

Bertil Holmlund

LABOR MOBILITY

Studies of Labor Turnover
and Migration
in the Swedish Labor Market



THE INDUSTRIAL INSTITUTE FOR
ECONOMIC AND SOCIAL RESEARCH



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Address

Industriens Utredningsinstitut
Grevgatan 34, 5 tr. S-114 53 Stockholm, Sweden
Tel. 08-783 80 00



The Industrial Institute for
Economic and Social Research

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in the Swedish Labor Market

by

Bertil Holmlund

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FOREWORD

Labor mobility has a long tradition on IUI's research agenda. Jan Wallander studied migration from the Swedish forest areas in an IUI publication from 1948. In 1964 the Institute published Bengt Rundblad's book on mobility in a local labor market. This field has become even more important during the last decade because of increased foreign competition and new demands for structural adjustment of the Swedish economy. At the same time, mobility appears to have been reduced by various factors; suffice it here to mention the progressivity of the income tax system, the reduction in wage dispersion and the growing number of households with two income earners.

The secular decline of various labor mobility indicators in Sweden is one point of departure for this monograph which has been written by Dr. Bertil Holmlund. The study primarily uses micro data and job mobility and migration patterns are related to characteristics of the individual, the household, the job and the labor market situation. The book also investigates the interaction of wages and job mobility.

Previous drafts of parts of this book have been presented at conferences and as articles. The author is grateful for many useful comments and suggestions. The Institute wants to thank Greg Duncan and Anders Klevmarken in particular. The Institute also acknowledges the cooperation with the Institute for Social Research at the University of Stockholm, which has made its rich data sets on individuals and households available.

Stockholm, May 1984

Gunnar Eliasson

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1 INTRODUCTION

1.1 Background and Purpose

The causes and consequences of labor mobility belong to the classical topics in labor economics. An understanding of the process in which workers and jobs are matched is important for several reasons. First, the adaptability of the labor market to changes in demand patterns has implications for the speed at which the benefits from a more efficient allocation of resources can be realized. Labor mobility may have consequences for macroeconomic stabilization policy as well. If employment relocations can take place only when accompanied by substantial relative wage changes and if nominal wages are sticky downwards, then it is possible that structural changes in the economy may require a high level of general wage inflation. Third, it is clear that mobility between jobs is a way in which workers can improve their economic position; individual wage and income changes come in large part from job changes.

In Sweden, the discussions on labor mobility have undergone several changes. Concerns in the early post-war period focused on the alleged costs of "excessive" labor mobility. (See, e.g., Meidner, 1954.) The idea was that high or "overfull" employment might lead to productivity losses related to increased absenteeism and rapid turnover. In retrospect, the evidence on the "productivity loss" hypotheses appears to have been more anecdotal than representative. Interestingly, however, the

ideas of adverse productivity effects of high turnover have received new interest in recent U.S. studies and discussions (see Brown and Medoff, 1978).

The concerns about labor mobility during the past few years have been quite different from those of the early post-war period. The current view seems to be that labor mobility is in some way "insufficient" to meet the predicted structural changes in Swedish industry. As will be shown later, it is not difficult to find empirical evidence supporting the view that the mobility of the Swedish labor force has decreased over time.

The purpose of this study is to expand our knowledge of the causes and consequences of labor mobility, keeping in focus the decline of mobility in Sweden since the mid 60s. By econometric analyses on several different data sets from the 60s, the 70s and the early 80s, we attempt to provide more detailed information about mobility behavior than what is available in the aggregate series. This, in turn, gives a necessary background for interpreting the secular development of mobility.

The issues addressed fall mainly into four broad categories:

- (i) the determinants of job search and quit behavior,
- (ii) the determinants of family migration decisions,
- (iii) the relationships between mobility and subsequent earnings,
- (iv) the dynamics of labor turnover in the context of overall labor market behavior.

1.2 Approaches, Themes and Limitations

This book's emphasis is empirical rather than theoretical. The theoretical framework that guides the empirical work includes elements from search theory as well as human capital theory.

A recurrent theme of the book is the view of job mobility as an outcome of a job search process where the objective is to maximize income (or utility). Mobility decisions are consequences of individual comparisons of costs and benefits associated with alternative options. This view ignores "involuntary" job separations, such as permanent layoffs. It will be demonstrated in Chapter 2 that layoffs account for only a minor fraction of all job separations.

Individual decisions on job mobility and migration are usually made without complete knowledge of their consequences. In particular, the non-pecuniary attributes of prospective jobs or geographic locations are not easily discovered before mobility decisions are made; workers may have to learn about them by actually working on the job or living in the location. This aspect of the job matching process may result in a series of job and locational changes; in fact, as will be shown in several chapters of this book, those who have recently moved are often those who are most likely to move again.

Mobility sequences have important implications for the functioning of the labor market as an interrelated dynamic system. Changes in the stocks of unemployed, employed and job vacancies occur as a result of sizeable flows of hirings, quits, lay-

offs and labor force transitions. Various feedbacks are typical features of labor market dynamics; through those mechanisms, the initial exogenous disturbances may sometimes be multiplied in subsequent periods. This view of the labor market is worked out in detail in Chapter 8.

The analyses are, of course, subject to a number of limitations. For example, job terminations related to labor force exits have been omitted. Another limitation has to do with the firms' behavior; no explicit analysis is offered of how firms may affect quit rates through their wage policies. Finally, it should be noted that the consequences of mobility are explored only with respect to individual wage effects. Other welfare implications of job mobility and migration - such as those associated with changes in non-pecuniary job (or location) attributes - are thereby disregarded.

The present study differs from earlier Swedish investigations of labor mobility not so much in the issues addressed as in the way it approaches them. For example, it utilizes much richer data sets than those previously available. It is the first Swedish study which uses household panel data as the basis for econometric analyses of mobility behavior. Earlier studies have often been based on cross-sectional aggregates, with little detail on the individual level.

The methodology used here makes it possible, among other things, to examine the role of individual earnings prospects in mobility decisions. To what extent do workers respond to perceived wage gains associated with mobility? Do workers actually gain

by changing jobs? And to what extent do the gains observed for movers reflect the likely gains to stayers, had they moved? The data also allow us to compare behavioral relationships at different points in time and hence to identify structural shifts that may have occurred.

1.3 Outline of the Study

Chapter 2 gives a descriptive overview of patterns of and trends in labor turnover and migration in Sweden. A marked secular decline of several measures of labor mobility is demonstrated.

Chapter 3 provides a theoretical discussion of mobility behavior, primarily within a search theory framework. A distinction is made between the decision to search and the decision to move, conditional on search. The interrelationships between on-the-job search and investments in specific human capital are briefly discussed.

The focus in Chapter 4 is on empirical analysis of job search and quit behavior. First, we present an empirical picture of on-the-job search in the Swedish labor market. Next, we perform econometric analyses of quit rates using data for manufacturing plants. Finally, we explore the determinants of quit intentions, as reported by Swedish workers in 1968, 1974 and 1981.

Chapter 5 deals with migration decisions among Swedish households in the 60s and the 70s, with a special emphasis on the role of family ties. The behavior of two-adult families is explained by taking account of characteristics of both spouses.

Chapter 6 deals with the effect of mobility on age-earnings profiles. To what extent are individuals able to transfer their skills when they move to a new job? Has an increased specificity of human capital investments made job changes more costly?

Chapter 7 analyzes the relationships between job mobility and wage growth. One aim is to explore the role of expected wage gains for mobility decisions, another is to investigate the effects of mobility on subsequent earnings. The analysis takes the interdependence between wage growth and mobility into account; wage growth rates are affected by mobility and mobility decisions respond to alternative prospective wage growth rates.

The dynamics of labor turnover are dealt with in Chapter 8. An econometric model consisting of 10 stochastic equations is developed and estimated. Among the variables endogenously determined are vacancies, unemployment, quits, layoffs and new hires. The model is driven as a self-contained system by exogenous output demand. The model is used in simulation experiments, in which the dynamic labor market responses to exogenous demand and supply changes are illustrated.

Chapter 9 concludes the book with a summarizing discussion of results and implications for future research.

2 LABOR TURNOVER AND MIGRATION: PATTERNS AND TRENDS

2.1 Introduction

This chapter gives a descriptive overview of patterns of and trends in labor mobility in Sweden. The mobility patterns explored are related to individual (and firm) behavior in several different contexts. We focus on labor turnover, job mobility and migration.

Section 2.2 deals with labor turnover as revealed by establishment data on quits, layoffs and new hires. The following two sections present information on job mobility and migration in Sweden. Section 2.5 provides some brief international comparisons. A summary concludes the chapter.

2.2 Trends and Fluctuations in Labor Turnover

The best-known source for current Swedish turnover data is the establishment-based monthly series on separations and new hires among workers in mining and manufacturing industry, published by Statistics Sweden (SCB). During the period 1916-47 data on quit rates were collected by the branch organization for engineering industries (Sveriges Verkstadsförening).

The series for blue-collar workers distinguishes between separations initiated by the employer and separations initiated by the employee. These cate-

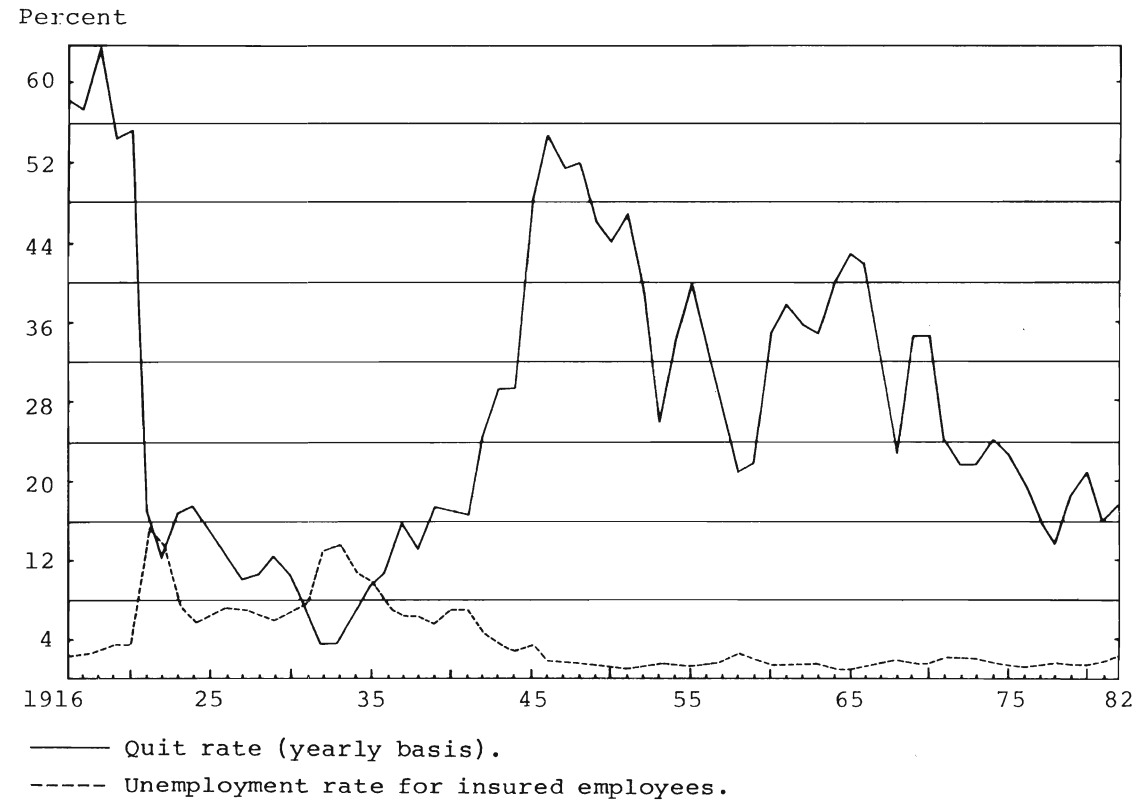
gories will be denoted "layoffs" and "quits", respectively. The data contain no information on the outcome of job separations; hence we do not know the extent to which they result in unemployment, retirement or direct transfer to a new establishment.

There are some problems of interpreting these data. One is related to the meaning of employee's initiative versus employer's initiative. Job terminations for "temporary workers" - workers hired for a fixed length of time - are not neatly captured by the quit-layoff dichotomy.

We have used the available sources and computed quit rates for the period from 1916 to the present date. Figure 2.1 displays quit rates during 1916-82 for blue-collar workers in engineering industries, along with the unemployment rate.¹ The figure shows substantial fluctuations in the yearly quit rate. For instance, in 1918 it reached 64 percent, whereas the bottom of the recession 1932-33 was associated with quit rates of 3 to 4 percent. The quit rate is highest in the years following World War I and World War II. The period after 1945 contains cyclical variations in quits but also a marked downward trend in the quit rate. The quit rate reached its post-war low during the recession year 1977.²

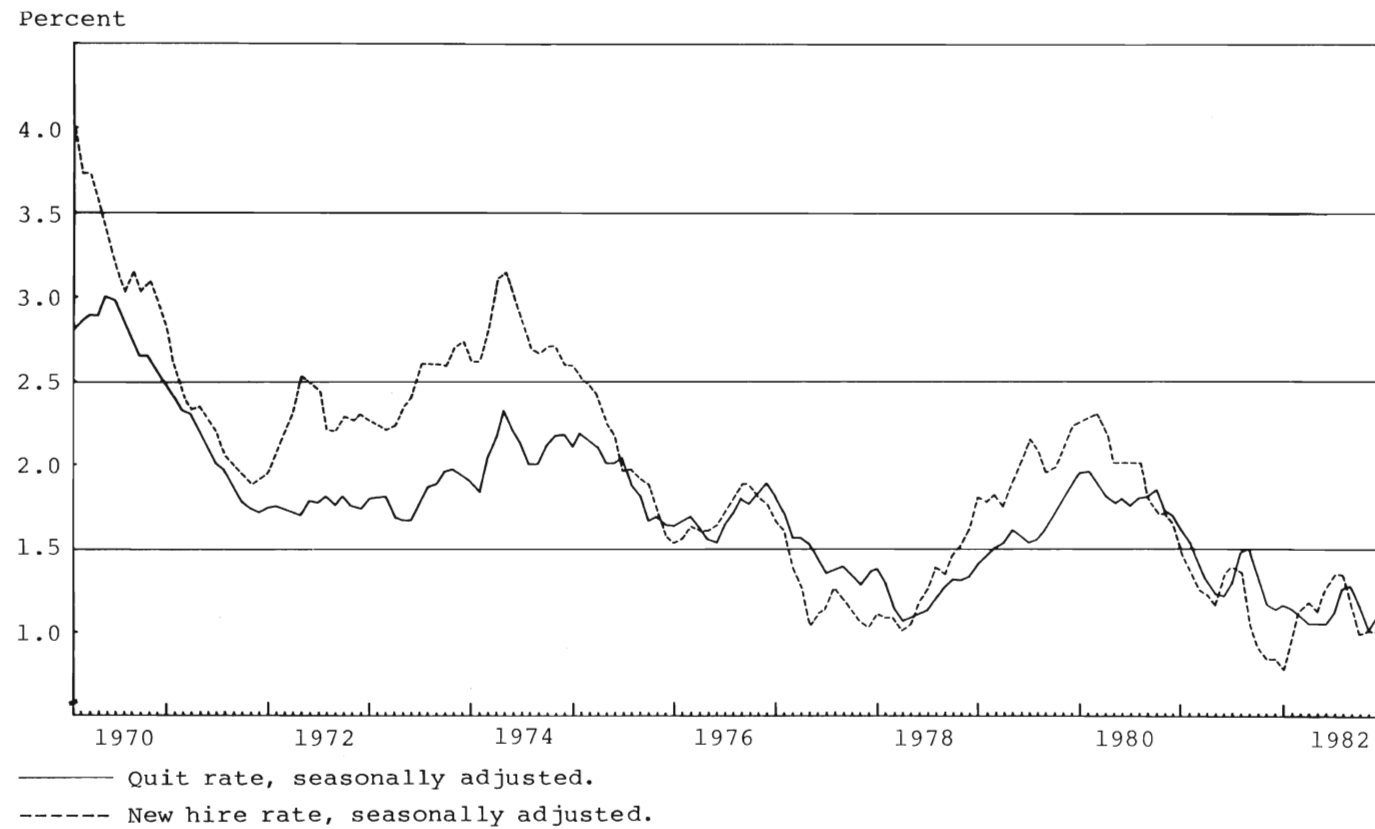
A more detailed display of recent turnover patterns is provided by Figure 2.2, showing seasonally adjusted monthly quit and new hire rates for the mining and manufacturing industry during the period 1970-82.³ The quit rate peak in 1970 coincides with a situation of marked excess demand in the labor market. The next cyclical peak, in 1974,

Figure 2.1 Quit rates among blue-collar workers in engineering industry and unemployment among insured employees, 1916-82



Sources: Quit rate: Sveriges Verkstadsförening, SCB and Eagly (1964).
 Unemployment rate: AMS.

Figure 2.2 Monthly new hire rates and quit rates for blue-collar workers in Swedish industry, 1970-82



Source: SCB.

was characterized by less imbalance in the labor market, and the quit rate did not reach its previous peak level. During the downturn in 1975-77, the quit rate decreased and started to increase again in the beginning of 1978, reaching in 1980 a new peak level.

A lead-lag relationship between new hires and quits can be observed in Figure 2.2. The new hire rate usually starts to change a few months before corresponding changes occur in the quit rate. Such behavior may be due to significantly higher quit rates among recently hired workers or to different patterns of response to changes in common determinants. Suppose, for example, that new hires and quits both respond to changes in the number of vacancies, new hires with no lag, and quits with a one-month lag. Such behavior would be sufficient for observing the typical lead-lag relationship between hirings and quits. We will return to this issue on several occasions in this study.

A monthly new hire rate of two percent implies an average duration of job-specific employment spells of 50 months, i.e., around four years. (In a steady state, where employment is constant, it holds that the average duration of an employment spell is equal to the inverse of the new hire rate.)

To what extent do workers quit into search unemployment? The available data provide no precise answer to this question. We can, however, get some information from the labor force surveys on the sources of flows into unemployment. The average monthly inflow into unemployment amounted to about 25 000 persons during the period 1975-77, or about

300 000 persons per year. The fraction of unemployment inflow attributable to quits was around 15-17 percent, or 50 000 persons during each year,⁴ which is 1.25 percent of the employed work force.

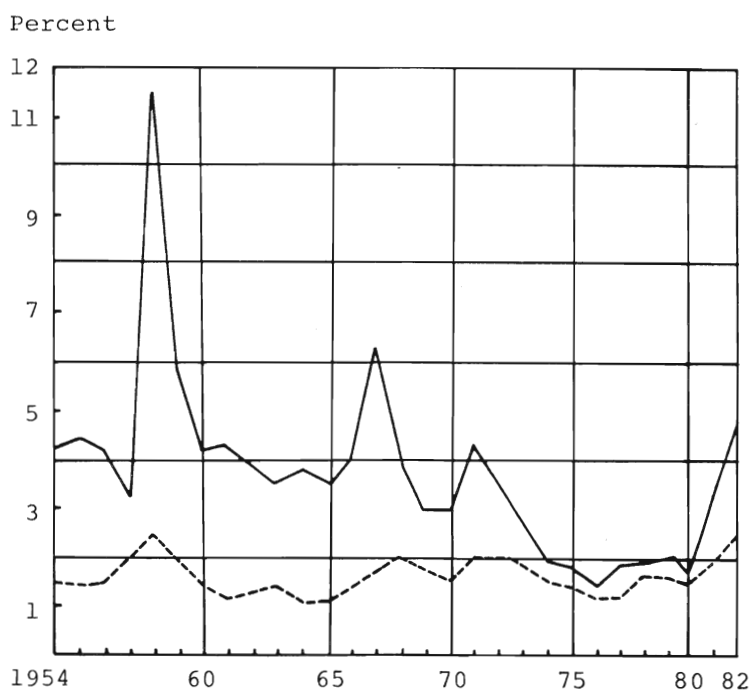
No data exist for quit rates in the labor market as a whole. On the basis of the data for mining and manufacturing, we would place the rate somewhere in the interval 10-20 percent during the years 1975-77. The conclusion supported by these comparisons is therefore that the fraction of quits that involve unemployment is fairly low, probably around 5 to 10 percent.⁵

Turning, next, to available information on layoffs, we show layoff rates for blue-collar workers in Figure 2.3. The figure reveals a marked downward trend in the layoff rate. The recession of 1958 produced a layoff rate of about 12 percent, much higher than the successively falling layoff rates during the three following recessions (1967-68, 1971-72, and 1976-78). During 1981-82, the layoff rate is approximately the same as during the recession of the early 70s.

The turnover data displayed so far cover blue-collar workers only. The available data for white-collar workers (tjänstemän) are based on establishment reports once per quarter (February, May, August and November). No distinction between quits and layoffs is made in this case.

Seasonally adjusted monthly turnover rates for white-collar workers are displayed in Figure 2.4.⁶ The separation rate shows procyclical behavior, implying that the quit-component dominates the layoff-component. We can also note - by comparing

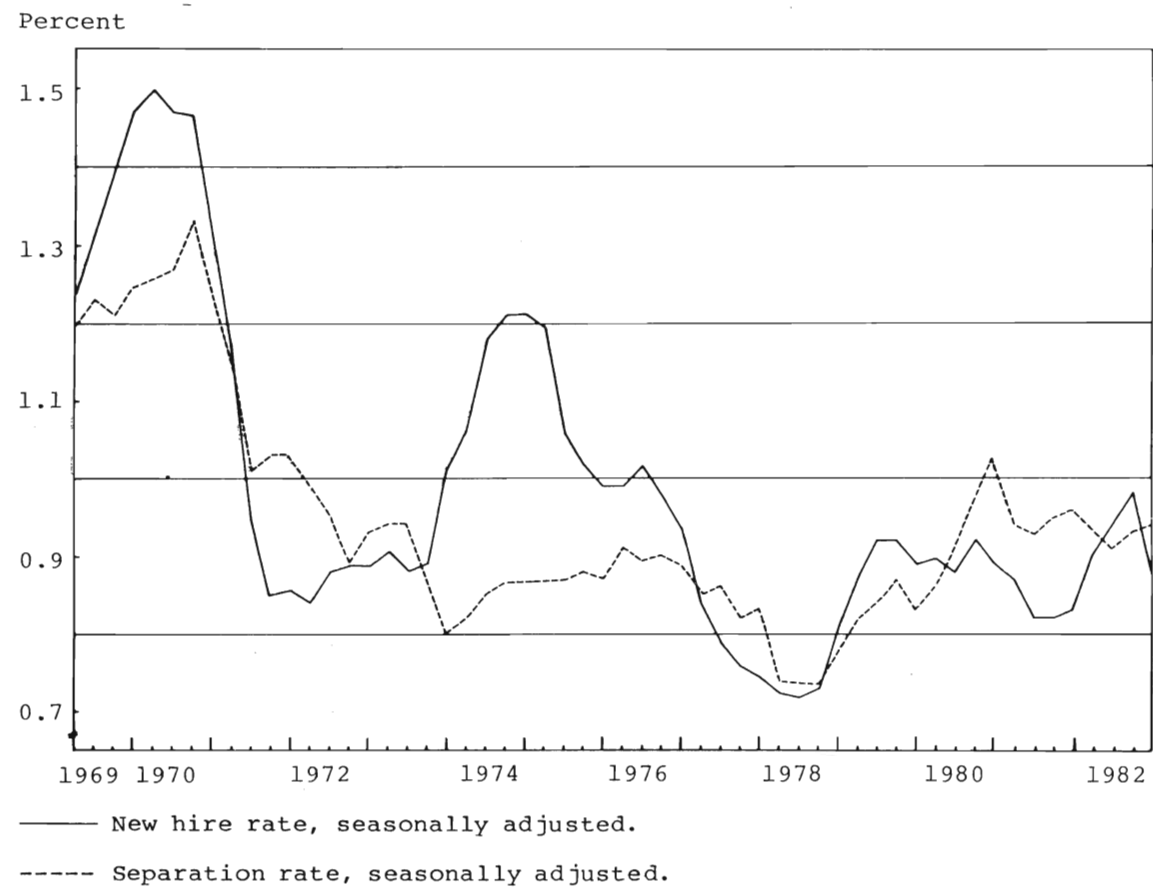
Figure 2.3 Layoff rates in Swedish industry and unemployment among insured employees, 1954-82



—— Layoff rate (yearly basis) in mining and manufacturing (blue-collar workers).
----- Unemployment rate for insured employees.

Sources: Layoff rate: SCB.
Unemployment rate: AMS.

Figure 2.4 Monthly turnover rates for white-collar workers in Swedish industry, 1969-82



Source: SCB.

Figures 2.2. and 2.4 - that total separations for blue-collar workers are, on average, about twice as high as separations for white-collar employees.

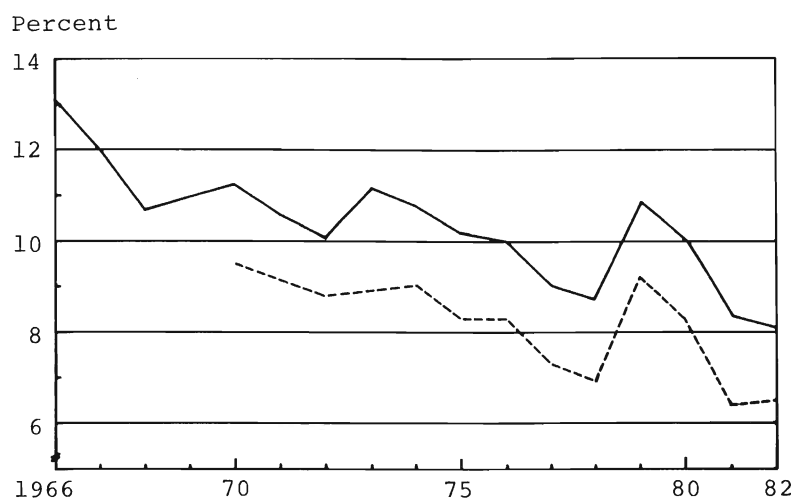
As displayed in earlier figures, the average yearly quit rates among blue-collar workers have been around 15-25 percent during the 70s. These averages mask considerable dispersion among individual plants. For example, about 40 percent of the plants in engineering industry had quit rates below 10 percent and only 25 percent of the plants experienced quit rates above 30 percent in 1977.⁷ The distribution of quit rates among plants is very skewed, and the average quit rate is well above the median.

2.3 Job Mobility

The retrospective Swedish labor force surveys, performed in February each year, ask employed respondents about the permanence of their attachment to the major employer.⁸ The questions permit identification of individuals changing employers at least once during the year. The surveys give no separate information on quit-induced and layoff-induced mobility.

Figure 2.5 displays job mobility rates according to the retrospective labor force surveys for the period 1966-82. The figure is based on all individuals in the labor force, in contrast to earlier figures for workers in mining and manufacturing. The figure is self-explanatory, indicating a downward trend in job mobility.

Figure 2.5 Job mobility, 1966-82



Note: The solid curve shows the number of persons, with at least one change of employer, in percent of the number of persons with some employment experience during the year.

The dashed curve is valid for persons who are in the labor force all weeks of the year.

There is no reliable information on changes of employer for 1969 and 1971; the figure shows crude estimates for those years. The figures for 1981 and 1982 are adjusted for changes in measurement techniques undertaken in 1981.

Source: The retrospective labor force surveys (SCB).

As is evident from the figure, changes of employer are less frequent among those who are "permanent" labor force participants (i.e., those who are in the labor force during all weeks of the year).

2.4 Migration

Turning next to geographical mobility, we display the development of migration between counties in Figure 2.6. The migration rate is higher in 1970 than in the middle of the 60s. The declining migration rates during the 70s appear, at first glance, to be consistent with a simple business cycle interpretation.

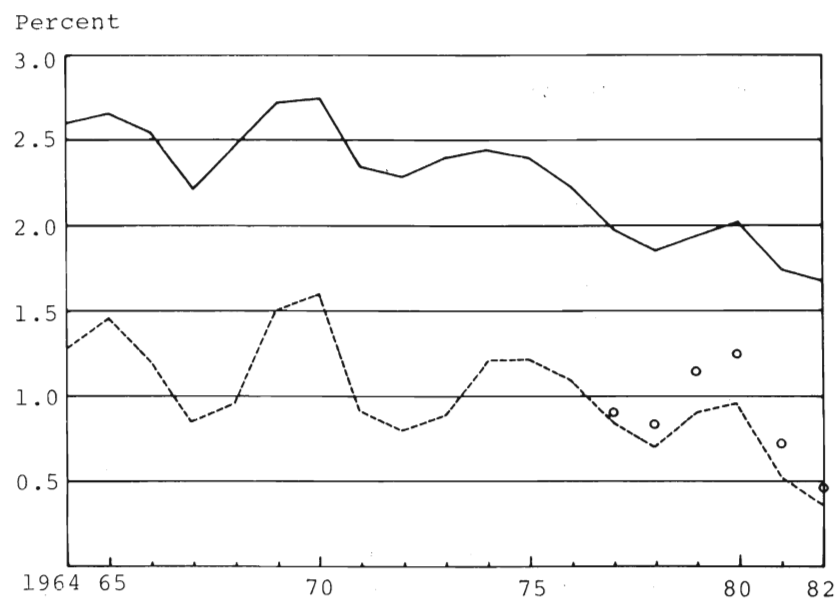
Figure 2.7 provides information about total residential mobility and some of its components. The average "total" migration rate for the period 1974-82 amounts to 14 percent of total population; this implies that Swedes on average move to a new dwelling every seventh year. Almost one half of total residential mobility consists of local moves (within the same parish).

2.5 Some International Comparisons

Are the Swedish experiences of decreasing turnover rates unique? And how do Swedish turnover rates compare with labor markets in other countries? These issues will be briefly touched upon in this section, with comparisons confined to Sweden, the United States and Japan.

Regarding trends in turnover, Swedish experiences differ from the development in U.S. manufacturing.

Figure 2.6 Migration rates and vacancy rates, 1964-82



— The number of migrations across county borders in percent of total population.

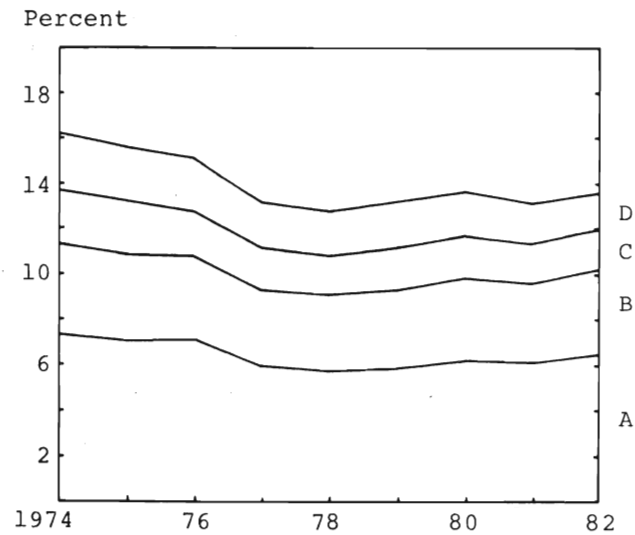
----- Unfilled vacancies in percent of the labor force.

Sources: Migration and labor force data: SCB.

Vacancies: AMS.

The vacancy data are adjusted for the compulsory registration of job openings introduced in the late 70s. This adjustment should be treated very cautiously. The circles for the years 1977-82 show unadjusted vacancy rates.

**Figure 2.7 Internal migration in Sweden, 1974-82,
by type of move**



Note: The number of migrations in percent of total population. A = local residential mobility; B = migration across parish borders; C = migration across commune borders, D = migration across county borders.

Source: SCB.

There are no visible trends in U.S. quit and layoff rates in the 60s and the 70s, clearly at variance with the Swedish experience.⁹ With regard to the magnitude of turnover, it appears from Table 2.1 that quit rate differentials are fairly small between Sweden and the U.S. However, there are important differences in employer-initiated separations. The U.S. layoff rate is of the same magnitude as the quit rate, whereas layoffs in Sweden account for only about 10 percent (on average) of the total number of separations.

**Table 2.1 Monthly turnover rates in manufacturing,
Sweden, United States and Japan**
Percent

	Sweden		United States			Japan
	Quits	Lay-offs	Quits	Lay-offs	Separations	Separations
1971	2.1	0.36	1.8	1.6	4.2	2.2
1972	1.9	0.29	2.2	1.1	4.2	1.9
1973	1.9	0.22	2.7	0.9	4.6	2.0
1974	2.2	0.16	2.3	1.5	4.8	1.9
1975	2.0	0.15	1.4	2.1	4.2	1.7

Note: The Japanese figures refer to plants with 30 employees or more. The smaller plants have slightly higher turnover rates. The Swedish figures apply to mining and manufacturing.

Sources: Sweden: SCB.

United States: Employment and Earnings.

Japan: Yearbook of Labor Statistics.

Several caveats are needed here. U.S. statistics distinguish among three causes of separations: (i) quits, (ii) layoffs, and (iii) other separations. The latter include, among other things, "terminations of employment because of discharge, permanent disability, death, retirement, (and) transfer to another establishment of the company".¹⁰ These latter two causes of separations are in Sweden allocated to "quits" and "layoffs", respectively. Accounting for those differences in definitions, it is likely that the "adjusted" U.S. quit rate is well above the Swedish one. An additional reason for such a conclusion is that the U.S. data cover both blue-collar and white-collar workers.

A substantial fraction of U.S. layoffs is temporary, in the sense that workers will be rehired later on. Temporary layoffs correspond roughly to what is called "permitteringar" in Sweden. Reliable time series on the flow of temporary layoffs in Swedish manufacturing are almost nonexistent. The available evidence, however, indicates that temporary layoffs are of much greater importance in the U.S. For instance, unemployed workers on temporary layoffs accounted for 2 to 3 percent of Swedish unemployment 1975-78; the corresponding U.S. figures have fluctuated between 10 and 20 percent.¹¹

Anecdotal information about the Japanese labor market abounds. The figures in Table 2.1 do not exactly fit the common notion of prevalent "lifetime" contracts; total separations (in percent of employment) are approximately of the same magnitude in Japan and Sweden, implying an average length of job spells of about 4 years.

2.6 Concluding Remarks

The evidence given in this chapter shows a clear downward trend in various measures of labor mobility. The available data on turnover rates, job mobility and migration all indicate a less mobile labor force in the 70s than in the 60s. Other information could have been added, showing, for instance, an increasing duration of unemployment spells as well as longer duration of vacancies.

Labor mobility, as observed in the data, has indeed decreased over time. To explore the causes underlying this development, it may be instructive

to decompose the observed mobility rates into different components. An employed worker's probability of moving between jobs and/or regions is the product of his probability of searching, his probability of finding an offer and his probability of accepting that offer. Several reasons for why mobility rates have decreased may now be considered:

- (i) Workers may have become less inclined to search for new jobs. They may search less intensively or perhaps not search at all.
- (ii) The availability of job openings may have decreased (fewer vacancies) or the availability of offers from found vacancies may have been reduced.
- (iii) The workers may have become more choosy in their job choices, decreasing the probability of accepting job offers, at a given distribution of offers. It may also be the case that the offer distribution itself has changed.

The analyses in this study will identify various determinants of mobility that are related to the probability of searching, the probability of finding an offer, and the probability of accepting an offer. Equipped with results from these analyses we can increase our knowledge of the causes underlying the decline in labor turnover and migration in the Swedish labor market.

3 THEORETICAL ISSUES: IMPERFECT INFORMATION, SPECIFIC CAPITAL AND FAMILY TIES

3.1 Introduction

This chapter provides a theoretical discussion of mobility behavior, primarily within a search framework. The aim is to illuminate a few important mechanisms influencing job mobility and migration and to use the results as a guide for selecting explanatory variables and interpreting empirical results.

The application of search theory to labor market issues has yielded important new insights regarding individual behavior during a spell of unemployment. A frequently cited model portrays the behavior of an unemployed worker in an environment characterized by (i) constant search costs, (ii) a known wage offer distribution, (iii) an exogenous job offer probability, and (iv) an infinite time horizon. It can be shown that the expected lifetime income maximizing strategy implies the selection of a reservation wage which is constant over time when the horizon is infinite. The worker leaves the unemployment pool when he receives an offer above the reservation wage and stays with the particular firm for quite a long time; in fact, the employment contract lasts forever.

The basic search model has some obvious limitations since it cannot be directly applied to the phenomenon of turnover in the labor market. A typical feature of job mobility is job-to-job

changes without intervening unemployment. Mattila (1974) has estimated that the majority of voluntary job changes in the United States occurs without interim unemployment, and we indicated in Chapter 2 that quits into the unemployment pool are even more rare in the Swedish labor market. An obvious inference from these observations is that on-the-job search appears to be quantitatively important. The superior search efficiency sometimes attributed to the unemployment state cannot be dominant given the magnitude of job mobility without intervening unemployment.

The plan of the chapter is as follows. Section 3.2 contains the principal contributions of the chapter. The section deals with various properties of optimal on-the-job search behavior, including job search aspects on migration and search, and mobility behavior when there are nonwage job attributes which are unobserved before the offer is accepted.

Approaches to mobility other than the search theory framework include those based on human capital theory. Section 3.3 provides a brief discussion of the interactions between on-the-job search, investments in specific human capital, and job mobility. Section 3.4 deals with migration decisions in a family context, and a summarizing discussion concludes the chapter.

3.2 On-the-Job Search under Imperfect Information

3.2.1 Permanent Jobs versus Stepping-Stone Jobs

Search models have usually focused on the behavior of unemployed workers with the implicit assumption being that search costs on the job are prohibitively high. (See Lippman and McCall, 1976, for a survey.) The acceptance decision is in this context an once-and-for-all decision with consequences throughout the lifetime. Workers are looking for permanent jobs in the sense that no future job changes are anticipated at the time acceptance decisions are made.

However, there is nothing in principle that precludes the use of the standard search model to characterize the behavior of an employed worker who is looking for a permanent job. We will outline the set of predictions that may be derived from this framework.

Searching for Permanent Jobs

Consider a worker with a current wage $\bar{w}$. Job search will take place if expected returns from search exceed the present value of the current wage. Search costs are incurred at the beginning of the period and wage offers are made at the end of the period. The time horizon is infinite and offers must be accepted immediately.

