rate of employer separation is higher for women, nonunion employees, employees without health limitations, employees with relatively less education, and part time workers. Although very few studies include age in their wage regressions, the employer separation rate tends to vary inversely with age. However, there is no significant evidence of age/earning relations in the current literature. Finally, while

experience was generally found to have an insignificant affect on employer separation, most studies invariably showed a positive and concave relation between earnings and labor market experience. Studies which also analyze the growth rate of wages generally found a higher growth rate for white men, employees with relatively more education, and residents of small towns.

B. Studies on Occupational Mobility

Although income growth is commonly associated with upward occupational mobility,[3] economists have paid relatively little attention to an individual's propensity to change occupations. Instead, the literature has, for the most part, focused on occupational choice and disregarded life time occupational changes. More generally, studies of occupational mobility can be classified into three main areas: (1) descriptive studies conducted by the Bureau of Labor Statistics; (2) on-the-job training, occupational mobility, and earnings; (3) and determinants of occupational mobility.

In the previous section, job-search and the job-matching theories of mobility attributed much of the relationship between wages and occupational or interfirm mobility to the higher productivity achieved by a better job-match. But since an implicit cause of the increased income that accompanies upward occupational changes is the increase in employee skills as well as the returns to those skills, this section will review the human capital investment and occupational mobility literature.

1. Studies by Bureau of Labor Statistics

The Bureau of Labor Statistics has conducted numerous analyses on occupational mobility trends using data from the

---

[3]Some examples of upward mobility sequences are: technician to engineer to manager; laborer to operative to craft worker; receptionist to secretary to administrative assistant.

Current Population Survey (CPS). For example, **Rytina (1983)**, **Seghal (1984)** and **Carey (1988)**[4] use this data set to analyze the rate of occupational mobility. This section summarizes some of the more notable relationships that have been identified between personal characteristics and occupational mobility.

The occupational mobility rate declines sharply with age. The reasons for the high rates of occupational mobility among young workers are numerous. For example, upon the completion of school, young persons often try several fields of employment before settling into a career. In addition, as young employees change their residence, they may also change occupations. In contrast, occupational change amongst older workers occurs less frequently because of attachments to a particular occupation and the concomitant risks of losing income, job security, and pension rights which frequently accompany an occupational shift.

Compared to the age differentials in occupational mobility, the gender differences are small. For both men and women, mobility rates decrease with age. However, women have a slightly higher rate of occupational mobility. This may reflect their shift into professional and managerial occupations as well as their presence in clerical jobs, where the rate of occupational change is traditionally been high.

Similarly, occupational mobility rates do not differ much according to race or ethnicity. For men, the rate of occupational

---

[4]Rytina (1983) uses Current Population Survey (CPS) of January 1981, Sehgal (1984) CPS of January 1983, Carey (1988) CPS of January 1987.

mobility is slightly higher among Hispanics, but this can be explained by the comparatively younger age distribution of Hispanics in these studies. For white women, the occupational mobility rate is higher than that for either black or Hispanic women, and this difference is present across most age groups.

Finally, both occupational tenure and employer tenure are closely associated to age. Among workers aged 35 to 44, more than one-third had been with the same employer for ten years or more, and among workers 45 and over, nearly one-third had been at their jobs for at least 20 years.

Unlike the previous studies, **Markey and Parks' (1989)** summary of workers' movement between occupations differentiates between voluntary and involuntary change of occupations.[5] Their findings show that age is the most significant predictor of voluntary mobility, with 92 percent of all workers making an occupational change less than 45 years of age. Second, higher levels of education are generally associated with higher rates of voluntary mobility. However, very specific training, such as specific professional training, reduces occupational mobility. Third, career change - such as a simultaneous occupation and employer change by a person with significant job tenure - is not common. Fourth, involuntary occupational changes often lead to lower pay in the new job.

---

[5]They analyze the CPS data of January 1987 which collect the reasons for changing occupations to permit an examination of the motivations behind occupational switches.

2. On-the-Job Training, Occupational Mobility and Earnings

Emphasizing a job applicant's demand for on-the-job learning opportunities in selecting amongst potential employers, **Rosen (1972)** provides a model of labor markets that suggests an explicit mechanism relating occupational mobility and employee age-earning profiles. Specifically, Rosen characterizes the labor market and the contract established between suppliers and demanders of jobs. Rather than simply "selling" a job to workers, Rosen describes firms as the sellers of a "package deal" which includes learning possibilities. These learning possibilities can also be described as personal human investment opportunities. Since learning opportunities can increase an employees marketable skills and future income, workers demand and pay for these learning possibilities through wage differentials.

However, the equilibrium price for the "package deal" also depends upon the firm's financial cost of providing the same learning opportunity to different employees. That is, the cost varies according to differences in each employee's learning capacity. Thus the wage differentials and the prices of learning from jobs are implicit, since they must act to balance the net advantage of alternative job opportunities.

Rosen formalizes the relationship between on-the-job training and occupational upgrading through an explanation of the dynamic interaction between profit maximizing firms and individual's attempting to maximize their lifetime wealth and profit-maximizing firms. He describes an optimal progression up

an occupational hierarchy over the course of an individual's working life. Occupational upgrading is related to occupational investments such as formal education and on-the-job training, by improving the capacity to learn in a particular job, they increase the speed with which an individual can progress between jobs.

Rosen concludes that the relation between earnings and work experience depends upon the real costs of providing learning options, the distribution of workers ability and education, initial capital endowments, access to capital markets, labor market restrictions and discrimination, and rental values on knowledge or skills.

More importantly, he demonstrates that the process for acquiring labor market skills will involve an optimal sequence of jobs, in which each job has a successively smaller increment of investment. From his model, it follows that over time the differential between worker's gross and net (of opportunity costs) earnings will shrink, until each workers investment process is completed and gross and net earnings are equalized. It is clear that within this general framework, some measure of post-school or on-the-job investments in human capital must be a fundamental and integral component of any possible explanation for differences in either individual life-time or cross-sectional earning profiles.

In order to estimate the relationship between post-school human capital investments and upward occupational mobility, both Leigh (1976a) and Shaw (1984) offer a model of the process of acquiring productive job skills. Each cites Mincer's book

entitled Schooling, Experience, and Earnings, the weakness in his formulation of the theory of post-schooling investment, and the difficulty in estimating the effect of an unobservable worker characteristic such as on-the-job "training". Nevertheless, each provides an improved specification of the Mincer's job experience variable, and then estimates the relationship between on-the job human capital investments and wage growth.

According to **Leigh (1976a)**, Mincer's use of the number of years of work experience as a proxy for post-school investments is inadequate since it fails to capture the variety, intensity, or rate of each employee's investment experience. As an alternative, Leigh proposes observed upward mobility in a job hierarchy as his proxy. He develops his proxy by first modeling the impact of personal characteristics on the determination of the level first-job occupation, then examining the determinants of occupational advancement through the current job. Finally, he examines the effect of both initial occupation level and occupational change on current wages.

Thus, Leigh uses occupational advancement to measure job progression, and to focus on the process of occupational mobility during the working lifetime as well as the impact of this mobility on earnings. Using the 1966 NLS data set for both black and white men aged 45-59 with a record of a first job and who were working in 1966, Leigh obtains a number of hypotheses for the wage differentials across race. In addition, his analysis suggests

both initial individual's occupation and occupational change should be strongly and positively related to his hourly wage rates.

Shaw's (1984) proxy for general human capital investments is based upon her hypothesis that the intensity of this investment varies by occupation and that a portion of these learned skills are transferable to other occupations. This hypothesis allows her calculate an individual's occupational investment at any time using that individual's history of occupational choices. Her definition of occupational investment is the accumulation of skills that an individual acquires in order to perform within an occupation. Thus, her approach to measuring experience allows her to introduce heterogeneity in a worker's experience.

After developing exogenous measures of these features, she uses 1966-1975 NLS data set for young men to calculate the occupational investment of 1447 employees. Using this occupational investment calculation in the earnings specification, Shaw finds that the occupational investment variable is a significant and robust determinant of earnings growth, dominating the effect of experience variable.

A later study by **Shaw (1987)** adds an analysis of the process of joint employer-occupational change to her previous analysis of the intensity of human capital investment and the transferability of occupational skills across occupations. By developing proxies

for investment intensity and skill transferability, she avoids the standard reduced form estimation of demographic determinants of occupational change, which she hypothesizes as independent of past occupational experience. Instead, she performs a direct estimation of a structural model of occupational change.

Her results indicate that a 25 percent increase in skill transferability will increase occupational change for a 29 year-old man by 11 percent, while increasing the probability of change for a forty year-old man by about 23 percent. If follows that individuals consider the alternative returns to their occupation- and employer-specific skills while making employer and occupational decisions. For example, workers with a large quantity of skills, such as craft workers, may continually change employers to maximize the return to their occupational skills. She concludes that individuals do change occupations to maximize the present value of their returns to investment.

Wilson and Green (1990) investigate the importance of occupation and occupational change in determining real labor income. This study is significant in that it attempts to combine aspects of both job-search theory and on-the-job specific human capital investment theories in its explanation for earning-profile differentials. This is done by including both personal characteristics and firm-specific human capital in their study of the changes in real earnings both in absolute terms and relative to an income distribution over time for a selected sample.

In this study, Wilson and Green use an instrumental variables technique to address the interdependence between turnover and changes in earnings. Their results show the importance of this interdependence as well as the importance of a variety of personal factors including measures of human capital, marriage, disability and geographic mobility on yearly changes in real income. Their results also show that occupation effects on earnings increments, especially in white-collar classifications, retain their significance even when adjusting for the other influences. In addition, their study of year-to-year changes within the overall distribution of real labor income reveals the strong association between occupational mobility and real labor earnings in both absolute terms and relative to an income distribution.