The value of pursuing an optimal policy for the employed worker is

$$V(\bar{w}) = \max\left\{\frac{\bar{w}(1+r)}{r}; \bar{w} - c + \frac{\theta}{1+r} \int_0^{\infty} \max\{V(\bar{w}); -C_M\right. \\ \left. + \frac{w(1+r)}{r}\} f(w)dw + (1-\theta) \frac{V(\bar{w})}{1+r}\right\} \quad (3.1)$$

where

c = the marginal search cost
 r = the discount rate
 θ = the job offer probability ($0 < \theta < 1$)
 C_M = moving costs
 $f(w)$ = the wage offer distribution.

Note, first, that the term $\bar{w}(1+r)/r$ is the present value of keeping the current job forever. The other terms on the RHS of (3.1) express the value of following an optimal search strategy. At some wage rate, the worker will be indifferent between searching and keeping the current job. This critical "search reservation wage", k , is given as the solution to

$$\frac{k(1+r)}{r} = k - c + \frac{\theta}{1+r} \int_0^{\infty} \max\{V(k); -C_M \\ + \frac{w(1+r)}{r}\} f(w)dw + (1-\theta) \frac{V(k)}{1+r} \quad (3.2)$$

The worker is induced to search when the current wage is below the search reservation wage. We can also note that the searching worker selects a wage that separates acceptable offers from unacceptable ones. Inspection of (3.1) reveals that this acceptance wage, w^* , satisfies the equality

$$V(\bar{w}) = -C_M + \frac{w^*(1+r)}{r} \quad (3.3)$$

In words, a worker accepting $w = w^*$ is indifferent between continued search and the present value of the acceptance wage, net of moving costs.

Several predictions emerge from this framework. It can be shown that:¹

- (i) An increase in the job offer probability (θ) implies a higher reservation wage. The searching worker becomes more choosy as the labor market improves.
- (ii) An increase in the search cost decreases the reservation wage. Since search has become more expensive, the worker is less willing to continue his search.
- (iii) An increase in the worker's current wage increases the reservation wage. Of course, this is formally equivalent to a decrease in search costs.
- (iv) A higher discount rate implies a lower reservation wage. The worker places more emphasis on returns in the near future and will therefore be more willing to accept a current offer rather than engage in future search.
- (v) Higher moving costs imply a higher reservation wage.

The probability of a job change in each period is given by

$$\text{Pr(Move)} = \theta(1-F(w^*)) \quad (3.4)$$

where $F(\cdot)$ is the cumulative wage offer distribution function. An increase in search costs, a decrease in the current wage, a higher discount rate or lower moving costs will accordingly increase the probability of moving. The response to an increase in the offer probability, however, is ambiguous. We have

$$\frac{\partial \text{Pr}(\text{Move})}{\partial \theta} = 1 - F(w^*) - \frac{\theta \partial F(w^*)}{\partial w^*} \cdot \frac{\partial w^*}{\partial \theta} \quad (3.5)$$

where $1 - F(w^*)$ is positive and the last term is negative. Hence, a fully anticipated improvement in labor market conditions (more vacancies) has ambiguous effects on the probability of moving for those engaged in search; the effect arising from a higher offer probability may be offset by a higher reservation wage.

The predictions set out above pertain to a searching worker. Observed mobility rates, however, are also influenced by the number of searchers. Various changes in individual and labor market characteristics will affect this number. Consider, therefore, how changes in the parameters of the problem will affect the worker's search reservation wage as determined by (3.2). A simpler expression can be used by recalling (3.3) and noting that the value of the search option equals the value of keeping the job for $\bar{w} = k$. Hence we have

$$V(k) = \frac{(1+r)w^*}{r} - C_M = \frac{(1+r)k}{r} \quad (3.6)$$

where $w^* = w^*(k)$. It holds that

$$\frac{\partial w^*}{\partial \bar{w}} = \frac{r}{r + \theta(1 - F(w^*))} < 1$$

which implies that k is increased by an increase in the job offer probability, a decrease in the search cost, a decrease in the discount rate, and a decrease in moving costs. We can then note that workers facing high moving costs are less inclined to move for two reasons; they are less likely to search and they are less likely to accept an offer, conditional on search. Workers exposed to a decrease in the rate of arrival of job offers will also be less likely to move for two reasons; they are less likely to search and they have greater difficulties in finding offers. Against these two effects is the influence of a decrease of the acceptance wage.

The basic search model also yields implications for wage gains due to mobility. First, it is of interest to note that the difference between the acceptance wage and the current wage - i.e., the minimum (gross) wage gain - is a decreasing function of the current wage. Denote this difference by G_0 . We have

$$G_0 = w^*(\bar{w}) - \bar{w} \quad (3.7)$$

and it can be shown that

$$\frac{\partial G_0}{\partial \bar{w}} = \frac{\partial w^*}{\partial \bar{w}} - 1 < 0 \quad (3.8)$$

since

$$\frac{\partial w^*}{\partial \bar{w}} = \frac{r}{r + \theta(1-F(w^*))} < 1.$$

Suppose that a worker earning 10 000 SEK per month requires an offer of 11 000 SEK in order to change job. A worker earning 6 000 SEK - but with otherwise identical characteristics - will then require more than 7 000 SEK in order to accept an offer.

The expected wage gain conditional on acceptance - in contrast to the minimum acceptable gain - is given by

$$G_1 = \frac{\int_{w^*}^{\infty} wf(w)dw}{1 - F(w^*)} - \bar{w} \quad (3.9)$$

The expected wage - the first term on the RHS of (3.9) - is denoted by $\tilde{w}$. We have

$$\frac{\partial G_1}{\partial \bar{w}} = \frac{\partial \tilde{w}}{\partial w^*} \cdot \frac{\partial w^*}{\partial \bar{w}} - 1 = \frac{f(w^*)(\tilde{w} - w^*)}{1 - F(w^*)} \cdot \frac{r}{r + \theta(1 - F(w^*))} - 1. \quad (3.10)$$

The sign of (3.10) is (certainly) negative if $\partial \tilde{w} / \partial w^* < 1$. This condition holds for several distribution functions, such as the uniform c.d.f. and the normal c.d.f.²

It is also straightforward to see that higher moving costs imply higher wage gains (since w^* is an increasing function of C_M) and this hardly offends intuition.

Searching for Stepping-Stone Jobs

In the basic search model outlined above it was assumed that an accepted offer was acceptable for-

ever. The worker was allowed to move only once; the possibility of using a higher-paying job as a stepping stone to further search and mobility was not taken into account.

Suppose instead that the worker follows a stepping-stone mobility strategy and moves as often as he prefers in order to maximize lifetime income. Let $V(\bar{w})$ denote the value of pursuing an optimal policy for a worker employed at $w = \bar{w}$.³

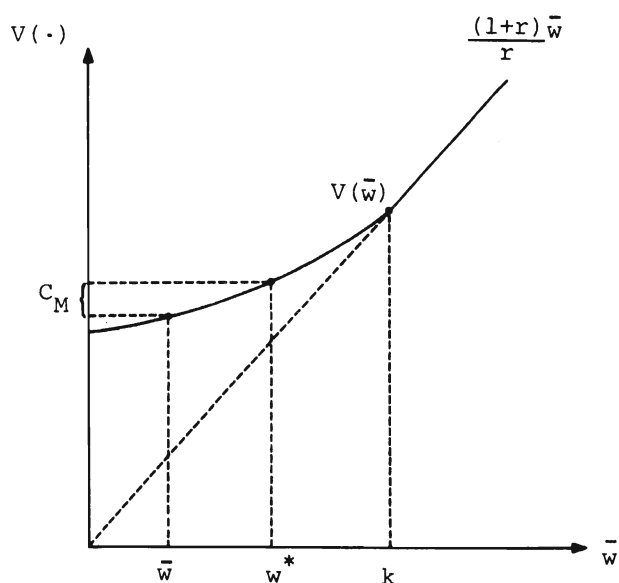
$$V(\bar{w}) = \max \left\{ \frac{\bar{w}(1+r)}{r}; \bar{w} - c + \frac{\theta}{1+r} \int_0^{\infty} \max \{ V(\bar{w}); -C_M + V(w) \} f(w) dw + (1-\theta) \frac{V(\bar{w})}{1+r} \right\} \quad (3.11)$$

It can be shown that there exists a unique solution to (3.11) and that $V(\bar{w})$ is convex and increasing in $\bar{w}$.

Some properties of the problem are illustrated in Figure 3.1. The ray from the origin has slope $(1+r)/r$. The vertical distance between the ray and the horizontal axis represents the value of remaining in the current job forever (for each $\bar{w}$). When $\bar{w} < k$ it holds that $V(\bar{w}) > \bar{w}(1+r)/r$; hence, the worker will engage in job search. The vertical distance between the $V(\cdot)$ function and the ray from the origin is the expected increase in lifetime income implied by an optimal search strategy. For $\bar{w} > k$ there is no payoff to search; hence, the ray and the $V(\cdot)$ function coincide in that interval.

The searching worker has to decide on a reservation wage, w^* , that separates acceptable from unacceptable offers. Wage offers for which $w > w^*$

Figure 3.1 Optimal on-the-job search



hold are acceptable, where w^* is given as the solution to

$$V(\bar{w}) = -C_M + V(w^*) \quad (3.12)$$

where $w^* = w^*(\bar{w})$.

Suppose that moving costs equal zero. It is then obvious from (3.12) and Figure 3.1 that $w^* = \bar{w}$. The worker will accept any offer above his current wage and use the higher wage as a stepping stone for new search efforts (as long as the wage falls below the critical search wage).

Consider, next, the case with positive moving costs. From Figure 3.1 it is clear that a higher cost of moving implies a higher acceptance wage and less inclination to search; the $V(\cdot)$ function shifts downward and the search reservation wage is reduced.

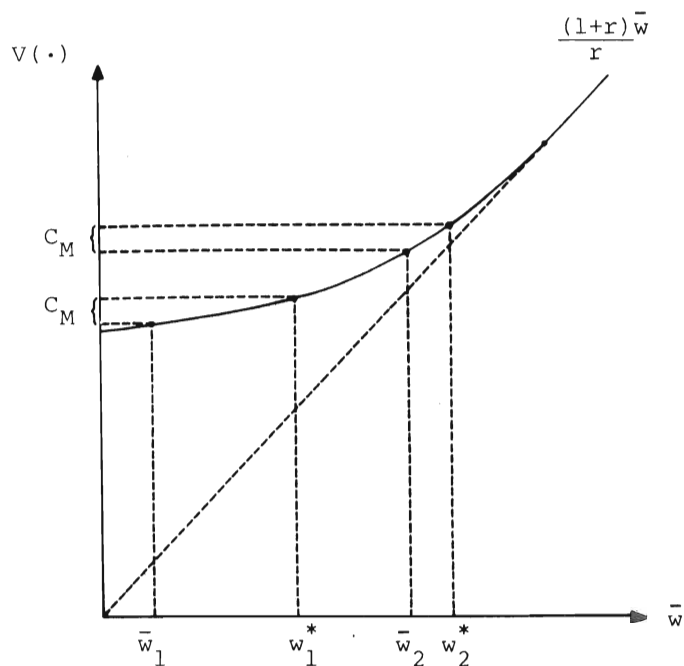
A decrease in the search cost or an increase in the job offer probability will shift the $V(\cdot)$ function upward; the worker becomes more inclined to search since the search reservation wage (k) is increased. The effect on w^* is negligible for small values of C_M and in the limiting case of zero moving costs there is no acceptance wage effect at all.

How is the required wage gain affected by the worker's current wage? In Figure 3.2 two persons - with identical moving costs - are compared, a low wage worker ($w = \bar{w}_1$) and a high wage worker ($w = \bar{w}_2$). Since $V(\bar{w})$ is a convex function it is clear that the low wage worker requires a higher (relative and absolute) wage premium in order to move.

3.2.2 Job Search and Migration Decisions

In the framework outlined above, a job change had effects only on the wage rate. Search and moving costs, for example, were the same for all prospective job changes. However, there are many situations in which mobility may affect the worker's "search environment". Mobility involving geographic relocations is a case in point. Moving costs may be substantial for the initial move to the new region but negligible for job changes

Figure 3.2 Wage gains to mobility



within the destination labor market. Likewise, search costs associated with interlocal search - search for offers at a distant labor market - are presumably higher than costs related to local search - search for offers within the worker's local labor market.

The arguments sketched above suggest that prospective migrants should take into account the possibility of improving future search opportunities by an initial locational change. The extent to which search opportunities can be improved will affect the worker's migration probability through the "migration reservation wage", i.e., the wage offer

that is sufficiently high to induce migration. Consider a worker who is contemplating migration to a pre-selected location. The costs associated with interlocal and local search are denoted c_1 and c_2 , respectively; by assumption $c_1 > c_2$. Moving costs, C_M , are related to the geographical relocation; we assume that no job transfer costs are present for moves between jobs within the prospective destination labor market.

The value of following an optimal policy for a worker employed at $w = \bar{w}$ is given by the expression

$$V(\bar{w}) = \max \left\{ \frac{\bar{w}(1+r)}{r}; \bar{w} - c_1 \right. \\ \left. + \frac{1}{1+r} \int_0^{\infty} \max\{V(\bar{w}); -C_M + T(w)\} f(w) dw \right\} \quad (3.13)$$

where $T(w)$ is the value of an offer from the destination labor market. It is assumed that the worker considers only two options; he may keep the current job and receive $\bar{w}(1+r)/r$ or he may engage in interlocal search. This presupposes that the worker's current local labor market has an offer distribution such that search does not pay there. For simplicity, it is also assumed that the job offer probability equals one ($\theta=1$).

Suppose that the searching worker receives an offer, w , from the destination labor market which is sufficient to induce migration. After migration the worker has two options; he may keep the job or continue to search. The expression for $T(w)$ is

$$T(w) = \max \left\{ \frac{w(1+r)}{r}; w - c_2 \right. \\ \left. + \frac{1}{1+r} \int_0^{\infty} \max \{T(w); T(s)\} f(s) ds \right\} \quad (3.14)$$

where s is a dummy variable of integration. The migration reservation wage, w_m^* , is given as the solution to

$$V(\bar{w}) = -C_M + T(w_m^*) \quad (3.15)$$

The worker will engage in local search at the destination if his accepted wage falls below the search reservation wage for this labor market. The latter (k_2) is given as the solution to

$$\frac{k_2(1+r)}{r} = k_2 - c_2 \\ + \frac{1}{1+r} \int_0^{\infty} \max \{T(k_2); T(s)\} f(s) ds \quad (3.16)$$

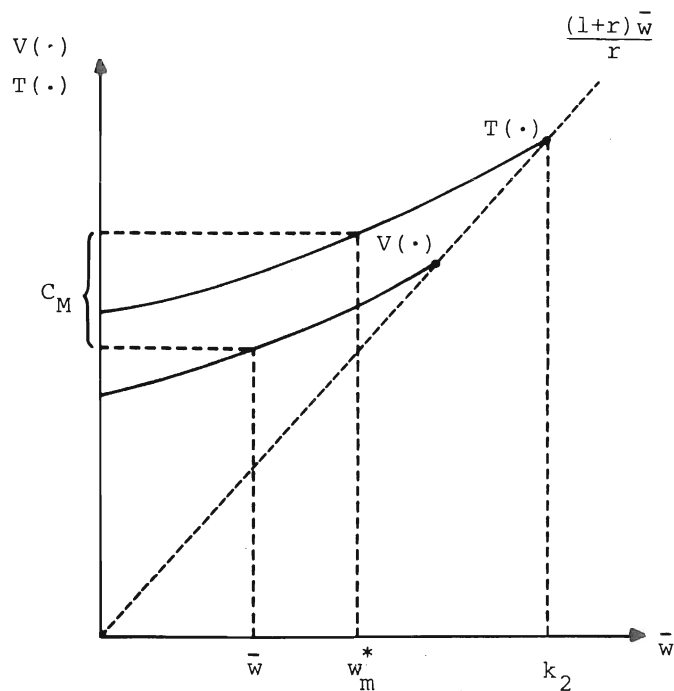
Since there are no moving costs for job changes within the destination labor market, any offer above the current wage is acceptable and will induce a local job change.

Figure 3.3 illustrates the problem. The $V(\cdot)$ function represents the value of pursuing external search and $T(\cdot)$ is the value of undertaking local search at the destination. The vertical distance between $T(\cdot)$ and $V(\cdot)$ represents the improvement of search opportunities associated with local search at the destination, expressed as the increase in lifetime income (for each $\bar{w}$) that would accrue to a worker who at no cost were transferred to the destination labor market.

The worker will pursue interlocal search for wage offers below w_m^* ; in this region it holds that $V(\bar{w}) > T(w) - C_M$. Migration occurs if an offer above w_m^* is received; the net value of moving is greater than the value of continued interlocal search ($V(\bar{w}) < T(w) - C_M$).

In the example illustrated in Figure 3.3, the migration reservation wage exceeds the worker's current wage. This is perhaps the most likely case but it is not necessarily true. For some values of moving and search costs it may be optimal to accept an offer below the current wage, thereby obtaining access to the more favorable search op-

Figure 3.3 Job search and migration decisions



portunities at the destination labor market. (This is easily seen from Figure 3.3 by shifting the $T(\cdot)$ function upward.) In fact, it may pay to quit into search unemployment at the destination labor market, especially if unemployment compensation is available. (In Sweden, workers who have quitted may receive unemployment compensation after a certain waiting period.)

An important implication from this analysis is that the immediate wage gains to migration may differ substantially from wage gains arising in the longer term.

The probability of local search, conditional on having moved, is given by

$$P_s = \Pr(\text{Search} | w > w_m^*) = \frac{F(k_2) - F(w_m^*)}{1 - F(w_m^*)} \quad (3.17)$$

The expression is decreasing in w_m^* ; workers with higher migration reservation wages are less likely to engage in subsequent job search at the destination. For example, workers with high moving costs - such as long-distance migrants - will set higher migration reservation wages and will therefore end up with higher post-migration wage rates and weaker incentives for subsequent moves.

3.2.3 Imperfect Information about Nonwage Job Attributes

Workers who are interested in utility-improving job changes will take account of all aspects of current and prospective jobs, including non-pecuniary components. Several empirical studies

have shown that nonwage job attributes are important determinants of quit rates. (See, for example, Viscusi, 1979, and Bartel, 1982.)

Many nonwage job attributes are not easily discovered by job searchers before acceptance decisions are made. Workers may have to learn about them by actually working on the job. This aspect of the job matching process has often been stressed in literature on labor mobility: "Voluntary mobility is essentially a form of job-shopping by workers Workers have great difficulty in judging the attractiveness of a job by talking it over in the company's employment office, the only way to judge it accurately is to work on it for a while. After a few weeks or months of work, one can tell whether the job is worth keeping. This explains why quits are most frequent during the first few months of service and diminish rapidly after that point." (Reynolds, 1951.)

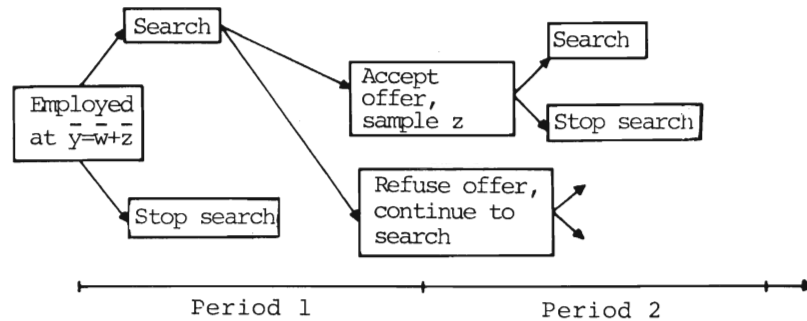
In this section we will outline the decision problem for a worker who is facing uncertainty about nonwage attributes when the acceptance decision is made.⁴ The worker is employed at a particular money wage, $\bar{w}$. The job is also associated with a particular non-pecuniary attribute, $\bar{z}$, measured in the same units as $\bar{w}$. The worker's full wage is accordingly $\bar{y} = \bar{w} + \bar{z}$.

A worker contemplating search is facing a known wage offer distribution, $f(w)$, and a conditional distribution of nonwage attributes, $g(z;w)$. We assume that $E(z) = 0$ for all w . An offer is associated with an observable component, the money wage, as well as an unobservable part, the nonwage

characteristic of the job. The worker may choose to accept an offer or to refuse it; in the latter case the offer expires immediately. In case the worker accepts the offer and starts to work, the nonwage attribute is immediately revealed. The realized value of the full wage may well be such that continued search is considered.

The decision process is illustrated in Figure 3.4.

Figure 3.4 The decision process under imperfect information about nonwage job attributes



The worker's objective is to maximize his discounted lifetime income, net of search and moving costs. Let $V(\bar{y})$ denote the value of pursuing an optimal policy for the employed worker,

$$V(\bar{y}) = \max \left\{ \frac{\bar{y}(1+r)}{r}; \bar{y} - c + \frac{1}{1+r} \int_0^{\infty} \max \{ V(\bar{y}); \right. \\ \left. - C_M + \int_{-\infty}^{\infty} V(w+z)g(z;w)dz \} f(w)dw \right\} \quad (3.18)$$

where c is the marginal search cost, C_M the moving cost and r the discount rate. For simplicity, it is assumed that the range of z is such that quits into search unemployment never will be considered. Note that the term $\bar{y}(1+r)/r$ is the present value of keeping the current job (and thereby receiving $\bar{y}$ forever).

It can be shown that there exists a unique solution to the functional equation (3.18) and that $V(\bar{y})$ is convex and increasing in $\bar{y}$. Again, the optimal decision process involves two critical wage rates. The "search reservation wage", first, is given as the solution to

$$\frac{k(1+r)}{r} = k - c + \frac{1}{1+r} \int_0^{\infty} \max \{ V(k); - C_M \\ + \int_{-\infty}^{\infty} V(w+z)g(z;w)dz \} f(w)dw \quad (3.19)$$

Clearly, at the full wage $\bar{y} = k$ the worker is indifferent between searching and keeping his current job. Eq. (3.19) expresses this equality condition.

The acceptance wage, w^* , is given as the solution to

$$V(\bar{y}) = - C_M + \int_{-\infty}^{\infty} V(w^*+z)g(z;w^*)dz \quad (3.20)$$

where $w^* = w^*(\bar{y})$. A sufficient condition for a unique w^* is that w and z are independent.⁵

The Quit Rate

Consider a worker who has been hired at the wage $w = \bar{w}$ but has not yet observed z . His probability (ex ante) of quitting in period $n + 1$, conditional on employment in n periods, is given by

$$\Pr(Q|n, w) = \frac{\int_{-\infty}^{k-w} [F(w^*(w+z))]^n [1-F(w^*(w+z))] g(z; w) dz}{\int_{k-w}^{\infty} g(z; w) dz + \int_{-\infty}^{k-w} [F(w^*(w+z))]^n g(z; w) dz} \quad (3.21)$$

where $F(\cdot)$ is the c.d.f. of w . Expression (3.21) may require some explanation. The numerator has three components. One of them is the probability of searching; search continues if the worker observes a value of z such that the full wage falls below the search reservation wage, i.e., $w + z < k$. The probability of remaining a searcher in n periods is $[F(w^*)]^n$ and the probability of accepting an offer in period $n + 1$ is $1 - F(w^*)$. The denominator is the sum of two terms, the first being the probability of observing a value of z such that the search process is terminated (i.e., $w + z > k$). The second term is the probability of remaining as searcher in n periods.

Inspection of (3.21) allows us to make the following claims:

- (i) If there are no nonwage attributes (i.e., $z = 0$ with probability one), then the quit-probability is independent of n ,
 $\Pr(Q|n, \bar{w}) = 1 - F(w^*)$
- (ii) If there is a distribution of nonwage attributes, then, in general, the quit-probability is decreasing in n

$$\frac{\partial \Pr(Q|n, \bar{w})}{\partial n} < 0$$

- (iii) The quit probability in the presence of nonwage attributes is in general approaching zero as n increases

$$\lim_{n \rightarrow \infty} \Pr(Q|n, \bar{w}) = 0$$

Claims (i) and (iii) are obvious; the proof of claim (ii) is given elsewhere.⁶

The negative relationship between quit rates and tenure has a straightforward intuitive interpretation. Workers who sample very low values of z will set low acceptance wages and therefore have high quit rates. Workers with higher values of z will select higher acceptance wages and therefore quit at a slower pace. Those observed as having long tenure will be those who have drawn high values of z ; hence their acceptance wages will be higher and their quit rates lower.

The distribution of workers by tenure reflects an underlying distribution of full wages. Nonwage attributes, however, are in general only partially observed and tenure may be used as a proxy for the unobserved characteristics.

The comparative static properties of the quit function are, in general, somewhat complicated. However, for $n = 0$ we can show that a higher money wage unambiguously decreases the first-period quit probability. A higher search cost as well as a higher moving cost will also most likely reduce the probability of quitting.

We conclude this section by noting that several different explanations have been suggested for observed empirical regularities between tenure and quit rates. One of them is the specific human capital hypothesis, according to which the gap between the worker's current wage and his market alternative increases with the length of the job.

Another interpretation relies on unobserved heterogeneity among workers. Since those who are inherently most mobile are most likely to show up with short tenure, the "duration dependence" of quit rates may reflect heterogeneity in unobserved individual characteristics.

We have here suggested an explanation based on a search theoretic framework expanded to account for imperfect information about nonwage job attributes. Those attributes are often difficult to observe prior to acceptance decisions; hence jobs will be accepted (or refused) without full knowledge of the value of offers. Conditional quit probabilities, at given money wage rates, are decreasing as tenure increases. Workers who sample favorable nonwage attributes are less likely to quit and will therefore be disproportionately represented among those with long tenure.

3.3 Mobility and Specific Human Capital

In the search models discussed above, a worker could improve his earnings only through job changes; the possibility of wage growth on the job through investments in human capital was not taken into account. Human capital theory becomes useful for understanding mobility behavior when the distinction between general and firm-specific investments is introduced. General training increases a worker's productivity in many other firms while specific training, on the other hand, only affects productivity in the firm providing the training.

Received theory suggests that workers pay the cost of general training while investments in firm-specific human capital are shared by workers and employers. The shared-investment view of specific training rests on two basic arguments. On the one hand, the worker has incentives to invest in specific capital - accepting a wage lower than the market alternative - if he later receives a return on this investment, i.e., is paid a wage higher than he would have received had he not undertaken the training. The employer, on the other hand, is willing to pay for specific training if the cost can be recouped in subsequent periods in the form of a wage rate below the trained worker's marginal product.

The principal turnover hypothesis implied by this framework is that layoff and quit rates are decreasing functions of the firm's and the worker's shares of specific capital (Becker, 1975). Examples of models explaining the sharing pattern are found in Parsons (1972) and Hashimoto (1981). The basic hypothesis is challenged in a paper by

Mortensen (1978). He explores the idea that the worker and the employer follow joint wealth maximizing strategies, and it is shown that the turnover rates in this case are independent of the wage rate.

In what follows we will ignore the sharing issue and provide a brief discussion of the interrelationships between on-the-job search and investment in specific capital. We will essentially outline the basic elements of a model presented by Jovanovich (1979). Among the assumptions of this model is that all search and training costs are borne by the worker. The worker's intensity of search determines the rate of arrival of wage offers. A fraction of available time is devoted to on-the-job search, another fraction to on-the-job training.

A worker's productivity on a particular job reflects the amount of "total match capital", which, in turn, determines the wage rate. Total match capital consists of two parts, the quality of the employer-worker match as well as the stock of specific human capital. The quality of the match differs across different employers and, by assumption, there is "a nondegenerate distribution of a worker's productivity across different employers" (Jovanovich, 1979).

By engaging in on-the-job search, the worker may improve his wage by achieving a better match. A quit decision is made when the improvement of the quality of the match exceeds the amount of specific capital; the latter is not transferable to the new firm.

A worker whose objective is to maximize lifetime income has two control variables at his disposal, the search intensity and time devoted to on-the-job training; the former determines the arrival of new offers, the latter controls the growth of specific capital. Since a quit decision implies loss of all specific capital, it is clear that the quality improvement of the match must be greater, the greater the stock of specific capital is (in order to motivate a job change).

Several predictions emerge from this framework. One implication is that "investment in human capital is reduced (at all levels of human capital) by the possibility of changing jobs". (Jovanovich, 1979.) It can also be shown that time devoted to search decreases with a better match or more specific capital (or, put differently, the search intensity decreases with total match capital, which determines the wage rate).

Another implication is that quit probabilities as functions of tenure are lower for those who are well matched because those who are well matched spend less time searching for alternatives, and when they receive offers they are less likely to accept them. Under additional assumptions it can be shown that the quit probability declines with tenure. Another finding is that the proportion of time devoted to search displays a monotonic decrease over time.

3.4 Migration and Family Ties

3.4.1 Private Gains versus Family Gains

So far we have paid no attention to interactions between different family members. This simplification is probably acceptable as a first approximation for workers engaged in search within their local labor markets. For a husband who attempts to maximize income, the wage rate of his wife has no obvious relevance for his local search behavior.

If the objective is to maximize a family utility function where the leisure of each spouse enters as argument, job search may interact with leisure through the time budget constraint. It is conceivable that a realistic model should take into account interaction between family members even if the search activities are restricted to the local labor market. We will, however, ignore this possibility and focus on situations involving migration to new destinations, where interactions between family members are much more obvious.

In the following discussion we will also ignore search behavior and assume that families move whenever this decision involves a net income gain.⁷ For a two-person husband-wife family this decision rule may be written as

$$G = G_1 + G_2 > 0 \quad (3.22)$$

where G is total family income gain and G_i is the gain for spouse i . Each spouse faces a distribution of prospective migration gains. For simplicity, it is assumed that $G_i \sim N(\mu_i, \sigma_i^2)$. The covariance term is denoted σ_{12} .

Consider, first, the probability of migration for the single individual i . This is

$$\Pr(G_i > 0) = 1 - F(Z_i) \quad (3.23)$$

where $F(\cdot)$ is the standardized cumulative normal density function and $Z_i = -\mu_i/\sigma_i$.

The mean of the distribution of family gains is $\mu = \mu_1 + \mu_2$, whereas the variance is given by $\sigma^2 = \sigma_1^2 + \sigma_2^2 + 2\sigma_{12}$. Hence, the probability of family migration is

$$\Pr(G > 0) = 1 - F(\tilde{Z}) \quad (3.24)$$

$$\text{where } \tilde{Z} = -(\mu_1 + \mu_2) / (\sigma_1^2 + \sigma_2^2 + 2\sigma_{12})^{1/2}$$

In general, expression (3.24) will differ from expression (3.23); hence, marital status per se has effects on the probability of migration. Consider, as a first example, a situation when two persons with identical and independent distributions are paired (i.e., $\mu_1 = \mu_2$, $\sigma_1^2 = \sigma_2^2$ and $\sigma_{12} = 0$).

We have then

$$\tilde{Z} = \frac{-2\mu_i}{(2\sigma_i^2)^{1/2}} = \frac{-\mu_i\sqrt{2}}{\sigma_i}$$

or $\tilde{Z}/Z_i = \sqrt{2} \approx 1.4$. Suppose that 10 percent of the individuals move when separate. As family members their migration probabilities will be much lower; in this example the probability of family migration equals 0.035.

It is possible to have family migration probabilities exceeding the individual probabilities, but under realistic assumptions married persons are less likely to migrate simply for "probabilistic reasons".

As another example, assume that female migration gains are a fixed fraction, β , of gains to men, i.e., $G_2 = \beta G_1$. This implies $\mu = (1+\beta)\mu_1$ and $\sigma^2 = (1+\beta^2)\sigma_1^2$ (assuming $\sigma_{12} = 0$). The probability of family migration is determined by the value of

$$\tilde{Z} = \frac{-(1+\beta)\mu_1}{((1+\beta^2)\sigma_1^2)^{1/2}} = \frac{(1+\beta)Z_1}{(1+\beta^2)^{1/2}} = Z_1 \left(\frac{(1+\beta^2+2\beta)}{1+\beta^2} \right)^{1/2}$$

Clearly, $\tilde{Z} > Z_1$ for $\beta > 0$; the probability of family migration is lower than the probability of moving for a single person. (In this example, we have $Z_1 = Z_2$ and consequently both men's and women's migration rates are reduced when married.) An equalization of experiences between husbands and wives - in the sense of an increase in β towards one - will decrease the probability of family migration.

In conclusion of this section there are two points to emphasize. We have noted that family formation itself may reduce the probability of migration, even if the underlying migration propensities of the individual family members are unchanged. (The "probabilistic interaction" we have illustrated may be reinforced by higher moving costs for husband-wife families; the presence of children is an obvious example.)

We have also seen that equalization between family members with regard to prospective migration gains will affect the probability of family migration. Under assumptions that appear reasonable, migration rates will fall. A stronger labor force attachment on part of women may therefore reduce migration propensities, to the extent that an equalization of work experience involves an equalization of gains from migration.

Empirically the relationships between changes in work experience and changes in gains from migration are not very well-defined. Labor supply and migration are both endogenous variables and presumably affected by approximately the same set of exogenous variables. A strong labor force attachment on part of the wife may reflect successful labor market search; she is permanently working because she has found an attractive job with a relatively high wage rate. This suggests that one should focus on actual as well as potential wage rates rather than labor force status per se; if wage data are lacking the latter variable may be interpreted as a crude proxy for wage levels.

3.4.2 Migration and Female Labor Supply

In the previous section the focus was on families attempting to increase total income through migration. The more common approach in studies of family labor supply assumes that each family maximizes a utility function in which leisure among the spouses enters as arguments. In the following section we will use a simple parameterized model to illustrate how interactions between family members affect household migration decisions. A point

of departure is the popular view that the growth in female labor force participation ratios will reduce family migration probabilities. Will factors that tend to increase female labor supply simultaneously decrease the probability of locational changes?

Consider a two-person household acting as a single decision unit and attempting to maximize a family utility function. The husband's working hours are exogenously given whereas the wife's labor supply responds positively to higher wage rates. For illustration, consider the Cobb-Douglas utility function

$$U = b \ln L_2 + (1-b) \ln Y \quad (3.25)$$

where L_2 is the wife's leisure and Y is total income. The latter, in turn, is given as

$$Y = \bar{H}_1 w_1 + (T - L_2) w_2 \quad (3.26)$$

where $\bar{H}_1$ is the husband's working hours and w_1 his wage rate. T is time endowment and w_2 is the wife's wage rate. Maximizing (3.25) yields the wife's leisure demand as

$$L_2 = \frac{b Y_F}{w_2} \quad (3.27)$$

where Y_F is full income, i.e., $Y_F = T w_2 + \bar{H}_1 w_1$.

The corresponding indirect utility function is

$$V = b' + \ln Y_F - b \ln w_2 \quad (3.28)$$

where $b' = b \ln b + (1-b) \ln(1-b)$.

Consider a family who is contemplating a move to a new location. Alternative offers are available at this prospective destination. Suppose that the family in each short period draws a joint offer (w_1, w_2) from a bivariate lognormal distribution. Let V_s denote the indirect utility associated with the spouses' current jobs and location. The condition for moving, in the absence of moving costs, is

$$V_m - V_s > 0$$

where V_m is the indirect utility associated with moving.

The family migration probability is then

$$\Pr(\text{Move}) = \Pr(V_m > V_s) \quad (3.29)$$

where V_m is a stochastic variable and V_s is a pre-determined constant.

Expression (3.29) has no simple explicit counterpart. We can, however, perform simulation experiments in order to illuminate how the migration probability is affected by changes in the parameters of the problem. An increase in female labor supply can be introduced by changing (current and expected) female wage rates or by changing the parameter b of the utility function; a lower value of b implies an increase in hours worked.

We have chosen parameters in order to obtain "reasonable" estimates of hours worked per week among women. In particular, we have $\bar{H}_1 = 40$ and $T = 168$. We have assumed that average wage rates are those reported by workers in the Level of Living Survey of 1974. For $b = 0.60$, these assumptions imply $H_2 = 36$, whereas $b = 0.70$ implies $H_2 = 14$. It may happen that certain offers induce nonparticipation (if the husband receives a "very high" offer and the wife gets a "very low" offer).

Table 3.1 shows simulated migration rates under different assumptions about initial wage rates and parameters of the utility function. The variance of the wage distribution was set equal to the estimated variance of log wage rates in the Level of Living Survey of 1974 and the spouses' offers were assumed uncorrelated.

**Table 3.1 Simulated family migration rates.
Cobb-Douglas utility function**

	$\bar{w}_1 = (2/3)\mu_1$ $\bar{w}_2 = (2/3)\mu_2$	$\bar{w}_1 = \mu_1$ $\bar{w}_2 = \mu_2$	$\bar{w}_1 = 1.5\mu_1$ $\bar{w}_2 = 1.5\mu_2$
$b = 0.5$	0.96	0.56	0.08
$b = 0.6$	0.96	0.60	0.09
$b = 0.7$	0.96	0.58	0.11

Note: $\bar{w}_i$ is the assumed initial wage for spouse i and μ_1 (μ_2) is the geometric mean of the wage distribution for men (women) according to the Level of Living Survey of 1974. The variance of the distributions was also set equal to the estimated variance of the distribution of (log) wage rates in the Level of Living Survey.

The basic conclusion emerging from the simulations is that the probability of family migration is largely unaffected by the wife's attachment to the labor market. This conclusion holds also when changes in female labor supply are induced by changes in wage rates. The results underline the need to be cautious about "effects" of female labor supply on migration behavior.

3.5 Concluding Remarks

We have provided a brief exposition of how a worker's search and mobility decision may be analyzed by means of search theory. A variety of search models exists and only few of them have been discussed in this chapter. It should be noted that the search theory framework does not provide the empirical analyst with any straightforward functional form; its role is primarily to serve as a guide in the selection of explanatory variables. What conclusions, then, can be drawn in this respect?

First, we have identified several ways in which changes in job availability may affect search and mobility decisions. When the labor market improves, more workers will engage in job search. Simultaneously, workers undertaking search will find that job offers arrive more frequently. This, in turn, induces them to be more choosy in their acceptance decisions.

An improvement in labor market conditions may have important indirect effects on mobility rates through increasing the flow of new hires. Moving to a new job or a new location is like a lottery

because not all job characteristics are known when acceptance decisions are made. A labor market improvement will increase the number of employed workers with short tenure; hence, more workers will be exposed to various "shocks" as they learn about the characteristics of their jobs. A series of job changes is likely to occur during a job matching process of this nature.