3. Determinants of Occupational Mobility

Drawing upon the dual labor market theory as well as Rosen's theory of an optimal progression up an occupational hierarchy, **Leigh (1976b)** questions whether structural demand-side barriers exist which limit the occupations and lifetime earnings of young white and black men.

In this study, Leigh questions the extent to which racial differences in occupational advancement can be attributed to differences in formal education and training. Secondly, he questions the importance of structural labor market segmentation

factors in determining occupational mobility.[6] Finally, he examines the effect of inter-firm mobility on upward occupational mobility.

Defining occupational change as the difference between occupational standing in 1965 and 1970, Leigh finds, first, that occupational advancement is positively related to the length of schooling, although that correlation is much weaker for black men than for white men. Second, participation in various vocational training programs is positively and comparably correlated with the occupational mobility of both whites and blacks. Finally, structural factors, such as initial industry or the region of residence, have little or no effect on the occupational mobility of either group. Despite the relatively weak correlation between education and occupational mobility for black men, Leigh concludes that the occupational advancement of blacks can be enhanced by continuing the long-run process of increasing their relative endowments of education.

In a study of the occupational mobility in Britain, **Mayhew and Rosewell (1981)** describe and explain the extent and causes of occupational mobility. The authors decompose job changes into the following constituent parts: occupation, status, county and industry changes, and examine the extent and spread of mobility on the Hope-Goldthorpe scale.[7]

---

[6]Data used in this study are collected from The 1/1000 Public Use of Sample of the 1970 Census.

[7]The Hope-Goldthorpe scale is developed by Goldthorpe and

Although their results provide a satisfactory explanation of the levels of Hope-Goldthorpe achievement, they cannot adequately explain the movement along the scale. Using discriminant analysis, the independent variables are used to explain the reasons for upward moves, downward moves, or stays. Based upon this analysis, the authors conclude that education and background have a small but significant affect on occupational mobility.

The effect of education on different types of occupational mobility has been analyzed by **Sicherman (1990).**[8] The focus of this analysis is on "career mobility", upward occupational mobility along a series of occupations that forms a worker's career. Their results show that, on average, more educated workers are less likely to change occupation. This may be due to their relatively larger amount of occupation-specific investment as well the smaller number of distinct occupations for careers requiring more education. Across individuals with the same initial occupation, however, more educated workers are more likely to move to a higher level occupation. This is true both within the firm (promotion) as well as across firms. Finally, for

---

Hope. It ranges from 18 (self-employed workers such as street vendors and jobbing gardeners) to 82 (self-employed professionals such as doctors, lawyers and accountants) and is a measure of the desirability of occupation/status combinations.

[8]The data set used for the empirical analysis is drawn from PSID. Individuals reported their occupations at the time of survey, or if unemployed, the last occupation held. Occupational change is defined to occur when the 2 digit PSID occupational category reported by the worker in two successive surveys is different.

occupations with a smaller correlation between schooling and wages, employees with more education are more likely to moving to experience upward occupational mobility.

In a follow-up study, **Sicherman and Galor (1990)**[9] analyze the role and significance of occupational mobility in the labor market. By focusing on individual careers, they analyze the effect of schooling on career mobility, wages and the possibility of promotion, the relationship between quitting and career mobility, and the duration effects on career mobility. Their analysis shows that career mobility is more likely to occur within a firm (promotion) than across firms for individuals with higher levels of experience. Moreover, within the same firm, tenure has a positive effect on career mobility. However, among workers who were not promoted, those with a higher probability of promotion are more likely to quit the firm.

4. Summary

Despite its important implications for income growth and labor market adjustments, only a handful of research has done in the area of occupational mobility. Much of the existing research interprets occupational changes for economic-based reasons as signals of upward job mobility, which often implies career-upgrading, and assumes the voluntary nature of occupational

[9]The authors use the same data set and same definition of occupational mobility used in Sicherman (1990).

mobility. The findings that emerge from this literature review can be summarized as follows:

1. Transferability of occupational investments tends to be positively related to occupational mobility (Rosen, 1972; Shaw, 1984, 1987).

2. Occupational mobility affects earning increments (Wilson and Green, 1990), and both initial occupation and occupational change have a positive relation with wage rates (Leigh, 1976a).

3. Age is the most significant predictor of voluntary occupational mobility. As the age of a worker increases, the likelihood of his or her experiencing occupational mobility decreases.[10] Similarly, the longer an employee has been attached to a particular employer, the less likely the employer is to change occupations.

4. On average, more educated workers tend to be less mobile. But within the same initial occupation, more educated workers are more likely to move to a higher level occupation, within or across the firm (Sicherman, 1990). As experience increases, career mobility is more likely to occur within the firm than across the firm (Sicherman and Galor, 1990). Distinguishing voluntary and involuntary occupational change, the ability to accumulate marketable skills is one likely determinant of voluntary occupational change.[11]

---

[10]This age/mobility relationship can be explained using human capital theory, which focuses on individuals and their efforts to increase their value in the market place. Simply stated, workers consider any action they may take to improve their earnings potential.

[11]Sehgal (1984) use the terms "push" or "pull" factors in occupational mobility and Sicherman (1990) planned or unplanned transitions between occupations.

CHAPTER III

ECONOMETRIC PROCEDURES AND DESCRIPTION OF DATA

A. Econometric Procedures

1. Preliminary

As was noted in the literature review, most of current studies on earnings and labor mobility treat only one dimension of mobility, that is, either interfirm mobility or occupational mobility. One exception is Nakosteen and Zimmer (1988)[12] where they examine simultaneous effects of employer separation and interindustry migration of workers on the their subsequent earnings.

Workers switch their occupations and employers either voluntarily or involuntarily. Their reasons of labor mobility may come from job matching, occupational choice, market conditions, and planned career path, among other factors.

Occupational mobility due to imperfect occupational matching may occur because workers have incomplete information about the nature of chosen occupations. Complete information may be revealed by actual work in that occupation. Alternatively, if the costs of entering the primary choice occupation are too high, some information may be gained by closely related occupation. Occupational mobility will be observed if there is not a good

---

[12]The data (CWHS) used in their study lack important personal characteristics such as educational level, experience and tenure which closely represent human capital. They use lagged earnings as a proxy for earnings capacity of workers.

match between the worker and the occupation, and often such mobility will also involve employer separation (see Table 4.1 and 4.2 on occupational and employer mobility).

Upon completion of school, young persons often try several fields of employment before settling into a career. In addition, as young employees change their residence or living arrangements, they may change occupations and/or employers.

Exogenous changes in the market might cause both firm and occupational change. If, for example, a firm is going out of business and workers are being laid off, some workers will find a job in a new firm, which will also involve working in a new occupation. This is likely to happen if the reason that forced the firm to go out of business also caused a drop in the demand for skills specific to the occupation.

Interaction between interfirm and occupational mobility can be caused by individual worker's career plan. Individual worker plans to move along a career line,[13] which is divided into several stages during a career. Sometimes the tasks performed in the different stages of this line fall into different occupational categories. Occupational mobility is observed when this occurs. This type of mobility can take place within the firm or among firms.

Viewed in this context, it seems more appropriate to analyze simultaneous effects of employer separation and occupational

---

[13]Spilerman (1977) defines career line as a worker history that is common to a portion of the labor force. Sicherman and Galor (1990) define it as a career path.

mobility on subsequent earnings, because employer separation interacts intimately and frequently with occupation mobility.

2. Theoretical Background

The economic theory of occupational choice suggests that workers, through their career, tend to enter or stay in an occupation which provides the highest expected returns[14] on their stocks of human capital. The nature of labor market is such that the number of occupations available to a worker within a single firm is limited. Hence, the individual worker who behaves to maximize his expected lifetime earnings might engage in interfirm mobility as well as occupational mobility.

This study starts with simple matching and specific human capital theory. At the beginning of his employment, a worker does not have complete information about his occupation and employer. The employer is also not informed completely about his employee. Thus the worker's productivity and the employer's reward are initially uncertain. But the degree of uncertainty will diminish with the worker's tenure in the firm as a consequence of repeated observations.

During his tenure in a particular occupation, if the match is satisfactory, the worker may accumulate not only occupation-

---

[14]The returns could be either economic or noneconomic. Economic returns include a stream of likely income from entry into a given profession, likely promotion opportunities, fringe benefits, and job security as well as the opportunity costs. Noneconomic returns include working conditions, job satisfaction, support of coworkers, and availability of adequate materials and equipment.

specific human capital but also firm-specific human capital. Consequently, the worker's wage capital along with specific human capital acquired on the job increase with tenure relative to the offers on alternative jobs, which implies that the propensity to separate diminishes over time.

An unsatisfactory match between the worker and his occupation may cause the worker to switch his occupation and possibly to change his employer simultaneously. In this case, the worker might begin period two with a new employer.

Consider a two period model in which worker *i* is employed with an initial occupation in a firm. At the end of period two, he might have switched occupation, or changed his firm, or both.

At the end of period one, the worker possesses a total stock of human capital which is partitioned into portions that are specific to the occupation, the firm, and a general component:

$$H_i(1) = H_{oi}(1) + H_{fi}(1) + G_i(1) \qquad (1)$$

$H_i(1)$ denotes total human capital possessed by an individual *i* at the end of period one, and $H_{oi}(1)$ and $H_{fi}(1)$denote specific human capital related to an occupation and a firm, respectively. The last term $G_i(1)$ represents general portion of human capital, which can be transferred across occupations and firms as well. At the end of period two the worker will possess a revised stock of human capital:

$$H_i(2) = H_{oi}(2) + H_{fi}(2) + G_i(2) \qquad (2)$$

The two selection rules of occupational mobility and interfirm mobility result in four decision regimes. If the worker remained in the original position, he would accumulate the amount of specific human capital related to both occupation and firm equivalent for additional time spent there, and thus all components of $H_i(2)$ should be greater than those of $H_i(1)$. If the worker changed both occupation and firm, he could not accumulate both firm-specific and occupation-specific human capital. Thus the resulting condition would be $H_{oi}(2)=0$, $H_{fi}(2)=0$ and $G_i(2)>G_i(1)$. If the worker changed occupation only, he could accumulate only firm-specific portion of human capital, and thus $H_{oi}(2)=0$, $H_{fi}(2)>H_{fi}(1)$ and $G_i(2)>G_i(1)$. If the worker changed firm only, only the occupation-specific portion would be accumulated, and then $H_{fi}(2)=0$, $H_{oi}(2)>H_{oi}(1)$ and $G_i(2)>G_i(1)$. Based on the four decision regimes, the second period wage equations would be restructured as one of the following functions:[15]

$$\ln W_1 = \gamma_1 Y_1 + \varepsilon_1, \quad \text{if} \quad H_{oi}(2) > H_{oi}(1),\ H_{fi}(2) > H_{fi}(1) \tag{3}$$

$$\ln W_2 = \gamma_2 Y_2 + \varepsilon_2, \quad \text{if} \quad H_{oi}(2) = 0,\ H_{fi}(2) > H_{fi}(1) \tag{4}$$

$$\ln W_3 = \gamma_3 Y_3 + \varepsilon_3, \quad \text{if} \quad H_{fi}(2) = 0,\ H_{oi}(2) > H_{oi}(1) \tag{5}$$

$$\ln W_4 = \gamma_4 Y_4 + \varepsilon_4, \quad \text{if} \quad H_{oi}(2) = 0,\ H_{fi}(2) = 0 \tag{6}$$

where Y denotes a vector of predetermined variables; γ denotes unknown parameters; and the ε's are unobserved random disturbance

[15]Wage equation follows log-wage form by Mincer (1974).

terms. The underlying assumption in equations (3)-(6) is that a worker's earnings capacity is proportional to his stock of human capital.

3. Econometric Model

In this study, we have three principal items of concern. First, we look for evidence on variables that influence worker's decision to change occupation and employer. Second, we examine the relationship between mobility and subsequent wage profiles, seeking evidence of discrepancies across migrant regimes. Finally, we look for evidence of self selection in the worker's decision process.

The model requires a sample of workers at two points in time. We observe a worker over time to determine whether he has experienced occupational change and/or employer separation. We observe his wage at each point, along with a vector of predetermined variables. The endogenous variables in the model are the mobility status indicators and second period wage. Our model consists of two mobility status equations , along with the wage equation corresponding to each of the four mobility categories.

Define I^*_{oi} and I^*_{fi} as latent indexes of worker i's propensity to switch his occupation and to separate from employer, respectively. The mobility decisions can be a function of log wage and other explanatory variables. For i^{th} worker in our random sample, we have

$$I^*_{oi} = \alpha^*_1 \ln W_i + \beta^*_1 X_{oi} + \varepsilon^*_{oi} \quad (7)$$

$$I^*_{fi} = \alpha^*_2 \ln W_i + \beta^*_2 X_{fi} + \varepsilon^*_{fi} \quad (8)$$

where the α^*'s are unknown scalars and β^*'s are unknown coefficient vectors for exogenous variables. The ε^*'s are disturbance terms, distributed normally with zero means and constant variances. Worker i experiences occupational mobility and interfirm mobility, respectively, if $I^*_{oi}>0$ and $I^*_{fi}>0$. Otherwise no mobility occurs. We do not observe I^*_{oi} and I^*_{fi}. Instead we observe the dichotomous variables I_{oi} and I_{fi} which indicate the outcomes of the two selection rules. We classify workers in the original sample as follows:

$$I_{oi} = \begin{cases} 1 & \text{if } I^*_{oi} > 0 \\ 0 & \text{otherwise} \end{cases} \quad (9)$$

$$I_{oi} = \begin{cases} 1 & \text{if } I^*_{oi} > 0 \\ 0 & \text{otherwise} \end{cases} \quad (10)$$

Equations (7) and (8) together with (9) and (10) jointly comprise the structure of the model. The two decision rules subdivide the sample into four groups of workers: workers experiencing neither employer mobility nor occupational mobility (S_1: I_{oi}=0, I_{fi}=0); those experiencing occupational mobility but not employer mobility (S_2: I_{oi}=1, I_{fi}=0); those experiencing employer mobility but not occupational mobility (S_3: I_{oi}=0, I_{fi}=1); those experiencing both occupational mobility and employer

mobility (S_4: I_{oi}=1, I_{fi}=1). In the remainder of this chapter, the subscript i will be suppressed for notational convenience. Allowing for this convention, the equations (3)-(6) are refined as the following unconditional actual wage equations for workers in subgroups S_1, S_2, S_3 and S_4:

$$\ln W_1 = \gamma_1 Y_1 + \varepsilon_1, \qquad (S_1) \qquad (11)$$

$$\ln W_2 = \gamma_2 Y_2 + \varepsilon_2, \qquad (S_2) \qquad (12)$$

$$\ln W_3 = \gamma_3 Y_3 + \varepsilon_3, \qquad (S_3) \qquad (13)$$

$$\ln W_4 = \gamma_4 Y_4 + \varepsilon_4, \qquad (S_4) \qquad (14)$$

In equations (11) through (14), Y's are vectors of exogenous variables, γ's are vectors of parameters, and ε's are disturbance terms which are independently and identically distributed across the sample with zero means and constant variances (denoted σ_j^2 j=1,...,4).

Substitution of each worker's wage equation into (7) and (8) yields reduced form mobility equations:

$$I_o^* = \delta_o^* Z_o + v_o^* \qquad (15)$$

$$I_f^* = \delta_f^* Z_f + v_f^* \qquad (16)$$

The v's are normally distributed error terms with zero means, constant variances denoted σ_{o*}^2 and σ_{f*}^2, and covariance σ_{of*}. We normalize (15) and (16), dividing by σ_{o*} and σ_{f*}, respectively. Thus the mobility decision criteria become

$$I_o = \begin{cases} 1 & \text{if } v_o > -d_o Z_o \\ 0 & \text{otherwise} \end{cases} \tag{17}$$

$$I_f = \begin{cases} 1 & \text{if } v_f > -\delta_f Z_f \\ 0 & \text{otherwise} \end{cases} \tag{18}$$

where $\delta_o = \delta_o^*/\sigma_{o^*}$, $\delta_f = \delta_f^*/\sigma_{f^*}$, $v_o = v_o^*/\sigma_{o^*}$, and $v_f = v_f^*/\sigma_{f^*}$.

Defining normalized disturbance term in the $\ln W_4$ equations as $v_4 = \varepsilon_4/\sigma_4$ for the subgroup S_4, we can have the following covariance matrix of disturbance terms among v_o, v_f and v_4.

$$\Sigma = \begin{vmatrix} 1 & \rho_{o4} & \rho_{f4} \\ \rho_{o4} & 1 & \rho_{o4} \\ \rho_{f4} & \rho_{o4} & 1 \end{vmatrix} \tag{19}$$

The normalized covariance, ρ_{of}, measures the correlation between unobservables in the reduced form. Thus nonzero correlation implies the possibility that the unobservables in the propensity to change occupations simultaneously affect the likelihood of interfirm mobility.

The model described here corrects self-selection bias. Self selection is present if there exist unobservable factors that simultaneously affect both the worker's propensity of mobility and subsequent wage. In that case we observe only the self-selected wage. Unless we correct the wage models, we obtain biased estimates.

4. Estimation Procedure

The model described above is characterized by a full information on the outcome of two selection rules, giving four

distinct subgroups. The probability P_j (where j=1,...,4) that an individual with explanatory variables Y_j will fall into the j^{th} subsample is given by:

$$P_1 = P(I_o = 0, I_f = 0) = P(v_o < -\delta_o Z_o,\ v_f < -\delta_f Z_f) = G(-c_o, -c_f\ ;\ \rho_{of}) \qquad (20)$$

$$P_2 = P(I_o = 1, I_f = 0) = P(v_o > -\delta_o Z_o,\ v_f < -\delta_f Z_f) = G(c_o, -c_f\ ;\ -\rho_{of}) \qquad (21)$$

$$P_3 = P(I_o = 0, I_f = 1) = P(v_o < -\delta_o Z_o,\ v_f > -\delta_f Z_f) = G(-c_o,\ c_f\ ;\ -\rho_{of}) \qquad (22)$$

$$P_4 = P(I_o = 1, I_f = 1) = P(v_o > -\delta_o Z_o,\ v_f > -\delta_f Z_f) = G(c_o,\ c_f\ ;\ \rho_{of}) \qquad (23)$$

where $G(\cdot, \cdot\ ;\ \rho_{of})$ denotes the standard bivariate normal distribution function with zero means and unit variance and correlation coefficient $\pm\rho_{of}$ and $c_o = -\delta_o Z_o$, $c_f = -\delta_f Z_f$. With I_o and I_f observed for everyone, equation (20)-(23) depict a bivariate probit structure. The likelihood function for the relevant structure is

$$L^* = \prod_{S_1} G(-c_o, -c_f, \rho_{of}) \cdot \prod_{S_2} G(c_o, -c_f, -\rho_{of}) \cdot \prod_{S_3} G(-c_o, c_f, -\rho_{of}) \cdot \prod_{S_4} G(c_o, c_f, \rho_{of}) \qquad (24)$$

The main objective of this study is to estimate wage equations for the subgroups in S_1 to S_4. The wage equation for S_4 having complete observations may be written as:

$$E(\ln W_4 \mid Y_4, T) = \gamma_4 Y_4 + E(\varepsilon_4 \mid Y_4, T) \qquad (25)$$

where the conditioning argument T denotes the joint outcome of the two selection rules, or the sample selection regimes.

If the $E(\varepsilon_4 | Y_4, T) \neq 0$, the linear regression of $\ln W_4$ on Y_4 in the subsample S_4 will result in inconsistent parameters, or selectivity bias. Consistent estimation of parameters requires knowledge of the form of the conditional expectation on the right hand side, hence the conditional distribution of the error term. This calls for imposing additional structure on the model.