Other determinants of mobility are related to search costs, moving costs and the wage rate, and non-pecuniary aspects of the worker's current job. The worker's age is also important, although this has not been dealt with in this chapter. As a searcher approaches the end of the labor force career, the period over which moving costs can be recovered is declining. At some period in time, the expected returns to search will be too low to motivate continued search. Typically, young workers are likely to be engaged in search to a much greater extent than older workers.⁸

4 JOB SEARCH AND QUIT BEHAVIOR: THE EMPIRICAL PICTURE

4.1 Introduction

This chapter provides an empirical picture of patterns of job search and quit behavior in the Swedish labor market. The basic analysis views search and quit decisions as determined by (i) personal characteristics, (ii) job characteristics and (iii) labor market characteristics.

An important objective is to illuminate the causes underlying the secular decline in quit rates, as displayed in Chapter 2. Is it the exogenous determinants of mobility that have changed or is it the worker's response to these determinants? In the latter case we may talk about structural shifts in mobility behavior.

The plan of the chapter is as follows. In Section 4.2 we present a descriptive overview of how on-the-job search varies over the life cycle and the business cycle. Of particular interest is whether the decline in quit rates and job mobility is associated with a similar decline in the probability of searching for new jobs.

Section 4.3 includes econometric analyses of quit rates in Swedish industry. We explore aggregate time series as well as pooled cross-section and time-series data for manufacturing plants. By using the latter data source it is, among other things, possible to show how quit behavior is

affected by changes in the worker's own wage compared to the market alternatives. The importance of some other characteristics of the plant and the regional labor market is also illuminated.

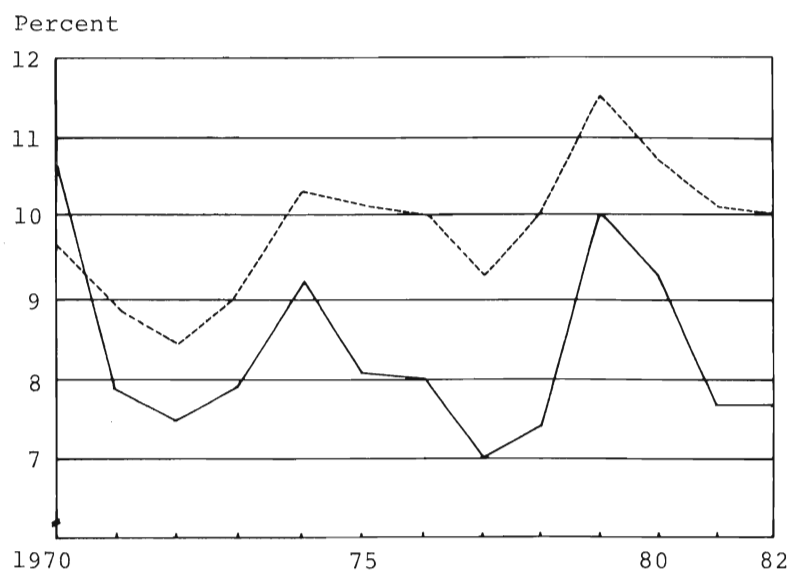
The analysis in Section 4.4 is based on data from the Level of Living Surveys of 1968, 1974 and 1981. The focus here is on quit intentions, as reported by the respondents. Several determinants of quit intentions, related to characteristics of the worker and his environment, are identified. A comparison of estimated functions for 1968, 1974 and 1981 makes it possible to examine behavioral shifts over time.

4.2 On-the-Job Search over the Business Cycle and the Life Cycle

The Swedish retrospective labor force surveys, performed in February each year, provide some information about on-the-job search. A person answering "yes" to the question "Did you some time last year seek a new job while employed?" may be classified as an on-the-job searcher. Aggregate search rates can be computed for different groups in the labor force to give a descriptive account of trends, cyclical fluctuations and life cycle characteristics of on-the-job search. Unfortunately, there are no data available showing the intensity of search among those engaged in on-the-job search.

First, consider the cyclical patterns. Does on-the-search fluctuate with the availability of job openings? Figure 4.1 displays the development of on-the-job search during the 70s. The message supported by the figure is that an increase in job

Figure 4.1 On-the-job search in Sweden, 1970-82
(Percent searching while employed)



----- Percent engaged in some on-the-job search among persons employed at least one week during the year.

———— Percent engaged in some on-the-job search among persons employed all weeks during the year.

Source: The retrospective labor force surveys (SCB).

availability will induce more workers to engage in on-the-job search (cf. the display of vacancy rates in Figure 2.6). The search rates peak during the years 1970, 1974 and 1979 and reach their troughs during the recession years 1972 and 1977.

The pro-cyclical fluctuations of search frequencies have a straightforward economic interpretation. When the probability of finding a job offer is increasing, the expected return from search is increasing as well and more workers will be pulled into the pool of job searchers. This prediction from basic search models appears thus to be consistent with the Swedish experience.

It is notable that the search frequencies display no downward trend, in contrast to various measures of actual job mobility (see Chapter 2). In fact, there is an upward trend for the aggregate search rate (the fraction of searchers among those employed at least one week during the year). A closer inspection of the data shows that the upward trend is due to the behavior among individuals with less than permanent labor force attachment (persons being in the labor force during only a part of the year). Among the permanent labor force participants - without unemployment experience - there is no visible trend in the probability of searching, as is displayed in Figure 4.1.

Turning, next, to the life cycle characteristics of on-the-job search, we present search rates by age and sex in Table 4.1. Marked age-patterns are present; around 20 percent of young workers report some on-the-job search activity whereas only around 5 percent of workers 50 years old are engaged in search.

**Table 4.1 On-the-job search by age and sex,
1970-82**
(Percent searching while employed)

Age	1970	1972	1974	1977	1980	1982
<u>Men</u>						
16-19	10.4	13.3	12.2	15.4	12.4	11.5
20-24	14.2	14.3	23.0	17.5	21.8	18.6
25-34	19.3	13.9	17.3	14.1	18.2	15.4
35-44	10.5	8.6	8.1	7.7	10.4	10.2
45-54	7.4	5.1	5.7	4.3	5.6	4.4
55-64	4.4	2.1	3.2	2.5	2.8	2.3
65-74	2.3	0.8	1.1	-	1.4	1.9
<u>Women</u>						
16-19	14.8	13.2	24.6	21.0	19.4	17.1
20-24	15.0	13.3	19.4	16.6	21.0	24.3
25-34	10.7	9.2	10.7	10.3	12.3	12.4
35-44	6.3	7.7	7.6	8.3	8.4	8.8
45-54	7.7	3.6	4.5	4.4	5.1	4.1
55-64	2.8	3.1	1.9	2.8	1.3	2.3
65-74	0.8	-	-	-	1.3	-

Note: The figures refer to the fraction of workers engaged in on-the-job search among persons employed at least one week during the year.

Source: The retrospective labor force surveys (SCB).

The life cycle patterns of on-the-job search are consistent with several different interpretations. First, there is likely to be an effect associated with specific capital; age is correlated with tenure and an increasing length of tenure implies a larger expected loss of firm-specific human capital if the worker quits. Hence, the expected gains from search are lower to the older workers.

In addition to human capital specificity, there are other age effects to consider. First, mobility costs are likely to increase over the life cycle. Second, a higher age means a shorter payoff period for mobility investments; job search will therefore be less likely to yield a positive (net) return to older workers. Third, older workers have typically higher wages than young workers, partly because of previous investments in search (and human capital). Life cycle wage improvements mean that workers are approaching the critical "search reservation wage" at which continued search no longer pays.

4.3 Determinants of Quit Rates: Evidence from Establishment Data

4.3.1 Quit Rates in Aggregate Time Series

The descriptive overview in Chapter 2 indicated substantial variations in yearly quit rates during the past 50 years, ranging from 5-10 percent in some years during the 1930s to 50-60 percent immediately after the two world wars. The quality of these data are perhaps questionable, although the sources and directions of possible errors are unknown. We have not used the long yearly time series in any regression analyses. Data quality issues aside, we simply lack information on crucial explanatory variables for this long period.

Yearly data are also likely to be inferior to quarterly or monthly data when we are interested in the dynamics of quit behavior, especially the role played by "job disappointments" among recently hired workers. In this section we will therefore estimate quit functions on monthly data.

As was discussed in Chapter 3, the quit probability is affected by, *inter alia*, the worker's current wage relative to the alternatives, the non-wage characteristics of the job and the job offer probability. The choice of vacancy rates to account for variations in offer probabilities is self-explanatory; it is assumed that workers have accurate information about vacancy rates, which allows us to ignore the distinction between actual and expected numbers. We also include the unemployment rate, since a larger number of unemployed searchers will make firms more choosy in their hiring decisions, thus reducing the searcher's probability of receiving an offer from a found vacancy.

The third main variable included in the quit function is the lagged new hire rate, capturing the fraction of workers with short length of tenure. There are basically two arguments involved. First, the theory of firm-specific human capital suggests that prospective mobility gains are decreasing with tenure. Second, we expect that job acceptance decisions are taken under imperfect knowledge about nonwage job attributes. Recently hired workers may therefore search because the nonwage components have just been revealed to them and they find themselves exposed to negative surprises.

The basic quit model to be estimated on monthly time-series data is

$$\begin{aligned} \ln QR_t = & \alpha_0 + \alpha_1 \ln VACR_{t-1} + \alpha_2 \ln UR_{t-1} \\ & + \alpha_3 \sum_i \ln HR_{t-i} + \varepsilon_t \end{aligned} \quad (4.1)$$

where

QR_t = quit rate (blue-collar workers in mining and manufacturing). Source: SCB.

$VACR_{t-1}$ = vacancy rate in industry, lagged one month, and defined as $VACR_{t-1} = 100 \cdot (V_{t-1} + IV_{t-1} / N_{t-1})$, where V is the stock of unfilled vacancies in manufacturing work, IV the flow of new vacancies and N the number of employed workers. Sources: AMS and SCB.

UR_{t-1} = unemployment rate, lagged one month, for industrial workers (manufacturing work). Source: SCB.

HR_{t-i} = lagged new hire rate (blue-collar workers in mining and manufacturing). Source: SCB.

ϵ_t = stochastic error term.

To this estimating equation we add three additional variables:

- (i) a dummy for the employment security legislation introduced in July 1974 (LAS).¹ This legislation requires that "last in-first out" should be the basic layoff rule. The expectation, therefore, is that workers have become less inclined to change jobs since 1974, since job mobility implies the loss of seniority,
- (ii) a trend variable that captures secular movements of omitted variables (TIME),

- (iii) a variable taking account of unexpected wage inflation. This variable, w/w^e , is obtained by dividing the actual wage rate for workers in mining and manufacturing with the expected wage level, the latter given by a simple adaptive formula:

$$w_t^e = w_{t-1} \sum_{i=1}^{12} \gamma_i \left(\frac{w_{t-1-i}}{w_{t-1-i}} \right) \quad (4.2)$$

$$\text{where } \sum_{i=1}^{12} \gamma_i = (1/78) \cdot \sum_{i=1}^{12} (13-i) = 1,$$

implying that wage inflation is forecasted on the basis of a 12-month distributed lag of past wage changes. Source: SCB.

The rationale for the last variable is that workers will compare current wages to the market alternatives. Wage increases thought of as particular to the firm rather than general will make the worker less inclined to search.² Workers are presumably better informed about their current wage rates than about available wage offers.

The results of various estimations are displayed in Table 4.2. Vacancies, unemployment and recent new hires appear to explain most of the variation in quit rates. The estimations also reveal a negative and significant trend-coefficient, whereas unexpected wage inflation and the LAS-dummy show up with unstable coefficients. The trend variable has no specific interpretation in these estimations; it simply acts as a proxy for omitted variables. The instability of the LAS-coefficient indicates that the emphasis placed on tenure in the employment security legislation has not pro-

Table 4.2 **Quit functions, blue-collar workers in mining and manufacturing.**
Monthly data, 1969.4-1977.10
(t-ratios in parentheses)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	1.186 (2.845)	1.292 (3.105)	1.396 (3.621)	1.190 (2.805)	1.306 (3.075)	1.350 (3.517)	1.339 (3.422)
$\ln \text{ VACR}_{t-1}$	0.293 (2.626)	0.298 (2.701)	0.246 (2.382)	0.295 (2.579)	0.302 (2.674)	0.223 (2.153)	0.219 (2.063)
$\ln \text{ UR}_{t-1}$	-0.067 (-1.607)	-0.107 (-2.273)	-0.146 (-3.434)	-0.066 (-1.560)	-0.106 (-2.219)	-0.129 (-2.951)	-0.130 (-2.931)
$\Sigma \ln \text{ HR}_{t-i}$	0.421 (3.614)	0.371 (3.127)	0.287 (2.571)	0.419 (3.527)	0.367 (3.025)	0.295 (2.662)	0.298 (2.638)
LAS		-0.050 (-1.742)			-0.050 (-1.740)	0.056 (1.513)	0.057 (1.516)
TIME			-0.002 (-4.170)			-0.003 (-4.045)	-0.003 (-4.022)
$\ln(w/w^e)$				-0.038 (-0.063)	-0.106 (-0.178)		0.101 (0.185)
DW	1.49	1.60	1.88	1.48	1.58	1.89	1.91
R^2	0.95	0.95	0.96	0.95	0.95	0.96	0.96

Note: Monthly turnover data collected according to uniform principles are available since 1968. Vacancy data during the late seventies are somewhat troublesome due to the successive introduction of compulsory registration of vacancies. Extending the estimation period beyond 1977 did, however, not alter the basic results.

duced any marked shift in quit behavior. Given the fact that layoffs were also governed by tenure rules before this legislation, these results are hardly unexpected.³

The estimated distributed lag pattern for new hires is shown in Table 4.3. The length of the lags was chosen after some experiments, where the criteria were (i) minimum standard error, and (ii) positive lag coefficients.⁴ The mean lag is located around two months and the lag sum is (roughly) in the interval 0.3-0.4. The interpretation of the latter figures is that a 10 percent increase in hirings implies a final effect on quits of about 3-4 percent. Since

$$\frac{\partial \ln QR_t}{\partial \ln HR_{t-i}} = \frac{\partial QR_t}{\partial HR_{t-i}} \cdot \frac{HR_{t-i}}{QR_t}$$

holds by definition, we can focus on the derivative $\partial QR_t / \partial HR_{t-i}$, assuming $HR_{t-i} \approx QR_t$. We can then interpret the lag coefficients as follows: Hiring 100 new workers will, after 2-3 quarters, increase the number of quits by 30-40 workers.

What is then captured by the trend variable? One obvious candidate is the age of the work force; a decreasing fraction of young workers should produce a downward trend in quit rates. However, there appears to be no empirical support for such an age-hypothesis. According to the Swedish labor force surveys, the proportion of young workers (age 16-24) in manufacturing work has been stable around 20 percent during the 1960s as well as the 1970s. The fraction of teenagers (16-19 years old) decreased slightly during the 60s but remained roughly constant during the 70s.

Table 4.3 The effect of new hires on quit rates
- estimates of distributed lag coefficients
(t-ratios in parentheses)

	Eq. (1)	Eq. (3)	Eq. (7)
v ₋₁	0.079 (1.527)	0.078 (1.644)	0.098 (1.966)
v ₋₂	0.075 (2.242)	0.063 (2.053)	0.074 (2.313)
v ₋₃	0.069 (3.293)	0.049 (2.510)	0.053 (2.646)
v ₋₄	0.061 (3.825)	0.037 (2.373)	0.036 (2.261)
v ₋₅	0.052 (3.150)	0.027 (1.644)	0.022 (1.309)
v ₋₆	0.041 (2.416)	0.018 (1.068)	0.011 (0.649)
v ₋₇	0.029 (1.934)	0.010 (0.712)	0.004 (0.266)
v ₋₈	0.015 (1.621)	0.004 (0.487)	0.000 (0.031)
Sum	0.421	0.287	0.298
Mean Lag	2.59	1.96	1.53

Note: The coefficients are estimated by the Almon-technique (2nd order polynomials with end-point constraints).

4.3.2 Quit Rates in Manufacturing Plants: Micro Data

We now turn to an analysis of quit rates by using a more informative data set pertaining to individual plants in engineering industry⁵. The focus is on quarterly quit rates during 1975-77, and the total number of plants in the sample is 642. If we account for lags and exclude missing values (e.g., plants with no employed workers during a particular quarter), the final sample is reduced to about 5000 observations.

To the set of explanatory variables we now add plant size and the fraction of women in the firm's work force. Plant size may be seen as a proxy for working conditions, as they are perceived by the employees. As is shown in Table 4.4, there is a striking positive association between plant size and a number of adverse job characteristics. Thus, the total compensation for employees at given money wage rates would appear to be lower in large plants.

On the other hand we could argue for beneficial "internal labor market effects" in large plants. Workers in large plants have access to a wider choice set of available job offers; they can search in the external labor market, but also - presumably at very low costs - in an internal labor market, which may be fairly differentiated. Employment in a large plant may enhance the worker's search productivity, i.e., the probability of finding an offer at given search efforts. This effect tends to reduce external mobility in large plants, thereby offsetting the "working conditions effect". Unfortunately, the current data

Table 4.4 Nonwage job-characteristics by plant size in private industry
Percent yes-answers

Number of employees at the establish- ment	Deafening noise constantly	Hectic	Monot- onous	Hectic and monot- onous	Assignment of working hours		Assignment of breaks	
					No influ- ence	Great influ- ence	No influ- ence	Great influ- ence
1- 4	6.8	51.1	12.9	4.4	40.5	31.7	28.0	39.0
5- 14	9.8	60.4	17.5	7.4	49.5	20.5	36.4	32.0
15- 24	14.0	68.1	18.2	12.0	50.3	24.3	40.3	32.2
25- 49	15.6	66.6	25.0	15.0	59.4	15.8	44.7	24.3
50- 99	16.6	59.2	27.7	15.9	65.2	12.4	48.3	19.8
100-199	19.6	59.9	26.0	16.1	64.1	13.5	48.8	23.7
200-499	26.7	63.6	32.4	20.7	68.0	9.7	55.5	17.8
500-999	27.1	57.0	29.3	18.7	72.9	9.2	46.0	25.3
1000-	28.6	53.5	26.9	16.6	75.1	5.6	54.8	14.0

Source: Yearbook of Environmental Statistics, 1978 (SCB).

set does not allow separate estimates of the two effects since no direct information on nonwage job attributes is available.

The "fraction of women" variable controls for differences in labor force attachment across the firms' work forces. The expectation is that women are more likely to quit due to their primary responsibility for household work in general and childbirth in particular.

The theoretical presumption is that an increase in the worker's current wage will reduce the probability of quitting, while a rightward shift of the relevant wage-offer distribution will increase it. An important issue, then, is how to represent the wage-offer distribution. Needless to say, data on actual offer distributions are nonexistent, forcing us to rely on observed wage distributions.

We have used the average wage rate for industrial workers (w^a). The maintained hypothesis is that quit rates are unaffected by equiproportionate changes in the firm's own wage (w) and the average wage; hence the relative wage, (w/w^a) , is used as explanatory variable.

The set of exogenous variables also includes dummies for so-called H-regions, reflecting the degree of urbanization of the local labor markets. The assumption is that vacancies are more easily located in urban areas because the search productivity is improved.⁶ The H-regions are:

H1 Stockholm (including suburbs and neighboring municipalities)

- H2 Göteborg and Malmö (including suburbs and neighboring municipalities)
- H3 Municipalities with more than 90 000 inhabitants within a radius of 30 kilometers around the center
- H4 Municipalities with more than 27 000 inhabitants and less than 90 000 within a radius of 30 kilometers and with more than 300 000 inhabitants within a radius of 100 kilometers
- H5 Municipalities with more than 27 000 inhabitants and less than 90 000 within a radius of 30 kilometer and with less than 300 000 inhabitants within a radius of 100 kilometers
- H6 Municipalities with less than 27 000 inhabitants within a radius of 30 kilometers around the center

The (grouped) data call for an estimation procedure that accounts for heteroscedasticity. The quit equations have been estimated by weighted least squares (WLS), using the number of employed workers as weights. There may also be a case for instrumenting the wage rate in the quit regression, since firms may adjust wages in order to influence quits. This possible source of simultaneity bias is, however, not easily removed given the lack of suitable instrumental variables in the actual data set.⁷

The estimated quit functions are displayed in Table 4.5. Of particular interest is the response to relative wages. Are firms that offer higher

Table 4.5 Estimated quit functions. Pooled cross-section and time-series data, 1975.IV-1977.IV. Establishment data for the engineering industry. WLS-estimates
(t-ratios in parentheses)

Dependent variable	QR	QR	ln QR	ln QR
Constant	4.335 (11.69)	1.793 (7.545)	1.212 (15.79)	0.683 (14.67)
$\ln(w/w^a)$	-2.537 (-3.219)	-3.289 (-4.204)	-1.089 (-6.906)	-1.264 (-8.127)
$\ln(VACR/UR)$	0.310 (2.919)	0.298 (2.793)	0.114 (5.414)	0.108 (5.150)
HR ₋₁	0.214 (17.87)	0.215 (17.890)	0.035 (8.017)	0.035 (14.40)
HR ₋₂	0.052 (4.617)	0.052 (4.630)	0.015 (14.50)	0.015 (6.420)
HR ₋₃	0.050 (4.691)	0.051 (4.808)	0.015 (6.453)	0.015 (7.099)
Fraction women	-0.003 (-0.722)	-0.004 (-1.150)	-0.001 (-1.022)	-0.001 (-1.978)
H1	0.282 (1.524)	0.451 (2.430)	0.024 (1.761)	0.077 (2.125)
H2	0	0	0	0
H3	-0.463 (-2.970)	-0.333 (-2.134)	-0.128 (0.657)	-0.099 (-3.253)
H4	-0.662 (-3.779)	-0.438 (-2.540)	-0.168 (-4.211)	-0.108 (-3.217)
H5	-0.880 (-3.140)	-0.654 (-2.345)	-0.248 (-4.885)	-0.183 (-3.339)
H6	-1.248 (-3.430)	-0.886 (-2.463)	-0.189 (-4.483)	-0.118 (-1.619)
$\ln$ (Number of workers)	-0.314 (-7.940)	-	-0.067 (-2.559)	-

continued

Table 4.5 Continued

Dependent variable	QR	QR	ln QR	ln QR
SIZE 1 (1-24)		1.952 (3.568)		1.057 (6.093)
SIZE 2 (25-99)		0.770 (3.210)		0.350 (6.285)
SIZE 3 (100-499)		0.566 (4.571)		0.068 (2.783)
SIZE 4 (500-999)		0.260 (1.799)		-0.001 (-0.025)
SIZE 5 (1000-)		0		0
Sample size	5 205	5 205	3 634	3 634
R ²	0.193	0.189	0.288	0.291

Note: Seasonal dummies for quarters II, III and IV are also included. The vacancy rates, capturing initial stocks plus inflow of new vacancies, refer to counties (län) whereas unemployment rates refer to A-regions (aggregates of communes within the counties).

wages "rewarded" by lower quit rates? The answer according to the estimations is affirmative; the wage elasticities are located in the interval between -0.5 and -1.⁸ The particular estimates should, however, be taken with care. We have, for example, not controlled for age differences among the plants' work forces. We suspect that this source of omitted variable bias has resulted in estimated wage elasticities that are too high (in absolute value).

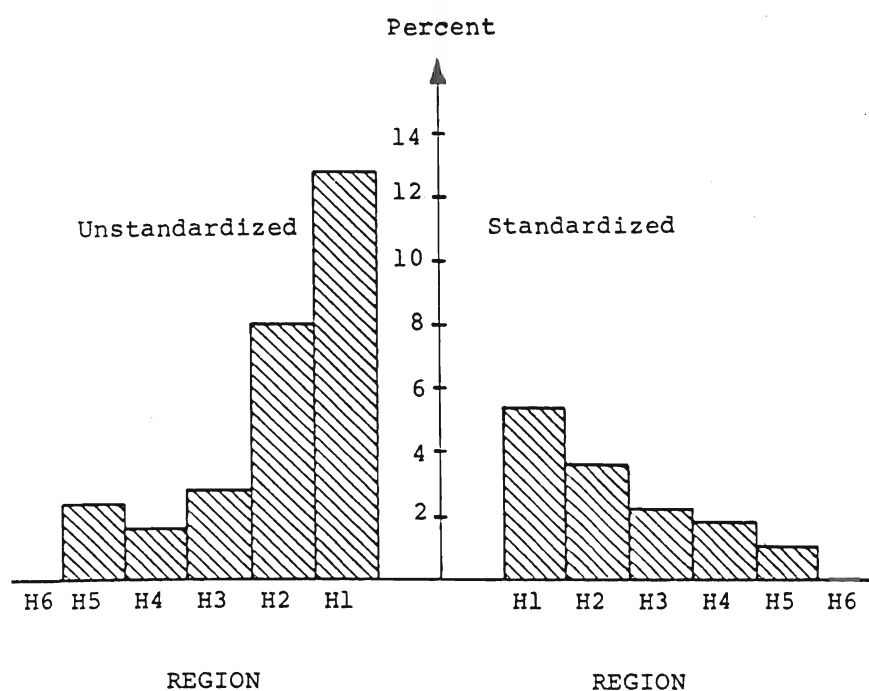
Another basic mechanism for labor reallocations works through job-rationing constraints. Firms can attract more labor - at given wage offers - simply

by opening up more vacancies. The third row in the table shows that workers are indeed responsive to such changes; quit rates are increasing with the state of excess demand in the regional labor market. This finding confirms the results from the aggregate time series.

Among other results, we observe that the fraction of women appears to have negligible effects on quit rates. Workers with short length of tenure have, however, much higher quit probabilities. The estimated coefficients in the first column of Table 4.5 are approximately interpretable as follows: A firm that hires 100 workers in a certain quarter will lose 20 of them the following quarter, and an additional 10 in the next two quarters. Roughly the same pattern is revealed by the other estimates in the table. The results are, moreover, fairly consistent with the estimation results based on aggregate monthly time-series data. Including an additional lag term for new hires (and limiting the estimation period to 1976:I - 1977:IV) did not produce a significant coefficient for this new variable.

Turning, next, to the importance of the labor market's degree of urbanization, it is noteworthy that the densely populated regions (i.e., H-regions with lower numbers) have substantially higher (standardized) quit rates. The regional differences are displayed in Figure 4.2 (based on the second column in Table 4.5). The unstandardized differential between quit rates in H1 and H6 (roughly Stockholm versus sparsely populated areas in northern Sweden) is above 12 percentage points on a yearly basis. Controlling for differences in relative wages, excess labor demand, sex composi-

Figure 4.2 Variations in yearly quit rates by type of region, unstandardized and standardized



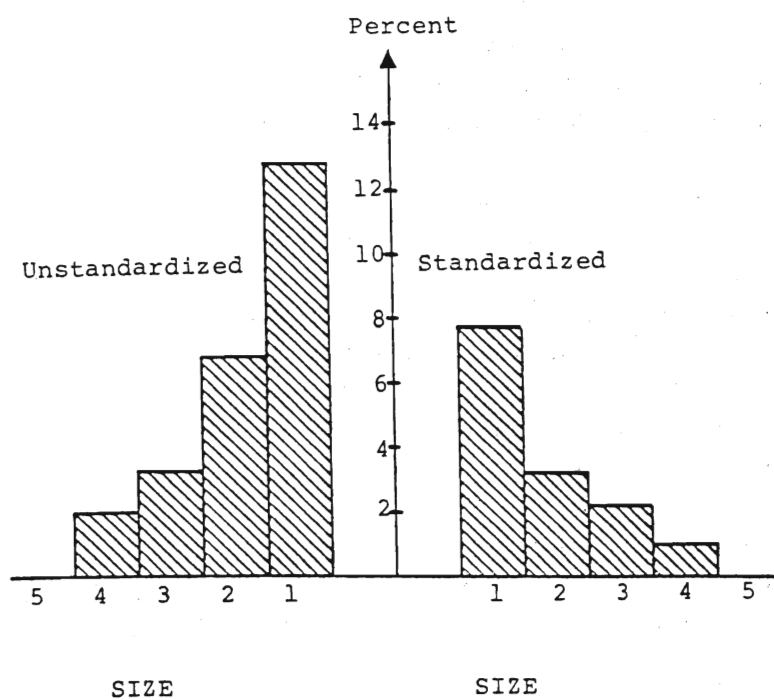
Note: The standardizing variables are: relative wage, labor market tightness, recent new hires, fraction women and plant size. Reference region: H6.

tion and plant size reduces that differential to about 5 percentage points. A substantial part of the regional variations in quit rates are apparently due to inter-regional differences in various quit determinants other than the degree of urbanization, in particular the tightness of the labor market. However, a "pure" region effect seems to remain, consistent with the search efficiency hypothesis mentioned above.

A final observation deals with the role of plant size. A quite pronounced inverse relationship between quit rates and plant size is uncovered by the estimations. As is displayed in Figure 4.3, the unstandardized quit rate differential between "small" plants (less than 25 workers) and "large" plants (more than 1000 workers) amounts to more than 12 percentage points (on a yearly basis). Standardizing for the other quit determinants reduces this differential to about 8 percentage points. The "internal labor market effect" clearly dominates the "working conditions effect".

This relationship between quit rates and plant size has implications for the downward trend in quit rates. The number of blue-collar workers per plant was 46 in 1968 and had increased to 50 in 1970, 55 in 1975 and 59 in 1980.⁹ The significant trend coefficient in the time-series analysis can thus at least in part be attributed to the secular growth in average plant size.

Figure 4.3 Variations in yearly quit rates by plant size, unstandardized and standardized



Note: The standardizing variables are those underlying Figure 4.2, except that region replaces plant size. Reference size: 1 000 workers or more. See Table 4.5 for an identification of the size-codes.

4.4 Determinants of Quit Intentions: Evidence from Household Data

4.4.1 Sample Characteristics

The Level of Living Surveys of 1968, 1974 and 1981 collected information on the degree of attachment between employed workers and their current employers. Among the respondents' alternatives were "expect to quit, even if the job could have been permanent" and "expect to be laid off".

Table 4.6 displays the relative frequencies of the different categories. A striking similarity between the three samples is present; taken at face values, the figures give no indication of any trends in the attachment of workers to their current employers. About 80 percent of the workers view their job as permanent (and expect to stay on it), whereas 8 percent expect to quit.

An expressed intention to quit may imply a plan to move between jobs or a plan to leave the labor force. We will focus primarily on the first alternative and interpret quit intentions as reflecting on-the-job search among the workers. Of course, some of those who intend to change jobs may prefer to quit before they search, i.e., quit into unemployment, but that possibility is likely to be the exception rather than the rule.

Tables 4.7, 4.8 and 4.9 show in some detail how various personal and job characteristics differ across workers with different kinds of job attachment. Workers expecting to quit and workers with an announced job termination date do share several characteristics. For example, they are typically

**Table 4.6 Employed individuals by degree of
attachment to the current employer,
1968, 1974 and 1981**

	1968	1974	1981
Expect permanent employment	0.82	0.84	0.84
Expect to quit	0.08	0.08	0.07
Expect to be laid off	0.03	0.02	0.04
Date fixed for termination of the job	0.02	0.03	0.04
Other employment characteristics	0.05	0.03	0.02
Sample size	3094	3075	3490

Note: The samples include workers with positive wages. Workers with reportedly uncertain wage statements 1974 are excluded.

Source: The Level of Living Surveys.

younger than the average, are less often married, have more education and lower wages and often have short tenure on the job and short length of residence in the current locality.

Workers anticipating layoffs are slightly older than the prospective stayers in 1968 but slightly younger than the stayers in 1974 and 1981. They have the lowest education of all categories and are more frequently in piece work, hard physical work and dangerous work.

The descriptive statements made so far do, of course, ignore covariations among the variables. We will therefore now turn to an econometric analysis with focus on the determinants of quit intentions. The sample will then be limited to respondents who either expect permanent employment or

Table 4.7 Characteristics of employed individuals by degree of attachment to the current employer, 1968

	Expect permanent employment	Expect to quit	Expect to be laid off	Date fixed for termination of the job
Age	40	33	42	34
Woman	0.37	0.51	0.29	0.46
Married	0.71	0.52	0.74	0.46
Schooling	8.50	9.10	7.80	10.10
Recently moved to current locality	0.07	0.18	0.08	0.20
Tenure	9.40	4.50	6.60	3.80
Big city	0.30	0.33	0.36	0.35
Piece work	0.17	0.15	0.26	0.09
Hours constraints	1.73	1.52	1.78	1.51
Hard physical work	0.99	0.94	1.57	1.01
Dangerous work	0.79	0.67	1.26	0.75
Stressful work	0.98	0.92	0.95	0.81
ln wage	6.92	6.69	6.87	6.88
Sample size	2536	247	77	74

Note: The following variables are (0,1)-dummies: Woman, Married, Recently moved, Piece work and Big city (Stockholm, Göteborg, Malmö). Hours constraints, Hard physical work, Dangerous work and Stressful work (defined on page 102) are indices of working conditions, scaled so that higher values mean worse conditions. The wage rate is earnings per hour in Swedish öre.

Source: The Level of Living Survey of 1968.

Table 4.8 **Characteristics of employed individuals by degree of attachment to the current employer, 1974**

	Expect permanent employment	Expect to quit	Expect to be laid off	Date fixed for termination of the job
Age	40	33	37	33
Woman	0.42	0.50	0.34	0.51
Married	0.76	0.55	0.64	0.57
Schooling	9.60	10.30	9.20	11.00
Recently moved to current locality	0.06	0.14	0.06	0.15
Tenure	9.40	5.10	3.10	4.10
Big city	0.29	0.36	0.29	0.33
Piece work	0.14	0.17	0.21	0.01
Hours constraints	1.71	1.69	1.62	1.51
Hard physical work	0.93	1.09	1.28	0.78
Dangerous work	0.84	0.87	0.94	0.72
Stressful work	1.05	0.90	0.81	0.91
ln wage	7.50	7.31	7.44	7.21
Sample size	2594	232	53	93

Note: The following variables are (0,1)-dummies: Woman, Married, Recently moved, Piece work and Big city (Stockholm, Göteborg, Malmö). Hours constraints, Hard physical work, Dangerous work and Stressful work (defined on page 102) are indices of working conditions, scaled so that higher values mean worse conditions. The wage rate is earnings per hour in Swedish öre.

Source: The Level of Living Survey of 1974.

Table 4.9 Characteristics of employed individuals by degree of attachment to the current employer, 1981

	Expect permanent employment	Expect to quit	Expect to be laid off	Date fixed for termination of the job
Age	40	30	37	32
Woman	0.47	0.47	0.46	0.54
Married	0.76	0.48	0.61	0.51
Schooling	10.40	11.40	10.10	11.80
Recently moved to current locality	0.07	0.15	0.06	0.22
Tenure	9.90	4.30	6.70	3.60
Big city	0.28	0.45	0.30	0.25
Piece work	0.06	0.11	0.13	0.03
Hours constraints	1.65	1.66	1.79	1.47
Hard physical work	0.92	1.15	1.34	0.77
Dangerous work	0.82	0.92	1.30	0.58
Stressful work	1.03	1.08	0.85	0.85
ln wage	8.21	8.09	8.17	8.12
Sample size	2941	230	87	129

Note: The following variables are (0,1)-dummies: Woman, Married, Recently moved, Piece work and Big city (Stockholm, Göteborg, Malmö). Hours constraints, Hard physical work, Dangerous work and Stressful work (defined on page 102) are indices of working conditions, scaled so that higher values mean worse conditions. The wage rate is earnings per hour in Swedish öre.

Source: The Level of Living Survey of 1981.

expect to quit. Furthermore, we will exclude elderly workers (above the age 55) in order to be able to ignore retirement plans. Which individual and job characteristics, then, are likely to induce a worker to contemplate a quit decision?

4.4.2 Estimation of Quit Intention Functions

Explanatory Variables

The empirical analysis in this section relates a worker's quit intention to three broad categories of explanatory variables. Included in the set of personal characteristics are age, sex, marital status, education, length of residence in the locality and length of tenure. Job characteristics include the wage rate as well as nonpecuniary aspects of the job (such as whether the job is dangerous, stressful, etc.). Labor market characteristics are taken account of by a dummy for metropolitan areas (Big city) and, in some estimations, the local unemployment rate.¹⁰

The rationale for some of the explanatory variables has already been given, but several additional points can be made at this stage. First, since prospective returns to search are decreasing over the life cycle, we expect age to be negatively related to the quit intention probability. We also expect women to be more inclined to quit, primarily because they find nonmarket alternatives more attractive than men (and therefore are more likely to leave the labor force).

Job search and job mobility among married workers may be constrained by family ties. For example, a

husband (or wife) is not likely to engage in inter-regional job search if the spouse has a strong attachment to the local labor market. In principle, however, the "spouse-effect" can go either way. A married woman will anticipate a quit if her husband has received an attractive offer from some other location.

There are two ways in which education can affect intentions to quit. First, it is likely that higher education enhances productivity in job search and, consequently, the returns to search. The returns to search are also affected by the location of available offers compared to current wages; higher education means that a worker's wage offer distribution has a higher mean. As a consequence, workers with higher education are more inclined to search (at given current wage rates).

Tenure and length of residence in the location affect search and mobility behavior for reasons already discussed. As they stay in their firm and/or location, workers will accumulate firm-specific as well as location-specific capital, both of which lead to higher mobility thresholds. The other reason is due to imperfect information about nonwage job and location attributes. Since job acceptance decisions are taken without full knowledge of the value of offers, search and quit decisions will be actualized as workers gain experience in their new jobs (or locations).

In the estimations of quit intention functions, we have captured "duration dependence" with two dummy variables for short tenure (hired during the current or the previous year) and short length of residence (moved to the locality during the cur-

rent or the previous year). These variables will primarily account for "adverse surprises" associated with the initial experiences in a new job or location.

The Level of Living Surveys provide detailed information about a number of nonwage job attributes. We have used four indices of adverse job characteristics:

Hours Constraints	= { Inflexible hours, punch clock, difficult to run errands }
Hard Physical Work	= { Heavy lifting, otherwise physically demanding, daily sweating }
Dangerous Work	= { Noise, smoke, shake, poison }
Stressful Work	= { Mentally demanding, hectic }

The RHS variables are dummies for the various job characteristics. An index is defined as the sum of the relevant dummy variables. In addition to these indices we have also included a dummy for workers with piece work. Since unions have aimed for a reduction in the frequency of piece work, there is a presumption that piece work, on average, represents an adverse job characteristic.