Under trivariate normal specification, the probability density function for $\ln W_j$ may be computed for each group. For example, assuming complete observations on the equation $\ln W_4$ are available for the subgroup S_4, where $I_o = 1$ and $I_f = 1$:

$$f(\ln W_4 \,|\, I_o = 1,\ I_f = 1) = \frac{1}{P_4} \int_{-c_f}^{\infty} \int_{-c_o}^{\infty} \frac{1}{\sigma_4} h\left(v_o,\ v_f, \frac{\ln W_4 - \gamma_4 Y_4}{\sigma_4}\right) dv_o\, dv_f \qquad (26)$$

where $h(\cdot, \cdot, \cdot)$[16] is the trivariate normal density for disturbance terms.

Suppose that we observe $\ln W_4$ if and only if $I_o = 1$ and $I_f = 1$. Indexing Π by S_j, product operator for the observations in the J^{th} subsample, the likelihood function is:

$$L_{S_4} = \prod_{S_1} G(-c_o, -c_f, \rho_{of}) \cdot \prod_{S_2} G(c_o, -c_f, -\rho_{of}) \cdot \prod_{S_3} G(-c_o, c_f, -\rho_{of})$$

$$\cdot \prod_{S_4} \frac{1}{P_4} \int_{-c_f}^{\infty} \int_{-c_o}^{\infty} \frac{1}{\sigma_4} h\left(v_o,\ v_f, \frac{\ln W_4 - \gamma_4 Y_4}{\sigma_4}\right) dv_o dv_f \qquad (27)$$

Subject to identifiability, one can estimate the parameters of

---

[16]The last term in the parenthesis corresponds to v_4 (ε_4 divided by σ_4) which represents the normalized disturbance term in $\ln W_4$ equation (14).

wage equations consistently along with the parameters of two selection equations and the matrix Σ (19) by maximizing the likelihood function (27). The complexity of this function makes full information maximum likelihood procedure difficult or even intractable when the number of parameters to be estimated is large. In addition, if the covariance terms between error terms in the probit equations, ρ_{jf} and ρ_{jo}, $j=1,...4$, in the proposed model were nonzero, least squares estimates would be biased and inconsistent. With these factors in mind, we turn to computationally simpler two-step procedure described by Maddala (1983; pp. 278-283). As before, for the purpose of illustration, I take the condition defining observability on $\ln W_4$ to be if and only if $I_o^* > 0$ and $I_f^* > 0$. For this case, equation (25) can be rewritten as

$$E(\ln W_4 \mid Y_4, T) = \gamma_4 Y_4 + E(\varepsilon_4 \mid v_o > -c_o,\ v_f > -c_f) \tag{28}$$

Given the trivariate normal specification, the conditional expectation on the right hand side is

$$E(\varepsilon_4 \mid v_o > -c_o,\ v_f > -c_f) = \rho_{o4}\frac{f(c_o)F(c_f^*)}{P_4} + \rho_{f4}\frac{f(c_f)F(c_o^*)}{P_4} = \rho_{o4}\lambda_1 + \rho_{f4}\lambda_2 \tag{29}$$

where $f(\cdot)$ and $F(\cdot)$ denote the standard univariate normal density and distribution functions respectively,

$$c_o^* = \frac{c_o - \rho_{of}\, c_f}{(1-\rho_{of}^2)^{1/2}}, \qquad c_f^* = \frac{c_f - \rho_{of}\, c_o}{(1-\rho_{of}^2)^{1/2}}.$$

P_4 is as defined in equation (23), and

$$\lambda_1 = \frac{f(c_o)\,F(c_f^*)}{P_4}, \qquad \lambda_2 = \frac{f(c_f)\,F(c_o^*)}{P_4} \tag{30}$$

The two λ's constitute the double-selection analogues of the inverse-Mill's ratio that arises in the context of a single selection. Using (24) in (22), the regression equation that takes explicit account of the fact that $\ln W_4$ is observed only for the individuals in subsample S_4 becomes

$$\ln W_4 = \gamma_4 Y_4 + \rho_{04}\lambda_1 + \rho_{f4}\lambda_2 + e_4 \tag{31}$$

where $E(e_4 | I_o = 1, I_{fo} = 1) = 0$. To estimate equation (31) we use a two-step estimation procedure. The first step is to estimate the reduced-form mobility status equations (17) and (18) with bivariate probit, and thus to obtain the likelihood function (24). Maximizing the likelihood function will yield consistent estimates $\hat{\delta}_o$, $\hat{\delta}_f$ and $\hat{\rho}_{of}$, hence $\hat{c}_o$, $\hat{c}_f$, $\hat{c}_o^*$, $\hat{c}_f^*$ and $\hat{\rho}_4$. Using these in equation (30), we obtain $\hat{\lambda}_1$ and $\hat{\lambda}_2$ for each individual in S_4. Inserting $\hat{\lambda}_1$ and $\hat{\lambda}_2$ into (31) we get

$$\ln W_4 = \gamma_4 Y_4 + \rho_{04}\hat{\lambda}_1 + \rho_{f4}\hat{\lambda}_2 + \tilde{e}_4 \tag{32}$$

where $\tilde{e}_4 = e_4 + \rho_{o4}(\lambda_1 - \hat{\lambda}_1) + \rho_{f4}(\lambda_2 - \hat{\lambda}_2)$. The next step is to fit linear regression of $\ln W_4$ on Y_4, $\hat{\lambda}_1$ and $\hat{\lambda}_2$ for the individuals in S_4. Consistency of the coefficient estimates follows from consistency of $\hat{\lambda}$'s. In similar fashion, wage equations for the remaining regimes are estimated after inserting the appropriate selectivity terms.

B. Description of Data

The proposed model will be estimated with data from The University of Michigan's Panel Study of Income Dynamics (PSID). The PSID is a longitudinal survey of a national sample that contains one observation for each person in each year the person was in the sample.[17] Although the survey started in 1968, many individuals entered the survey in later years.

The PSID is an uncommonly rich source of information on the dynamics of change in people's lives over the eighteen-year period and has several advantages for this study. First, because mobility can be measured at one-year intervals, the PSID enables us to detect a large fraction of all separations that are made. Second, because the study followed up respondents annually, it discloses whether they changed their occupations or firms along with changes in other aspect of their lives.

We have chosen mobility decision interval from the 1986 survey to the 1987 survey. The sample contains 3,087 heads of households who were employed during the 1986 survey and the 1987 survey.

Table 3.1 presents the definition of variables selected for the model estimation. The operational definition of employer mobility is that employer in 1986 is different from the employer

---

[17]Thus, the PSID excludes members of the initial sample who refused to be interviewed in a subsequent year or who could not be interviewed - for example, because the person had died or who could not be located despite attempts at followup.

Table 3.1

Variable Definitions

Variable	Description
Age86/87	Years of age in 1986 and 1987.
Sqage86/87	Age squared.
Female	Dummy variable takes one if female, zero otherwise.
Nonwhite	Dummy variable takes one if not white, zero otherwise.
lnW86/87	logarithm of real hourly wage in cents if paid hourly or real hourly salary if salaried in 1986 and 1987.
Edu86/87	Years of formal schooling.
Exp86/87	Years of work experience.
Sqexp86/87	Experience squared.
Ten86/87	Years of tenure with current employer.
Sqten86/87	Tenure squared.
SMSA86/87	Dummy equals one, if size of largest city (SMSA) in the county of residence is greater than 50,000.
Union86/87	Dummy equals one if union member, zero otherwise.
Married86/87	Dummy equals one if married, zero otherwise.
Disable86	Dummy equals one if physical or nervous condition limits the type of work or amount of work, zero otherwise.
Depend86	Number of dependents of household heads.
Unemp86	Local unemployment rate in percent
Ocdem86	Percentage change of actual occupational employment nationally in two digit occupational classification between January 1986 and January 1987.

in 1987, whether or not unemployment intervenes. Occupational mobility is defined as a change in two-digit occupation classification code in the survey of 1986 from the one reported for the 1987 survey. For each individual we record the binary indicator $I_f = 1$ if identified as an employer separation, zero otherwise; $I_o = 1$ if occupational mobility occurred.

C. Model Specification

In the next chapter, we report estimates of the specifications reported in Table 3.2. This specification satisfies conditions for identification, which require that each probit equation contain at least one variable not included in the log wage equation and at least one variable not contained in the other probit equation.

In the framework outlined in the previous section we suggest that the mobility status equations include variables that measure the worker's earnings capacity, along with indicators of specific human capital. The model provides several testable hypotheses regarding the parameters in equations (20)-(23). Age, experience and tenure with their squares are included in the model to control for human capital. The deterrent effect of age on migration has appeared in many studies in a strong negative form. This age effect in occupational and employer mobility may not be as significant as in geographical mobility where more moving costs are always involved. Still a negative relation between age and

Table 3.2

Variables Included in the Model Specifications

Equation	Variables
Occupational Mobility Probit	Age86, Sqage86, Exp86, Sqexp86, Ten86, Sqten86, Edu86, SMSA86, Union86, Married86, Nonwhite, Female, Disable86, Depend86, Quit, Layoff, Ocdem86
Employer Mobility Probit	Age86, Sqage86, Exp86, Sqexp86, Ten86, Sqten86, Edu86, SMSA86, Union86, Married86, Nonwhite, Female, Disable86, Depend86, Unemp86
Log Wage Equation	Age87, Sqage87, Exp87, Sqexp87, Ten87, Sqten87, Edu87, Union87, Nonwhite, Female, SMSA87

mobility is expected. Tenure is included to control for firm-specific human capital. Workers who have accumulated more time in a given occupation and with a given employer are less willing, *ceteris paribus*, to relinquish their stocks of firm-specific capital because firm-specific training increases productivity on the current job; we expect the sign of tenure with current employer to be negative.

The variables such as education, experience, number of dependents, and physical disability of household heads jointly proxy the likely value of other jobs and mobility cost. On the one hand, education and experience should be directly related to the

value of alternative occupations and jobs, and thus positively related to the mobility probability; on the other hand, more educated and experienced workers may have also searched more efficiently prior to the current job, thus achieving a better job match with less likelihood of occupational and employer separation. Thus we are unable to sign the coefficients on those variables *a priori*. Number of dependents and physical disability are assumed to have a negative effect on mobility. We expect a positive sign on the SMSA coefficient, because those who live in a larger city may have more options for alternative employment. Evidence on the mobility by race is mixed, thus the sign of nonwhite variable is ambiguous, *a priori*. Usually females appear to be less mobile than males due to their tendency to assume dependent roles in the family. Union status captures some aspect of individual productivity but probably also indicates the presence of other valuable job characteristics such as pension plan, seniority rights, and grievance procedures that lower the incidence of employer separation (Freeman, 1980).

Two variables, changes in occupational employment (Ocdem86) and local unemployment rate (Unemp86), are included in the probit equations in part for identification purpose. At least one independent variable must appear in each probit equation that is not in the other. Ocdem86 is included only in the occupational mobility probit to reflect the effect of actual occupational demand on occupational mobility. Thus we can expect that the sign of this variable should be positive. Unemp86 is included only in

the employer mobility probit to reflect local labor market condition.

The log wage equation includes age, experience and tenure with their squares to measure the effects of general and specific human capital. The estimated coefficients of age and age square are expected to be positive and negative, respectively. The coefficients of experience and tenure are expected to be positively related to the wage rate. Education is included following standard practice to control for schooling and later general human capital complementaries. Nonwhites and Females are expected to have lower wage profiles, as is commonly suggested by previous studies. Union members appear to be economically better protected by just being a member. Living in relatively large city (SMSA area) may give more and better job opportunities and have a positive impact on wages. Thus we expect the positive coefficients of union87 and SMSA87. In addition, we include selectivity terms of occupational mobility and employer separation in the log wage equation.

In the probit equations we hypothesize that mobility decisions are motivated by the worker's perceived growth opportunities in his present status. Accordingly in the log wage equation we seek to determine whether realized growth outcomes affect the worker's wage subsequent to his mobility decision.

CHAPTER IV

ANALYSIS OF SAMPLE DATA FROM THE PSID AND MODEL ESTIMATION

A. Analysis of Sample Data from the PSID

1. Patterns of Occupational Mobility and Employer Separation

In the previous chapter, we suggested some possible interactions between occupational mobility and employer separation. In this subsection, we analyze the data to identify whether there exist systematic interactions between occupational mobility and employer separation and to see the mobility trends in the different age groups.

The data set used for the analysis is the PSID. It consists of 3,087 heads of households aged 18-64 who were employed for pay. Individuals are observed during the period 1986-1987. Table 4.1 presents the rates of occupational mobility and employer separation by ages groups.

The annual mean rate of occupational mobility, using PSID two-digit occupational classification, is around 0.297. As can be seen in the column of changed occupation of Table 4.1, this rate decreases with age, from 0.4161 for ages 18-24 to 0.2074 for the ages 35-39 though the rate rises for ages 40 to 50. The decline of occupational mobility appears to be dramatic for younger workers. In addition, Table 4.1 reports the rate of employer mobility along with the rates of quit and layoff for the whole sample and by age groups. The annual mean rate of employer mobility is around 0.162 which is lower than occupational mobility

rate. The rate of employer mobility decreases gradually from 0.343 for ages 18-14 to 0.091 for ages 55-59. While the layoff rate declines gradually with age, the quit rate decreases sharply until ages 50-54 and then rises just prior to the conventional retirement age. The quit rate seems high at early stage of individual's working career and is higher than the layoff rate especially for younger workers. The declining trend of

Table 4.1

Rates of Occupational Mobility and Employer Mobility by Age Groups: Ages 18-64, Heads of Households.

Age	N	Changed occupation	Changed Employer	Quit	Layoff
18-24	274	0.4161	0.3431	0.2445	0.0985
25-29	566	0.3498	0.2173	0.1537	0.0636
30-34	672	0.2842	0.1726	0.1205	0.0521
35-39	516	0.2074	0.1240	0.0891	0.0349
40-44	302	0.2881	0.0993	0.0497	0.0497
45-49	253	0.3004	0.0988	0.0672	0.0277
50-54	218	0.3119	0.0917	0.0642	0.0275
55-59	199	0.2814	0.0905	0.0452	0.0452
60-64	87	0.2184	0.1379	0.1034	0.0345
Total	3087	0.2967	0.1623	0.1118	0.0505

occupational mobility and employer separation (especially quits) among younger workers may be due to the fact that upon completion of school, young persons often try several fields of employment before settling into a career, or they may change their residence

or living arrangements. In addition, this trend may reflect job matching because occupational matching and employer matching are typical in the early stages of a working career. The generally decreasing trend of interfirm mobility with age can be explained by firm specific investment in human capital. Because of specific human capital accumulated within the firm, the mobility rates decrease with the time spent in the firm. Thus, both quits and layoffs can be expected to decrease with age.

Table 4.2 presents the rates of occupational mobility for workers who changed or did not change their employers. On the

Table 4.2

Rates of Occupational Mobility for Workers
Who Changed/Did Not Change the Employer

SAMPLE:	EMPLOYER CHANGED		EMPLOYER NOT CHANGED	
Age	N	Changed Occupation	N	Changed Occupation
18-24	94	.6064	180	.3167
25-29	123	.5366	443	.2980
30-34	116	.5086	556	.2374
35-39	64	.4688	452	.1704
40-44	30	.5000	272	.2647
45-49	24	.7083	229	.2576
50-54	20	.6000	198	.2828
55-59	18	.6667	181	.2431
60-64	12	.5833	75	.1600
TOTAL	501	.5489	2586	.2479

average, 0.5489 of workers who change employer also change occupation. This ratio decreases with age, from 0.6064 for ages 18-24, to 0.4688 for ages 35-39, and increases later, but the ratio drops at the end.

Among workers who do not change their employers, the mean rate of occupational mobility is 0.2479, decreasing from 0.3167 for ages 18-14 to 0.1704 for ages 35-39. The rate of occupational mobility declines steadily for younger workers, levels off at ages 40-49, and drops again at the ages for 60-64.

2. Descriptive Statistics from the PSID

Table 4.3 presents sample means of selected variables for different separation categories. Employer movers are approximately thirty three years old and tend to be younger compared to thirty seven years of grand mean. Within the categories of occupational nonmigrants, employer movers are about five years younger than employer nonmigrants. Female workers and nonwhites are more prone to change their employers.

The hourly wage data offer useful insights. In 1986, employer stayers tend to have higher wage rate on average than employer movers. The mean wage of nonmigrants in both occupation and employer is $7.60 and is $0.66 higher than $7.28 of grand mean. Double movers suffer from the lowest mean wage rate of $5.98. In 1987, compared to grand mean of $10.74, the employer stayers still enjoy higher mean wage, $10.85 for occupational migrants and $11.39 for occupational nonmigrants. In addition,

Table 4.3

Selected Sample Means

	Selection Categories				
	Occupation Migrant		Occupation Nonmigrant		Grand
Variable	Firm Mover	Firm Stayer	Firm Mover	Firm Stayer	Mean
Age86	33.316	37.187	32.951	38.095	37.104
Sqage86	1228.6	1499.4	1174.2	1561.2	1490.4
Female	0.2909	0.2293	0.3008	0.2123	0.2293
Nonwhite	0.3964	0.3869	0.3982	0.3655	0.3751
Wage86	597.61	712.54	667.01	760.10	728.93
Wage87	723.63	1085.0	908.85	1139.4	1074.2
Edu86	11.927	12.320	12.792	12.866	12.663
Edu87	12.691	12.777	12.947	12.878	12.845
Exp86	13.167	16.680	12.588	17.523	16.559
Sqexp86	281.31	382.96	241.30	412.31	382.02
Exp87	13.796	17.591	13.088	18.215	17.316
Sqexp87	300.09	432.97	252.45	446.51	416.45
Ten86	3.4948	8.7880	2.4926	9.6947	8.4269
Sqten86	45.732	143.40	22.818	163.31	138.42
Ten87	0.9615	9.0621	0.9705	10.684	8.7698
Sqten87	6.9326	141.61	4.5600	183.30	145.84
SMSA86	0.6400	0.6037	0.5664	0.5959	0.5993
SMSA87	0.6727	0.6006	0.5487	0.5954	0.5600
Union86	0.1127	0.2247	0.0974	0.2612	0.2284
Union87	0.1091	0.2215	0.1150	0.2658	0.2316
Married86	0.5491	0.6287	0.5044	0.6602	0.6323
Married87	0.5055	0.6240	0.5221	0.6627	0.6304
Disable86	0.0764	0.0562	0.0531	0.0581	0.0590
Depend86	2.8327	2.9719	2.6726	3.0864	3.0100
Unemp86	6.4982	6.3463	6.5487	6.7111	6.6045
Ocdem86	2.4775	2.4997	2.4624	2.4432	2.4594
Sample Size	275	641	226	1945	3087
(Percent)	8.91	20.76	7.27	63.01	

they enjoy faster wage growth than grand mean wage growth: the differences in mean wages between 1986 and 1987 are $3.79 for occupational nonmigrants, $3.73 for occupational migrants and $3.45 for grand mean. In the employer movers category, occupational nonmigrants are paid $9.09 and occupational migrants $7.24, which are below the grand mean of 1987 wage. Although employer movers tend to have lower wages in 1986, among them occupational nonmigrants are rewarded with slightly faster wage growth: $1.26 for occupational movers and $2.42 for occupational stayers. Double movers appear to have the lowest wage and also suffer the slowest wage growth, while double stayers enjoy the fastest wage growth with the highest wages among all selection categories.