Empirical Results

Table 4.10 displays results of the estimated quit intention functions for the three survey years. Possible behavioral differences between men and women are here only accounted for by a dummy variable for female workers.

**Table 4.10 Logit estimates of determinants of
quit intentions, 1968, 1974 and 1981**
(t-ratios in parentheses)

	1968	1974	1981
Constant	2.317 (1.948)	5.138 (3.014)	4.829 (2.085)
Age	-0.052 (-5.475)	-0.048 (-4.760)	-0.098 (-8.374)
Woman	0.318 (1.779)	0.332 (1.735)	-0.028 (-0.162)
Married	-0.115 (-0.637)	-0.427 (-2.427)	-0.624 (-3.792)
Schooling	0.065 (1.914)	0.097 (3.041)	0.100 (3.461)
Recently moved to current locality	0.425 (2.004)	0.275 (1.159)	0.233 (1.035)
Short tenure	0.743 (4.428)	0.474 (2.672)	0.131 (0.709)
Big city	0.206 (1.210)	0.508 (2.986)	0.915 (5.736)
Piece work	0.218 (0.915)	0.419 (1.717)	0.925 (3.370)
Hours constraints	-0.265 (-3.230)	0.022 (0.255)	0.018 (0.212)
Hard physical work	0.094 (1.112)	0.243 (2.784)	0.126 (1.520)
Dangerous work	-0.032 (-0.351)	1.000 (1.114)	0.004 (0.045)
Stressful work	0.047 (0.420)	-0.116 (-1.042)	0.231 (2.168)
ln wage	-0.540 (-2.821)	-1.013 (-4.025)	-0.715 (-2.370)
Log likelihood	-613.2	-568.2	-602.4
Likelihood ratio	192.1	184.0	283.9
Sample size	2320	2324	2719

Among the worker's personal characteristics, age is highly significant; the probability of observing a quit-inclined worker is decreasing with the worker's age.

In 1968 as well as 1974 female workers had significantly higher quit intention probabilities than the male workers. This sex-pattern appears to change over time; in the 1981 survey there is no significant difference between male and female quit intention probabilities. The interpretation of this pattern is not difficult; female labor force participation ratios have, during the period of investigation, shown a dramatic increase (from 50 percent in 1968 to 65 percent in 1981, according to the labor force surveys). It should be of no surprise to find that the stronger labor force attachment partly works through lower quit probabilities.

Table 4.10 also reveals the expected results that quit intentions are positively affected by education, short length of residence, short tenure and living in a big city. The education variable is significant all three years, whereas the other mentioned variables show a less stable pattern. The coefficients for marital status imply that married workers are less inclined to contemplate a quit.

Consider, finally, the role of job characteristics. The wage rate variable always has the expected negative coefficient, whereas the measures of adverse nonwage job attributes show no consistent pattern. Piece work and hard physical work have always the expected positive signs and are sometimes significant at conventional levels. Hours

constraints, dangerous work and stressful work, on the other hand, have negative coefficients in 3 out of the 9 cases.

Several empirical studies on U.S. data have shown that nonwage job attributes are indeed important determinants of quit behavior. (See, for example, Viscusi (1979) and Bartel (1982).) The reasons for the mixed results obtained on Swedish data are not clear, but measurement errors in the working conditions variables are an obvious possibility. The questions posed in the surveys are somewhat vague and different respondents may interpret them differently. For example, "very noisy" or "hectic" may mean different things to different workers. (See Duncan and Holmlund (1983) for a more detailed discussion of measurement errors in survey reports on working conditions.)

Are the estimated relationships significantly different between the different years? We have performed likelihood-ratio tests for models excluding the four working conditions variables (hours constraints, dangerous work, stressful work and hard physical work). Comparisons were made between 1968 and 1974 as well as between 1974 and 1981. A null hypothesis of unchanging structure between 1968 and 1974 could not be rejected at the 5 percent level. The test, however, did indicate a change in structure between 1974 and 1981.

Quit Intention Functions by Sex

The equations estimated so far take account of sex differences in quit behavior only by an intercept dummy. However, numerous empirical studies show

that labor market behavior differs between men and women; labor supply elasticities, for example, tend to be higher among women. We have therefore also estimated separate quit intention functions for men and women. As before, workers above age 55 are excluded from the analysis. Table 4.11 displays results where data have been pooled for 1968-74 and 1974-81, respectively. The four working conditions indices have been deleted in these estimations. Possible behavioral shifts over time are accounted for by an intercept dummy for the last observation period (1974 and 1981, respectively). Interpretations of the estimated coefficients in terms of partial derivatives, calculated at mean probabilities, are given in Table 4.12.

An interesting difference between male and female workers is revealed by the estimates; women appear to be much more sensitive to changes in relative wage rates. The results imply that a 10 percent wage increase - at a given average wage rate - will decrease the female quit intention probabilities by 0.007-0.008 units (or approximately 10 percent in relative terms). The responses to changes in wage rates among men are less pronounced; in fact, the relative wage coefficients are not significant at conventional levels.

The only notable behavioral shift over time concerns women's quit behavior. There is a weak tendency for female workers to be less prone to quit in 1974 than in 1968, and less prone to quit in 1981 than in 1974. This effect presumably reflects an increasing labor force attachment for women.

Table 4.11 Logit estimates of determinants of quit intentions, by sex
(t-ratios in parentheses)

	Men		Women	
	1968-74	1974-81	1968-74	1974-81
Constant	-0.974 (-1.918)	-1.219 (-2.551)	-1.999 (-3.997)	-0.654 (-1.228)
Age	-0.072 (-6.518)	-0.082 (-7.109)	-0.033 (-3.613)	-0.068 (-6.563)
Married	-0.341 (-1.871)	-0.651 (-3.824)	-0.191 (-1.092)	-0.478 (-2.820)
Schooling	0.059 (1.903)	0.096 (3.716)	0.069 (2.097)	0.046 (1.445)
Recently moved to current locality	0.476 (2.211)	0.408 (1.867)	0.393 (1.721)	0.048 (0.198)
Short tenure	0.492 (2.864)	0.327 (1.888)	0.763 (4.497)	0.302 (1.632)
Big city	0.277 (1.650)	0.745 (4.629)	0.370 (2.205)	0.647 (3.936)
Piece work	0.314 (1.680)	0.894 (4.451)	0.166 (0.478)	0.351 (0.866)
$\ln(w/w^a)$	-0.306 (-1.259)	-0.387 (-1.354)	-0.888 (-4.752)	-1.047 (-4.294)
Dummy for 1974	-0.013 (-0.083)	-	-0.200 (-1.224)	-
Dummy for 1981	-	0.175 (1.117)	-	-0.183 (-1.136)
Log likelihood	-620.7	-614.6	-571.5	-571.3
Likelihood ratio	189.4	252.6	151.2	184.3
Sample size	2732	2737	1912	2306

Note: The variable w^a is the geometric average of wage rates for men and women, respectively, during the actual years.

Table 4.12 Changes in quit intention probabilities due to changes in exogenous variables

	Men		Women	
	1968-74	1974-81	1968-74	1974-81
Age	-0.005	-0.006	-0.003	-0.005
Married	-0.023	-0.046	-0.018	-0.037
Schooling	0.004	0.007	0.006	0.004
Recently moved to current locality	0.032	0.029	0.037	0.004
Short tenure	0.033	0.023	0.072	0.023
Big city	0.019	0.053	0.035	0.050
Piece work	0.021	0.063	0.016	0.027
$\ln(w/w^a)$	-0.021	-0.027	-0.084	-0.081

Note: The partial derivatives are calculated at the mean of the quit intention probabilities, $\bar{P}$, i.e.,

$$\frac{\partial P}{\partial X} = \hat{\beta} \bar{P}(1-\bar{P})$$

where X is an exogenous variable and $\hat{\beta}$ an estimated coefficient. The $\bar{P}$ -values for men are 0.073 and 0.077, respectively, and the corresponding values for women are 0.106 and 0.084, respectively.

We have also tested for structural shifts by means of the likelihood-ratio test. For men no significant change in the quit intention function is found between 1968 and 1974 or between 1974 and 1981. For women, on the other hand, the null-hypothesis of unchanged structure was rejected at the 10 percent level for 1968-74 and at the 5 percent level for the period 1974-81.

4.5 Concluding Remarks

Has labor mobility in Sweden decreased over time? We have tried to illuminate this issue by placing it into an econometric framework. The lack of long time series makes a careful analysis difficult. We can, however, estimate quit functions on a reasonably comparable monthly data set from 1969 to date. The results of the analysis in this chapter indicate a weak downward trend in average quit rates among workers in mining and manufacturing, holding cyclical variables constant. The employment security legislation of 1974 appears to have had negligible independent effects on quits.

How do quit rates respond to characteristics of individual plants, such as relative wages and the number of employees? The results obtained in this chapter indicate that quit rates decrease with higher relative wages and larger plant size. The prevalence of a varied internal labor market in large plants seems to more than offset the less desirable working conditions typically found in large plants.

It was also shown that substantial regional variations prevailed even after controlling for relative wages, new hires, labor market tightness and plant size. The standardized differential in yearly quit rates between the metropolitan areas and the most sparsely populated regions amounts to about 5 percentage points. (The "observed" unstandardized difference is, however, much higher, amounting to more than 12 percentage points.)

Actual mobility rates capture both individual search efforts ("mobility propensities") and exoge-

nous factors influencing the outcome of search efforts. Using household data from the Level of Living Survey we explored the determinants of quit intentions, as stated by the respondents in 1968, 1974 and 1981. Some structural changes appear to have occurred between the years, although the similarities between the periods dominate the picture. The most important shift pertains to women who were more likely to contemplate a quit in 1968 than in the later years. No behavioral shift was detected for male workers.

Among other results we found that workers in big cities were more quit prone, as were workers with higher education, short length of tenure, piece work and low wage rates.

What light do these results shed on mobility patterns over time? First, it is clear that the weakened demand for labor in the 70s is a major explanation of the decline in quit rates. Also important are the indirect cyclical effects. The reduction in the flow of vacancies has led to substantial reductions in new hire rates. Since recently hired workers are those who are most likely to quit there are indirect mobility decreasing effects arising from a reduction in vacancy rates.

Other determinants of quit behavior have also changed in a mobility decreasing direction. There has been, for example, a secular increase in average plant size in manufacturing industry, implying a growing importance for internal labor markets.

One important structural shift pertains to women, whose firmer attachment to the labor force is

revealed as lower quit intentions. This change, however, does not necessarily reflect a reduced willingness to move between jobs; most likely it primarily indicates a decreasing frequency of labor force transitions.

5 DETERMINANTS OF FAMILY MIGRATION DECISIONS

5.1 Introduction

The analysis in Chapter 4 focused on quit behavior without paying explicit attention to geographical mobility. Some job movers will, of course, make locational changes as well, but job mobility does not necessarily imply migration. By the same token local residential mobility over short distances can take place without a simultaneous job change. Migration is usually defined by where the individual lives whereas job mobility is determined by where he works.

It has been estimated that around 2.5 percent of adult Swedes in working ages were migrating between local labor markets during 1971.¹ This figure represents an approximate estimate of the extent to which residential mobility is associated with simultaneous job changes (including changes of employer or transfers between work places within the same firm).

Migration behavior is the result of a complicated decision-making process within families in general and two-earner households in particular. Individual income maximization on part of the spouses may suggest different locational choices, a solution usually ruled out by the requirements of family integrity. And even if the spouses are engaged in job search pertaining to the same destination labor market, it is possible that their expected (and actual) search time differs; an

acceptable offer found by one spouse at a point in time may call for family migration even if the other spouse so far has been unsuccessful in search. Hence the presence of family ties is of vital importance for migratory behavior and may result in actions different from those taken by single-member households. (Cf. the discussion in Chapter 3.)

This chapter investigates family migration in Sweden, using panel data from the Level of Living Surveys. A discussion of determinants of migration is given in Section 5.2. The empirical analyses in Section 5.3 provide information on a variety of issues, including the role of education, prior mobility and locational ties. A summarizing discussion concludes the chapter.

One virtue of the data is that some characteristics of both spouses can be identified. The information is, however, rather incomplete in several respects. For example, we know of wage rates and employment status during the survey week only for the spouse who happens to be a respondent. Information about labor market experience for the respondent's spouse is given (by the respondent) for the previous year.

5.2 Benefits and Costs of Migration

5.2.1 The Analytical Framework

We will discuss migration behavior as if the locational changes involve simultaneous job changes. The basic determinants of migration are related to expected (gross) benefits from moving as well as

moving costs. Let V_{mi} denote prospective income if family i moves, V_{si} prospective income if the family does not move and C_{Mi} moving costs. Migration occurs if

$$V_{mi} - V_{si} - C_{Mi} > 0 \quad (5.1)$$

where V_{mi} , V_{si} and C_{Mi} are interpreted as including pecuniary as well as non-pecuniary components.

Income opportunities available at current and alternative destinations are not directly observed, nor are mobility costs. Assume that V_{mi} , V_{si} and C_{Mi} are given by the functions

$$V_{mi} = X_{mi}\beta_m + \epsilon_{mi} \quad (5.2)$$

$$V_{si} = X_{si}\beta_s + \epsilon_{si} \quad (5.3)$$

$$C_{Mi} = Z_i\gamma + u_i \quad (5.4)$$

where ϵ_{mi} , ϵ_{si} and u_i are stochastic errors.

Hence, migration occurs if

$$I_i = X_{mi}\beta_m - X_{si}\beta_s - Z_i\gamma + \epsilon_{mi} - \epsilon_{si} - u_i > 0 \quad (5.5)$$

Accordingly, the probability of moving is

$$\Pr(I_i > 0) = \Pr(W_i \Pi > \epsilon_i^*) \quad (5.6)$$

where $W_i = (X_{mi}, X_{si}, Z_i)$ and $\epsilon_i^* = -\epsilon_{mi} + \epsilon_{si} + u_i$. It is assumed that the stochastic errors follow a logistic distribution.

We will discuss below the empirical counterparts to the vectors X_m , X_s and Z_i . These variables will be used as predictors of migration in the logit model (5.6). This procedure is equivalent to estimating "reduced form", rather than "structural", decision equations. No attempt will be made to impute "opportunity incomes" to the households. The effect of a particular RHS variable may work through the income equations as well as the cost function, but those channels are not identified in the reduced form analysis presented below.

5.2.2 The Determinants of Migration

The determinants of migration can be categorized as follows:

$W_i = \{ \text{age, education, income, local tax rates, employment status, locational ties, family ties, length of residence} \}$

The role played by these variables in affecting prospective incomes and/or moving costs is discussed in the order given above.

Migration over the Life Cycle

To a large extent, life time incomes are determined by educational and occupational choices made in early stages of the life cycle. The individual's human capital is malleable ex ante but may be highly specific ex post. With substantial amounts of human capital specific to a firm or an occupation, older workers will have a fairly narrow choice set of alternative careers. We might

say that their relevant wage offer distribution has a small variance; the incentives for income-enhancing job search may consequently be quite restricted.

Young workers, on the other hand, have a choice set involving not only their current skills, but their potential skills as well. The wage offer distribution corresponding to the young workers' current skills may have a small variance, but there may be a substantial dispersion of life-time earnings, since jobs offer different training opportunities. The incentives for job search are therefore likely to be stronger for younger workers.

Moreover, age is likely to be related to moving costs as well. The purely monetary moving costs are usually increasing over the life cycle because of accumulation of consumer durables. In addition - and perhaps more important - there are psychic costs that are related to migration.

It should also be noted that migration rates are likely to fall over the life cycle even if offer distributions and moving costs remain unchanged. The reason is that the time span over which moving costs can be amortized decreases as the worker approaches retirement age.

Education

Consider next the role of education in migration decisions. The highly educated often face labor markets with restricted local demand for their specific skills. A brick-layer may have a good

chance of switching to a new job without being forced to change his residence. For a physician, on the other hand, there may be only a very limited number of possible positions in the same area; job changes will therefore have to be accompanied by locational changes. The expectation, therefore, is that persons with higher schooling levels are more likely to migrate, since there are only limited opportunities for local job changes within their current occupations.

Highly skilled workers are presumably also more effective in job search and "production" of job offers since they should be more able to obtain and analyze information. In particular, they may have access to means of communication (telephone, business travel) that facilitate long distance search by decreasing search costs and increasing the probability of finding job offers. This reinforces the hypothesis of a positive association between migration rates and educational levels.

A third point has to do with the psychic costs associated with migration. It is commonly assumed in migration literature that such costs are lower for the more highly educated. However, there is little direct evidence in favor of this hypothesis.

Higher schooling levels also imply higher potential wages, which lead to a higher probability of moving at a given initial wage rate.

Income Levels and Tax Rates

Migration will be contemplated if the expected net earnings at a potential destination exceed avail-

able local income opportunities. We noted in Chapter 3 that a higher current wage will increase a searcher's reservation wage and therefore reduce the probability of moving. It is also to be expected that higher income makes job search less attractive per se; at some level of earnings, job search will not pay at all. The expected effect of income on migration is thus negative, holding constant the searcher's alternative income opportunities.

What matters for migration decisions are net benefits; the properties of the prevailing tax system should therefore be taken into account. A higher local tax rate implies stronger incentives to move for people who are concerned about their net incomes. Likewise, prospective increases in the local tax rate will make out-migration more attractive. Analogous arguments apply to local price levels, the supply of local public goods, etc. Unfortunately, however, the data set to be explored includes no such information.

Employment Status

Unemployment implies, inter alia, a reduction in the household's current income and therefore an increase in the probability of migration. This effect is reinforced if unemployment entails other undesirable personal consequences. Unemployment may also increase the likelihood of migration because it provides an opportunity to specialize in job search, and thus may increase the number of job offers from a prospective destination labor market.

Locational Ties

Other migration costs are related to locational ties. Persons with frequent contacts with friends and relatives are likely to experience a loss in psychic income upon moving, especially if they move a long distance. Similar ties may be present for households with children in school; a prevalent notion is that family migration is deterred because of the ties between children and their schools and friends.

Another widespread idea in the Swedish debate is that migration costs are higher among owners of single family houses. However, the rationale for this presumption is not so obvious. Home owners in Sweden usually have had few difficulties in selling their property at satisfactory prices. (This judgment is, of course, not valid for persons living in depressed areas with substantial unemployment and declining industries.) Perhaps one should regard home ownership as another indicator of non-monetary locational ties. Home ownership may also simply reflect a previous decision to stay in the locality for some years, thus capturing an unobserved propensity to stay.

Family Ties

Does labor force participation on part of the women reduce family migration probabilities? The argument rests on a situation in which the husband refuses distant job offers because of the wife's attachment to the local labor market.

In Mincer's terminology, the husband becomes a "tied stayer" (Mincer, 1978). Counterexamples are not difficult to find, however. Consider a family where the wife becomes unemployed and has difficulties in finding a new job in the local labor market. The stronger her labor force attachment, the more likely it is that the family will contemplate a locational change. And the higher her earnings at a potential destination, the larger are the prospective gains from migration. A reasonable conjecture is that families with non-working wives with high potential earnings are more likely to move than families, where the wife is working.

Length of Residence

Imperfect information (ex ante) about destination characteristics will lead to surprises (ex post) among the recent in-migrants. Some of them will be exposed to favorable surprises, other will have less luck. Among the latter we will find those who will reconsider their previous locational choice and start to search once again. The process of information gathering about "true" locational characteristics is clearly related to length of residence. Hence we expect that recent migrants are more likely to be engaged in job search and possible subsequent migration to a new location or back to where they came from (return migration).

Information about previous migration may be useful for other reasons as well. To the extent that individuals differ with respect to unmeasurable "mobility propensities", we would like to control for this source of heterogeneity. Variables captur-

ing previous mobility experiences are obvious candidates here. However, it appears difficult if not impossible in empirical analysis to separate the "surprise effect" from the "heterogeneity effect"; migration-prone individuals will also, on average, have a short length of residence.

5.3 The Empirical Picture: Family Migration Patterns

5.3.1 Sample Characteristics

The data source for our empirical analysis is the Level of Living Surveys. We focus on locational changes between February 1968 and October 1970 (using the 1968 survey) as well as migration subsequent to 1974 (using the 1974 survey). In the latter case we focus on mobility between January 1974 and November 1975 as well as between January 1974 and December 1978. As an attempt to identify "permanent" two-adult families, the sample was restricted to cases where the respondent was married during each of the years 1973, 1974, 1975 and 1978, and had a spouse whose birth year remains the same during each of those years.

Some "initial" characteristics of migrating and non-migrating families are displayed in Tables 5.1, 5.2 and 5.3. The personal characteristics are reported by the respondents, whereas migrant status is measured with register data.

The migrants of the 1970s are classified as either "long-distance" movers or "short-distance" movers. The former definition pertains to mobility between counties (län) whereas the latter refers to mobili-

Table 5.1 Characteristics of migrating and non-migrating families, 1968-70.
Migration between counties

	Migrants	Non-migrants
Age of husband	37	48
Husband's schooling GE 12	0.32	0.12
Wife's schooling GE 12	0.24	0.08
Frequent contacts with friends or relatives	0.31	0.28
Single family house	0.27	0.41
In-migration 1967-68	0.26	0.05
In-migration 1961-66	0.43	0.19
Working wife 1967	0.40	0.49
Working wife with schooling GE 12	0.13	0.06
Sample size	225	3762

Note: All variables except age are dummies.
GE = greater than or equal to.

Source: The Level of Living Survey of 1968 and register data subsequent to the survey.

Table 5.2 Characteristics of migrating and non-migrating families, 1974-75. Migration between counties and communes

	Between counties		Between communes	
	Migrants	Non-migrants	Migrants	Non-migrants
Age of husband	37	49	36	49
Husband's schooling GE 12	0.44	0.14	0.27	0.14
Wife's schooling GE 12	0.26	0.09	0.11	0.09
Frequent contacts with friends or relatives	0.34	0.40	0.56	0.40
Single family house	0.32	0.57	0.54	0.57
Children in school	0.38	0.38	0.43	0.38
In-migration 1973-74	0.15	0.03	0.16	0.03
Locational change 1968-74	0.74	0.23	0.63	0.22
Working wife 1973	0.57	0.58	0.67	0.58
Working wife with schooling GE 12	0.15	0.07	0.08	0.07
Household income 1973 (SEK)	51700	48300	53800	48200
Local tax rate	0.24	0.24	0.24	0.24
Unemployment experience 1973, husband	0.06	0.02	0.02	0.02
Unemployment experience 1973, wife	0.02	0.03	0.03	0.03
Sample size	68	2901	63	2851

Note: All variables except age, income and the local tax rate are dummies. GE = greater than or equal to.

Source: The Level of Living Survey of 1974 and register data subsequent to the survey.

Table 5.3 Characteristics of migrating and non-migrating families, 1974-78. Migration between counties and communes

	Between counties		Between communes	
	Migrants	Non-migrants	Migrants	Non-migrants
Age of husband	40	49	38	49
Husband's schooling GE 12	0.42	0.14	0.24	0.13
Wife's schooling GE 12	0.27	0.08	0.09	0.08
Frequent contacts with friends or relatives	0.33	0.40	0.51	0.40
Single family house	0.39	0.57	0.49	0.57
Children in school	0.31	0.38	0.39	0.38
In-migration 1973-74	0.10	0.03	0.14	0.03
Locational change 1968-74	0.64	0.22	0.56	0.21
Working wife 1973	0.55	0.58	0.65	0.58
Working wife with schooling GE 12	0.16	0.07	0.04	0.07
Household income 1973 (SEK)	53800	48200	51300	48000
Local tax rate	0.24	0.24	0.24	0.24
Unemployment experience 1973, husband	0.05	0.02	0.03	0.02
Unemployment experience 1973, wife	0.04	0.03	0.04	0.03
Sample size	137	2845	110	2735

Note: All variables except age, income and the local tax rate are dummies. GE = greater than or equal to.

Sources: The Level of Living Survey of 1974 and register data subsequent to the survey.

ty between communes within a county. The data do not show whether the locational change involved a job change. This, however, is likely to be the case for most inter-county moves.

The tables reveal various pieces of information about the characteristics of migrants and non-migrants, some less well-known than others. First of all, the sample clearly confirms the general presumption that migrants tend to be younger than non-migrants. It is also evident that migrants tend to have a higher level of education; this appears to hold for both spouses. There is also a quite pronounced difference between long-distance and short-distance movers; migrants across county borders have higher average education levels than do intra-county movers.

Another striking difference between migrants and non-migrants concerns previous migration behavior. About 15 percent of the migrants 1974-75 had moved to their current locality within the previous year or so, whereas that was true of only 3 percent of the non-migrants.² More than 70 percent of the migrants 1974-75 - but only about 20 percent of the stayers - report some locational change during the period 1968-74.³

Other differences between migrants and non-migrants are less clear from the data. Inter-county movers are less likely to be living in single family houses than other groups. Initial household incomes are highest for long-distance movers and lowest for those who show no geographical mobility.

Previous unemployment experiences are rare for all groups, although slightly more common for those

who later move across county borders. If we instead focus on labor market status during the survey week, it is notable that none of the respondents among the 1974-75 migrant households was unemployed.

Another noteworthy difference between migrants and non-migrants is their subsequent migration (not shown in the tables). Some 20 percent of the inter-county movers between 1974 and 1975 also migrated across county borders in the period between 1975 and 1978, compared to only 3 percent of the non-migrants. Needless to say, the number of observations decreases drastically when we attempt to display more detailed and disaggregated features of the sample and this cautions against any far-reaching interpretations.

5.3.2 Estimation of Migration Functions

Logit estimates of basic migration models are given in Tables 5.4 and 5.5. We focus first on inter-county migration in the 1960s and the 1970s.

Migration probabilities clearly decrease with age but increase with education. In addition, the educational attributes of both spouses are of importance for migration decisions; in fact, the male and female education coefficients are approximately equal.

Another observation is that non-pecuniary locational ties appear to be of greater importance in the 1970s than in the 60s. In the 70s, households with frequent contacts with friends or relatives had significantly lower migration rates than families

**Table 5.4 Logit estimates of family migration
determinants, 1968-70. Inter-county
migration**
(t-ratios in parentheses)

	(1)	(2)
Constant	-1.763 (-4.849)	-2.213 (-6.275)
Age of husband	-0.033 (-4.673)	-0.031 (-4.319)
Husband's schooling GE 12	0.594 (3.036)	0.644 (3.291)
Wife's schooling GE 12	0.578 (2.669)	0.838 (2.939)
Frequent contacts with friends or relatives	-0.050 (-0.300)	-0.064 (-0.389)
Single family house	-0.532 (-2.991)	-0.441 (-2.504)
In-migration 1967-68	1.987 (8.631)	1.954 (8.529)
In-migration 1961-66	1.180 (6.171)	1.208 (6.358)
Working wife	-0.727 (-4.439)	
Working wife with schooling GE 12		-0.649 (-1.924)
Log-likelihood	-623.6	-631.9
Likelihood ratio	266.7	250.0
Sample size	3528	3528

Note: GE = greater than or equal to.

Table 5.5 Logit estimates of family migration determinants in the 70s
(t-ratios in parentheses)

	Migration between counties		Migration between communes within counties	
	1974-75	1974-78	1974-75	1974-78
Constant	-2.580 (-4.028)	-2.265 (-5.136)	-1.662 (-2.501)	-1.356 (-2.788)
Age of husband	-0.036 (-2.891)	-0.024 (-2.841)	-0.066 (-4.564)	-0.050 (-5.065)
Husband's schooling GE 12	1.132 (3.775)	1.132 (5.136)	0.508 (1.578)	0.580 (2.220)
Wife's schooling GE 12	1.032 (2.210)	1.398 (3.933)	-0.264 (-0.344)	0.456 (0.867)
Frequent contacts with friends or relatives	-0.779 (-2.778)	-0.734 (-3.629)	0.246 (0.926)	0.105 (0.509)
Single family house	-1.048 (-3.803)	-0.789 (-4.129)	- 0.48E-03 (-0.18E-02)	-0.262 (-1.277)
In-migration 1973-74	0.583 (1.477)	0.220 (0.658)	0.727 (1.843)	0.846 (2.529)
Locational change 1968-74	1.527 (4.806)	1.294 (6.091)	0.978 (3.224)	0.832 (3.585)
Working wife with schooling GE 12	-1.230 (-2.273)	-1.299 (-3.202)	-0.654 (-0.753)	-0.806 (-2.657)
Log-likelihood	-254.5	-456.2	-260.2	-399.3
Likelihood ratio	130.5	190.0	85.8	110.5
Sample size	2948	2948	2881	2808

Note: Inter-county migrants are excluded from the sample underlying the last two columns. GE = Greater than or equal to.

without such ties. In the 1960s, however, there is no significant difference between the two groups. One interpretation is that the psychic costs associated with migration have increased between the periods.

Another result, valid for the 1960s and the 1970s, is that migration probabilities are lower among home owners. Moreover, recent migratory experiences are important for subsequent migration probabilities. Households with geographical mobility in the recent past have significantly higher probabilities of moving in subsequent years.

How are migration probabilities affected by female participation in market work? In the late 1960s, the evidence is quite conclusive: households with a working wife had significantly lower migration probabilities. This pattern prevails also in the 70s, although with some differences. In the latter period, it is primarily market work among highly educated wives - with more than 12 years of schooling - that inhibits migration. For this period we found that labor market participation among women with less education had negligible effects on migration probabilities (not shown in the tables).

Another view of the role played by stronger female labor force attachment can be obtained by focusing on intra-family income dispersion. A convenient measure of this dispersion is

$$DS = \frac{|Y_H - Y_W|}{Y_H + Y_W}$$

where Y_H , Y_W are incomes of husbands and wives, respectively. The numerator gives the absolute value of the income difference between the spouses. It is obvious that DS lies between zero and unity; DS equals zero when the spouses' incomes are exactly equal.

**Table 5.6 Family migration probabilities and
 intra-family income dispersion.**

Inter-county migration

(t-ratios in parentheses)

	1974-75	1974-78
DS ₁₉₇₃	0.497 (1.242)	0.499 (1.720)
DS ₁₉₇₄	0.581 (1.450)	0.454 (1.566)

Note: Other variables as in Table 5.5 except "Working wife with schooling GE 12".

Including this income dispersion variable yields the results shown in Table 5.6. Although not estimated very precisely, the coefficients confirm earlier results. Families with larger income differentials between the spouses tend to be more likely to migrate. In practice, this means in most cases that families with a higher male/female income ratio will be more inclined to move.⁴ (When the female experience-education interaction variable is included, however, the standard errors of the estimated DS-coefficients increase substantially.)

The results for short-distance (intra-county) mobility reveal some notable differences from the results for inter-county migration. Age remains as

a significant determinant of migration, whereas education is reduced in importance; the wife's education does not show any significance, and the coefficient for the husband's education variable falls sharply. We can also note that locational ties - as represented by frequent contacts with friends and relatives - seem to be of no importance for short-distance migration. Psychic costs associated with migration appear to increase with the distance moved. This result is, of course, not unexpected.

The influence of some other possible determinants of migratory behavior has been tested and the results are presented in Table 5.7. It turns out that characteristics such as children in school, initial income and previous unemployment experiences are insignificant predictors of migration probabilities.

The effects of local tax rates are ambiguous and without obvious interpretations. Migration between counties appears to be less influenced by taxes than migration over short distances. Taken at face value, the estimates in columns (3) and (4) imply that households with a higher initial local tax rate have a lower probability of out-migration. However, expected tax increases seem to induce out-migration. (The households are assumed to have accurate information about future tax increases in their initial commune; we simply impute to each family the actual tax increases for their initial commune.) Of course, the results should be viewed with some skepticism. We expect that locational choices are influenced by the net benefits related to different regions, including local price levels. Ideally, we would like to impute not only

Table 5.7 Determinants of family migration decisions - various tests

(t-ratios in parentheses)

	Migration between counties		Migration between communes within counties			
	1974-75	1974-78	1974-75		1974-78	
	(1)	(2)	(3)	(4)	(5)	(6)
Children in school	0.176 (0.637)					
Household income 1973	0.26E-05 (0.564)					
Local tax rate 1974	0.069 (0.642)		-0.485 (-4.429)	-0.403 (-3.419)	-0.403 (-4.773)	-0.402 (-4.259)
Change in local tax rate 1974-75	-0.267 (-1.838)		0.499 (3.522)	0.309 (2.049)		
Change in local tax rate 1974-78		0.053 (0.706)			0.195 (2.373)	-0.003 (-0.032)
Unemployment experience 1973, husband	0.183 (0.286)	0.281 (0.597)				

Note: Other variables included are those in Table 5.5. The change in the local tax rate (τ) is defined as $\tau(1975) - \tau(1974)$ and $\tau(1978) - \tau(1974)$, respectively (τ is expressed in percentage points). All variables in columns (1) - (3) and (5) are included one at a time. In columns (4) and (6) tax levels and tax changes are included simultaneously. Note that the tax changes pertain to the initial commune.

local tax rates but the supply of local public services as well. (A positive correlation between local tax rates and the level of public services is to be expected.) Note also that equilibrating population movements may have established an inverse relationship between local tax rates and, for example, local housing prices.

Table 5.8 gives interpretations of the estimated coefficients in terms of partial derivatives (based on Table 5.5). The probabilities are nonlinear functions of the explanatory variables and the values in the table are computed at the means of the probabilities.

5.3.3 Other Evidence

The estimations of migration functions indicated that two-earner families were less migration-prone, and especially so if the working wife had a high education. This finding may be interpreted as showing that migration is more likely to occur if the wife has low earnings compared to her potential earnings. This pattern is also visible in another and much larger data set, where migration rates for married couples in different categories are calculated. Table 5.9 displays migration rates for married couples, by the wife's income and education level.

Families where the wife has low education and high income are the least likely to migrate; families where the wife has high education and low income have the highest migration rates. Within each female education level, migration rates are declining with the wife's income, but this decline

Table 5.8 Relationships between unit changes in exogenous variables and changes in inter-county family migration probabilities

	1974-75	1974-78
Age of husband	-0.001	-0.001
Husband's schooling GE 12	0.025	0.050
Wife's schooling GE 12	0.023	0.061
Frequent contacts with friends and relatives	-0.017	-0.032
Home ownership	-0.023	-0.035
Locational change	0.034	0.057
Working wife with schooling GE 12	-0.027	-0.057

Note: The partial derivatives are calculated at the sample means of the migration probabilities ($\bar{P}$). The formula is

$$\frac{\partial P}{\partial X} = \hat{\beta} \bar{P}(1-\bar{P})$$

where X is the particular explanatory variable and $\hat{\beta}$ the estimated coefficient.

**Table 5.9 Migration rates 1971 for families,
by the wife's income and education.
Husband's age 30-39**

Education level	Income (SEK)		
	0-4499	4500-29999	30000-
Pre-secondary (för- gymnasial utbildning)	1.9	1.5	1.3
Secondary (gymnasial utbildning)	3.2	2.1	1.6
Post-secondary (efter- gymnasial utbildning)	5.2	3.9	3.1

Note: The table is based on official income and population statistics. The data set includes 350 000 families, among which 8 000 moved between local labor markets during 1971.

Source: Springfeldt et al. (1976).

is most pronounced for the highest education level.

According to our basic analytical framework, family migration occurs in order to increase net family income. Of course, an increase in household income associated with migration may sometimes involve an income loss for one spouse and a (larger) income gain for the other spouse. Table 5.10 shows income changes for families moving between local labor markets during 1971. (Again we present information from another and much larger data set, based on official income and population statistics.)

Table 5.10 is self-explanatory. Income changes for migrating families are larger than income changes among non-migrants. This apparent gain in total household income is, however, associated with a

Table 5.10 **Income changes among spouses moving between local labor markets during 1971 relative to income changes among non-migrants**

Education level	Income change (SEK)	
	wife	husband and wife
Pre-secondary (för-gymnasial utbildning)	-1100	+700
Secondary (gymnasial utbildning)	-1600	+1600
Post-secondary (efter-gymnasial utbildning)	-2200	+1500

Note: The calculations refer to families moving during 1971 where the husband's age is 30-39. Income levels are registered 1970, 1972 and 1973. The number of migrating families is 8 000.

Source: Springfeldt et al. (1977).

simultaneous decline in female incomes. A similar pattern has also been found in the U.S. (see Polachek and Horvath, 1977).

5.4 **Concluding Remarks**

In this chapter we have explored the determinants of family migration decisions in Sweden during the 60s and 70s. By using panel data with information on both spouses, it has been possible to provide empirical results of some detail.

Do migration patterns of the 70s differ from those of the 60s? Our basic migration functions (for inter-county mobility) differ between the decades with respect to the role of locational ties. The

data set includes direct information on the frequency of contacts with friends or relatives, presumably related to prospective psychic costs associated with (long distance) migration. Families of the 1970s were found to be sensitive to this indicator of mobility costs; families of the late 60s appear to be unaffected (or at least less affected). It appears as if psychic costs related to migration have increased among Swedish households.

Another finding is that both spouses' characteristics affect family migration rates; the possible paternalistic hypothesis that only male attributes matter is not upheld by the data. In particular, high education on part of both spouses leads to higher migration probabilities. Our results also show that the importance of education increases with the distance moved; persons with high education are disproportionately represented among long-distance migrants (i.e., migrants between counties in our data).

Among other results, we find some evidence in support of the view that higher female labor force participation lowers family migration probabilities. However, the importance of the stronger female labor force attachment is, at least in the 70s, related to the woman's earnings power; families in which working wives are highly educated are less likely to migrate.

Another issue frequently discussed deals with the role of home ownership. The empirical results show that families in single family houses are less mobile, but one should be careful about the interpretations. The household's tenure choice may well reflect the presence of locational (dis)equilibri-

um, and hence be an effect rather than a cause of the particular family migration plans.

The empirical evidence on the role of unemployment in migration decisions has not been very conclusive. On the one hand, it seems to be the case that migration rates are higher among the unemployed; this is also what theory would suggest. However, when we take other determinants of migration into account, the unemployment state per se appears to be of no importance. Again, this unexpected result may be a feature of our data and not of the population as a whole; there are few unemployed at the survey date and there is no information on employment status for the periods during which migration events are recorded.