Differences in the education level of workers (Edu86 and Edu87) is not pronounced among different categories. The occupational nonmigrants have slightly higher education level than grand mean in 1986: about 12.8 years of formal education for employer movers, 12.87 years for employer stayers, and 12.67 years for grand mean.

More experienced (Exp86 and Exp87) and more tenured workers (Ten86 and Ten87) are less likely to change their employers. The mean values of experience for employer migrants are still smaller than the value for grand mean: 13.17 years for occupational migrants, 12.59 years for occupational nonmigrants, and 16.56 years for grand mean, while employer stayers are more experienced. The tenure variable follows the same trend as experience.

Comparing all categories based on age, experience, tenure, and wage, the younger workers tend to have relatively shorter experience and shorter tenure, and thus to be paid less. Among all other categories, workers who change employers in the same occupation are the youngest but tend to have the highest education level. Their educational level seems to reward them with relatively higher wage than employer movers in the different occupation.

According to the city size variable (SMSA86), workers in the larger cities are more likely to change both occupation and employer in 1986: the mean value of 0.64 for double movers and 0.60 for the whole sample.

Union members appear not to change their employers. Among unionized employer stayers, the mean value of union status variable (Union86) for occupational nonmigrants is 0.26 and is higher than 0.23 of grand mean. Married workers (Married86) are less likely to change their employers. The mean of marital status variable is 0.66 for double movers which is greater than 0.63 of grand mean, and 0.63 for occupational movers in the same employer.

Disabled workers are less prone to change both occupation and employer compared to grand mean: 0.076 for the stayers in both occupation and employer and 0.059 for grand mean. Workers with less dependents to support are more likely to change employer. Workers who do not change occupation but employer have average 2.7 dependents and double movers average 2.8, which are less than 3.0 of grand mean. Unemployment rate in 1986 (Unemp86) is little

higher for the group of employer and occupational nonmigrants than other groups: 6.7 percent for double movers and 6.6 for grand mean, and the national occupational demand for 1986 (Ocdem86) for occupational migrant group.

B. The Results of Model Estimation

1. Log Wage Equation with Pooled Sample

In order to isolate the mobility effects, and as a benchmark for further comparison, we present ordinary least squares estimates of 1987 log wages in Table 4.4. In this context we view the mobility categories as predetermined dummy variables in the wage profiles. The variable MM denotes double movers, MS denotes occupational migrants and employer nonmigrants, and SM denotes occupational nonmigrants and employer migrants. The reference group is nonmigrants in both occupation and employer. Estimates of the dummy coefficients reveal that the patterns in Table 4.4 stand up after controlling for other determinants of wages (see Table 3.1 for variable definitions). Occupational mobility is associated with a downward shift in the wage profile. For workers who separate from their employers the decline is approximately 14 percent and is highly significant.[18] For those workers who do not separate from their employers the decline is less than 1 percent and is significant at the 90 percent level. The coefficient for SM is positive, although significant at only 50 percent level, meaning that workers who separate from their employers in the same occupation the increase is approximately 2 percent.

The remaining estimates reveal a highly convex age-wage and experience-wage relationship, meaning that wage increases at a

---

[18]The percentage effect is calculated from the approximation formula exp$b$-1, where b is the estimated dummy coefficient.

Table 4.4

Estimates of Log Wage Equation:
Pooled Sample OLS[a]

Variable	Coefficient	t-stat
Constant	5.2081	42.257
Age87	0.1695E-01	2.540
Sqage87	-0.2316E-03	-3.249
Exp87	0.1062E-01	3.162
Sqexp87	-0.1119E-03	-2.846
Ten87	0.2649E-01	8.821
Sqten87	-0.4029E-03	-4.340
Edu87	0.8425E-01	27.399
Union87	0.18507	10.787
Nonwhite	-0.22112	-14.298
Female	-0.23624	-13.199
SMSA87	0.11042	7.460
MM	-0.15147	-5.294
MS	-0.2010E-02	-0.113
SM	0.2045E-01	0.669
R^2	0.4602	

[a]Dummy variable definitions: MM=1 if I_o=1 and I_f=1; MS=1 if I_o=1 and I_f=0; SM=1 if I_o=0 and I_f=1; The reference group consists of stayers: I_o=0 and I_f=0.

decreasing rate with age and experience. The tenure effect also has a convex relationship with wage and is extremely significant. This may be due to the fact that firm-specific human capital is accumulated over time, given a successful match, and the returns grow over time.

The coefficients for education and union membership show a significantly positive effect on wage. The dummy variables of female and nonwhite reveal a familiar pattern of lower wage after correcting for mobility. The city size (SMSA87) does have a positive and quite significant effect on wage. A possible reason for this result is that being in an larger city means more options for better job and better wage.

We note, however, that all of these results must be interpreted carefully, since the OLS framework treats the mobility variables as exogenous. All these results are preliminary and for illustrative purposes. In order to endogenize the mobility experience, in the next sections we jointly estimate the model of mobility and wage outlined in the previous chapter.

2. Reduced Form of Bivariate Probit

In order to estimate log wage functions corrected for self selection, first we need to estimate the reduced form of the bivariate probit for occupational mobility and employer separation. Table 4.5 presents estimates of the reduced form bivariate probit.

Table 4.5

Bivariate Probit Estimates:
Equations (17)-(18)

	Occupational Mobility		Employer Mobility	
Variable	Coefficient	t-stat.	Coefficient	t-stat.
Constant	1.9141	2.912	1.8178	2.818
Age86	-0.10532	-2.740	-0.9255E-01	-2.174
Sqage86	0.1229E-03	2.730	0.9856E-03	1.907
Exp86	0.4434E-01	1.993	O.4647E-01	1.868
Sqexp86	-0.1091E-02	-2.318	-0.9005E-03	-1.634
Ten86	-0.2450E-01	-1.348	-0.17369	-14.118
Sqten86	0.5795E-03	1.207	0.3864E-O2	7.765
Edu86	-0.6015E-01	-5.864	-0.3640E-01	-3.514
SMSA86	0.8470E-01	1.631	0.2514E-01	0.392
Union86	-0.10611	-1.615	-0.33374	-3.703
Married86	0.3382E-01	0.425	-0.2330E-01	-.227
Nonwhite	-0.1207E-01	-0.219	0.2816E-01	0.420
Female	0.3406E-01	0.407	0.11432	1.162
Disable86	0.2311E-01	0.105	0.8511E-01	0.632
Depend86	-0.1027E-01	-0.520	0.1452E-03	0.005
Ocdem86	0.4439E-01	2.673		
Unemp86			-0.1271E-01	-1.126
Quit	0.29909	0.735		
Layoff	0.24841	0.603		
χ^2	224.67		501.17	
Rhohat	0.2443			

Column one lists estimates of the occupational change parameters, and column two gives results for employer change (see Table 3.1 for variable definitions).

The coefficient of education is negative and highly significant in both categories. This may be due to the fact that more educated workers may have searched more efficiently prior to current occupation and current employer than less educated workers, thus achieving better employer match and occupational match.

The results for variables of rate change in occupational demand (Ocdem86) and local area unemployement rate in 1986 (Unemp86) are noteworthy. The rate change in actual occupational demand has a significant and positive effect on occupational mobility. Within occupations where occupational demand is high, workers are more prone to be mobile. Although not significant at a conventional level (significant at 26 percent level), the negative effect of local area unemployment rates on employer mobility means that workers tend not to change their employers during local economy downturn.

This model includes both age and experience. Despite potential collinearity between the two variables, t-statistics are still statistically significant, indicating independent effects of age and experience in the whole sample. The columns reveal same age-mobility profiles. Mobility declines at an increasingly moderate rate as age increases, which is similar to the results in Table 4.1 and Table 4.2. Table 4.5 presents convex experience-

mobility and concave tenure-mobility profiles. The effect of experience is significant in both categories. Tenure effect is more significant on employer separation than on occupational mobility. This result is predictable because tenure is defined as the length time spent with current employer rather than in current occupation. Experience and tenure appear to take a portion of general (transferable) and specific (nontransferable) human capital, respectively, because mobility increases with experience and decreases with tenure.

The effect of city size (SMSA86) is positive and significant in both columns, although significant only for occupational migrants at 10 percent level. A possible explanation for this result is that living in a a relatively large city means more alternative occupations and firms to change in the local market.

The effect of union membership (Union86) is negative and significant at 10 percent level on occupational mobility and is highly significant on employer mobility. Union seniority provisions may discourage union workers from separating their employers. The effect of union membership mobility can be explained from two aspects. First, the career structure of union workers may restrict them to remain in their current occupations. Second, typical careers of union members involve occupations in which advancement is by changing grade levels within the same occupation or moving to a similar occupation within the same category. Such movement of union members in general will not change their PSID occupational codes in two digit classification.

Therefore we can see why employer mobility is affected more by union membership than occupational mobility.

Results in both columns attest to the increased mobility for females, although both coefficients are not significant, they are positive, which is quite unusual. This result may be possibly caused by sample data where all the females included are heads of households. That means female heads of households may have a similar labor market behavior as their male counterparts. Quit and layoff are included in the occupational mobility probit. It turns out that these variables are not significant in the model after controlling all other explanatory variables. Remaining variables are insignificant.

The estimated correlation between the probit error terms is 0.244. While this parameter has no economic interpretation, its sign is plausible, indicating that workers with unmeasured tendencies to change occupations tend to possess unobserved propensities to separate employers as well. Finally the Chi Square statistics in each column easily reject the null hypotheses that the respective coefficient vectors are jointly zero.

It is worth mentioning that the estimates in Table 4.5 cannot be interpreted as representing mobility decisions, because wage variables are substituted in the mobility decision equations. The reduced form of the model should, however, be stressed: The influences of many of these factors affecting mobility cannot be separated. We use the estimates of reduced form probit to

calculate the selectivity terms for both occupational mobility and employer separation.

3. The Second-Stage Log Wage Equations

As is described in the previous chapter, the second stage of the estimation procedure entails construction of bivariate selection terms based on the estimated probit coefficients. Log wage equations are estimated with OLS after including the appropriate selectivity terms as explanatory variables. The results are presented in Table 4.6, where SELECT(O) and SELECT(F) denote occupation and employer selectivity terms, respectively.

These estimates differ from the least squares - dummy variable results in Table 4.4 in three aspects. First, we allow four distinct wage regimes. Second, we permit correlation between migrant selection and wage determination. Third, the wage regimes possess distinct variances. With these modifications, few of the results in Table 4.1 are preserved across migrant regimes.

The age-wage profile is insignificant in the first three categories (significant at above 50 percent level) while it is significant at less than 5 percent level in the category of double movers. The wage advantages of experience and tenure have been considerably diluted. It seems that the collinearity between age and experience gets serious in the first three categories after the sample is divided into four subsamples, more so than in the aggregate wage equation. For workers changing occupations within the firm (the second category) the experience effect is the most

Table 4.6

Second-Stage Log Wage: Equations (11)-(14)[a]

	Separation Categories			
	Occupational Migrant		Occupational Nonmigrant	
Variable	Firm Mover	Firm Stayer	Firm Mover	Firm Stayer
Constant	4.6793 (9.935)	5.2766 (18.67)	5.6725 (5.641)	5.2398 (19.13)
Age87	0.2082E-01 (0.669)	0.6162E-02 (0.375)	0.1596E-01 (0.310)	0.2060E-01 (2.169)
Sqage87	-0.2940E-03 (-0.767)	-0.1613E-03 (-0.902)	-0.2701E-03 (-0.390)	-0.2434E-03 (-2.434)
Exp87	0.2496E-01 (1.538)	0.1601E-01 (2.228)	0.1440E-01 (0.595)	0.7108E-02 (1.661)
Sqexp87	-0.4975E-03 (-1.318)	-0.1601E-03 (-2.130)	-0.1447E-03 (-0.205)	-0.6575E-04 (-1.286)
Ten87	0.4376E-01 (1.767)	0.3989E-01 (4.548)	0.7832E-01 (1.941)	0.6529E-02 (1.109)
Sqten87	-0.7314E-03 (-0.702)	-0.8044E-03 (-3.252)	-0.3826E-02 (-1.994)	0.4811E-04 (0.324)
Edu87	0.11115 (8.843)	0.9035E-01 (9.663)	0.8241E-01 (4.552)	0.8274E-01 (15.546)
Female	-0.8685E-01 (-1.879)	-0.14953 (-3.599)	-0.22519 (-3.229)	-0.28363 (-12.01)
Nonwhite	-0.20416 (-4.643)	-0.26716 (-7.306)	-0.17814 (-2.869)	-0.20824 (-10.78)
Union87	0.22289 (3.297)	0.16189 (3.777)	0.21575 (2.360)	0.17411 (7.951)
SMSA87	0.8596E-01 (1.859)	0.16705 (4.639)	0.11014 (1.683)	0.8302E-01 (4.265)
SELECT(O)	-0.17371 (-0.807)	0.7670E-02 (0.049)	-1.5345 (-3.680)	-0.33273 (-1.687)
SELECT(F)	-0.1014E-01 (-0.176)	-0.7488E-01 (-0.785)	0.64910 (2.714)	0.37547 (3.381)
R^2	0.463	0.404	0.440	0.455

[a]Figures in the parentheses are t-statistics.

significant (at less than three percent level), while workers changing only employer (The third category) it is almost negligible. The tenure effect is extremely significant and positive among workers who change occupations within the firm and is still significant at 5 percent level among workers who change only employer. Experience also has a significant and positive effect for workers who move occupation within the firm (in the second category). It appears that experience and tenure encourage intrafirm transfers and promotions from which workers can get a wage raise. Interestingly all these variables have a convex relationship with wage, except one last category. Their coefficients appear to provide a decomposition of worker returns to general and specific human capital investment. Because both occupation-specific and firm-specific human capitals are accumulated over time, given a successful match, and the returns grow over time, both the rate of growth of these returns and their ultimate level may affect mobility: the tenure effect is positively correlated with both. Thus the concavity of tenure-mobility (Table 4.5) and convexity in tenure-wage profiles (Table 4.6) may be due to the eventual completion of occupation-specific and/or firm-specific capital accumulation in the firm.

The education effect still remains positive and the most significant in all categories among other variables, although it is quite weakened compared to the aggregate wage equation. More educated workers tend to have more opportunity for wage raise. The coefficients of female and nonwhite are negative and extremely

significant, meaning that nonwhites and females are likely to have the usual wage disadvantage. The coefficients of union membership is positive and very significant. Thus union workers seem to be economically better protected by virtue of union membership. The coefficients of city size are extremely significant for employer nonmigrants, while it is still significant at less than 10 percent level for employer migrants. The size of city where workers live does have a significant effect on the wage rates they are paid. Thus living in a relatively larger city seems to give wage advantages especially to employer nonmigrants.

Self selection is significant in the categories of occupational nonmigrant (categories three and four in Table 4.6). Table 4.7 summarizes the effects of self selection in the different migrant regimes.

For employer movers the subsample means of both selectivity terms are positive: 0.585 for occupation term and 0.707 for employer term. The effects of self selection, as measured by the product of the coefficient and the subsample mean, are negative for the occupational term and positive for the employer term. We interpret this to mean that, within the category where workers change their employers but not their occupations, those who possess unmeasured tendencies to change occupation suffer from unmeasured wage disadvantages by changing it, while workers who possess unmeasured tendencies to separate employers enjoy unmeasured wage advantages by doing so. For employer stayers the sample means are both negative; -0.424 for occupational term and

Table 4.7

The Effects of Self Selection
in the Different Migrant Regimes

		SELECT(O)			SELECT(F)		
Occupation	Employer	Coefficient	Mean	Effect[a]	Coefficient	Mean	Effect[a]
Move	Move	-0.174	0.798	-0.139	-0.010	1.168	-0.012
Move	Stay	-0.008	1.169	-0.009	-0.075	0.346	-0.026
Stay	Move	-1.535**	0.585	-0.898	0.649*	0.707	0.459
Stay	Stay	-0.333**	-0.424	0.141	0.376**	-0.209	-0.079

[a]Column Effect is product of Coefficient and Mean of each selectivity terms.

* Significant at 10 percent level (see Table 4.6).

**Significant at 1 percent level.

SELECT(O) is a selectivity term for occupational mobility and SELECT(F) for employer separation.

-0.209 for employer term. Thus the effects of self selection are positive for the occupational term and negative for the employer term. Within the category of stayers both in occupation and employer, workers who possess unmeasured tendencies not to change their occupations enjoy wage advantages by staying, while workers who possess unmeasured tendencies not to separate their employers suffer wage disadvantages by staying. Other selectivity coefficients are not significant at conventional levels of significance.

In order to compare the wage profiles, we measure the regression corrected percentage wage gap (*WG*) between each regime and reference group, double stayers:

$$WG_j = \exp\{\overline{X_j}(b_j - b_4)\} - 1, \quad j = 1, 2, 3$$

where $\overline{X}_j$ denotes the average vector of explanation for regime j, and b_j denotes the vector of estimated wage coefficients for regime j, b_4 denotes the estimates of reference group. This statistic summarizes differences between regime j and the reference group subject to the condition that both groups are endowed with the average characteristics of group j.[19]

The calculated *WG* is 0.212 for double movers, 0.645 for only occupational migrant (intrafirm transfers and promotions), and -0.605 for only employer migrants. Overall within the category of occupational migrants, workers appear to enjoy efficient economic returns, although they can be still better off by not changing employers than changing. We can see wage deficiency of workers who end up with the same occupation with different employer. All of this may have something to do with the individual circumstances leading to mobility, which are impossible to determine from the data.

These results are quite interesting compared to the wage differentials between 1986 and 1987 in Table 4.3 and the dummy coefficients of MM, MS and SM in Table 4.4. Because the condition for the wage gap calculation is that both the reference group and group j have the average characteristics of group j, the result is different from the results in the Tables 4.3 and 4.4. Thus simple analysis of raw data and OLS estimation are misleading here.

---

[19]Another application of this statistic is found in Nakosteen and Zimmer (1988).

Analysis of raw data does not sufficiently account for differences in measurable characteristics within regimes, while OLS estimation does not account for differences in unmeasurable characteristics.

Overall, selectivity significantly affects occupational nonmigrants. However, wage differentials between reference group and occupational migrants groups are significant, especially for those who get promoted or transfer within a firm.

CHAPTER V

CONCLUSIONS

Workers mobility is an important component of the process whereby markets adapt to change. Based on the job matching and specific human capital framework, this study is primarily concerned with simultaneous treatment of occupational mobility and interfirm mobility, and their effects on the subsequent earnings profile. This study focuses on workers' decisions to change occupations and employers. We assume that workers behave as if they monitor their expected earnings from continued employment in their present positions. Earnings are presumed to be a function of variables that describe the worker's productivity and prospects for future wage growth.

Our framework gives rise to three principal items of concern. First, we seek evidence on variables that influence interfirm and occupational mobility decisions. Second, we examine the post-mobility wage profiles, seeking evidence of discrepancies across migrant regimes. Finally, we look for evidence of self selection in the migrant decision process.

Our model consists of a bivariate probit equations describing the worker's mobility status along with a wage equation corresponding to each possible outcome of the selection process. The education variable is found to have a negative and very significant effect on the decision to change occupations and employers. This result suggests that more educated workers may

have searched more efficiently prior to current position than less educated workers, thus achieving better employer match or occupational match. The rate change in actual occupational demand has a significant and positive effect on occupational mobility. It seems plausible because within the occupation where occupational demand is high, workers tend to have more opportunities to move.