6 LABOR MOBILITY AND SUBSEQUENT EARNINGS: THE CROSS-SECTIONAL EVIDENCE

6.1 Introduction

In the preceding chapters we have dealt with the relationships between wages and mobility, with the causation running from the former to the latter. We now address the issue from a different viewpoint: How are a worker's earnings over the life cycle affected by alternative mobility patterns? We stay, in this chapter, within a traditional human capital approach to cross-sectional earnings functions. Possible simultaneity between earnings and mobility will be ignored here but explicitly dealt with in Chapter 7.

Standard human capital econometric specifications of earnings functions imply a relationship between the natural logarithm of the wage rate and years of work experience. A well-known formulation by Mincer (1974) is

$$\ln w = \alpha_0 + \alpha_1 S + \alpha_2 \text{EXP} + \alpha_3 \text{EXPSQ} + \epsilon \quad (6.1)$$

where S is schooling, EXP is experience and EXPSQ is experience squared. This form can be derived from assumptions about human capital investment behavior. The essential idea is that the fraction of working time allocated to investment in knowledge decreases over the life cycle. This conclusion follows from models of optimal investment in human capital (see, e.g., Ben-Porath, 1967). The basic reason for the result is that invest-

ments undertaken later in life have a shorter payoff period.

Job mobility affects the life cycle distribution of earnings in two ways. One effect presupposes the existence of firm-specific capital, which - by definition - is non-transferable across jobs. Workers involved in job changes may experience wage reductions because of the specificity of their acquired knowledge. Against this effect works the possibility of wage improving job changes associated with investment in job search. Specific capital as well as job search may require a modification of the basic specification of the earnings function. This is one objective of this chapter.

The plan of this chapter is as follows. First, in Section 6.2, we derive unsegmented as well as segmented earnings functions and discuss how alternative assumptions about investment behavior affect the interpretation of the estimable parameters of the models. Section 6.3 presents the empirical analyses, performed on data from the Level of Living Surveys of 1968 and 1974. We compare the estimated functions for the two years and note some interesting changes that appear to have occurred. Implications for changes in mobility over time and some related issues are briefly discussed. A summarizing discussion concludes the chapter.

6.2 Derivation of Earnings Functions

6.2.1 The Basic Earnings Function

The basic earnings function as outlined in, e.g., Mincer (1974) has the following concepts:

E_t = earnings capacity at time t . E_t equals the actual ("net") wage if there is no on-the-job training.

C_{t-j} = post-school monetary investment costs in period $t-j$.

r = the rate of return to investments in human capital.

k_t = C_t/E_t = the investment ratio, i.e., the fraction of earnings capacity foregone through on-the-job training.

The following identity holds:

$$E_t = E_{t-1} + rC_{t-1} \quad (6.2)$$

Defining E_s as post-school earnings capacity, (6.2) is equivalent to

$$E_t = E_s \prod_{i=s+1}^{t-1} (1+rk_i) \quad (6.3)$$

or

$$\ln E_t = \ln E_s + \sum_{i=s+1}^{t-1} \ln(1+rk_i) \quad (6.4)$$

which for small rk_i approximately equals

$$\ln E_t = \ln E_s + r \sum_{i=s+1}^{t-1} k_i \quad (6.5)$$

or

$$\ln E_t = \ln E_s + r \sum_{i=1}^{EXP} k_i \quad (6.6)$$

where EXP is labor market experience since the completion of school.

Earnings capacity depends on the amount of and the returns to accumulated human capital. Neither earnings capacity, nor investment ratios are easily observed. In order to derive estimable equations, some assumptions about investment behavior are required. The linear function

$$k = k_0 - \beta \cdot EXP \quad (6.7)$$

is a simple way of introducing the basic idea that investment in human capital is declining over the life cycle. The parameter k_0 may be interpreted as the fraction of time devoted to on-the-job training when the individual enters the labor market.

Inserting Eq. (6.7) into Eq. (6.6) and translating into continuous time gives

$$\ln E_t = \ln E_s + r \int_0^{EXP} (k_0 - \beta t) dt \quad (6.8)$$

which after integration yields

$$\ln E_t = \ln E_s + rk_0 EXP - \frac{r\beta}{2} EXP^2 \quad (6.9)$$

The worker's observed wage equals earnings capacity less investment costs, i.e.,

$$w_t = E_t - C_t = E_t(1 - k_t) \quad (6.10)$$

which implies

$$\ln w_t = \ln E_s + rk_0 \text{EXP} - \frac{r\beta}{2} \text{EXPSQ} + \ln(1-k_t) \quad (6.11)$$

The last term on the RHS of (6.11) can be approximated by a second-order Taylor expansion

$$\ln(1-k_t) \approx -k_t - \frac{k_t^2}{2} \quad (6.12)$$

which yields a wage equation in terms of observable experience variables

$$\begin{aligned} \ln w_t = \ln E_s - k_0 - \frac{k_0^2}{2} + (rk_0 + \beta + k_0\beta) \text{EXP} \\ - \frac{(r\beta + \beta^2) \text{EXPSQ}}{2} \end{aligned} \quad (6.13)$$

Assuming that post-school earnings capacity is a linear function of years of schooling, this equation is equivalent to (6.1). Clearly, one can not identify the rate of return to on-the-job training (r) without knowledge of the rate at which the investment ratio declines over time (β).

The basic earnings function presupposes that job mobility does not affect investment behavior and that acquired knowledge is transferable across jobs. It also ignores returns to job search. For several reasons, these assumptions are not very realistic. Since specific training is non-transferable, we may expect that the returns to on-the-job training outside the current job are lower than investments undertaken at the current job. A fraction of accumulated human capital may become

obsolete when job separations occur, and discontinuities in the life cycle wage path should therefore be of no surprise.

Investment behavior may also differ across jobs because of individual optimizing decisions or "exogenous" differences across jobs with respect to investment opportunities. Consider the case with investment ratios freely chosen by the worker at each job. It is likely that the first years of a labor market career involve a substantial amount of job search, including information gathering by "job shopping". Investment plans are realized only when a job is found that is considered to be of some duration. Along these lines, it has been suggested (Borjas, 1981) that the level of investment at each job is related to the expected duration of the job.

In what follows we will modify the basic earnings function to account for specific training and job mobility. This involves derivation of segmented earnings functions, as have been suggested by Mincer and Polachek (1974) and Borjas (1981).

6.2.2 The Segmented Earnings Function

The earnings functions derived below focus on the simple case where there are only two segments, corresponding to the current job and all previous jobs, respectively. This restriction is tailored to the data sets to be analyzed, where working life histories can be characterized by tenure and total labor market experience. In this case the expression for earnings capacity takes the form

$$\begin{aligned} \ln E_t = \ln E_s + r_c \sum_{i=1}^{TEN} k_{c,i} + r_p \sum_{i=1}^{PEXP} k_{p,i} \\ + r_s \sum_{i=1}^{EXP} k_s \end{aligned} \quad (6.14)$$

where

PEXP = EXP - TEN = previous experience (time in the labor force prior to the current job),

r_j = the rate of return to investment in training on the current job ($j=c$), training prior to the current job ($j=p$) and search ($j=s$),

k_j = the investment ratio pertaining to training on the current job ($j=c$), training on the previous jobs ($j=p$) and search during the past labor market history ($j=s$).

Earnings capacity thus depends on the amount of and the returns to human capital accumulated within and outside the current job. It depends also on previous search activities.

Some assumptions about investment behavior are required in order to derive estimable equations. Consider the following relations:

$$k_c = k_{0,c} - \beta_c TEN \quad (6.15)$$

$$k_p = k_{0,p} - \beta_p PEXP \quad (6.16)$$

$$k_{0,c} = \gamma - \delta PEXP \quad (6.17)$$

$$\sum_{i=1}^{EXP} k_s = M \quad (6.18)$$

The initial investment ratio for segment i is denoted k_{0i} ($i=c,p$) and β_i is the associated rate of decline of this ratio. M is a vector capturing information about the workers mobility history.

The economic interpretations of these equations are as follows:

- (i) Since investment in human capital is likely to decrease over the life cycle, it may also decline within jobs. This behavior is implied by Eqs. (6.15) and (6.16).
- (ii) Eq. (6.17) implies that the initial investment ratio at the current job is a decreasing function of experience acquired outside this job. For persons with a continuous labor market participation this reflects lower initial investment ratios for jobs started at higher ages. This behavior is consistent with the basic conclusions from optimization models of life cycle human capital accumulation. Eq. (6.17) does not require any assumption about variable investment opportunities at the job. Workers may obtain their desired initial investment ratios by choosing jobs with the suitable training characteristics.
- (iii) Investments in job search are undertaken if the prospective gains to such activities are positive. On average we expect that job search and voluntary quits involve wage gains to workers (at least in terms of present values of lifetime earnings). This effect may offset the

possible negative earnings effect related to mobility induced reductions in the value of specific training.

Inserting Eqs. (6.15) - (6.18) into Eq. (6.14) and translating into continuous time gives

$$\begin{aligned} \ln E_t = \ln E_s + r_c \int_0^{\text{TEN}} (\gamma - \delta \text{PEXP} - \beta_c t) dt \\ + r_p \int_0^{\text{PEXP}} (k_{0,p} - \beta_p t) dt + r_s M \end{aligned} \quad (6.19)$$

which after integration yields

$$\begin{aligned} \ln E_t = \ln E_s + r_c \gamma \text{TEN} - \frac{r_c \beta_c \text{TENSQ}}{2} + r_p k_{0,p} \text{PEXP} \\ - \frac{r_p \beta_p \text{PEXPSQ}}{2} - r_c \delta \text{TEN} \cdot \text{PEXP} + r_s M \end{aligned} \quad (6.20)$$

where $\text{TENSQ} = \text{TEN} \cdot \text{TEN}$ and $\text{PEXPSQ} = \text{PEXP} \cdot \text{PEXP}$.

Since the worker's observed (log) wage is

$$\ln w_t = \ln E_s + \ln(1 - k_{c,t}) \quad (6.21)$$

we can arrive at the estimable wage equation

$$\begin{aligned} \ln w_t = \ln E_s - \gamma - \frac{\gamma^2}{2} + (r_c \gamma + \beta_c + \gamma \beta_c) \text{TEN} - \frac{(r_c \beta_c + \beta_c^2) \text{TENSQ}}{2} \\ + (r_p k_{0,p} + \delta + \gamma \delta) \text{PEXP} - \frac{(r_p \beta_p + \delta^2) \text{PEXPSQ}}{2} \\ - (r_c \delta + \delta \beta_c) \text{TEN} \cdot \text{PEXP} + r_s M \end{aligned} \quad (6.22)$$

where a second-order Taylor expansion has been used to approximate $\ln(1 - k_{c,t})$.

The rates of return and the investment parameters are not readily identifiable from estimates of Eq. (6.22). Note, however, that the interaction term provides a test of the investment hypothesis specified in Eq. (6.17); if the initial investment ratio in the current firm is unrelated to previous experience, i.e. $\delta=0$, the coefficient for $TEN \cdot PEXP$ will be insignificantly different from zero. Other tests are possible under some additional assumptions about investment behavior. Consider the case where investment ratios are invariant with respect to job mobility, as expressed in Eq. (6.7) above. This implies a wage equation as given by Eq. (6.23):

$$\begin{aligned} \ln w_t = & \ln E_s - k_0 - \frac{k_0^2}{2} + (r_c k_0 + \beta + \beta k_0) TEN \\ & - \frac{(r_c \beta + \beta^2) TENSQ}{2} + (r_p k_0 + \beta + \beta k_0) PEXP \\ & - \frac{(r_p \beta + \beta^2) PEXSQ}{2} - (r_c \beta + \beta^2) TEN \cdot PEXP + r_s M \end{aligned} \quad (6.23)$$

It is clear that these restrictions allow us to test whether $r_c > r_p$; this inequality holds if the coefficient for tenure exceeds the coefficient for previous experience. Likewise, the absolute value of the coefficient for $TENSQ$ should be greater than the absolute value of the coefficient for $PEXSQ$.

6.3 Empirical Analysis

6.3.1 Sample Characteristics

The data to be explored are from the Level of Living Surveys of 1968 and 1974. Unfortunately, there is little detailed information on past experiences of mobility. We have represented past mobility as follows:

$$M = \{ \text{Job mobility at least once since labor force entry (JM), migration at least once since age 16 (GM), job mobility and migration (JM \cdot GM)} \}$$

Job mobility is defined as change of employer; JM equals one if total years of experience are greater than years of tenure.

Table 6.1 gives information about basic characteristics of the workers in the two samples. Years of tenure are around 10 for men and around 6-7 for women; corresponding figures for previous experience are 12 and 8, respectively. Around 80 percent of the workers report some change of employer and around 60 percent report some locational change since age 16.

6.3.2 Estimation of Wage Equations

The segmented wage equation is given by Eq. (6.26). The post-schooling potential wage is represented by a linear schooling term. Controls for sex and marital status are also added.

Table 6.1 Characteristics of employees, 1968 and 1974

	1968		1974	
	Men	Women	Men	Women
Age	40	38	39	39
Married	0.71	0.62	0.75	0.72
Schooling	8.6	8.7	9.8	9.6
Experience (EXP)	23.0	14.7	21.7	14.6
Tenure (TEN)	10.1	6.1	10.1	7.0
Previous experience (PEXP)	12.9	8.6	11.6	7.6
Job mobility (JM)	0.83	0.79	0.83	0.78
Migration (GM)	0.62	0.66	0.57	0.62
Job mobility with migration (JM•GM)	0.57	0.56	0.51	0.52
ln wage	7.010	6.688	7.582	7.316
Sample size	1948	1236	1749	1326

Note: The following variables are (0,1)-dummies: Married, Job mobility, Migration and Job mobility with migration. (JM=1 if EXP>PEXP). The wage rate is earnings per hour in Swedish öre.

Source: The Level of Living Surveys of 1968 and 1974.

Estimation results are presented in Table 6.2; all coefficients except the intercept are here constrained to be equal for men and women. Measurement errors in the data result in some cases in negative values of previous experience; the data do not preclude tenure to exceed years of work experience. Table 6.2 gives estimations based on observations with non-negative values of previous experience in columns (2) and (4). It turns out that the basic results are independent of whether this sample restriction is imposed.

Inspection of Table 6.2 reveals a number of noteworthy results. Focusing first on the experience variables, we observe that the interaction term, $TEN \cdot PEXP$, shows up with a highly significant negative sign. The interpretation is that the initial investment ratio in the current firm is negatively related to previous experience; jobs started closer to the horizon will involve less training since the payoff period is shorter.

The estimated equations show that the tenure-coefficient exceeds the coefficient for previous experience. The difference between the coefficients is largest in 1974. For this year we also observe that the coefficient for $TENSQ$ is substantially larger (in absolute value) than the coefficient for $PEXPSQ$. If we are willing to assume that life time investment behavior is roughly independent of job mobility, the conclusion would be that returns to inside training exceed returns to outside training. Hence, a fraction of accumulated knowledge is not transferable between jobs.

A comparison of the estimates for 1968 and 1974 shows a marked decrease over time in the coeffi-

Table 6.2 Wage equations for 1968 and 1974
(t-ratios in parentheses)

	1968		1974	
	(1)	(2)	(3)	(4)
Constant	5.791 (178.4)	5.790 (172.6)	6.685 (235.5)	6.676 (224.8)
Women	-0.251 (-18.38)	-0.252 (-18.24)	-0.212 (-18.93)	-0.207 (-18.22)
Married	0.153 (10.16)	0.150 (9.847)	0.089 (7.079)	0.086 (6.820)
Schooling	0.076 (31.68)	0.075 (31.03)	0.046 (26.29)	0.047 (26.29)
TEN	0.034 (15.01)	0.035 (14.43)	0.031 (15.58)	0.031 (14.37)
TENSQ/1000	-0.488 (-9.202)	-0.505 (-8.702)	-0.501 (-10.02)	-0.455 (-8.417)
PEXP	0.030 (14.59)	0.028 (12.94)	0.020 (10.79)	0.020 (9.958)
PEXPSQ/1000	-0.535 (-13.01)	-0.483 (-10.38)	-0.361 (-9.317)	-0.339 (-7.553)
TEN•PEXP/1000	-0.913 (-12.16)	-1.004 (-11.05)	-0.817 (-10.96)	-0.820 (-9.629)
JM	0.074 (2.962)	0.087 (3.245)	0.087 (4.305)	0.095 (4.311)
GM	0.139 (4.466)	0.121 (3.563)	0.132 (5.242)	0.154 (5.427)
JM•GM	-0.067 (-1.955)	-0.047 (-1.267)	-0.086 (-3.088)	-0.106 (-3.452)
R ²	0.448	0.446	0.388	0.387
Sample size	3164	3078	3070	2940

Note: Eqs. (2) and (4) are restricted to observations for which PEXP > 0 hold.

cient for previous experience and a smaller decrease in the tenure-coefficient. Likewise the absolute value of the coefficient for PEXPSQ is strongly reduced whereas the coefficient for TENSQ is roughly unchanged. It appears as if the rate of return differential between inside and outside training is small or negligible in 1968 but substantial in 1974. It seems as if human capital specificity is growing in importance; skills acquired on the job were more transferable across jobs in 1968 than in 1974.

Turning, next, to the returns to job search, we find that local job changes ($JM=1$ and $GM=0$) are associated with an upward shift of the earnings profile amounting to 7-9 percent in 1968 and 9-10 percent in 1974. The returns to inter-local job mobility ($JM=1$ and $GM=1$) is 14-16 percent in 1968 and 13-14 percent in 1974.

Pure residential mobility ($JM=0$ and $GM=1$) involves a shift of the profile of around 12-15 percent. It is not clear exactly what kind of job mobility that is captured by this latter category. Workers who always have worked for the same employer but report locational changes may have had experiences of transfers between plants. The locational changes may also reflect mobility associated with studies or other non-market activities. We would certainly expect wage premiums from inter-regional job transfers; such transfers may typically be promotions. It is less clear why residential mobility per se should affect earnings. The data are unfortunately unable to distinguish between mobility between companies, and mobility between plants.

Among other results displayed in Table 6.2, we observe that the standardized wage differential between men and women amounted to 25 percent 1968 and 20 percent 1974. Being married implied 15 percent higher wage rates in 1968 and 9 percent higher wages in 1974. The schooling coefficient is also reduced in size; the rate of return to an additional year of education was 8 percent 1968 but only 5 percent in 1974.

A hypothesis put forward by Borjas (1981) is that the level of investment at each job is an increasing function of the prospective duration of the job. The idea is not easily translated into a testable form, since data on expected job durations are rare. We run separate regressions for those who reported their jobs to be "permanent" (as opposed to those who anticipated a job separation). The results were very similar to the results for the whole sample.

Wage Equations by Sex

The wage equations specified and estimated are based on the assumption that differences between the male and female wage functions can be represented solely by an intercept dummy. In other words, the slopes of the experience-earnings profiles are constrained to be the same for both sexes. This restriction may be questioned according to some well-known arguments provided by the human capital framework. The basic idea is that women expect to spend less time in the labor force and will have weaker incentives to engage in human capital investments. (See Mincer and Polachek, 1974.) The resulting female earnings profiles will consequently be flatter for women than for men.

It is straightforward to check for wage equation differences between the sexes by running separate regressions for men and women. The results in Table 6.3 reveal some interesting differences. The male coefficients for tenure and previous experience are virtually identical in 1968, indicating that job changes did not reduce the value of acquired training; in fact, the coefficient for PEXPSQ is larger, in absolute value, than the coefficient for TENSQ. The corresponding female coefficients, however, differ substantially; the tenure coefficient is almost twice as large as the coefficient for previous experience and the absolute value of the coefficient for TENSQ is more than twice as large as the coefficient for PEXPSQ.

A comparison across years reveals a decrease in the male coefficient for previous experience but no change in the tenure coefficient. Obviously the interpretation in terms of increased specificity in on-the-job training is valid for men. The picture for women does not fit that story exactly; the coefficients for tenure and previous experience are both reduced, although in similar proportions. What we observe in 1974 are experience earnings profiles with almost negligible differences between the sexes. The basic similarity also hold for the "wage premium" to marriage. Married men in 1968 had 17 percent higher wage rates than unmarried men; the corresponding number for married women was 13 percent. In 1974 we find that married men had 9 percent higher wages than unmarried men and that married women had 8 percent higher wages than unmarried women.

Other noteworthy differences across sexes and years pertain to the mobility variables. Men in

Table 6.3 Wage equations for 1968 and 1974, by sex
(t-ratios in parentheses)

	1968		1974	
	Men	Women	Men	Women
Constant	5.801 (150.1)	5.513 (100.3)	6.696 (191.3)	6.436 (144.6)
Married	0.168 (8.393)	0.133 (5.510)	0.093 (5.615)	0.083 (4.123)
Schooling	0.073 (25.03)	0.080 (18.84)	0.047 (21.17)	0.047 (16.09)
TEN	0.031 (11.31)	0.045 (9.205)	0.031 (12.29)	0.033 (9.408)
TENSQ/1000	-0.417 (-7.037)	-0.838 (-5.581)	-0.475 (-8.086)	-0.593 (-5.806)
PEXP	0.030 (12.09)	0.027 (6.239)	0.023 (9.674)	0.018 (5.370)
PEXPSQ/1000	-0.545 (-11.83)	-0.398 (-3.688)	-0.393 (-8.624)	-0.341 (-4.407)
TEN•PEXP/1000	-0.865 (-10.10)	-1.289 (-5.989)	-0.764 (-9.830)	-0.722 (-5.310)
JM	0.102 (3.414)	0.052 (1.141)	0.060 (2.363)	0.119 (3.604)
GM	0.182 (4.426)	0.078 (1.563)	0.085 (2.478)	0.176 (4.611)
JM•GM	-0.120 (-2.695)	0.013 (0.236)	-0.053 (-1.426)	-0.113 (-2.613)
R ²	0.422	0.332	0.333	0.270
Sample size	1937	1227	1747	1323

Note: Observations for which PEXP < 0 hold are not excluded. The results from data for which PEXP > 0 are almost identical.

1968 receive an upward shift of the earnings profile of 10 percent upon a local job change and a gain of 16 percent upon an inter-local change. The women's mobility gains are smaller, if any; all mobility coefficients are, in fact, insignificantly different from zero.

In 1974 the pattern is almost reversed. Men's mobility gains are now reduced (6 percent for local job changes, 10 percent for inter-local job mobility). Women's gain, however, has increased substantially (12 percent for local job changes, 19 percent for inter-local job mobility). One should, of course, not take these precise numbers too seriously. Nevertheless, they indicate a noteworthy change over time. The much stronger female labor force attachment of 1974 appears to have involved structural shifts in the female earnings function. The similarities between the male and female equations outweigh the differences.

6.3.3 The Rewards to Mobility over the Life Cycle

Two basic findings emerge from the above estimations. First, it appears as if job mobility and migration are associated with an upward shift of the earnings profile. There is, however, also a loss of specific training associated with a job change. The latter effect will affect the level as well as the slope of the earnings profile. The net effect on earnings is ambiguous a priori, but can be calculated from our estimates.

We can now make some illustrative calculations showing how discounted future earnings are af-

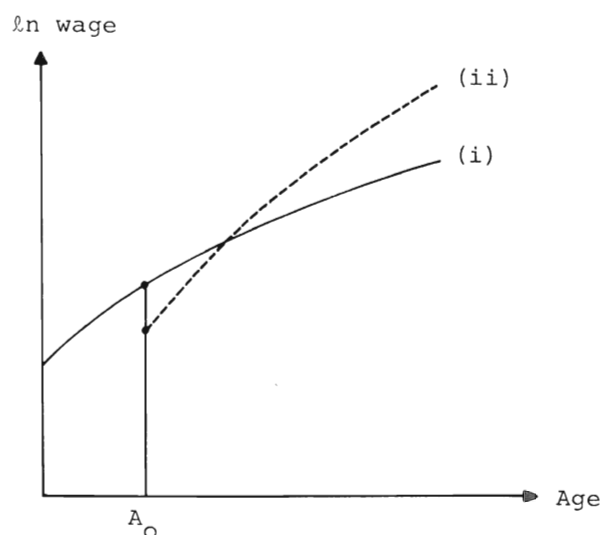
affected by alternative "mobility careers". The calculations will be contingent upon some strong and not very realistic assumptions, but may be instructive for two reasons. First, we will be able to demonstrate how returns to mobility vary over the life cycle and, secondly, we can provide some information about changes over time in the patterns of returns to mobility.

Consider Figure 6.1. A worker of age A_0 has so far made no job change and expects to follow path (i) if he refuses to move. He may, however, consider a prospective earnings stream such as (ii). Presumably, the choice will be dictated in part by a comparison of discounted present values associated with the two paths. Such a comparison is in principle not difficult to make given our estimated earnings function.

The reference-path is the stayer-career ((i) in Figure 6.1). We compute the discounted present value of earnings, assuming a discount rate of 4 percent, at different points in the life cycle; the selected points are ages 25, 35, 45 and 55. The horizon is set at 65. These reference earnings are compared with the present value of moving (local job change and inter-local job change). The alternative earnings streams are discounted back to the four chosen points during the life cycle. Hence, we do not calculate total lifetime earnings but rather earnings pertaining to the remaining labor force period.

Needless to say, the use of cross-sectional earnings profiles to characterize life cycle wage growth is not without problems. The results reported below should be viewed as rough indicators

Figure 6.1 Alternative earnings paths, mover and stayer



on how the returns to mobility vary over the life cycle; more reliable estimates would require longitudinal data.

The results set out in Table 6.4 have two noteworthy features. First, there is a very pronounced age-pattern in the rewards to mobility. Young workers receive positive changes in discounted earnings upon moving; old workers experience decreases in earnings. Another interesting observation is that the rewards to job changes seem to have undergone a substantial reduction between 1968 and 1974 for young and middle-aged workers. Finally, we can note that inter-local job mobility entails higher wage premiums than local job changes; this is, of course, a reasonable result, but it is obvious from Table 6.3 alone.

Table 6.4 Change in the present value of male earnings due to mobility, in percent of (discounted) stayer earnings

Mobility at age	1968		1974	
	Local job mobility	Inter-local job mobility	Local job mobility	Inter-local job mobility
25	8.5	15.5	2.5	5.8
35	3.6	10.3	-1.7	1.5
45	-3.3	2.9	-5.4	-2.3
55	-11.9	-6.2	-8.9	-0.06

Note: The calculations are based on the estimates in Table 6.3. The discount rate is 4 percent and labor force exit is assumed to occur at age 65.

6.3.4 Other Issues

The above wage equations disregard the fact that job mobility may have a variety of different causes, such as voluntary job changes, mobility related labor force interruptions or job changes due to layoffs and subsequent unemployment. There is little reason to believe that such different sources of mobility have identical wage consequences. Unfortunately, the data set precludes any detailed analysis of these issues. A few remarks are nevertheless in order.

First, regarding the distinction between voluntary and involuntary mobility, it appears that unemployment-induced mobility plays a relatively minor role in the Swedish labor market. Among those who changed locality between 1968 and 1974, only 12 percent reported that the last move was caused by difficulties of obtaining a job (Vuksanovich, 1979).

The retrospective data on unemployment provide additional information of interest. It shows that 15 percent of those employed 1974 had been unemployed at least once during the last 5 years (i.e. roughly 1969-73).

The relationships between unemployment and subsequent wages have been explored by Björklund (1981). His basic finding is that the unemployment occurrence per se has negligible effects on future wage rates. There is, however, some evidence indicating that long duration of unemployment may have adverse wage consequences.

The idea of tied spouses, notably tied wives, was discussed in Chapter 5. To what extent do locational changes on part of two-person households imply a deterioration in the women's economic position? The effects may show up as labor force exits, unemployment or job changes associated with wage reductions. The procedure for dealing with the third possible effect is straightforward: A dummy for married women with recent experiences of locational changes can be appended to the wage equation.

For 1968 we found a significant positive difference between all recent migrants and married women in this category. This evidence in favor of the tied wife hypothesis was, however, not supported by the data for 1974. Suffice it here to say that the data for the mid-seventies did not support the tied wife hypothesis as far as wage rates go.

6.4 Concluding Remarks

A certain amount of a worker's acquired training is specific to the job and, by definition, not transferable across different jobs. In this chapter we have applied a simple earnings-model with special emphasis on the role of specific human capital. The analysis provides a number of new empirical results, with implications for the behavior of earnings and mobility over the life cycle. It gives clues to an understanding of the trends in mobility as well.

The analysis confirms the importance of distinguishing between general and specific work experience. The returns to training acquired on the current job appear to exceed returns to outside experience. The possibility of a capital loss upon a job change is therefore obvious. For men, the importance of specificity has increased between 1968 and 1974. This, in turn, implies stronger incentives to avoid job changes.

Mobility decisions are likely to be affected by the available alternative prospective earnings streams. The calculations in this chapter show that hypothetical (discounted) income gains from mobility fall rapidly over the life cycle. The well-known inverse relationship between age and mobility rates has therefore a straightforward economic interpretation.

One piece of evidence has relevance for the interpretation of the secular changes in various mobility rates, as described in Chapter 2. We show that the prospective returns to mobility have decreased

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between the 60s and the 70s. This, in turn, appears to be due to the increasing degree of specificity in on-the-job training.

**7 LABOR MOBILITY AND WAGE GROWTH:
 ON SELECTION RULES AND REWARDS**

7.1 Introduction*

This chapter has two interrelated objectives. The first aim is to explore the role of expected wage gains in mobility decisions. The second aim is to investigate the effects of mobility on subsequent earnings. Do workers actually gain by moving or would they do better by not moving? This information, in turn, will illuminate the relationships between life cycle earnings profiles and life cycle patterns of job mobility.

The approach in this chapter is an extension of the standard approach in mobility studies, in which earnings differentials between stayers and movers are captured by a dummy variable in an earnings function. A tacit assumption in this traditional approach - adhered to in the previous chapter - is that the computed wage differential (if positive) measures the stayers gain from moving, had they moved. However, the movers and stayers are not randomly selected groups but rather self-selected, presumably on the basis of perceived benefits associated with the alternatives. The earnings of movers are, therefore, not necessarily attributable to stayers, had they moved; nor are the stayers' earnings necessarily attributable to those who actually moved, had they not moved.

* A previous version of this chapter was presented at the European Econometric Society Meeting in Dublin, September 1982.

The analysis in this chapter takes the interdependence between wage growth and mobility into account; wage growth rates are affected by mobility and the mobility decision responds to alternative prospective wage growth rates. The framework we use results in a model with binary and limited dependent variables.¹

7.2 The Model

Assume that the worker's mobility decision is based on a comparison between two prospective earnings streams associated with job mobility and no job change, respectively. The worker knows, at each point in time, his actual wage and has anticipations about his wage growth. Mobility occurs if discounted life time earnings, net of job transfer costs, are improved, i.e.,

$$V_{mi} - V_{si} - C_i > 0 \quad (7.1)$$

where V_{mi} , V_{si} are the life time earnings of the i th individual related to moving and staying, respectively. The cost of changing job is denoted C_i .

To simplify the analysis, we assume that the worker behaves as if his working life were of infinite length. However, each worker is facing a known and constant death risk, δ . Likewise, he is aware of the possibility of involuntary separations from the firm. Denote the separation probability by μ and assume that the worker treats μ as a constant. There is little reason to expect separation probabilities to be independent of the worker's mobility decision; because of seniority

rules, we would expect higher layoff-risks in a hypothetical new firm than in the current one. Taking account of positive death and layoff risks, the "total" discount rate is

$$\rho_{mi} = r_i + \delta_i + \mu_{mi} \quad (7.2)$$

$$\rho_{si} = r_i + \delta_i + \mu_{si} \quad (7.3)$$

where r_i is the conventional discount rate. The present values of earnings for the alternative options are then

$$V_{mi} = \int_0^{\infty} w_{oi} \exp(g_{mi}t - \rho_{mi}t) dt = w_{oi} / (\rho_{mi} - g_{mi}) \quad (7.4)$$

$$V_{si} = \int_0^{\infty} w_{oi} \exp(g_{si}t - \rho_{si}t) dt = w_{oi} / (\rho_{si} - g_{si}) \quad (7.5)$$

where w_o is the initial wage rate and g_m , g_s are rates of wage growth associated with mobility and staying, respectively.

The wage growth functions related to mobility and staying are given by

$$g_{mi} = X_i \beta_m + \epsilon_{mi} \quad (7.6)$$

$$g_{si} = X_i \beta_s + \epsilon_{si} \quad (7.7)$$

where $\epsilon_m \sim N(0, \sigma_1)$, $\epsilon_s \sim N(0, \sigma_2)$

and, likewise, the discount rates are given by

$$\rho_{mi} = Q_{mi} \gamma_m + \eta_{mi} \quad (7.8)$$

$$\rho_{si} = Q_{si} \gamma_s + \eta_{si} \quad (7.9)$$

where $\eta_m \sim N(0, \sigma_3)$, $\eta_s \sim (0, \sigma_4)$.

Now assume that job transfer costs are proportional to prospective income with the current employer, and related to a vector Z of various personal and other characteristics, i.e.²,

$$C_i/V_{si} = Z_i \theta + u_i \quad (7.10)$$

where $u_i \sim N(0, \sigma_5)$

Let I_i denote the selection index and let $c_i = C_i/V_{si}$. The criterion for moving becomes then

$$\begin{aligned} I_i &= \ln(V_{mi}/V_{si}(1+c_i)) = \\ &= -\ln(\rho_{mi}-g_{mi}) + \ln(\rho_{si}-g_{si}) - \ln(1+c_i) > 0 \end{aligned} \quad (7.11)$$

which, through a Taylor approximation around the means, can be rewritten as

$$I_i = \alpha_0 + \alpha_1(g_{mi}-\rho_{mi}) + \alpha_2(g_{si}-\rho_{si}) + \alpha_3 c_i \quad (7.12)$$

where $\alpha_1 = 1/(\bar{\rho}_m - \bar{g}_m)$, $\alpha_2 = -1/(\bar{\rho}_s - \bar{g}_s)$ and $\alpha_3 \approx -1$ (assuming c_i to be small).

The wage growth equations (7.6) and (7.7) cannot be estimated for all individuals; g_m is only observed for those who move, g_s only for those who stay. The conditional expectations are

$$E(g_{mi} | I_i > 0) = X_i \beta_m + E(\epsilon_{mi} | I_i > 0) \quad (7.13)$$

$$E(g_{si} | I_i < 0) = X_i \beta_s + E(\epsilon_{si} | I_i < 0) \quad (7.14)$$

Those observed mean wage increases may differ from the population means if the error terms pertaining to the censored samples have non-zero means. The approach followed involves finding explicit expressions for the error terms. Substitute, therefore, Eqs. (7.6) - (7.10) into Eq. (7.12)

$$I_i = \alpha_0 + X_i(\alpha_1\beta_m + \alpha_2\beta_s) - \alpha_1 Q_{mi}\gamma_m - \alpha_2 Q_{si}\gamma_s + \alpha_3 Z_i\theta + \alpha_1\epsilon_{mi} + \alpha_2\epsilon_{si} - \alpha_1\eta_{mi} - \alpha_2\eta_{si} + \alpha_3 u_i = W_i\Pi - \epsilon_i^* \quad (7.15)$$

where

$$W_i = (X_i, Q_{mi}, Q_{si}, Z_i) \text{ and}$$

$$-\epsilon_i^* = \alpha_1\epsilon_{mi} + \alpha_2\epsilon_{si} - \alpha_1\eta_{mi} - \alpha_2\eta_{si} + \alpha_3 u_i.$$

The probability of observing a person as mover is accordingly

$$\Pr(I_i > 0) = \Pr(W_i\Pi > \epsilon_i^*) = F(W_i\Pi/\sigma_{\epsilon^*}) \quad (7.16)$$

where $F(\cdot)$ is the standardized cumulative normal density function. Obviously,

$$\Pr(I_i < 0) = 1 - F(\cdot).$$

Next, define λ_{mi} and λ_{si} as

$$\lambda_{mi} = -f(W_i\Pi/\sigma_{\epsilon^*})/F(\cdot) \quad (7.17)$$

$$\lambda_{si} = f(W_i\Pi/\sigma_{\epsilon^*})/(1-F(\cdot)) \quad (7.18)$$

It can be shown that

$$E(\epsilon_{mi} | \epsilon_i^* < W_i \Pi) = (\sigma_{1\epsilon^*} / \sigma_{\epsilon^*}) \lambda_{mi} \quad (7.19)$$

$$E(\epsilon_{si} | \epsilon_i^* > W_i \Pi) = (\sigma_{2\epsilon^*} / \sigma_{\epsilon^*}) \lambda_{si} \quad (7.20)$$

where $\sigma_{1\epsilon^*}$ and $\sigma_{2\epsilon^*}$ are covariance terms. Hence it turns out that non-zero covariances may introduce sample selection bias. If the error in the decision equation is uncorrelated with the errors in the wage equations, no bias will occur. Note, however, that OLS estimation and non-zero covariances will only bias the intercept if the relevant selection variable is uncorrelated with the variables included in the X-vector.

The estimating wage change equations, conditional on observed mobility status, will be

$$g_{mi} = X_i \beta_m + \kappa_m \hat{\lambda}_{mi} + \xi_{mi} \quad (7.21)$$

$$g_{si} = X_i \beta_s + \kappa_s \hat{\lambda}_{si} + \xi_{si} \quad (7.22)$$

where $E(\xi_{mi} | I_i > 0) = 0$, $E(\xi_{si} | I_i < 0) = 0$,

$$\kappa_m = \sigma_{1\epsilon^*} / \sigma_{\epsilon^*} \quad \text{and} \quad \kappa_s = \sigma_{2\epsilon^*} / \sigma_{\epsilon^*}$$

The introduction of the variables $\hat{\lambda}_{mi}$ and $\hat{\lambda}_{si}$, predicted from the reduced form probit (7.16), will result in consistent OLS-estimates purged of selection bias (if no other sources of selectivity bias exist).

The estimated wage change equations yield predicted wage growth rates for each individual,

$\hat{g}_{mi}$ and $\hat{g}_{si}$, which can be substituted back into the structural index,

$$I_i = \alpha_0 + \alpha_1 \hat{g}_{mi} + \alpha_2 \hat{g}_{si} - \alpha_1 Q_{mi} \gamma_m - \alpha_2 Q_{si} \gamma_s + \alpha_3 Z_i \theta - \epsilon_i^* \quad (7.23)$$

which also is estimable by probit. It can be noted that the parameter vectors γ_m , γ_s and θ show up in the same form in the reduced form index as in the structural index.

7.3 Variables and Data

The data analyzed are from the Swedish Level of Living Surveys of 1968 and 1974. In particular, we will explore the determinants of mobility and wage growth for male workers between 1968 and 1974. Mobility is defined as change of employer and is implicitly given by the respondents' reports on tenure in the 1974 survey. Workers who report 1968 as hiring year both in 1968 and in 1974 were excluded from the sample (since change of employer is uncertain in this case). Workers with uncertain wage reports were also excluded, as were persons with unemployment experiences during the period. The reason for the latter restriction is that our framework may not apply to job changes due to "involuntary" unemployment. There is no possibility of distinguishing different types of unemployment in the current data set.

The general framework outlined above includes five stochastic equations. The two wage growth equations include a vector of explanatory variables specified as follows:

$$X = \{\Delta\text{Schooling}, \Delta\text{Experience}, \Delta(\text{Experience})^2, \\ \Delta\text{Marital status}, \text{local unemployment rate}, \\ \ln \text{initial wage}\}$$

This corresponds to a standard human capital earnings function, where log earnings are explained by education, work experience and work experience squared (and possibly some other personal characteristics as well).³ Changes in log earnings will accordingly be related to changes in the human capital attributes. We have also added the local unemployment rate to the wage change equation, capturing responses to varying degrees of labor market tightness.

The period of investigation is characterized by ambitious efforts by the trade unions to reduce existing wage differentials (the so-called wage policy of solidarity). A concurrent change was marked increase in university educated manpower. Those changes may have affected the returns to schooling and on-the-job training. We take account of this possibility by including the initial wage level in the wage change equation. It can be shown that this specification amounts to a uniform proportional change of all parameters of the wage level equations. See Appendix A for details.

The vector Z, capturing mobility costs, is given as

$$Z = \{\text{tenure}, (\text{tenure})^2, \text{age}, \text{marital status}, \\ \text{recently moved}\}$$

The arguments are basically self-explanatory. A worker's ties with the employer will increase with his length of tenure. This is due to accumulated

firm-specific human capital, but also to firm-specific ties arising from established social relations with co-workers.

Insofar as job mobility involves migration, we also expect that mobility costs are higher for older workers, for married ones and for persons with a substantial length of residence in the current locality. Older workers are likely to face higher psychic migration costs and, because of their accumulations of consumer durables, higher pure monetary mobility costs as well. Married workers will also be constrained by family ties, as with the wife's attachment to the local labor market. Finally, persons who recently moved to the current locality should have negligible locational ties, and consequently be less reluctant to move again.

The Q-vectors explaining discount rates are specified to include tenure and age variables. In particular, workers with short tenure are facing higher layoff risks with their current employer. And old workers are likely to place more emphasis on returns in the near rather than in the distant future. Hence,

$$\begin{aligned} Q_m &= \{\text{age}\} \\ Q_s &= \{\text{tenure}, (\text{tenure})^2, \text{age}\} \end{aligned}$$

The data are summarized in Table 7.1. Movers generally tend to be younger, unmarried and with shorter length of tenure. The initial wage level is lower for movers, whereas their rate of wage growth is higher than the average. In terms of nominal growth rates per year, movers receive 11.9 percent and stayers 9.4 percent. In real terms

Table 7.1 Sample characteristics

	All workers	Job movers	Job stayers
Age	37	32	40
Recently moved to current locality (=1 if the person moved in 1967 or 1968, zero otherwise)	0.09	0.14	0.06
ΔSchooling	0.8	1.1	0.7
ΔExperience	5.2	4.9	5.3
Marital status (=1 if married, zero otherwise)	0.73	0.55	0.81
ΔMarital status	0.10	0.22	0.05
Tenure	9.8	5.2	12.0
Local unemployment rate	2.1	2.1	2.1
ln initial wage	7.066	6.959	7.116
Real wage increase per year, percent	3.6	5.3	2.8
Sample size	1047	330	717

Note: The figures refer to 1968 and to changes between 1968 and 1974. The wage rate is earnings per hour in Swedish öre. The local unemployment rate is the average for 1970-73 of unemployment rates in regions of co-operating communes (A-regions). Age, Schooling, Experience and Tenure are measured in years.

(before taxes) these figures imply 5.3 percent for movers and 2.8 percent for stayers.

7.4 Empirical Results

7.4.1 Wage Change and Reduced Form Decision Equations

The first step of the estimation procedure involves estimating the reduced form probit, as given by Eq. (7.16). The results are set out in the first two columns of Table 7.2. As spelled out above, the reduced form includes arguments of the wage growth equations as well as the equations for mobility costs and discount rates.

The wage change equations include the initial wage level among the RHS variables. There is, however, reason to question the assumption of uncorrelatedness of the initial wage level with the error terms of the wage change equations (see Appendix A). We applied the Wu test as a check.⁴ The (log) initial wage level was regressed on a number of personal characteristics and human capital attributes and the residuals were appended as a new variable to the wage change equation. The coefficients on the residual variables were significantly different from zero in both wage change equations, thus indicating possible simultaneous equations bias.

The estimates presented are, therefore, given under two alternative assumptions about the error terms of the wage change equations. First, we maintained the hypothesis of zero correlation between errors and RHS variables; hence the initial

Table 7.2 Estimated decision equations
(t-ratios in parentheses)

	Reduced form		Structural form		
	(1)	(2)	(3)	(4)	(5)
Constant	2.129 (2.415)	0.872 (0.691)	0.474 (3.086)	0.090 (0.423)	0.057 (0.153)
$\hat{g}_m$			17.02 (2.552)	14.30 (2.228)	14.67 (2.010)
$\hat{g}_s$			-24.86 (-2.222)	-20.92 (-1.861)	-21.31 (-1.803)
Recently moved to current locality	0.294 (1.949)	0.274 (1.807)	0.269 (1.809)	0.254 (1.712)	0.256 (1.710)
Tenure	-0.113 (-7.802)	-0.115 (-8.011)	-0.108 (-7.583)	-0.110 (-7.587)	-0.111 (-7.569)
(Tenure) ² /100	0.214 (5.397)	0.225 (5.827)	0.211 (5.278)	0.215 (5.364)	0.215 (5.350)
Married	-0.319 (-2.485)	-0.377 (-2.847)	-0.347 (-3.304)	-0.431 (-3.848)	-0.433 (-3.822)
Local unemployment rate	0.006 (0.116)	0.010 (0.210)			
ln initial wage	-0.207 (-1.620)				
ln predicted initial wage		0.119 (0.583)			
Age		-0.027 (-2.166)			0.000 (0.108)
Δ Marital status	0.143 (1.100)	0.113 (0.862)			
Δ Schooling	0.045 (1.454)	0.037 (1.214)			
Δ Experience	-0.077 (-2.179)	-0.173 (-3.113)			
Δ (Experience) ² / 1 000	-0.019 (-0.046)	0.002 (1.989)			
Log likelihood	-543.22	-542.00	-545.55	-547.66	-547.65
Likelihood ratio	218.51	220.96	213.86	209.64	209.65

Note: Column (3) corresponds to wage growth equations estimated by OLS, columns (4) and (5) to wage growth equations with instrumented initial wage on the RHS.

wage was used as regressor. Second, the initial wage was treated as endogenous and therefore predicted by a set of instrumental variables.

The reduced form estimates are used to compute selectivity variables $\hat{\lambda}_{mi}$ and $\hat{\lambda}_{si}$, respectively. Those are appended to the estimating wage change equations. The results are given in Table 7.3.

The human capital variables have signs consistent with a priori expectations. Wage rates increase with improved education and increase, at a decreasing rate, with years of work experience; the negative (and highly significant) sign for the coefficient of the squared experience variable implies lower wage growth rates for older workers. The local unemployment rate shows up with coefficients of expected signs, although with fairly large standard errors.

Another finding deals with the role of the initial wage rate. It appears as if initial earnings have substantial detrimental effects on wage growth during this period. This is consistent with other evidence of a reduction in wage dispersion. It is beyond the scope of this paper to explore the causes behind this process of wage equalization. Suffice it here, again, to mention that significant changes in the supply of university-educated manpower have taken place. And the importance of the "wage policy of solidarity", pursued by the trade unions in centralized collective bargaining, could hardly be overlooked.

To what extent do the experiences of actual movers also capture what a random sample of workers would have earned, had they moved? The evidence on selec-

Table 7.3 Estimated wage growth equations

(t-ratios in parentheses)

Dependent variable: $\ln(1974 \text{ Wage}) - \ln(1968 \text{ Wage})$

	Job stayers		Job movers	
	(1)	(2)	(3)	(4)
Constant	3.146 (20.73)	2.295 (10.22)	4.872 (19.70)	3.440 (7.177)
Δ Schooling	0.012 (2.280)	0.006 (0.904)	0.022 (2.531)	0.023 (1.963)
Δ Experience	0.014 (2.392)	0.005 (0.791)	0.011 (1.208)	0.006 (0.437)
$\Delta(\text{Experience})^2 / 1000$	-0.236 (-3.774)	-0.191 (-2.627)	-0.551 (-4.363)	-0.483 (-2.897)
Δ Marital status	0.008 (0.382)	0.015 (0.598)	0.014 (0.462)	-0.003 (-0.078)
Local unemployment rate	-0.013 (-1.720)	-0.015 (-1.657)	-0.013 (-0.890)	-0.019 (-0.992)
$\ln$ initial wage	-0.368 (-18.28)	-	-0.599 (-16.46)	-
$\ln$ predicted initial wage	-	-0.246 (-8.151)	-	-0.375 (-5.443)
$\hat{\lambda}_s$	0.057 (1.669)	0.108 (2.735)	-	-
$\hat{\lambda}_m$	-	-	-0.012 (-0.264)	0.085 (1.351)
R^2	0.414	0.190	0.561	0.231
MSE	0.033	0.045	0.058	0.101
F	71.66	23.74	58.82	13.84

tion bias in the movers' wage equation is inconclusive. There is some weak indication of negative selection bias when the predicted initial wage is used as regressor. (Note that $\hat{\lambda}_m$ is negative; a positive coefficient implies a negative selection effect.)

The evidence on selection bias is more conclusive when we turn to the stayers' wage equation. The estimated $\hat{\lambda}_s$ -coefficients are positive in both forms of wage change equations, implying positive censoring effects (since $\hat{\lambda}_s > 0$). The implication is that those who chose to stay did better as stayers than what measurably similar movers would have done, had they decided not to move.

A selection rule based on comparative advantage would suggest that individuals choose mobility status on the basis of perceived benefits associated with the alternatives. Those actually observed as movers (stayers) would be precisely those who are likely to benefit from being movers (stayers). This leads us to expect positive censoring effects.

7.4.2 Prospective and Actual Wage Gains

The estimated wage change equations for stayers and movers allow us to impute hypothetical wage growth rates to each individual in the sample. The computations are straightforward. The characteristics of each individual are applied to the Eqs. (7.6) and (7.7), giving hypothetical wage increases as $\hat{g}_{mi} = X_i \beta_m$ and $\hat{g}_{si} = X_i \beta_s$. The results of the calculations, expressed in terms of yearly real wage growth rates, are set out in Table 7.4.

**Table 7.4 Actual and hypothetical real wage
growth rates 1968-74**
Percent per year

	Actual wage growth	Wage growth, moving	Wage growth, staying
All workers	3.6	5.5	2.3
Age 16-29	6.2	8.2	3.8
Age 30-49	2.5	4.5	1.7
Age 50-	1.9	3.4	1.4
Movers	5.3	(6.7)	3.0
Stayers	2.8	4.9	(2.0)

Note: The estimates in column (2) and column (4) of Table 7.3 have been used.

The numbers in the table may be interpreted as wage change prospects that workers are facing ex ante (Björklund, 1983). It can be noted that prospective wage gains associated with mobility decrease over the life cycle; young workers (age 16-29) expect the moving option to yield a 4 percent higher growth rate whereas old workers (over 50) receive a corresponding premium of 2 percent.

Consider, next, wage gains to mobility for those who actually have moved. For worker i the wage gain equals the expected wage increase in the mobility case less that in the nonmobility case, conditional on the fact that the worker is a mover. The relevant expression is

$$E(g_{mi} - g_{si} | I_i > 0) = X_i(\beta_m - \beta_s) + (\sigma_{1\varepsilon}^* - \sigma_{2\varepsilon}^*)\lambda_{mi} \quad (7.24)$$

The first term on the RHS of Eq. (7.24) gives the predicted wage gain for a worker drawn at random

with characteristics X_i . The second term captures the self-selection, or sorting, effect.

Using the estimates of $\sigma_{1\epsilon}^*$ and $\sigma_{2\epsilon}^*$ from columns (2) and (4) in Table 7.4, we can infer that the last term in Eq. (7.24) is positive (since $\sigma_{1\epsilon}^* - \sigma_{2\epsilon}^* < 0$ and $\lambda_{mi} < 0$). This indicates the presence of positive sorting gains; the excess wage growth from changing versus staying is higher for actual movers than for stayers. Note that the stayers' excess wage growth from changing is given by

$$E(g_{mi} - g_{si} | I_i < 0) = X_i(\beta_m - \beta_s) + (\sigma_{1\epsilon}^* - \sigma_{2\epsilon}^*)\lambda_{si} \quad (7.25)$$

The last term is negative (given our estimates of $\sigma_{1\epsilon}^*$ and $\sigma_{2\epsilon}^*$ and since $\lambda_{si} > 0$). Hence, the inequality

$$E(g_{mi} - g_{si} | I_i > 0) > E(g_{mi} - g_{si} | I_i < 0)$$

holds, implying that self-selection works in a direction that improves the allocative efficiency of the labor market. This conclusion, however, should be taken with some care given that the covariance terms are estimated with fairly large standard errors.

For average movers, the yearly growth rate is increased by around 4 percent, compared to a situation where they had stayed (based on Eq. (7.24)).

We noted in the discussion of optimal search and moving strategies in Chapter 3 that low wage workers will require higher wage gains in order to move. The estimates in Table 7.3 show that the coefficient for the initial wage rate is larger (in absolute value) for movers. This implies that

the wage improvements for low wage workers are greater for movers; in other words, the prospective relative wage gains to mobility are decreasing with the initial wage level. It can also be shown that the estimates in Table 7.3 imply that even absolute wage gains are decreasing with the initial wage level. Thus, the prediction from the search model is not refuted by our results.

7.4.3 Structural Decision Equations

The worker's mobility decision is by assumption based on a comparison of two alternative earnings streams, associated with job mobility and job staying, respectively. The estimated wage growth equations allow us to impute alternative wage paths to each individual. Hence, we obtain the estimable structural decision equation. The results are displayed in the last three columns of Table 7.2.

Of special interest here is to see whether workers respond to their potential wage gains. As is shown in Table 7.5, the coefficients for $\hat{g}_m$ and $\hat{g}_s$ have the expected signs and with (absolute) t-values around 2. An increase in $\hat{g}_m$ by 1 percentage point implies an increase in the probability of moving by 0.05. Likewise, an increase in $\hat{g}_s$ by 1 percentage point will reduce the mobility probability by 0.07. Job mobility decisions are clearly affected by prospective wage gains.

Among other results, we observe that length of tenure is a highly significant determinant of job mobility. More surprising is the insignificance of the age coefficient in the structural probit. Age is (inversely) correlated with mobility gains (see

**Table 7.5 Changes in job mobility probabilities
due to changes in the determinants of
job mobility**

	$\Delta F(\cdot)$	$\Delta F(\cdot)/F(\cdot)$
Increase in $\hat{g}_m$ by 1 percentage point	0.048	0.171
Increase in $\hat{g}_s$ by 1 percentage point	-0.071	-0.249
Increase in tenure by 1 year (tenure = 0)	-0.037	-0.131
Increase in tenure by 1 year (tenure = 10)	-0.023	-0.081
Change in marital status	-0.146	-0.514
Recently moved to current locality	0.086	0.303

Note: The partial derivative of the probit model is calculated for values of the normal density corresponding to the mean value of the probit index, i.e., $f(\cdot) = f(\bar{I})$, $F(\cdot) = F(\bar{I})$. The estimates in column (4) of Table 7.2 have been used.

Table 7.4), which partly may explain this anomalous result. Finally, we can note that married workers have much lower probabilities of moving than those who are not married.

It is noteworthy that the average discount rates, $\bar{\rho}_m$ and $\bar{\rho}_s$, are exactly identified in the model. The estimates taken together with Eq. (7.12) imply that

$$\hat{\alpha}_1 = 1/(\bar{\rho}_m - \bar{g}_m) = 14.298$$

$$\hat{\alpha}_2 = -1/(\bar{\rho}_s - \bar{g}_s) = -20.919$$

Estimates of $\bar{g}_m$ and $\bar{g}_s$ are given in Table 7.4. Using the values for the typical worker, we have $\bar{\rho}_m = 0.125$ and $\bar{\rho}_s = 0.071$. As noted above, there is little reason to expect the two discount rates to be equal. The finding that $\bar{\rho}_m$ is greater than $\bar{\rho}_s$ is consistent with the conjecture that the average worker expects higher layoff risks in the hypothetical new firm than in the current one. This is a quite reasonable implication, since a change of employer involves loss of seniority rights.

7.4.4 Responses to Tax Changes

We have so far said nothing about the effects of progressive taxes for mobility decisions. Indeed, it is reasonable to expect that workers care about the net benefits associated with job mobility. Let us therefore illustrate the impact of tax changes by introducing a particular parameterization of the tax system. Let Y_n denote disposable income

and assume that income after tax is an iso-elastic function of pre-tax income, i.e.,

$$\ln Y_n = \eta \ln Y \quad (7.26)$$

where $\eta = d \ln Y_n / d \ln Y$ shows the percentage increase in net income resulting from an increase in gross income by one percent. It is easily shown that $\eta = (1-m)/(1-t)$, where m is the marginal and t the average tax rate. A lower value of η corresponds to a more progressive tax system; the Lorenz curve will be shifted towards the origin with decreasing values of η .⁵

Workers concerned with net earnings will compare

$$V_m^* = Y_{on} / (\rho_m - g_m^*) \quad (7.27)$$

with

$$V_s^* = Y_{on} / (\rho_s - g_s^*) \quad (7.28)$$

where g_m^* and g_s^* are real wage growth rates after taxes, i.e., $g_m^* = g_m \eta_m$ and $g_s^* = g_s \eta_s$. If $\eta_m = \eta_s$, it is straightforward to see that the structural decision equation will be

$$I = \alpha_0^* + \alpha_1^*(\eta g_m - \rho_m) + \alpha_2^*(\eta g_s - \rho_s) + \alpha_3^* c \quad (7.29)$$

instead of Eq. (7.12). The relationship between the estimates in (7.12) and (7.29) will be

$$\hat{\alpha}_1 = \hat{\alpha}_1^* \eta \text{ and } \hat{\alpha}_2 = \hat{\alpha}_2^* \eta.$$

We just have to divide our estimated coefficients from (7.12) by the tax elasticity to obtain esti-

mates of responses to increases in wage growth rates net of taxes. Likewise, we can easily compute mobility responses to changes in the progressivity of the tax system. We have

$$\frac{\delta I}{\delta \eta} = (\hat{\alpha}_1/\eta)\bar{g}_m + (\hat{\alpha}_2/\eta)\bar{g}_s \quad (7.30)$$

It is of some interest to note that (7.30) has no presumptive sign; it may be positive, as intuition would suggest, but a negative sign cannot be ruled out. The reason for this ambiguity lies in the fact that lower progressivity increases life time earnings related to both moving and staying.

Given our estimates of the relevant parameters $(\hat{\alpha}_1, \hat{\alpha}_2, \bar{g}_m, \bar{g}_s)$ we can conclude that the mobility response to a lower progressivity will be positive in Sweden. We have

$$\frac{\delta I}{\delta \eta} = 0.306(1/\eta) > 0$$

The magnitude of this effect is, however, rather small. A decrease in η , from, say, 0.75 to 0.65, would decrease the mobility rate for this period by somewhat more than one percentage point. Again, it should be emphasized that those exercises are based on a parameterization of the tax system that involves approximations of reality. In a more ambitious treatment of progressive taxes, one might want to make the tax elasticity endogenous. Such an approach, however, is beyond the scope of this study.

7.4.5 Other Evidence

For several reasons, our particular estimates should be taken with care. For example, the sample size has been small, there are likely to be measurement errors in the data and different specifications of wage growth and mobility models are conceivable.

To get a rough check on how reasonable the estimates are, we have made comparisons with information from register data on incomes. Table 7.6 shows initial income levels 1970 and income growth 1970-73 for Swedish men. Income is total net income (sammanräknad nettoinkomst) and migrants are defined on the basis of a moving distance exceeding 50 kilometers; in most cases such migrants are likely to be job movers..

The message from Table 7.6 is broadly consistent with earlier estimates in Table 7.4. On average, migrants experience higher income growth than workers in general and the excess income growth for migrants is rapidly falling over the life cycle. For young workers, the excess income growth for migrants amounts to 8 percent per year; for the oldest age-group the income growth advantage for migrants is negligible.

7.5 Concluding Remarks

We have analyzed the interrelationships between job mobility and wage growth in the Swedish labor market. Since workers are likely to move in response to their potential wage gains, there is a two-way causality between mobility and wage

**Table 7.6 Average income 1970 and income growth
1970-73**

Age		Income 1970 (SEK)	Nominal income growth 1970-73, percent per year
20-29	All	20 000	10.0
	Migrants	17 000	18.4
30-39	All	32 000	4.8
	Migrants	32 000	6.9
40-59	All	32 000	3.5
	Migrants	36 000	3.8
20-59	All	28 000	5.4
	Migrants	24 000	11.1

Note: The table is based on data on 2 100 000 men, among which 54 000 moved between local labor markets during 1971.

Source: Springfieldt et al. (1977).

growth. The econometric procedures utilized take this interdependence into account.

The results of the empirical analyses indicate that job movers during the period 1968-74 obtained around 4 percentage points higher real wage growth compared to a situation where they had decided not to move. Mobility gains are higher for workers with low initial wage rates. It is also interesting to see that potential mobility gains decrease over the life cycle, consistent with the illustrative calculations made in Chapter 6 using cross-sectional earnings profiles. This provides one piece of an economic interpretation of observed life cycle patterns of mobility and earnings. The traditional human capital explanation of life

cycle earnings profiles appears to need an extension to account for mobility behavior over the life cycle (and wage gains associated with this mobility).

Population heterogeneity is likely to interfere with unbiased estimates of the returns to individual job changes. We find evidence of positive self-selection for stayers; a random group of workers will experience lower wage growth rates as stayers than what actual stayers obtained. The evidence on self-selection is less conclusive for movers, although the preferred equation provides some weak evidence of negative self-selection. The "combined" self-selection effect, however, indicates that labor mobility is efficiency improving; the excess wage growth from job changing is higher for movers than for measurably similar stayers.

An interesting consequence of the adopted procedure is the possibility of estimating structural decision equations, where hypothetical wage growth rates enter as arguments. We find that workers respond to their opportunity wages in the expected direction.

8 THE DYNAMICS OF LABOR TURNOVER: A SIMULATION MODEL

8.1 Introduction

One of the most important points of departure for the "new" microeconomics of unemployment is the view of the labor market as an interrelated dynamic system. This general framework, first outlined by Holt & David (1966), has provided labor market research with new insights and fruitful analytical tools.

This chapter develops an econometric model of the labor market for Swedish industrial workers along the lines suggested by this search-turnover approach.¹ The model is intended to illuminate some important dynamic features of the labor market and to focus on the behavioral relationships that govern the flows between the stocks of employed, unemployed and job vacancies. The model - consisting of ten stochastic equations estimated on monthly data - describes the firm sector's decisions on production, vacancies, recruitments, layoffs and hours. The behavior of the household sector is taken into account in equations explaining the number of quits and the rate of change of unemployment. Employment and unfilled vacancies are determined residually from flows and initial stock values. The model is driven as a selfcontained system by exogenous output demand, represented by sales and unfilled orders.

Section 8.2 presents the basic structure of the model and derives the estimating equations. Next, the estimation results are reported and commented on. Finally, the performance of the complete model in dynamic simulations and the outcome of some simulation experiments are described.

8.2 The Structure of the Model

8.2.1 Basic Features

The model is demand oriented, although both employment and unemployment are partially affected by job search and job acceptance decisions taken by the household sector. The quit and unemployment specifications are focusing on job availability effects rather than inflationary surprises, an approach which has empirical underpinning.² The emphasis placed on job availability is not inconsistent with search theory per se, only with certain restrictive versions of the search model.³

As workers search for jobs, employers search for employees to fill job vacancies. Employers' attempted recruitments are distinguished from their actual hirings, the latter being affected by the state of the labor market.

Employment changes via hirings or layoffs are likely to be affected by significant adjustment costs. An optimal policy would most likely imply employment smoothing with respect to demand fluctuations. The principal short-run means of adjusting labor input are variations in hours per worker. We describe the firms' decisions on men and manhours as being recursive in nature; the

basic determinant of hours per worker is taken to be the difference between the actual and the desired number of workers on hand.

We model the labor market for industrial workers as more or less isolated from the government and service sectors. This seems to be a realistic empirical approximation in the short run.

The model does not include equations for wage and price formation. Nor are there any (other) feedbacks from the labor market to output demand. It is in principle straightforward to extend the model to account for wage and price changes. Such an extension is, however, beyond the scope of this chapter.

Later on, the model will be simulated as a self-contained system, showing the dynamic indirect responses that occur throughout the labor market if one part of it is directly changed. Policy changes that affect unemployment or the duration of vacancies will have indirect consequences for wage and price increases and, accordingly, for output demand as well. Since the model does not account for such feedbacks, it is clear that the simulation results should be viewed as conditional on compensating policies that keep output demand on the predetermined path.

8.2.2 Production Decisions and the Demand for Labor

A. The production function and desired employment

This section deals with the firms' short-run demand for workers and hours. We first introduce a

simple aggregate production function,

$$O_t = \alpha_0 \hat{HRS}_t e^{\alpha_1 T} \quad (8.1)$$

where O_t is real output, $\hat{HRS}$ the number of productive hours and T is time, the latter variable being a proxy for growth in technology and the capital stock.

The distinction between productive and paid-for hours (HRS) is crucial. The assumption is that firms face adjustment costs with respect to labor, such as search, screening and training costs as well as loss of good-will associated with volatile fluctuations in employment.⁴ This may result in short-run deviations between the actual and the long-run desired work force. It may also result in short-run fluctuations in observed productivity due to labor hoarding; by labor hoarding - or excess labor - we mean a situation where paid-for hours are greater than the number of hours worked, i.e., $HRS > \hat{HRS}$.⁵ By inverting the production function productive hours can be expressed as

$$\hat{HRS}_t = \alpha_2 O_t e^{-\alpha_1 T} \quad (8.2)$$

where $\alpha_2 = 1/\alpha_0$ and where O_t should be interpreted as planned output.

The next assumption is required by the need to split total hours into number of workers and hours per worker. Let $HRSN$ denote the actual paid-for number of hours per worker and let $SHRSN$ be standard (or normal) hours; the latter concept has a long tradition in studies of labor demand⁶ and can

be viewed as determined by legislation and institutional forces as well as by social conventions.

If actual hours exceed normal hours, firms will have to pay overtime premiums (or excessive wage increases in order to affect the supply of hours from part-time workers). Conversely, a reduction in hours below the normal level is also likely to incur costs associated with union resistance and higher quit rates. We choose to equate standard hours and the long-run desired number of hours per worker.⁷ By dividing productive hours by standard hours, the number of desired workers is determined as

$$N_{t-1}^* = \frac{k\hat{HRS}_t}{SHRSN_t} = \frac{k\alpha_2 O_t e^{-\alpha_1 T}}{SHRSN_t} \quad (8.3)$$

where N_{t-1}^* refers to the desired stock at the beginning of month t and the constant k is the desired degree of excess labor ($k > 1$).

The number of productive hours is in general not observable (contrary to paid-for hours). However, some observations are needed in order to estimate the parameters of the aggregate production function. We will adhere to the "peak-productivity approach", and assume that productive hours equal paid-for hours at the peaks of the labor productivity cycle. An equation for potential productivity $O\hat{HRS}_t = O_t/\hat{HRS}_t$, will be estimated on a small number of peak observations.

Standard hours are obtained by regressing (the log of) actual hours per worker on time and seasonal dummies. The predicted values obtained are inter-

preted as standard hours; the trend coefficient captures the long-run increase in absenteeism as well as legislation on shorter workweeks.

The firm's desired employment, standard hours (desired hours per worker) and planned output will be important determinants of the adjustment of workers and hours. Before going into these details, a few remarks should be offered concerning the firms' production decisions.

B. Production decisions

We assume that firms treat demand as given exogenously. Production will, however, display a sluggish response to variations in demand, since rapid changes in production are costly; an optimal policy is likely to involve production smoothing with respect to demand fluctuations. We postulate the following simple relation as an approximate description of the firm sector's production decisions:

$$\ln O_t = \beta_0 + \beta_1 \ln B_{t-1} + \beta_2 \sum_i w_i \ln S_{t-i} \quad (8.4)$$

where B_{t-1} is the backlog of orders and $\sum_i w_i \ln S_{t-i}$ is a distributed lag of (log) sales, both in real terms. The distributed lag expression is intended to take account of lagged response rather than expectations of future sales; the realism of this assumption is, of course, difficult to test.⁸

C. Vacancies and hirings

How will the firm adjust hirings and/or layoffs in order to approach the long-run desired employment

level? Consider, as an illustrative starting point, the behavior of an individual firm with homogeneous labor, a fixed number of hours per worker and negligible adjustment costs. The desired number of hirings (H_t^*) and layoffs (L_t^*) can be expressed as:

$$H_t^* = \max[N_t^* - N_{t-1} + Q_t^e, 0] \quad (8.5)$$

$$L_t^* = \max[-(N_t^* - N_{t-1} + Q_t^e), 0] \quad (8.6)$$

where N_{t-1} is the actual number of workers at the beginning of month t and Q_t^e the expected number of quits. Hirings and layoffs will be mutually exclusive in this case. Since workers and jobs are heterogeneous and labor force adjustments are costly, we modify (8.5) and (8.6) as follows:

$$\ln H_t^* = \gamma_0 + \gamma_1 \ln Q_t^e + \gamma_2 \sum w_i \ln(N_{t+i}^*/N_{t-1}) \quad (8.7)$$

$$\ln L_t^* = \epsilon_0 + \epsilon_1 \ln Q_t^e + \epsilon_2 \sum w_i \ln(N_{t+i}^*/N_{t-1}) \quad (8.8)$$

Desired hirings (layoffs) are determined by expected quits and the difference between actual employment and expected future optimal employment. Desired hirings can be interpreted as attempted recruitments, i.e., the quantity of labor that firms actively try to recruit during a certain period. Since workers are forthcoming with some delay and require training, the optimal policy implies that current recruitment efforts respond to future manpower needs.⁹ Attempted recruitments will be defined as vacancies.

Relation (8.7) above is not directly suitable for estimation. It holds, in the first place, that observed vacancies are those notified to the public employment offices; notified vacancies will be fewer than desired hirings. There is some evidence suggesting that firms have registered vacancies somewhat sluggishly with respect to their desired recruitments. For instance, firms might in some periods have a queue of job seekers available or they may try other recruitment methods at an initial stage.¹⁰ The following relation between the flow of new (notified) vacancies and desired hirings is specified:

$$\ln IV_t = \gamma_3 + \gamma_4 \ln H_t^* + \gamma_5 \sum_i \ln (N_{t-i}^* / N_{t-i}) \quad (8.9)$$

where IV_t is new vacancies and the last term captures lagged response to past excess demand. Substituting (8.7) into (8.9) gives

$$\begin{aligned} \ln IV_t = & (\gamma_3 + \gamma_0 \gamma_4) + \gamma_1 \gamma_4 \ln Q_t^e + \gamma_2 \gamma_4 \sum_i \ln (N_{t+i}^* / N_{t-1}) \\ & + \gamma_5 \sum_i \ln (N_{t-i}^* / N_{t-i}) \end{aligned} \quad (8.10)$$

as estimating equation.

The notification of new vacancies is a decision variable under complete control by the firms. Actual hirings, on the other hand, are partly affected by the behavior of the household sector. Consequently, firms will sometimes find it difficult to fill their vacancies due to an insufficient supply of labor. Consider the behavior of an individual firm with a certain recruitment probability expressed as

$$\text{Pr}(\text{Hiring}|\text{Search})_t = \phi_t \theta_t F_a(w)_t \quad (8.11)$$

where the probability of recruitment, conditional on search, equals the product of three different terms:

- ϕ_t = the probability of encountering a job seeker
- θ_t = the probability of a contact resulting in a wage offer from the firm (i.e., the probability that the firm will find a seeker acceptable)
- $F_a(w)_t$ = the probability of finding a worker who accepts the wage offer ($F(\cdot)$ is the distribution of reservation wages and w is the wage offer)

The following relationships are postulated for these three probabilities:

$$\ln \phi_t = \delta_0 + \underset{(+)}{\delta_1} \ln U_{t-1} + \underset{(+)}{\delta_2} \ln \text{VAC}_t \quad (8.12)$$

$$\ln \theta_t = \delta_3 + \underset{(-)}{\delta_4} \ln U_{t-1} + \delta_5 \sum \underset{(+)}{w_l} \ln (N_{t+i}^*/N_{t-1}) \quad (8.13)$$

$$\ln F_a(w)_t = \delta_6 + \underset{(-)}{\delta_7} \ln \text{VAC}_t + \underset{(+)}{\delta_8} \ln U_{t-1} \quad (8.14)$$

where U_{t-1} is the number of unemployed at the beginning of the period and VAC_t the total number of vacancies during the period.

The rationale for (8.12) is, inter alia, that the extent of on-the-job search increases with job availability (cf. Chapter 4). Eq. (8.14) captures the search theoretic prediction that more vacancies or lower unemployment will decrease a job seeker's acceptance probability (shift the distri-

bution of reservation wages to the right). Eq. (8.13) relies on the idea that lower unemployment as well as higher expected need for workers will induce the firm to lower its recruitment thresholds.¹¹

Substituting (8.12), (8.13) and (8.14) into (8.11) gives

$$\begin{aligned} \ln(H/VAC)_t &= (\delta_0 + \delta_3 + \delta_6) + (\delta_1 + \delta_7) \ln VAC_t \\ &+ (\delta_1 + \delta_4 + \delta_8) \ln U_{t-1} + \delta_5 \sum_i w_i \ln(N_{t+i}^*/N_{t-1}) \end{aligned} \quad (8.15)$$

as the equation to be estimated. The aggregate recruitment probability has been represented by the recruitment frequency, obtained as the ratio between hirings (H) and vacancies (VAC). Note that the effect of unemployment increases is ambiguous a priori; the positive "availability coefficient" (δ_1) and the positive "reservation wage coefficient" (δ_8) are offset by a negative coefficient (δ_4), reflecting the firm's adjustment of its recruitment thresholds. It seems, however, fairly unlikely that the latter effect should completely outweigh the first two effects.

D. Layoffs

Within certain limits given by legislation, layoffs are under the firm's control. We will modify the basic function for desired layoffs (Eq. (8.8) above) to take account of unemployment and adjustment costs, the latter causing a lagged response of layoffs to excess labor. Consider, first, the role played by unemployment for the firm's layoff decisions. The hypothesis is that layoffs will

respond more sluggishly to excess labor when there is a tight labor market. The rationale for this assumption is that firms will be more careful in firing workers if they feel that a sudden upturn will be associated with recruitment difficulties due to low unemployment.

The existence of monetary as well as non-monetary firing costs will call for gradual adjustments of layoffs. This lagged response effect will be represented by a distributed lag of past excess labor. The estimating equation is

$$\begin{aligned} \ln L_t = & \epsilon_0 + \epsilon_1 \ln Q_t^e + \epsilon_2 \sum w_i \ln(N_{t+i}^*/N_{t-1}) + \epsilon_3 \ln U_{t-1} \\ & + \epsilon_4 \sum v_i \ln(N_{t-i}^*/N_{t-i}) \end{aligned} \quad (8.16)$$

The role played by unemployment in the layoff equation is symmetrical with its function in the hiring equation. A high level of unemployment will induce more significant employment fluctuations via a faster recruitment process or more layoffs. The unemployment variable in the layoff equation indicates a possible destabilizing mechanism in the labor market; a high level of unemployment will increase layoffs, thereby increasing the flow into unemployment, which will increase the number of layoffs, and so on.

E. Hours per worker

The recruitment and layoff functions described so far have relied on the assumption that firms are adjusting towards a certain desired employment level for the periods within the planning horizon.

There is, however, a possibility that the recruitment strategy adhered to will fail and that firms will have too few workers on hand at the beginning of a month. The principal short-run means of adjusting labor services is variations in hours per worker. The current shortage of labor, N_{t-1}^*/N_{t-1} , will therefore be one determinant of the firms' hours decision. Adjustment costs may also be associated with changes in hours per worker, which create incentives to smooth paid-for hours with respect to desired hours. Let $HRSN^*$ denote desired hours per worker and assume that the adjustment process is given by

$$\ln HRSN_t - \ln HRSN_{t-1} = \rho_0 (\ln HRSN_t^* - \ln HRSN_{t-1}) \quad (8.17)$$

where $0 < \rho_0 < 1$. Suppose that desired hours are a function of standard hours, the degree of excess labor on hand and expected future need for labor services

$$\begin{aligned} \ln HRSN_t^* = & \ln SHRSN_t + \rho_1 \ln(N_{t-1}^*/N_{t-1}) \\ & + \rho_2 \sum_i \ln(\hat{HRS}_{t+i}/\hat{HRS}_t) \end{aligned} \quad (8.18)$$

where the last term captures the influence of expected increases in productive hours (expected output growth net of expected growth in labor productivity). Substituting (8.18) in (8.17) gives the estimating equation

$$\begin{aligned} \ln(HRSN_t/HRSN_{t-1}) = & \rho_0 \ln(SHRSN_t/HRSN_{t-1}) \\ & + \rho_0 \rho_1 \ln(N_{t-1}^*/N_{t-1}) + \rho_0 \rho_2 \sum_i \ln(\hat{HRS}_{t+i}/\hat{HRS}_t) \end{aligned} \quad (8.19)$$

In the special case where full adjustment of hours takes place within one month we have $\rho_0 = 1$ and

equality between $HRSN_t^*$ and $HRSN_t$. Eq. (8.18) would then be the appropriate relation to estimate.