Our probit results support the human capital hypothesis. As workers accumulate occupation-specific and firm-specific human capital in their current firms, they become less likely candidates for separation. These results are also consistent with the hypothesis that low quality matches between workers and occupations or employers are likely to be discovered in their early stage of career, leading to separations by the more poorly matched workers.

Our estimates of the second-stage wage equation (Table 4.6) differ from the estimates of pooled OLS wage equation (Table 4.4) in three aspects. First, we allow four distinct wage regimes. Second, we permits correlation between migrant selection and wage determination. Third, the wage regimes possess distinct variances.

The tenure effect is highly significant among workers who change occupations within the firm and among workers who change only employer. Experience has also a significant effect especially for workers who change only occupations. Experience and tenure appear to encourage intrafirm transfers and promotions

from which workers can get a wage raise. In almost all mobility categories age, experience and tenure have a convex relationship with wage. Their coefficients appear to provide a decomposition of worker returns to general and specific human capital investment. Because both occupation-specific and firm-specific human capitals are accumulated over time, given a successful match, and the returns grow over time, both the rate of growth of these returns and their ultimate level may affect mobility: the tenure effect is positively correlated with both. Thus the concavity of tenure-mobility (Table 4.5) and convexity in tenure-wage profiles (Table 4.6) may be due to the eventual completion of occupation-specific and/or firm-specific capital accumulation in the firm.

Based on the results from wage gap calculations, we find that within the category of occupational migrants, workers enjoy efficient economic returns, although they can be still better off by not changing employers than changing (intrafirm transfers and promotions). We can see the wage deficiency of workers who end up with the same occupation with a different employer. This result is conflicting with the wage differentials between 1986 and 1987 in Table 4.3 and the dummy coefficients of MM, MS and SM in Table 4.4. It is apparent that simple analysis of raw data and OLS estimation can be misleading in this study.

Our model permits the possibility of endogeneous selection of mobility status and wage. Self selection manifests itself in a manner that cannot be casually observed. It arises as a

correlation between unmeasured characteristics in the worker's propensity to migrate and his subsequent wage rate. We find evidence of self selection in occupational nonmigrants. The effects of self selection, as measured by the product of the coefficient and the subsample mean, are negative for the occupation term and positive for the employer term. We interpret this to mean that, within the category where workers change their employers but not their occupations, those who possess unmeasured tendencies to change occupation suffer from unmeasured wage disadvantages by changing it, while workers who possess unmeasured tendencies to separate employers enjoy unmeasured wage advantages by doing so. For employer stayers, the effects of self selection are positive for the occupation term and negative for the employer term. Within the category of stayers both in occupations and employers, workers who possess unmeasured tendencies not to change their occupations enjoy wage advantages by staying, while workers who possess unmeasured tendencies not to separate their employers suffer wage disadvantages by staying.

BIBLIOGRAPHY

Antel, John J. (1986). Human capital investment specialization and the wage effects of voluntary labor mobility. The Review of Statistics and Economics, 68, 477-83.

_____ (1991). The wage gains of voluntary labor mobility with and without intervening unemployment. Industrial and Labor Relations Review, 44(2), 299-306.

Ashenfelter, Orley (1978). Estimating the effects of training programs on earnings. Review of Economics and Statistics, 60(1), 47-57.

Bartel, Ann (1979). The migration decision: What role does job mobility play? American Economic Review, 69(1), 775-86.

_____ (1980). Earnings growth on the job and between jobs. Economic Inquiry, 18(1), 123-37.

_____ (1982). Wages, nonwage job characteristics, and labor mobility. Industrial and Labor Relations Review, 35, 578-89.

Bartel, Ann and Borjas, George (1981). Wage growth and job turnover: An empirical analysis. In S. Rosen (ed.), Studies in labor markets (pp. 65-90). Chicago: University of Chicago.

Blau, F. and Kahn, L. M. (1981). Race and sex differences in quits by young workers. Industrial and Labor Relations, 34, 563-77.

Borjas George (1981). Job mobility and earnings over the life cycle. Industrial and Labor Relations Review, 34(3), 365-376.

Borjas George and Rosen, Sherwin (1980). Income prospects of job mobility of younger men. In R. G. Ehrenberg (ed.), Research in labor economics, 8 (pp. 159-181). Greenwich, CT: JAI Press Inc.

Bureau of Labor Statistics (1986). Employment and Earnings, 36(1) 35.

_____ (1987). Employment and Earnings, 36(1), 35.

Carey, Max L. (1988). Occupational tenure in 1987: many workers have remained in their fields. Monthly Labor Review, 111, 3-12.

Catsiapis, G. and Robinson, C. (1982). Sample selection bias with multiple selection rules. Journal of econometrics, 18, 351-368.

Datcher, L. (1983). The impact of formal networks on quit behavior. Review of Economics and Statistics, 56, 491-95.

Dauffenbach, Robert C. (1982). The determinants of occupational mobility patterns among blue-collar jobs. Journal of Economics and Business, 34, 367-375.

Devine, T. J., and Kiefer, N. M. (1991). Empirical labor economics. New York: Oxford University.

Fishe, R. P. H., Trost, R. P. and Laure. P. (1981). Selectivity bias and comparative advantage: General approach. Economics of education review, 1, 169-91.

Flinn, C. J. (1986). Wages and job mobility of young workers. Journal of Political Economy, 94(3), pt. 2, S88-S110.

Greene, William H. (1990). Econometric analysis. New York: Macmillan.

Greenwood, Michael J. (1985). Human migration: Theory, models and empirical studies. Journal of Regional Science, 25(4), 521-544.

Ham, John C. (1982). Estimation of a labor supply model with censoring due to unemployment and underemployment. Review of Economics and Statistics, 64, 335-54.

Hausman, Jerry and Wise, David (1979). Attrition bias in experimental and panel data: The Gary income maintenance experiment. Econometrica, 47(2), 455-473.

Heckmann, J. J. (1976). The common structure of statistical models of truncation, sample selection and limited dependent variables and a simpler estimator for such models. Annals of Economic and Social Measurement, 5, 475-92.

_____ (1979). Sample selection bias as a specification error. Econometrica, 47, 153-61.

Jovanovic, Boyan (1979). Job matching and the theory of turnover. Journal of Political Economy, 87, 972-990.

Leigh, Duane E. (1976a). Job experience and earnings among middle-aged men. Industrial Relations, 15, 130-146.

_____. (1976b). The occupational mobility of young men, 1965-1970. Industrial and Labor Relations Review, 30(1). 68-78.

Lillard, Lee, Smith, James P., and Welch, Finis (1986). What do we really know about wages? The importance of nonreporting and Census imputation. Journal of Political Economy, 94(3), 489-506.

Markey, James P. and William Parks II (1989). Occupational change: Pursuing a different kind of work. Monthly labor Review, 112, 3-12.

Marshall, Robert C. and Gary A. Zarkin (1987). The effect of tenure on wage offers. Journal of Labor Economics, 5, 301-324.

Maddala, G. S. (1983). Limited-dependent and quantitative variables in econometric. Cambridge: Cambridge University.

Mayhew, Ken and Bridget Rosewell (1981). Occupational mobility in Britain. Oxford Bulletin of Economics and Statistics, 43(3), 225-255.

Miller, Paul W. and Paul A. Volker (1985). On the determination of occupational attainment and mobility. Journal of Human Resources, 20(2). 197-213.

Mincer, Jacob (1974). Schooling, experience and earnings. New York: NBER, Columbia University.

_____ (1986). Wage changes in job changes. In R. G. Ehrenberg (ed.), Research in labor economics, 8 (pp. 171-197). Greenwich, CT: JAI Press Inc.

Mincer, Jacob and Jovanovic, Boyan (1981). Labor mobility and wages. In Sherwin Rosen (ed.), Studies in labor markets (pp. 21-63). Chicago: University of Chicago.

Mortensen, Dale T. and Neumann, George R. (1989). Interfirm mobility and earnings. in N. M. Kiefer and G. R. Neumann (eds.), Search models and applied labor economics (pp. 247-283). Cambridge: Cambridge University.

Nakosteen, Robert and Zimmer, Michael A. (1982). The effect of earnings of interregional and interindustry migration. Journal of Regional Science, 22(3) 325-41.

_____ (1988). Mobility of labor between employers and industries. Journal of Economics, 14, 155-167.

Polachek, S. and Horvath. (1977). A life cycle approach to migration. In R. G. Ehrenberg (ed.), Research in labor economics, 1, Greenwich, CT: JAI Press Inc.

Rosen, Sherwin (1972). Learning and experience in the labor market. Journal of Human Resources, 7(3), 326-341.

_____ (1981). Studies in labor market. Chicago: University of Chicago.

Rytina, Nancy F. (1983). Occupational changes and tenure, 1981. Bulletin 2126: Bureau of Labor Statistics, 4-11.

Sehgal, Ellen (1984). Occupational mobility and job tenure in 1983. Monthly Labor Review, 107, 18-23.

Shaw, Kathryn L. (1984). A formulation of the earnings function using the concept of occupational investment. Journal of Human Resources, 19, 319-340.

_____ (1987). Occupational change, employer change, and the transferability of skills. Southern Economic Journal, 53(3). 792-719

Ruhm, Christopher J. (1987). The economic consequences of labor mobility. Industrial and Labor Relations Review, 41(1), 30-42.

Sicherman, Nachum and Oded Galor (1990). A theory of career mobility. Journal of Political Economy, 98(1), 169-92.

Sicherman, Nachum (1990). Education and occupational mobility. Economics of Education Review, 9(2), 163-79.

Spilerman, Seymour (1977). Careers, labor market structure, and socioeconomic achievement. The American Journal of Sociology, 83(3).

Wilson, Mark A. and Carole A. Green (1990). Occupation, occupational change and movement within the income distribution. Eastern Economic Journal, 56(3), 209-220.