8.2.3 The Quit Function

The determinants of quit-fluctuations have been discussed in some detail in Chapter 4. We expect that the intensity of search increases with the number of vacancies, possibly lagged. We also take account of the wellknown observation that quit probabilities fall with increasing length of tenure. Newly hired workers will, after some time, revise their initial evaluations of their jobs ("learning by working"). The newly hired also have low attachment to the particular firm (because of fewer personal ties to coworkers as well as less firm-specific experience).

The quit probability, conditional on a given search intensity, depends on

- (i) the probability of encountering a job opening, which is a function of the number of vacancies in the labor market;
- (ii) the probability of obtaining a wage offer from a found vacancy, which is a function of unemployment; recall the earlier discussion of the firms' recruitment thresholds;
- (iii) the probability that a received job offer will be accepted, a function of the number of vacancies and unemployed.

The arguments briefly stated can be translated into an estimating quit equation of the following form:

$$\ln Q_t = \lambda_3 + \lambda_4 \ln VAC_{t-1} + \lambda_5 \ln U_{t-i} + \lambda_6 \sum w_i \ln H_{t-i} \quad (8.20)$$

Regarding the last term, it holds by assumption that $w_i = 0$ for $i = 0$; a worker hired during month t never quits during the same month.

8.2.4 Unemployment

The unemployment equation combines two relationships, one for the flow into the unemployment pool and one for the outflow. The point of departure is the approximation

$$U_t - U_{t-1} \approx IU_t - P_t U_{t-1} \quad (8.21)$$

where IU is unemployment inflow and P_t the transition probability, i.e., the probability of leaving the pool of unemployed.¹² Rearranging (8.21) gives

$$\Delta U / U_{t-1} = IU_t / U_{t-1} - P_t \quad (8.22)$$

The next step is to specify explicit relationships for the inflow and for the transition probability, and then to substitute these functions into (8.21) in order to obtain an estimating equation.¹³ First, consider the inflow relation. As a pure identity, the flow into unemployment consists of quits, layoffs and labor force entries:

$$IU_t \equiv \mu_1 Q_t + \mu_2 L_t + \mu_3 E_t \quad (8.23)$$

where E_t is gross inflow into the labor force and μ_i ($i = 1, 2, 3$) is "unemployment propensities" associated with the three flows. Empirical evidence

indicates that μ_1 is substantially below unity; most job changes take place without intervening unemployment spells.¹⁴ We specify the following relationship for the unemployment inflow:

$$IU_t = \tau_0 + \tau_1 L_t + \tau_2 VAC_t \quad (8.24)$$

(+)\quad (+)\quad (+)

The inflow consists of an autonomous component, τ_0 , unaffected by the state of the labor market. Unemployment inflow is also affected by the number of layoffs and finally by quits and labor force entrants via the number of vacancies. The hypothesis is that quits into unemployment as well as labor force entries will increase with a tighter labor market.¹⁵

Next, consider the transition probability, P_t . The search theoretic framework is retained, explaining P_t by variables associated with the likelihood of finding vacancies, receiving wage offers and accepting offers. Recalling the arguments already given regarding the recruitment probability, it should be obvious that essentially the same variables affect the placement of vacancies and the flow out of the unemployment pool. Approximating the theoretical model with a linear function the transition probability equation can be written as¹⁶

$$P_t = \tau_3 + \tau_4 (VAC_t / U_{t-1}) \quad (8.25)$$

where the coefficient on (VAC/U) has a theoretically ambiguous sign. Substituting (8.24) and (8.25) into (8.22) yields

$$\Delta U/U_{t-1} = -\tau_3 + \tau_0 \left(\frac{1}{U_{t-1}} \right) + \tau_1 \left(\frac{L_t}{U_{t-1}} \right) + (\tau_2 - \tau_4) \left(\frac{VAC_t}{U_{t-1}} \right) \quad (8.26)$$

as estimating equation.

8.2.5 Closing the Model

In order to close the model two identities and one additional equation are required. The two identities are those for employment and vacancies:

$$N_t - N_{t-1} \equiv H_t - Q_t - L_t \quad (8.27)$$

$$V_t - V_{t-1} \equiv IV_t - FCV_t \quad (8.28)$$

where (8.27) gives the change in employment as the difference between hirings, quits, and layoffs. The second identity expresses the change in the stock of vacancies as the difference between the flow of new vacancies (IV_t) and filled and canceled vacancies (FCV_t). The latter variable - given by employment exchange data on stocks and flows of notified vacancies - is strongly related to the number of hirings according to establishment data. (No time-series information is available that allows a division of FCV_t into its two components.)

An additional equation explaining the development of filled and canceled vacancies is used to close the model. We impose the restriction $0 < FCV_t < VAC_t$ by choosing a logistic function. The equation to be estimated is

$$\ln\left(\frac{\text{PFCV}_t}{1-\text{PFCV}_t}\right) = \eta_0 + \eta_1 \ln \text{VAC}_t + \eta_2 \ln U_{t-1} + \eta_3 \sum_i \ln(N_{t+i}^*/N_{t-1}) \quad (8.29)$$

where $\text{PFCV}_t = \text{FCV}_t / \text{VAC}_t$ and the LHS of (8.29) is the logit ratio.

The firms' decisions on vacancies, hirings, lay-offs and hours are affected by anticipated future demand and labor market conditions as well as expectations about quit probabilities. The assumptions are that firms use current and lagged labor market experiences as predictors of future conditions, that firms at the beginning of a month are perfectly informed about quits during the month and that firms have perfect demand expectations for the current month as well as three months ahead. The last assumption implies that actual future values of output are used to calculate those future manpower requirements that are used in the estimating equations. We also hypothesize that expectations about future values of standard hours are perfect. The perfect foresight proposition has been found to display reasonable empirical validity in earlier studies¹⁷ and is convenient for our purposes, which focus on labor market phenomena rather than the exact nature of output decisions.

8.2.6 Supply Constraints and Policy Changes

As it stands, the model is driven by exogenous output demand (sales and unfilled orders). The equation for production decisions does not account for possible supply constraints, associated with, for instance, difficulties to fill job openings.

How serious is this simplification? It is clear that many Swedish firms have faced recruitment difficulties at the cyclical peaks; this is, for instance, revealed by the Business Tendency Surveys undertaken by the National Institute of Economic Research (Konjunkturinstitutet). It should be noted, however, that the estimation period for the output equation starts after the peak of 1970. The monthly series on sales and orders are not available before 1970 and the distributed lags imply that the first observations for 1970 cannot be included in the sample. Labor shortages appear to have been much more pronounced in the 1970 peak than during subsequent upturns.

Crude tests for supply constraints are possible by appending the equation for output decisions with variables reflecting recruitment difficulties. We have experimented with variables related to the duration of vacancies. In some preliminary regressions the coefficients of those variables had the expected positive signs, although with considerable standard errors. Given the insignificant estimates, we have ignored feedbacks from recruitment difficulties to output decisions. However, it should be emphasized that the model is not a suitable instrument for describing labor market responses to extreme increases in output demand.

The model is completely recursive, with the causation running from output demand to manpower requirements, thereby affecting the flow of new vacancies, which, in turn, will influence hirings, layoffs, unemployment and quits. Changes in the stocks come about as a result of changes in the flows.

A summary of the model is given in Table 8.1. Several of the equations are modified to account for labor market policies and institutional characteristics. The three most important policies are the inventory subsidy schemes (1972 and 1975-77), the employment security legislation (in operation from July 1974) and the employment subsidy program (most actively undertaken during the recession 1977-78).

The inventory subsidies were paid to firms conditional upon unchanged volume of employment; the firms under consideration were those where employment reductions were likely in the absence of the policy. The employment subsidies were intended to affect temporary and permanent layoffs; firms with high expected layoff probabilities were subsidized, given that they provided their excess labor with training during a specified period of time.

The employment security legislation (LAS), already mentioned in Chapter 4, protects employment for tenured workers. The employers' free right to dismiss is replaced by legislation which demands objective cause for dismissal. "Shortage of work" is considered to be one such objective cause. Firms have also to give employed workers up to six months advance notice before anyone can be laid off.

The employment subsidy scheme will mainly affect unemployment via longer durations of existing jobs. The employment security legislation has employment preserving aims and strong layoff-discouraging rules and is therefore likely to reduce the flow into unemployment. The recruitment behavior of firms will, presumably, also be influenced,

Table 8.1 Variables of the model

1. Variables explained by stochastic equations

$PFCV_t$	filled and canceled vacancies (employment exchange statistics) divided by the total number of vacancies
H_t	new hires (establishment data)
$HRSN_t$	paid-for hours per worker
IV_t	the flow of new vacancies
O_t	index of industrial production in real terms
$\hat{O}HRS_t$	potential productivity
Q_t	quits
$SHRSN_t$	standard paid-for hours per worker
$\Delta U/U_{t-1}$	the relative rate of change of unemployment
L_t	layoffs

2. Exogenous variables

B	index of backlog of orders in real terms
D72	dummy for the inventory subsidy scheme 1972
D7577	dummy for the inventory subsidy scheme 1975-77
LAS	dummy for the employment security legislation
D2, D3 ... D12	seasonal dummies
NSUB	the fraction of non-subsidized excess labor
S	index of sales in real terms
T	time

Table 8.1 cont.

3. Definitions that close the model

$HRS_t = HRSN_t \cdot N_{t-1}$	the total number of paid-for hours during month t
$\hat{HRS}_t = O_t / \hat{O}HRS_t$	the total number of productive hours during month t
$N_t^* = \hat{HRS}_t / SHRSN_t$	desired employment at the beginning of month t, desired excess labor excluded
$N_t = N_{t-1} + H_t - Q_t - L_t$	actual employment at the end of month t
$U_t = (1 + \Delta U / U_{t-1}) U_{t-1}$	the number of unemployed at the end of month t
$VAC_t = V_{t-1} + IV_t$	the total number of vacancies during month t
$V_t = V_{t-1} + IV_t - FCV_t$	the stock of unfilled vacancies at the end of month t
$FCV_t = PFCV_t \cdot VAC_t$	filled and canceled vacancies

since the laws make it difficult to revise past hiring decisions based on erroneous information. The result is likely to be longer vacancy durations (falling recruitment probabilities). The inventory subsidy program focused on net changes in employment as a requirement for subsidies; hence we expect that hiring decisions as well as layoffs were affected via production and inventory accumulation.

The rationale for the various "policy-augmented" specifications have been given elsewhere¹⁸. Suffice it here to comment on the variable NSUB, which appears in the layoff equation. It captures the employment subsidies available for firms with

excess labor and is defined as $NSUB = 1 - s/w_c$, where s is the subsidy per hour and w_c is wage cost per hour. It holds, accordingly, that $0 < NSUB < 1$; $NSUB$ is the fraction of non-subsidized excess labor. The expectation is that layoffs will decrease as the subsidies increase ($NSUB$ decreases).

Since $NSUB$ is exogenous, the subsidy to wage cost ratio, s/w_c , is clearly exogenous as well. The simulation experiments below will be conditional on unchanged values of $NSUB$; to the extent that the wage level is affected by the induced labor market changes, we assume compensating policies that keep $NSUB$ unchanged.

8.3 Estimation Results

The vacancy data are published by AMS whereas the other series are supplied by SCB. The data on turnover, employment and hours worked refer to blue-collar workers in mining and manufacturing work. The number of unemployed blue-collar workers are estimated by applying the unemployment rates from the Labor Force Surveys (manufacturing work) to the employment figures for blue-collar workers.¹⁹

The stochastic equations have been estimated by OLS and the results are summarized in Table 8.2. The distributed lag coefficients - estimated by the Almon-technique - are shown in Table 8.3; only the sum of the coefficients are set out in Table 8.2.

Table 8.2 Estimation results for the equations of the simulation model
(t-ratios in parentheses)

Potential productivity

$$\ln \text{HRS}_t = 0.656 + [0.502\text{E-}02] \cdot T$$

(5.182)

Periods: 1969.1-1969.3
1970.4-1970.6
1974.4-1974.6
 $R^2 = 0.79$ $DW = 3.58$

Standard hours^a

$$\ln \text{HRSN}_t = -1.846 - [0.171\text{E-}02] \cdot T + \text{SD}$$

(-11.289)

Period: 1969.1-1978.6
 $R^2 = 0.95$ $DW = 2.74$

Industrial production

$$\ln O_t = 4.861 + 0.122 \ln B_{t-1} + 0.018D72 + 0.011D7577$$

(4.966) (1.528) (1.336)

$$+ 1.325 \sum_{i=0}^5 w_i \ln S_{t-i} + \text{SD}$$

(10.64)

Period: 1970.8-1978.12
 $R^2 = 0.98$ $DW = 1.36$

^a Predicted values from this equation are interpreted as (log) standard hours.

Note: Seasonals are not presented but indicated by SD if they appear in an equation.
The intercept refers to January.

Table 8.2 (cont.)

New vacancies

$$\begin{aligned} \ln IV_t = & 6.008 + 0.453 \ln Q_t + 2.206 \ln(N_t^* \cdot N_{t+1}^* \cdot N_{t+2}^*/3N_{t-1}) \\ & (4.868) \quad (3.152) \\ & + 5.492 \sum_{i=1}^6 w_i \ln(N_{t-i}^*/N_{t-i}) + SD \\ & (5.741) \end{aligned}$$

Period: 1969.2-1977.10

$R^2 = 0.95$ DW = 2.07

$\rho = 0.60$

Hirings

$$\begin{aligned} \ln H_t = & 1.380 + 0.706 \ln VAC_t + 0.103 \ln U_{t-1} - 0.77 LAS \\ & (19.25) \quad (2.080) \quad (-2.273) \\ & + 1.755 \ln(N_t^* \cdot N_{t+1}^* \cdot N_{t+2}^*/3N_{t-1}) + SD \\ & (4.236) \end{aligned}$$

Period: 1969.2-1978.12

$R^2 = 0.97$ DW = 1.43

Layoffs

$$\begin{aligned} \ln L_t = & 4.273 + 0.261 \ln U_{t-1} - 0.452 LAS + 1.205 \ln NSUB_t \\ & (2.252) \quad (-2.683) \quad (2.637) \\ & - 1.859 \ln(N_t^* \cdot N_{t+1}^* \cdot N_{t+2}^*/3N_{t-1}) - 6.216 \sum_{i=1}^6 w_i \ln(N_{t-i}^*/N_{t-i}) \\ & (-2.506) \quad (5.097) \end{aligned}$$

Period: 1969.2-1978.12

$R^2 = 0.55$ DW = 1.66

Hours per worker

$$\begin{aligned} \ln(HRSN_t/HRSN_{t-1}) = & 0.032 + 1.058 \ln(SHRSN_t/HRSN_{t-1}) \\ & (54.97) \\ & + 0.352 \ln(N_{t-1}^*/N_{t-1}) + 0.043 \ln(\hat{HRS}_{t+1} \cdot \hat{HRS}_{t+2} \cdot \hat{HRS}_{t+3}/3HRS_t) \\ & (3.920) \quad (1.647) \end{aligned}$$

Period: 1969.2-1978.12

$R^2 = 0.98$ DW = 2.55

Table 8.2 (cont.)

Quits

$$\ln Q_t = 2.683 + 0.291 \ln VAC_{t-1} - 0.093 \ln U_{t-2} + 0.486 \sum_{i=1}^8 w_i \ln H_{t-i} + SD$$

(2.369) (-1.866) (3.682)

Period: 1969.2-1977.10
R² = 0.94 DW = 1.42

Unemployment

$$\Delta U/U_{t-1} = -0.020 + 3043.63(1/U_{t-1}) + 0.743(L_t/U_{t-1}) - 0.686(LAS \cdot L_t/U_{t-1}) - 0.037(VAC_t/U_{t-1}) + SD$$

(3.279) (2.505) (-2.027) (-2.843)

Period: 1969.2-1979.5
R² = 0.62 DW = 1.93

Filled and canceled vacancies

$$\ln\left(\frac{PFCV_t}{1-PFCV_t}\right) = 6.479 - 0.774 \ln VAC_t + 0.195 \ln U_{t-1} - 0.178 LAS - [0.466E-02] \cdot T + SD$$

(-14.16) (3.146) (-2.924) (-4.521)

Period: 1969.2-1978.12
R² = 0.86 DW = 1.85

Table 8.3 Distributed lag coefficients
(t -ratios in parentheses)

	Equations for			
	$\ln O_t$	$\ln IV_t$	$\ln L_t$	$\ln Q_t$
$w_0 (v_0)$	0.286 (10.64)			
$w_1 (v_1)$	0.238 (10.64)	0.286 (5.741)	-0.299 (-5.232)	0.247 (1.846)
$w_2 (v_2)$	0.190 (10.64)	0.238 (5.741)	-0.243 (5.740)	0.206 (2.447)
$w_3 (v_3)$	0.143 (10.64)	0.190 (5.741)	-0.189 (-4.629)	0.169 (3.379)
$w_4 (v_4)$	0.095 (10.64)	0.143 (5.741)	-0.137 (-3.340)	0.134 (3.744)
$w_5 (v_5)$	0.048 (10.64)	0.095 (5.741)	-0.089 (-2.468)	0.103 (2.675)
$w_6 (v_6)$		0.048 (5.741)	-0.043 (4.902)	0.072 (1.763)
$w_7 (v_7)$				0.045 (1.234)
$w_8 (v_8)$				0.021 (0.914)
Σw_i	1.0	1.0	1.0	1.0
Mean lag	1.67	1.67	1.60	2.15

Note: Almon-lags with endpoint constraints. Second degree polynomials are used for $\ln L_t$ and $\ln Q_t$; first degree polynomials are used elsewhere.

The estimated production function equation, explaining potential productivity by a time trend through the peaks, reveal a long-run growth in labor productivity of 0.5 percent per month, or about six percent per year. We have assumed that the monthly growth rate in potential productivity is 0.45 percent per month after 1974; the assumption of a slower long-run growth in productivity is conventional wisdom in contemporary economic debate in Sweden.

The equation for standard hours indicates a marked decrease over time in hours per worker. The production equation, aiming to capture the production decisions of the firm sector, shows an expected sensitivity to the backlog of orders and actual and past sales.

The equation for the flow of new vacancies was estimated by the Cochrane-Orcutt method, since the regressions indicated serially correlated error terms. The results show that firms' recruitment efforts respond to quits as well as actual and future manpower requirements.²⁰ There is, furthermore, strong evidence suggesting that past excess demand will contribute to the flow of notified vacancies. However, it is not obvious if the latter effect reflects a real "recruitment-effort-lag" or merely a "registration-lag".

The equation for the recruitment frequency, $\ln(H/VAC)_t$, is estimated with hirings as dependent variable. The vacancy coefficient (0.706) is significantly less than one, implying that a higher number of vacancies will decrease the aggregate recruitment frequency (increase the duration of the vacancies). A 10 percent higher level of unem-

ployment will, *ceteris paribus*, increase hirings with 1 percent; this result indicates that the availability and reservation wage effects outweigh a likely increase of the firms' recruitment thresholds, due to higher unemployment. However, firms' minimum requirements on jobseekers seem to fall when expected demand are calling for more employment in the near future; the highly significant coefficient on $\ln(N_{t+1}^*/N_{t-1})$ lends support to this hypothesis. We observe, finally, that the higher layoff costs implicit in the LAS-scheme have produced a more careful screening procedure by firms; hirings are falling, *ceteris paribus*, by about 8 percent, implying longer vacancy durations.²¹

The layoff equation has certain similarities with the vacancy function. One variable from the theoretical specification, the number of quits, is absent in the estimated equation; the reason is simply unsuccessful attempts to produce a reasonable and stable coefficient estimate. This failure might be due to aggregation phenomena. The expected negative micro relation between quits and layoffs is presumably not easily detected when aggregate layoffs are regressed on aggregate quits.

It is interesting that a significant positive unemployment coefficient was obtained in the layoff equation, indicating a destabilizing mechanism of labor market dynamics.²² The employment security legislation as well as the employment subsidy program have both contributed to a decrease in the number of layoffs. Layoffs react with some lag to the quantity of excess labor on hand and, like vacancies and hirings also respond to expected future manpower needs. It is noteworthy that the coefficients for past and future manpower require-

ments are fairly similar in magnitude in the equations for vacancies and layoffs, respectively.

The estimated equation for hours per worker reveals a rapid adjustment of actual hours with respect to desired hours; the estimated adjustment coefficient is in fact slightly greater than one. The degree of excess labor on hand at the beginning of the month turns out to be a significant determinant of paid hours per worker. The significance of future hours requirements are not established by conventional criteria (but are nearly so).

This rapid adjustment of hours has motivated a respecification of the equation, imposing the restriction $\rho_0 = 1$, implying full adjustment within one month.²³ The new equation is

$$\ln(\text{HRSN}_t / \text{SHRSN}_t) = 0.020 + 0.230 \ln(N_{t-1}^* / N_{t-1})$$

(3.476)

$$R^2 = 0.09 \quad DW = 2.66$$

One implication of these estimates is noteworthy. Assume that a 10 percent increase in output will require a 10 percent increase in desired employment, N_{t-1}^* . The short-run effect on hours paid-for will be about 2 percent, which implies observed short-run increasing returns to labor services. This is in conformity with the basic results from various studies of short-run labor demand. The interpretation here is the excess labor hypothesis in which firms usually can increase production without altering the quantity of paid-for labor input.

The quit equation is self-explanatory; variations in quits are governed by the number of vacancies, the level of unemployment and past hirings.

The unemployment equation is satisfactory in terms of statistical performance and produces reasonable estimates. The "autonomous" component of the unemployment inflow equals about 3000 workers each month, or about 0.5 percent of the number of employed workers. The cyclical part of the inflow is captured by the three remaining terms. The LAS-reform seems to have contributed to a marked decrease in unemployment associated with layoffs via the advance warning rules; the slope dummy coefficient is negative and significant. The final term, VAC_t/U_{t-1} , has an estimated coefficient with a negative sign, suggesting that the unemployment-reducing effect (via the transition probability) outweighs the unemployment creating effect (via quits and new entrances into unemployment).

8.4 Simulation Experiments

8.4.1 The Predictive Accuracy of the Model

Some historical simulations were performed in order to investigate the tracking ability of the model. The model takes initial values of exogenous and endogenous variables for the months preceding 1970.7 and is allowed to run on its own from that point for 126 months, ending in December 1980. The exogenous variables driving the system are sales, unfilled orders, the policy parameters, season and time. The historical simulations reveal that the model stays roughly on track over time. Actual and simulated values for employment and unemployment

are displayed in Figures 8.1 and 8.2 (yearly averages). The model predicts an increase in employment during the cyclical upturn 1979-80, which, however, does not show up in the actual data.

The predictive accuracy of the model is summarized in Table 8.4 where the mean absolute percentage errors between actual and simulated values are set out. One simulation was run with output as exogenous driving variable. A comparison between the two columns in the table reveals that errors in the production equation are of minor importance for the predictive performance of the model as a whole.²⁴

The prediction errors are smallest for the stock of employed workers (0.9 percent). This result is unsurprising since the monthly flows are small relative to the stock. The errors are considerably higher (about 23 percent) for the stock of unfilled vacancies, where the monthly flows are of the same magnitude as the size of the stock. Layoffs turn out to be the most difficult variable to predict with precision, a result which partly may be due to relatively large measurement errors in the variable itself; recall also that the regressions produced much lower coefficient of determination for layoffs compared to other flows.

8.4.2 The Dynamic Responses to an Exogenous Increase in Unemployment Inflow

In the following section we will use the model to simulate the impact of an exogenous increase in unemployment inflow. Technically, this is done by increasing the coefficient for $1/U_{-1}$ by, say,

Figure 8.1 Employed workers, actual and simulated numbers, 1970-80

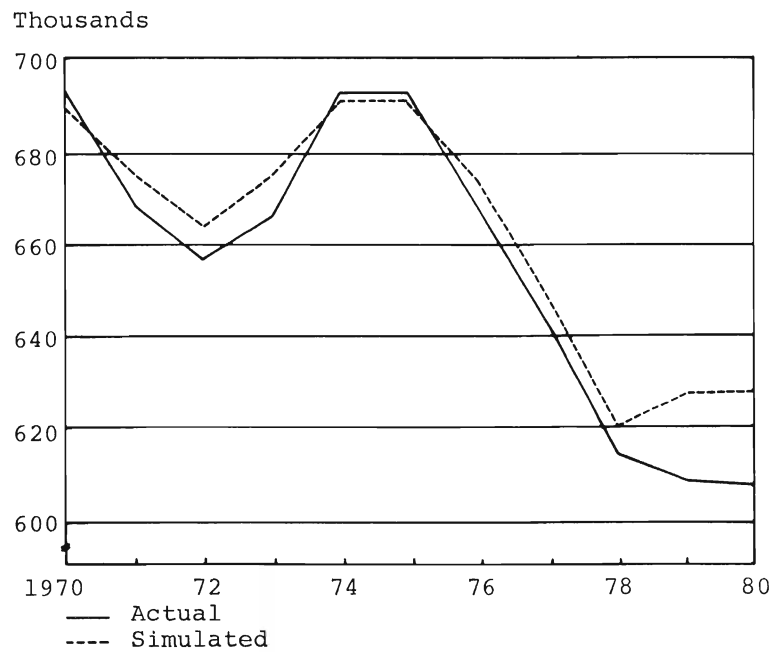


Figure 8.2 Actual and simulated unemployment rate, 1970-80

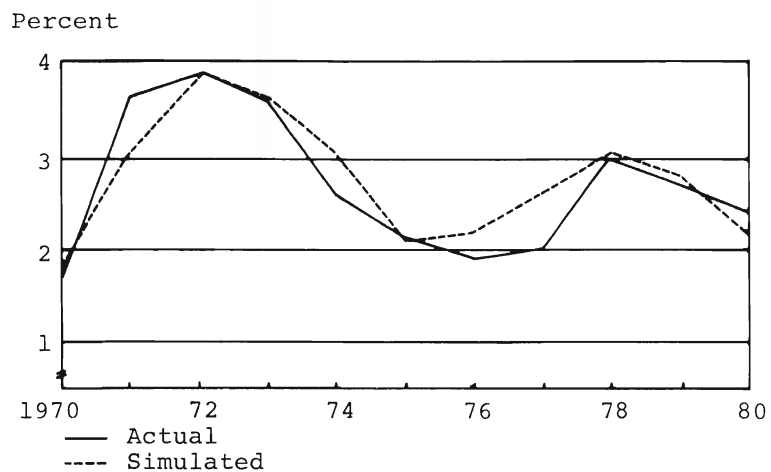


Table 8.4 Historical simulations - mean absolute errors. Period 1970.7-1978.12

	Exogenous sales and orders	Exogenous output
Output	2.2	
New vacancies	13.6	15.8
Unfilled vacancies	22.8	24.8
Hirings	14.7	15.2
Layoffs	34.5	35.1
Quits	15.6	15.5
Hours per worker	4.2	4.1
Total hours	4.2	4.1
Employment	0.9	1.0
Unemployment	15.2	15.5

1000, corresponding to an exogenous increase by 1000 workers per month. It is assumed that compensatory policies, if necessary, will keep the level of output demand unaffected. The simulation experiment is useful for illustrating the properties of the model and will also provide information about the dynamics of labor turnover in an overall labor market context.

The simulations were performed as follows. First, the model was run in a full dynamic simulation, starting in 1970.7, and with the actual values of the exogenous variables. The output from this "base simulation" was recorded and compared to the output from simulations with a higher autonomous unemployment inflow. The hypothetical change in inflow was transitory (lasting for 6 months) in one simulation but permanent in another.

Before reporting the simulation results, it should be instructive to recall some basic features of the model. When there is an increase in unemployment inflow, the end-of-period unemployment stock will increase as well. This will speed up recruitments on part of the firms; hirings will increase and the duration of vacancies will fall. This, in turn, will reduce the end-of-period stock of unfilled vacancies.

When unemployment goes up, quit rates will fall; workers will be more reluctant to choose search unemployment and their offer probabilities will decrease, since firms can be more choosy in their search. The reduced flow of quits tends to decrease the flow of new vacancies, which will add to the decrease in the stock of unfilled vacancies. And when the number of vacancies are falling, the quit reducing effect is reinforced. Analogously, when vacancies are reduced by an exogenous increase in unemployment inflow, the unemployment increasing effect is reinforced via longer duration of unemployment spells.

The firms' layoff behavior will also contribute to the increase in unemployment. Higher unemployment implies that firms find layoffs less risky, since future recruitment efforts should be less costly.

In addition to the positive feedbacks sketched so far, the model includes forces that tend to offset an increase (or decrease) in unemployment or labor turnover. For instance, when hirings increase due to higher unemployment inflow, the number of workers with short tenure will increase as well, which in turn will induce higher quit rates in subsequent periods, thereby increasing the flow of new vacancies, and so on.

The result of two simulations, capturing temporary and permanent unemployment inflow increases, respectively, are set out in Tables 8.5 and 8.6. The increase in inflow was set to 1000 workers per month, which roughly corresponds to 20 percent of the actual inflow during the early 70s.²⁵ The output from the base simulation is indexed with a "B".

With regard to responses to a transitory increase in unemployment inflow, we can note that the initial increase by 1000 persons more than triples after 6 months. The reasons for this "multiplier effect" are several. Since the average unemployment spell lasts for more than one month, a fraction of the newly unemployed will be in the unemployment state for several periods. In addition, there will be an increase in the duration of unemployment, since the number of vacancies available per month will decrease, as shown in rows (5) and (6) in Table 8.5. This is due to the decrease in the duration of vacancies, which occurs when there are more job searchers. It also depends on the decrease in the flow of new vacancies that is induced by the reduction in quit rates.

In addition to the initial increase in unemployment inflow and the induced increase in unemployment duration, there is also an induced inflow effect; the number of layoffs will be about 4 percent higher after 6 months.

Table 8.5 reveals that the effects of a 6 months unemployment inflow increase will last well beyond the six months period. Most of the effects are, however, negligible after a couple of years; the unemployment rate, for example, is virtually iden-

Table 8.5 Simulation experiment: An autonomous increase in the monthly unemployment inflow by 1000 workers for six months
($t = 1972.1$)

Month	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$	$t+6$	$t+10$	$t+20$	$t+30$
1. $U-U_B$	1000	1823	2533	3055	3301	3531	2471	832	357
2. $RU-RU_B$	0.14	0.25	0.35	0.42	0.46	0.49	0.34	0.11	0.05
3. U/U_B	1.030	1.059	1.086	1.112	1.139	1.166	1.095	1.038	1.020
4. N/N_B	1.000	1.000	1.000	1.000	1.000	1.000	1.001	1.001	1.000
5. IV/IV_B	1.000	1.000	0.999	0.997	0.996	0.993	0.985	0.987	0.992
6. V/V_B	1.000	0.996	0.991	0.985	0.976	0.967	0.947	0.960	0.973
7. PH/PH_B	1.003	1.006	1.010	1.013	1.016	1.021	1.017	1.010	1.008
8. Q/Q_B	1.000	1.000	0.998	0.995	0.992	0.989	0.980	0.981	0.987
9. L/L_B	1.008	1.015	1.022	1.029	1.035	1.043	1.030	1.014	1.007
10. H/H_B	1.003	1.005	1.006	1.006	1.005	1.002	0.987	0.985	0.988

Note: The stocks of unemployed, employed and unfilled vacancies refer to the beginning of the months. RU is the rate of unemployment (in percent) and PH is the recruitment frequency ($PH = H/VAC$).

Table 8.6 Simulation experiment: A permanent autonomous increase in unemployment inflow by 1000 workers per month
(t = 1972)

	Year	t	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8
1.	$U-U_B$	3 499	7 606	8 913	9 257	9 481	9 037	8 261	8 587	9 988
2.	$RU-RU_B$	0.48	1.03	1.19	1.25	1.29	1.25	1.17	1.24	1.47
3.	U/U_B	1.138	1.304	1.423	1.631	1.624	1.512	1.410	1.491	1.708
4.	N/N_B	1.000	1.002	1.003	1.006	1.010	1.013	1.014	1.009	1.009
5.	IV/IV_B	0.992	0.965	0.937	0.882	0.828	0.800	0.813	0.846	0.820
6.	V/V_B	0.967	0.879	0.800	0.668	0.567	0.535	0.608	0.651	0.524
7.	PH/PH_B	1.018	1.048	1.076	1.129	1.151	1.137	1.099	1.117	1.194
8.	Q/Q_B	0.989	0.949	0.906	0.834	0.775	0.763	0.807	0.816	0.742
9.	L/L_B	1.037	1.085	1.121	1.188	1.226	1.238	1.228	1.201	1.229
10.	H/H_B	1.000	0.971	0.932	0.856	0.798	0.784	0.826	0.835	0.750

Note: RU is the rate of unemployment (in percent) and PH is the recruitment frequency ($PH = H/VAC$).

tical after 30 months, and quits, layoffs and new hires differ from their "base values" by no more than (approximately) one percent.

We next turn to the responses to a permanent increase in unemployment inflow. The results, compared to the base simulation, are displayed in Table 8.6. It is evident that the initial unemployment effects are quite drastically multiplied via induced increases in unemployment duration as well as induced increases in layoffs. Unemployment is about 50 percent higher after two or three years. Firms can more easily fill their vacancies, which will reduce the end-of-period stock of vacancies. The higher unemployment and the reduction in the stocks of vacancies will make workers less inclined to quit, and the flow of new vacancies will fall as a consequence. Quits will be about 20 percent lower after three years, the flow of new vacancies 10 percent lower, the stock of unfilled vacancies 30 percent lower and recruitment frequencies more than 10 percent higher.

It may be instructive here to recall the familiar identity

$$U = IU \cdot D_u \quad (8.30)$$

where IU is unemployment inflow and D_u is the average duration of unemployment spells. The unemployment increase resulting from an increase in inflow is

$$\Delta U = D_u \cdot \Delta IU \quad (8.31)$$

provided that duration is unaffected. The average duration of unemployment has been about three

months in industry.²⁶ An increase in inflow by 1000 workers would increase unemployment by 3000 workers if duration was unaffected. The simulated increase is about three times as large, which shows the importance of the indirect effects that work upon unemployment duration through the induced changes in the availability of vacancies.

8.4.3 The Dynamic Responses to an Exogenous Increase in Output Demand

The next simulations will trace the responses to exogenous increases in output demand. We consider anticipated demand increases by 5 percent, starting with a transitory change (lasting 6 months) and concluding with a permanent increase.

How does the model transmit an anticipated demand increase through the labor market? In the first round, the demand increase affects the flows of vacancies, hirings and layoffs. The demand increase implies that the number of desired workers goes up, which will increase hirings and the flow of new vacancies; in addition, the firms will be less willing to layoff employed workers.

In subsequent periods, the initial effects on vacancies and hirings will affect quit behavior. And unemployment will decrease both as a consequence of lower layoff rates and as a response to the increase in the number of vacancies. This, in turn, will further reduce quit and layoff rates.

The simulation results are presented in Table 8.7 (transitory change) and Table 8.8 (permanent change). Focusing, first, on the case with a tem-

**Table 8.7 Simulation experiment: An anticipated increase in output demand by 5 percent
for six months
($t = 1972.3$)**

Month	t	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$	$t+10$	$t+20$	$t+30$
1. $U-U_B$	0.00	-68	-198	-363	-667	-1120	-3508	985	976
2. $RU-RU_B$	0.00	-0.01	-0.04	-0.07	-0.13	-0.20	-0.59	0.13	0.13
3. U/U_B	1.000	0.998	0.993	0.985	0.969	0.952	0.889	1.043	1.056
4. N/N_B	1.000	1.001	1.002	1.006	1.012	1.014	1.027	1.003	1.002
5. IV/IV_B	1.037	1.079	1.123	1.213	1.281	1.347	1.025	0.918	0.965
6. V/V_B	1.000	1.039	1.101	1.178	1.322	1.452	1.553	0.783	0.898
7. PH/PH_B	1.022	1.039	1.052	1.023	0.987	0.964	0.890	1.046	1.025
8. Q/Q_B	1.000	1.013	1.036	1.067	1.112	1.162	1.222	0.894	0.946
9. L/L_B	0.969	0.942	0.919	0.848	0.807	0.776	1.034	1.048	1.025
10. H/H_B	1.048	1.108	1.173	1.229	1.283	1.330	1.084	0.895	0.952

Note: The demand increase anticipated at time t pertains to month $t + 3$. The stocks of unemployed, employed and unfilled vacancies refer to the beginning of the months. RU is the rate of unemployment (in percent) and PH is the recruitment frequency ($PH = H/VAC$).

Table 8.8 **Simulation experiment: An anticipated permanent increase in output demand by 5 percent**
($t = 1972$)

	Year	t	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$	$t+6$	$t+7$	$t+8$
1.	$U-U_B$	-1 072	-4 139	-3 357	-2 219	-1 641	-966	-357	-252	-446
2.	$RU-RU_B$	-0.19	-0.70	-0.57	-0.39	-0.32	-0.25	-0.19	-0.16	-0.17
3.	U/U_B	0.957	0.835	0.846	0.851	0.893	0.946	0.983	0.985	0.968
4.	N/N_B	1.012	1.044	1.048	1.048	1.048	1.048	1.049	1.049	1.051
5.	IV/IV_B	1.212	1.192	1.091	1.084	1.086	1.073	1.043	1.027	1.022
6.	V/V_B	1.358	1.652	1.328	1.292	1.290	1.229	1.103	1.060	1.080
7.	PH/PH_B	0.976	0.903	0.935	0.937	0.9453	0.963	0.986	0.989	0.981
8.	Q/Q_B	1.123	1.274	1.151	1.132	1.130	1.100	1.048	1.029	1.038
9.	L/L_B	0.867	0.891	0.934	0.934	0.944	0.958	0.974	0.982	0.986
10.	H/H_B	1.227	1.251	1.130	1.127	1.125	1.096	1.045	1.032	1.039

Note: RU is the rate of unemployment (in percent) and PH is the recruitment frequency ($PH = H/VAC$).

porary demand increase, Table 8.7 shows how firms immediately will increase their hirings. This change comes about both through more new vacancies and through lower recruitment thresholds (a higher frequency of recruited workers per 100 vacancies). The number of workers employed will have increased by one percent after four months; an implication, then, is that the firms' short-run responses to the demand increase will involve a higher output per worker as well as some increase in hours per worker.

After 10 months, the unemployment decrease amounts to 0.6 percentage points or 3 500 workers. However, when the firms anticipate the reduction in demand, they start to be more choosy in their recruitment behavior. The recruitment frequencies will fall and, subsequently, the flow of new vacancies. Associated with this turning point is an increase in unemployment. Over time, the endogenous variables will approach their "base values", but some oscillations are visible. For instance, the unemployment increase associated with the demand switch (back to the base path) will induce a temporary increase in recruitment frequencies.

Let us next turn to the case of a permanent increase in demand. The decrease in the unemployment rate is 0.2 percent during the first year, 0.7 percent during the second and 0.6 percent during the third. As employment increases, the unemployment differential decreases; in the long run unemployment and the level of real output are approximately independent. To understand this result, note that it has been assumed that a 5 percent increase in expected output will imply an equivalent 5 percent increase in the number of desired workers; cf. Eq. (8.3) above. It is the difference

between actual and desired employment that drives labor demand (i.e., the equations for hours per worker, new vacancies, hirings and layoffs). When actual employment approaches desired employment, the flow of new vacancies will fall and, consequently, the duration of unemployment will increase. As the "employment gap" approaches zero, so will the unemployment differential.

A prerequisite for the validity of the result is, of course, that the manufacturing firms can recruit workers from the non-manufacturing sectors, from the not-in-the-labor-force state or through immigration. Again, the possibility of supply constraints should be recognized; the simulation results should be viewed as conditional on an environment where the feedbacks from labor market events to output decisions are negligible in the short run.

8.5 Concluding Remarks

In this chapter we have attempted to provide some insights into how the labor market works as an interrelated dynamic system. A self-contained econometric model of the labor market for Swedish industrial workers has been developed and estimated for this purpose. The model is able to depict how unemployment, employment and labor turnover respond to supply disturbances (such as an exogenous increase in unemployment inflow) or shifts in the path of output demand. The model has been reasonably successful in tracking the actual labor market development of the 70s. Although the exact numbers produced by the simulation experiments should be treated cautiously, several lessons do emerge from the exercise.

The labor market is indeed an interrelated system with important feedback mechanisms. For instance, an increase in unemployment inflow will induce an increase in unemployment duration. This comes about as a response to the reduction in stocks and flows of vacancies, that the unemployment increase produces.

The labor market effects of temporary disturbances may involve substantial lags. For example, a temporary increase in demand will involve not only a temporary unemployment reduction but also unemployment increases in periods subsequent to the demand disturbance.

In the long run, the level of unemployment appears to be approximately independent of the level of real output. It is the difference between actual and desired employment that determines the flow of vacancies and, indirectly, the duration of unemployment. When desired employment is reached, vacancies will return to "normal" levels and the initial unemployment reduction will taper off.

It is beyond the scope of this study to discuss policy implications of the results. Suffice it here to mention one point. To the extent that the government wants to foster structural changes in the economy, an unemployment-increasing policy is a double-edged weapon. Persons in the unemployment state are presumably more inclined to change location, but, on the other hand, higher unemployment makes employed workers less willing to change jobs. This decrease in quit rates will, in turn, affect vacancies, and will reduce quits in subsequent periods.

9 SUMMARY AND TOPICS FOR FUTURE RESEARCH

9.1 Summary

One starting point for this study was the decline observed in Sweden during the past two decades in various indicators of labor mobility. Available measures of quit rates, job mobility and migration have all displayed a downward trend, raising some concern about the possible adverse allocation effects of a less mobile labor force.

This study was intended to go beyond the often rather anecdotal interpretations of observed changes in aggregate mobility indicators. To do so requires identification and quantitative assessment of factors that govern individual decisions on job and locational changes. This has been the main approach in the present study. By econometric analyses on, primarily, micro data it has been possible to provide information of much richer detail than what is available in aggregate series.

The variety of data sets explored do not usually have exact counterparts in the most well-known aggregate series, for example those covering quits and migration. Hence, it is not without problems to use the results from the micro-data analyses to provide a complete decomposition of the observed trends in the aggregate mobility series. However, a number of clues do emerge that allow us to identify various key factors.

First and foremost, it is clear that the weakened demand for labor during the 70s is a major explanation of the decline in mobility rates that has occurred during this period. Quit rates among blue collar workers in Swedish industry reflect cyclical fluctuations; the estimates in Chapter 4 based on aggregate data indicate an elasticity with respect to vacancy rates of around 0.3, implying that an increase in vacancies by 30 percent will induce a 10 percent increase in quits.

There are also important indirect cyclical effects to consider. The weakened demand for labor has produced substantial reductions in new hire rates. We have shown that short length of tenure is one of the most important predictors of subsequent job mobility. Consequently, a reduction in vacancy rates will decrease mobility indirectly by reducing the frequency of new hires.

The average plant size in Swedish industry has shown a steady increase during the 1960s and 70s. This development indicates a growing importance for internal labor markets and weaker incentives for workers to contemplate external mobility. The empirical evidence presented in Chapter 4 shows that quit rates in large plants are substantially below those in small plants, holding constant a number of characteristics of the plants and the local labor markets.

We have also (in Chapter 6) provided evidence of the increasing importance of firm-specific human capital. It appears that the wage payoff to male workers of "inside training" (i.e., training within the current firm), has increased relative to "outside training". This obviously implies

stronger incentives to avoid repetitive job changes.

The 1970s have brought a dramatic increase in labor force participation of Swedish women. This development has implications for mobility behavior as well. We find in Chapter 4 that female workers were more quit prone in the 1960s than in the 70s and early 80s. Most likely, this reflects a stronger labor force attachment on part of women, resulting in less frequent labor force transitions.

The growing number of two-earner households has also affected the frequency of locational changes. We show in Chapter 5 that family migration probabilities are lower if the wife is working; the higher female participation ratios have, accordingly, contributed to a reduction in migration rates.

The importance of locational ties seems to have increased over time. The analyses in Chapter 5 indicate that frequent contacts with relatives or friends had insignificant migration consequences during the late 60s, but pronounced adverse mobility effects during the late 70s. It appears as if Swedish households have become more sensitive to non-pecuniary costs associated with migration.

Mobility incentives are related to the tax system. Higher progressivity will reduce potential wage gains associated with mobility, thereby also reducing the incentives to change jobs. Chapter 7 provides illustrative estimates of how progressive taxes affect mobility behavior, indicating that a less progressive tax system would have produced a higher rate of job mobility.

Workers are likely to move in response to prospects of higher wage growth rates, and rates of wage growth are affected by mobility. The econometric analyses in Chapter 7 indicate that job movers during the period 1968-74 on average obtained about 4 percentage points higher real wage growth compared to a situation where they had decided not to move. There is also some evidence consistent with the hypothesis that self-selection in the labor market is efficiency improving; the excess wage growth from job changing is higher for movers than for measurably similar stayers. It is interesting to note that mobility gains fall rapidly over the life cycle.

Disincentives to mobility may have been strengthened by legislative changes. The employment security legislation is an obvious example. The effects are several, partly of opposite directions. One effect shows up in the behavioral equations for permanent layoffs and unemployment, presented in Chapter 8; layoff rates have declined and so has unemployment inflow. Simultaneously, however, firms have become more choosy in their recruitment behavior, presumably because of higher layoff costs. It is quite likely that the legislation has resulted in a substitution of quits for layoffs. Workers who have been offered advance notice on future layoffs have strong incentives for on-the-job search and may change jobs prior to the layoff date. Against this effect, however, is the loss of seniority associated with job changes among those not threatened by layoffs which results in an increase in the cost of moving.

A positive association between mobility probabilities and education is found in several data sets.

There are different plausible interpretations to suggest, discussed in Chapters 4 and 5 of this study. It is likely, therefore, that the improved education of the work force has made job and locational changes more frequent over time. This effect has offset some of the changes of the past two decades that have deterred mobility.

Another objective of the study has been to illuminate the dynamics of labor turnover by viewing the labor market as an interrelated system of stocks and flows. To this end, a self-contained econometric model of the labor market for Swedish industrial workers was developed and estimated in Chapter 8. We have by simulation experiments illustrated how labor market flows respond to supply disturbances as well as shifts in the output demand path. They show, for example, that an increase in unemployment inflow will be accompanied by an induced increase in unemployment duration. This effect is a response to the reduction in the number of vacancies that is produced by the unemployment increase.

9.2 Topics for Future Research

A number of issues has been omitted from the present study. Some of the omissions are imposed by data constraints. For obvious reasons, it is preferable to undertake analyses of job mobility and migration on panel data. Not only do panel data allow identification of mobility status (mover vs stayer), but they also provide information on outcomes of interest, e.g. post-mobility wage rates.

The Level of Living Surveys are the most useful existing data sets for microeconomic analyses of labor mobility in Sweden. However, the LLS data have some weaknesses. For example, the data contain little detailed information about household members other than the respondent. There is every reason to believe that the employment status and earnings power of both spouses should influence family migration decisions. In fact, our results in Chapter 5 indicate that this is the case. Estimation of structural household mobility models requires more data about both spouses; wage information is the most obvious example.

Moreover, the LLS panel waves are between 6 and 7 years apart, and labor market events between the survey dates are not well measured. We can register whether job mobility has taken place between the surveys, but we cannot take into account the fact that some individuals change jobs several times between those dates. Recent advances in "continuous time methods" allow the analyst to take into consideration the timing of mobility events throughout the period in question. (Key references are Tuma et al., 1979, and Flinn and Heckman, 1982.) Future survey designs should, in principle, try to capture all moves between the survey dates, thereby allowing the analyst to extract more information from the data.

Population heterogeneity is likely to interfere with unbiased estimates of the monetary returns to individual job changes. By using explicit self-selection models it is possible, at least in principle, to take into account the interdependence between the mobility decision and the expected returns to mobility. An example of this approach is given in Chapter 7.

The self-selection approach is, however, not without problems. Matching processes in the labor market are certainly not unrelated to hiring and firing rules practiced by employers. To the extent that job separations are induced by firms, there is little reason to have much confidence in selection rules based on income-maximizing employee behavior. For example, the income effects associated with job mobility resulting from plant closures would presumably differ from income effects related to voluntary job mobility. A deeper understanding of the causes and consequences of labor mobility would therefore require more detailed information on the characteristics and behavior of employers.

We have indicated on several occasions in this book that actual and prospective wages do indeed appear to have a significant impact on the allocation of labor. The evidence on the role of non-wage job attributes, however, was rather mixed. The reasons for these results are not clear, but measurement errors in the working conditions variables are among the possibilities to be considered. Pooling data on employers with data on "objective" rather than respondent reported work place characteristics may be necessary in order to settle the issue of the role of nonwage job attributes in the allocation of labor.

The normative implications of a less mobile labor force have not been dealt with in this study. There is no simple relationship between mobility and efficiency, except in some cases where the reasons for a reduction in mobility are well understood. For example, a progressive tax system drives a wedge between the private and social

gains of mobility, thereby resulting in "underinvestment" in mobility.

There may, however, also be social gains associated with a less mobile labor force. In particular, a reduction in turnover rates will make employers more inclined to train their workers; the incentives for investing in firm-specific human capital clearly increase. There may also be other productivity-enhancing effects arising from a more stable work force, and some empirical evidence indeed suggests that lower turnover rates contribute to higher productivity at the plant level (Brown and Medoff, 1978). This is an important point to recognize in future research on the microeconomic determinants of productivity growth.

No obvious normative conclusions follow from decreases in mobility that are due to changes in preferences. To some extent the growth in the labor force participation rates of women may reflect such changes in preferences. An induced reduction in family migration probabilities is in that case hardly a major social concern.

As is well known, the secular increases in real income have had significant effects on household consumption patterns. It should be no surprise, then, that the demand for "location-specific capital goods" has changed as well. The increasing demand for single-family houses is one example, the increasing emphasis placed on local ties with friends and relatives may be another.

APPENDIX A ON WAGE LEVEL AND WAGE CHANGE EQUATIONS

The point of departure for the analysis of wage growth in Chapter 7 is the Mincer-type of cross-sectional wage equations, with arguments such as schooling (S), experience (EXP) and possibly other personal characteristics explaining wage levels at each point in time. Assume that the following specifications are valid for the years t and t-k,

$$\ln w_{it} = \alpha_0 + \alpha_1 S_{it} + \alpha_2 EXP_{it} + \alpha_3 EXPSQ_{it} + \varepsilon_{it} \quad (A.1)$$

$$\ln w_{it-k} = \beta_0 + \beta_1 S_{it-k} + \beta_2 EXP_{it-k} + \beta_3 EXPSQ_{it-k} + \varepsilon_{it-k} \quad (A.2)$$

where EXPSQ is experience squared. The wage change equation is given by

$$\begin{aligned} \Delta \ln w_i = & \alpha_0 - \beta_0 + \alpha_1 \Delta S_i + \alpha_2 \Delta EXP_i + \alpha_3 \Delta EXPSQ_i \\ & + (\alpha_1 - \beta_1) S_{it-k} + (\alpha_2 - \beta_2) EXP_{it-k} \\ & + (\alpha_3 - \beta_3) EXPSQ_{it-k} + \varepsilon_{it} - \varepsilon_{it-k} \end{aligned} \quad (A.3)$$

It is clear from (A.3) that levels of human capital variables belong to a wage change equation only if there are reasons to believe that the coefficients have changed over time. The Swedish setting provides an example where the possibility of such effects should be recognized.

Estimation of a wage change equation including the initial levels of all human capital attributes will certainly involve multicollinearity problems.

However, a convenient restriction can be imposed by replacing the initial values of the human capital variables with the lagged wage level. This restriction implies that all coefficients are forced to change in the same proportion, to the extent that there is some change at all. Assume that the following constraints are imposed on the schooling and experience coefficients,

$$\alpha_1 - \beta_1 = \delta\beta_1, \text{ i.e., } \alpha_1 = \beta_1(\delta+1) \quad (\text{A.4})$$

$$\alpha_2 - \beta_2 = \delta\beta_2, \text{ i.e., } \alpha_2 = \beta_2(\delta+1) \quad (\text{A.5})$$

$$\alpha_3 - \beta_3 = \delta\beta_3, \text{ i.e., } \alpha_3 = \beta_3(\delta+1) \quad (\text{A.6})$$

where δ is a factor of proportionality, equal to zero if no change of the parameters takes place. Substituting (A.4) - (A.6) into (A.3) yields

$$\begin{aligned} \Delta \ln w_i = & \alpha_0 - \beta_0 + \alpha_1 \Delta S_i + \alpha_2 \Delta \text{EXP}_i + \alpha_3 \Delta \text{EXPSQ}_i + \\ & \delta\beta_1 S_{it-k} + \delta\beta_2 \text{EXP}_{it-k} + \delta\beta_3 \text{EXPSQ}_{it-k} + \varepsilon_{it} - \varepsilon_{it-k} \end{aligned} \quad (\text{A.7})$$

From (A.2) we have

$$\begin{aligned} \ln w_{it-k} - \beta_0 - \varepsilon_{it-k} = & \beta_1 S_{it-k} + \beta_2 \text{EXP}_{it-k} \\ & + \beta_3 \text{EXPSQ}_{it-k} \end{aligned} \quad (\text{A.8})$$

Multiplying both sides by δ and substituting in (A.7) gives

$$\begin{aligned} \Delta \ln w_i = & \alpha_0 - \beta_0(1+\delta) + \alpha_1 \Delta S_i + \alpha_2 \Delta \text{EXP}_i + \alpha_3 \Delta \text{EXPSQ}_i \\ & + \delta \ln w_{it-k} + \varepsilon_{it} - (1+\delta)\varepsilon_{it-k} \end{aligned} \quad (\text{A.9})$$

and hence the proportional shift factor, δ , will show up as the coefficient for the lagged wage level. It is clear that $\delta < 0$ implies a reduction (in absolute value) of all coefficients.

The presence of a lagged dependent variable introduces some estimation problems, since the composite error term in (A.9) generally will be correlated with the lagged wage rate. However, if the stochastic errors in the wage level equations are autocorrelated,

$$\varepsilon_{it} = \rho \varepsilon_{it-k} + u_{it} \quad (\text{A.10})$$

it holds that ε_{it-k} drops out if $\rho = 1 + \delta$. Thus, the consistency of OLS in this context requires that the stochastic errors in the wage level equations follow a particular autocorrelation structure. In the general case OLS will produce inconsistent estimates and an appropriate estimation procedure requires instrumenting the lagged wage rate.

The validity of the specification of the wage change equation in (A.9) is of course conditional on the appropriateness of the specified wage level equations and on the realism of the uniform shifts of the coefficients. A simple check of the latter issue is displayed in Table A.1, giving estimated wage level equations for men in the panel we study. A clear pattern is that all coefficients are numerically smaller in 1974, with a mean ratio slightly above 0.5, implying an average factor of proportionality, δ , somewhat below 0.5. The pattern of uniform coefficient reductions is rather striking; the restrictions implied by (A.9) thus seem to be roughly supported by the data and will

therefore be used in the estimations of wage change equations.

Table A.1 Estimated wage level equations for men, 1968 and 1974
(t-ratios in parentheses)

	1968		1974		Ratio between coefficients (3)/(1) (4)/(2)	
	(1)	(2)	(3)	(4)		
Constant	5.846 (151.1)	5.766 (140.6)	6.822 (168.8)	6.793 (160.4)		
Schooling	0.077 (25.17)	0.081 (25.72)	0.051 (22.59)	0.052 (22.32)	0.66	0.64
EXP	0.042 (15.24)	0.043 (15.30)	0.021 (8.998)	0.021 (9.172)	0.50	0.49
EXPSQ/1000	-0.751 (-12.71)	-0.733 (-12.55)	-0.323 (-7.862)	-0.327 (-7.997)	0.43	0.45
Married	0.141 (6.482)	0.134 (6.156)	0.070 (5.030)	0.070 (4.004)	0.50	0.52
R ²	0.465	0.471	0.334	0.336		
Sample size	1231	1233	1192	1192		

Note: Eqs. (1) and (3) use reported values of experience, whereas (2) and (4) use values of experience calculated as $EXP = AGE - S - 7$. Workers with unemployment experiences 1968-74 are not excluded. The data set includes men in the panel of the Level of Living Surveys of 1968 and 1974.

APPENDIX B TURNOVER DATA AND CHANGES IN EMPLOYMENT

SCBs turnover data for blue-collar workers are intended to represent accessions and separations during the month. However, the actual measurement period chosen by the responding establishments may cover only two weeks (at minimum). SCB estimates monthly turnover figures on the basis of these reports from plants in the survey.

The establishments' reports on the number of employed workers refer to one particular day, chosen by the plant within the measurement period of at least two weeks. For obvious reasons, changes in employment according to the stock data may differ from employment changes calculated from the flow data.

To obtain some information about this stock-flow inconsistency, we proceeded as follows:

First, a comprehensive monthly series on the number of employed workers was constructed for a period starting in January 1968.¹ By linear interpolation these employment figures were redefined as pertaining to the beginning of the month. Let ΔN denote the change in employment during the month and define DIF as the difference between stock and flow computed change in employment, i.e.

$$\text{DIF} = \Delta N - (\text{H-Q-L}) \qquad (\text{B.1})$$

where H is hirings, Q quits and L layoffs. It is found that DIF has a mean value of -1836 for the period 1968;2-1978;6, implying that the flow data overestimate the number of accessions and/or underestimate the number of separations.

In order to gain further information on the nature of the stock-flow inconsistency three "stock-adjusted" flow series were constructed. These data fulfill the constraint

$$\Delta N = \hat{H} - \hat{Q} - \hat{L} \quad (B.2)$$

and $\hat{H}$, $\hat{Q}$, $\hat{L}$ are the adjusted flows (hirings, quits, layoffs). Next, define the latter variables as follows:

$$\hat{H} = H \left[1 + \frac{DIF}{H+Q+L} \right] \quad (B.3)$$

$$\hat{Q} = Q \left[1 - \frac{DIF}{H+Q+L} \right] \quad (B.4)$$

$$\hat{L} = L \left[1 - \frac{DIF}{H+Q+L} \right] \quad (B.5)$$

The residual, DIF, has now been allocated to the flows according to the magnitude of the different flows. We observe the following mean values for the period 1968;2-1978;6:

H = 17001	$\hat{H}$ = 15804
Q = 14028	$\hat{Q}$ = 14618
L = 1479	$\hat{L}$ = 1527

The original turnover variables were regressed on the adjusted variables plus seasonal dummies. The results are set out in Table B.1. The most important observation is that the stock-adjusted flow series display a different seasonal pattern than

Table B.1 Comparisons of original and adjusted turnover series
(t-ratios in parentheses)

	H	Q	L
Constant	346.7 (0.91)	-15.37 (-0.05)	-18.1 (-0.45)
$\hat{H}$	1.05 (62.91)		
$\hat{Q}$		0.94 (55.9)	
$\hat{L}$			0.98 (69.1)
D2	135 (0.32)	-66 (-0.21)	-58 (-1.26)
D3	-371 (-0.87)	345 (1.08)	-16 (-0.33)
D4	-693 (-1.63)	651 (2.03)	46 (0.99)
D5	-3122 (7.28)	2604 (8.11)	232 (4.95)
D6	7373 (15.78)	-2399 (-7.27)	-276 (-5.93)
D7	396 (0.91)	-373 (-1.13)	-70 (-1.45)
D8	-2092 (-4.42)	2706 (6.19)	113 (2.36)
D9	594 (1.33)	-274 (-0.80)	-89 (-1.86)
D10	497 (1.13)	-225 (-0.68)	-75 (-1.58)
D11	150 (0.35)	-70 (-0.21)	-76 (-1.60)
D12	-1596 (-3.63)	1426 (4.29)	212 (4.44)
R^2	0.99	0.99	0.98
DW	1.95	1.75	1.59

Note: D2,...,D12 are seasonal dummy variables for the months February to December.

the original data. The differences are quite pronounced for the months May, June, August and December, i.e., months where short-term jobs (e.g. vacation substitutes) are most likely to be frequent. Vacation substitutes hired in June appear to show up in the original hiring data to a much larger extent than in the stock data (cf. the large positive coefficient for the June-dummy in the H-equation). Likewise, the termination of those jobs in August is registered in the flow data but less so in the stock data (cf. the large positive August-coefficient in the Q-equation).

The quit equation estimated in Chapter 4 is based on unadjusted data on quits. In Chapter 8, on the other hand, we use stock-adjusted data on quits, layoffs and new hires.

**APPENDIX C LABOR TURNOVER AND MIGRATION:
A SURVEY OF EMPIRICAL RESEARCH**

In this appendix we survey some empirical studies on labor mobility. Most of these studies are based on U.S. data; a few studies are British. We confine the survey of non-Swedish studies to papers published during the last two decades. Needless to say, the survey does not pretend to be complete.

C.1 Sweden

Most previous Swedish studies of labor mobility have been based on data for cross-sectional aggregates of industries or regions. One of the first was the dissertation by Rudolf Meidner (1954) on the Swedish labor market at full employment (Svensk arbetsmarknad vid full sysselsättning). The study was inspired by the early postwar period debate on "excess mobility", and "disorganization" in the labor market. A popular view was that full, or "overfull", employment might lead to productivity losses through high quit rates, high absentee rates and weak incentives for occupational training. Meidner's objective was to describe the magnitude of mobility, its business cycle variations and its dependence on certain worker-specific and firm-specific conditions.

One important observation in Meidner's study concerns the extent of branch mobility versus local mobility among work places. Meidner found a pronounced attachment to branches and occupations but

a high degree of mobility among firms in local labor markets.

Meidner was also able to reveal seasonal and cyclical patterns in mobility behavior. Another observation was that mobility turned out to be highly concentrated among young workers with short length of tenure. Furthermore, mobility displayed a positive relationship with the degree of urbanization; the turnover rates appeared to be about 2-3 times higher in Stockholm than in small towns.

Meidner also tried to ascertain possible relationships between mobility and relative wage rates. His studies of mobility between different trade unions indicated that the relationship between wages and "leavers" was stronger than the association between wages and "arrivals".

Meidner's study was primarily based on analyses of fairly aggregate data. Bengt Rundblad's IUI-study (1964) on the mobility of labor (Arbetskraftens rörlighet) was, on the other hand, based on interviews with male workers in a local labor market (Norrköping). Some results such as the relationships between age and mobility confirmed Meidner's findings. Almost one third of the total number of respondents stated economic motives for job mobility. About 20-30 percent were disappointed with work-place conditions and many respondents were unable to give any rational explanation of their behavior. About 30-40 percent of the workers stated as reason for accepting the current employment that they accepted what was available or took the first found offer. This type of answer was especially prevalent among young workers but substantially lower among white collar workers.

A third Swedish study is Magnus Hedberg's "The Process of Labor Turnover" (1967). This study is essentially a descriptive analysis of cyclical and seasonal fluctuations in labor turnover as well as turnover variations among different age groups and groups with different length of tenure. Hedberg demonstrated a marked relationship between quit rates and length of tenure; a cohort of new hires tends to be halved after one year. The tenure effect turns out to be non-linear; the quit-probability for a person with two years of tenure is not significantly different from the quit-probability for a person with three or four years of employment in the same firm.

A few studies on migration have focused on migration rates for counties (län) or "A-regions" (aggregates of municipalities within counties). A paper by Gallaway et al. (1973) explores the determinants of Swedish inter-county migration in 1967. Migration flows are explained by average regional income levels, the distance between the regions and population density. Distance is an proxy for moving costs and population density is assumed to capture preferences for rural living. The estimations by Gallaway et al. confirm the suggested hypotheses. In particular, the migrants are found to be highly responsive to regional income differentials.

The model specified and estimated by Gallaway et al. was criticized by Holmlund and Dahlberg (1978). They showed that the estimated income elasticities were sensitive to the choice of data and suggested that a job vacancy approach should be more fruitful when explaining inter-county migration flows as well as cyclical fluctuations in

migration rates. Their estimations supported this view; inclusion of vacancies among the RHS variables produced a drastic reduction in estimated income elasticities.

The model estimated by Holmlund and Dahlberg has been extended by Nilsson (1982), who has been working with pooled cross-section time-series data for inter-county migration. Again, the state of the labor market in current and prospective regions turns out to be of importance for migration flows. There is, however, also a trendwise reduction in migration that is unexplained by cyclical and regional labor market characteristics.

In the mid-1970s, the Swedish Ministry of Labor contributed to an ambitious project on social and economic effects of geographical mobility. Some of the results are presented in Dahlberg (1978) and Åberg (1978). The study focused on a group of persons who moved from six municipalities in northern Sweden in 1969 and 1970 and, simultaneously, received mobility subsidies. This implies that the persons were unemployed or were facing risks of becoming unemployed. Experiences of the migrants were compared to control groups of stayers.

The economic analyses indicated that individual income gains (net of taxes) were negligible whereas social gains (in terms of contribution to total output) in general were positive, especially for migration to the metropolitan areas.

As this study indicates, migration may have significant consequences for income and employment growth. Prospective migrants may, however, also

respond to expected changes in income or employment opportunities. Hence, migration, income and employment may be treated as jointly dependent variables within a simultaneous-equations framework. Greenwood ((1973) and (1975)) has developed such models to account for various interactions between urban growth and migration in the U.S. Dahlberg and Holmlund (1978) apply the basic ideas to Swedish data. A four-equation model is specified where out-migration rates, in-migration rates, changes in income and changes in employment are endogenous variables. Migration between the 70 Swedish A-regions during the 1960s are investigated.

C.2 Other Countries

A. Quit rates and job mobility

Cross-sectional industry data and aggregate time-series data

Quit rate studies appearing in the literature during the 1960s and the early 70s were based mainly on data for cross-sectional aggregates, mostly for U.S. manufacturing industries. Among the more well-known studies are those of Stoikov and Raimon (1968), Burton and Parker (1969), Pencavel (1972), and Parsons (1972). They all corroborate the view that quit rates decrease with higher (relative) wage rates. This result holds in OLS-estimations, but also if possible simultaneity between wages and quit rates is accounted for ((Pencavel (1972) and Shorey (1980))). Another result revealed by several cross-section studies, including those above, is the positive quit effect arising from short length of tenure.

The cross-sectional studies have not always been able to establish any significant relationship between quit rates and firm size; an exception is Shorey (1980), who reports the expected negative sign. A negative relationship between quit rates and union membership appears also to be established. The union effect is consistent with an "exit-voice" theory of the labor market; the fact that workers are unionized indicates that they prefer collective actions (voice) against the employer rather than individual quits (exit).

Several researchers have tried to establish the relationship between non-wage job characteristics and quit behavior. Viscusi (1979) concludes that workers demand wage premiums for jobs with high injury risks. He also finds that quit rates are higher in industries with high injury risks, holding constant other industry characteristics.

The role of union-negotiated seniority provisions for labor mobility has been addressed by several U.S. researchers. One example is the study by Block (1978). The hypothesis is that the seniority provisions - related to, e.g., rules for promotions, layoffs and recalls - would reduce mobility by imposing costs (foregone benefits) on workers who change firms. Block's empirical analysis indicated that such provisions did indeed reduce quit rates. Of particular importance were provisions related to promotions.

In 1965 an OECD group of experts presented a report on "Wages and Labour Mobility", which analyzed data on changes in earnings and changes in employment for several countries. An important conclusion of the study was that "there is no

evidence of a strong systematic relationship between changes in earnings among individual industries and variations in relative employment" (p. 16). The OECD report has, however, some weaknesses. For instance, the study claims job availability to be the most important mechanism for the allocation of labor but provides no analysis of the relative importance of job availability vs. relative wages.

A study by Pissarides (1978) addresses the issues raised by the OECD report by using more appropriate model specifications and statistical techniques. Employment flows between industries in Britain were explained by relative wages and excess demand for labor. The results indicated that job availability did succeed in inducing some movement, but "where used, relative wages have been very effective in inducing labour movement".

A few time-series studies of quit rates have been published. The investigations usually attempt to estimate the cyclical sensitivity of quit rates. In some cases the authors have focused on the role of inflation and inflationary expectations or the effects of institutional changes.

In general, these studies find pro-cyclical quit variations. Hamermesh (1969) estimates a strong negative relationship between unemployment rates and quit rates but also a surprising positive relationship between quits and changes in unemployment. Hamermesh presents no interpretation of the latter result.

Mattila (1969) finds a strong positive relationship between quit rates and vacancies. He also

observes that this relationship is especially pronounced in low wage industries. Male quit rates turn out to be more sensitive to changes in labor demand. Finally, the number of new hires in the preceding month is shown to have a significant effect on quit rates.

Parsons (1973) presents a fairly elaborated theoretical model and estimates quit equations on monthly data. The objective is to test a search theoretic hypothesis: Does unexpected wage inflation cause a reduction in quit rates? Parsons interprets his result as a rejection of this hypothesis. A problem, however, is that Parsons' empirical analysis makes no distinction between wage inflation per se and unexpected wage inflation; the explanatory variable used is the actual relative change in the nominal wage rate.

Barron and McCafferty (1977) make the distinction between quits entering unemployment and job mobility without intervening unemployment. They found that the quit rate into unemployment is responsive to vacancy rates; when the labor market improves, workers are more inclined to quit into search unemployment. An interpretation put forward by the authors is that unemployment inflow partly "may be viewed as utility maximizing rather than 'exogenous' behavior".

Household Micro Data

The growing availability of household panel data has substantially improved the possibilities for more decisive tests of hypotheses about quit behavior. For instance, the exit-voice framework has

been applied by Freeman (1980) to an analysis of quits. The results strongly suggest that "trade unionism appears to reduce the exit propensity of workers, with at least some of the effect due to the operation of unions as an institution of collective voice" (Freeman, 1980).

Other studies on household micro-data are presented in Viscusi (1979). Among other findings, Viscusi reports that workers are less likely to quit as they grow older, and more likely to quit if their education improves (holding wage rates, tenure and some other personal characteristics constant). Again, the presence of injury risks implies higher quit probabilities and higher expressed quit intentions as well.

The role of non-wage job characteristics on quit decisions has also been investigated by Bartel (1982). The results show that some nonwage job attributes had significant effects on quit behavior, but the effects were different across age groups. A strong positive effect of job repetitiveness was found for young men, whereas job repetitiveness actually reduced quits among middle-aged men.

Job mobility may have implications for life cycle earnings profiles. Mincer and Jovanovich (1981) and Borjas (1981) address this issue. Both studies conclude that job mobility is an important determinant of the distribution of earnings. Mincer and Polachek find that differences in mobility during the first decade of working life do not produce long-run differences in earnings. Persistent movers at later stages of working life have lower wage levels and flatter life cycle wage growth.

The emergence of longitudinal micro-data sets has enhanced the possibilities of studying the outcome of decisions on job changes and migration. Typically, such studies focus on effects on earnings. A standard approach involves estimating wage growth functions and adds an intercept dummy - and possibly some interaction variables - to capture mobility effects. Examples of this approach are Duncan (1979), Black (1980) and Bartel and Borjas (1981). Bartel and Borjas find greater gains associated with mobility among young men. In addition, the effects of turnover on wage growth vary with the cause of turnover; workers who quit experienced more favorable outcomes than those who were laid off.

Another look at the relationship between earnings growth and mobility is taken by Bartel (1980). By using detailed information on salary histories of individuals it is possible to decompose earnings growth into growth occurring on the job and growth occurring between jobs. Bartel finds that earnings gains due to job mobility vary by education; the least educated individuals had the largest proportion of earnings gains occurring between jobs.

Job mobility and wage growth are likely to be simultaneously determined - workers respond to prospective wage gains and actual mobility decisions will result in such gains. This two-way causality between wages and mobility is taken into account by Borjas and Rosen (1980), who apply Heckman's (1979) technique for handling self-selection. Although the standard errors are large, their results indicate the presence of positive sorting effects in the labor market; job changers attained greater wage growth on the new job than stayers

(and stayers had greater wage growth in their job than what changers would have had, had they stayed).

B. Migration

Numerous contributions to the migration literature have been made by researchers in economics, sociology, demography and geography during the past decades. A survey of some of the contributions from economists is given in Greenwood (1975). Since this survey was published, a number of new research efforts have taken place in conjunction with the emergence of longitudinal data sets for individuals and families. We will mention a few studies dealing with migration, information, employment status and income.

A common finding in migration studies is that distance acts as a deterrent to migration; the usual interpretation is that distance is a proxy for moving costs, including non-pecuniary (psychic) costs. There is, however, also an interpretation based on the notion of imperfect spatial information. The amount of information flows between two regions diminishes as the distance between them increases; hence migration may decrease with distance because of reducing awareness of job opportunities at alternative destinations. On the basis of empirical analyses Schwartz (1973) argues that "the distance effect is really an information effect". Likewise, Herzog and Schlottman (1981) present empirical evidence indicating that "the negative relationship exhibited between migration propensity and distance is an information cost phenomenon".

Imperfect spatial information also plays an important role for the interpretation of subsequent (including return) migration. Yezer and Thurston (1976) as well as Allen (1979) argue that subsequent migration is predominantly a response to the migrant's disappointment at the destination. Migrants with less accurate information will show a higher probability of subsequent migration.

The role of employment status for migration has been explored by DaVanzo (1978). The study shows, *inter alia*, that families whose heads are unemployed are more likely to move than those whose heads are employed.

The relationships between migration and job mobility are explored by Bartel (1979) with micro data. The theme of the study is that a proper understanding of the migration process requires knowledge of the links between migration and job mobility. Bartel shows, among other things, that the wage gains to migration depend on whether the move was related to a quit or a layoff.

Most migration studies have focused on the individual and have ignored the family context. Mincer (1978) takes a first step towards analyzing migration decisions within two-adult households. Family ties are said to exist when individual migration gains of family members differ in sign. The assumption is that a family moves when net family gain from moving is positive. The tied person is one whose gain (or loss) is smaller in absolute value. Mincer's empirical analysis shows lower migration rates of families with working wives. The deterrent effects are stronger when the wife's attachment is more permanent and where her earning power is higher.

The idea that an individual's migration activity is chosen on the basis of perceived returns associated with the alternatives is not new. However, it is problematical to empirically implement this hypothesis on micro data. Studies by Polachek and Horvath (1977) and Nakosteen and Zimmer (1980) are examples of attempts to estimate structural decision models for migration. Polachek and Horvath focus on two-adult families but ignore self-selection whereas Nakosteen and Zimmer deal with individuals but take self-selection into account. Both studies find that agents respond to prospective income gains in the expected direction. Polachek and Horvath, however, find that expected increases in the wife's earnings had negligible effects on migration.

NOTES

Chapter 2

¹ The unemployment rate for insured employees, chained to the unemployment rate for trade union members.

² It is not easy to make well-informed judgments about the quality of the statistics underlying Figure 2.1. Among other things, it should be noted that SCB introduced new measurement techniques in 1968, which may have affected the possibilities of making reliable comparisons over time. Essentially the same definitions and measurement procedures have, however, been applied since 1968.

³ Three term moving averages on seasonally adjusted data.

⁴ Björklund (1978), p 383.

⁵ An important source of unemployment inflow is termination of temporary jobs ("åtaget arbete slutfört"). This component accounts for about 20 percent of the inflow. It is likely that a substantial part of this flow is reported as "employee initiated" separations by the firms (i.e., quits in our terminology).

⁶ Three term moving averages on seasonally adjusted data.

⁷ The data are based on a sample from the engineering industry and include about 600 plants. This data source is obtained from SCB and will be further exploited in Chapter 4.

⁸ The questions have been:

- A. Which was your major employer during the year?
- B. Did you work in this firm all of your employment weeks during the year?

⁹ Employment and Earnings, various issues. However, a recent paper by Ragan (1984) finds a significant downward trend in the U.S. manufacturing quit rate when, among other things, changes in the demographic composition of the work force are taken into account.

¹⁰ Employment and Earnings, Explanatory Notes.

¹¹ See Feldstein (1975) and Employment and Earnings, various issues.

Chapter 3

¹ For a searching worker, Eq. (3.1) can be written as

$$V(\bar{w}) = \bar{w} - c + \theta(1-F(w^*))\left(\frac{\tilde{w}(w^*)}{r} - \frac{C_M}{1+r}\right) + (1 - \theta + \theta F(w^*))\left(\frac{V(\bar{w})}{1+r}\right) \quad (3.1)'$$

where $\tilde{w}(\cdot)$ is the expected acceptable wage, i.e.,

$$\tilde{w}(w^*) = \frac{\int_0^\infty wf(w)dw}{1 - F(w^*)}$$

By substituting Eq. (3.3) into (3.1)' an implicit equation determining w^* is obtained. Straightforward implicit differentiation yields the predictions stated in the text.

² The inequality $\partial\tilde{w}/\partial w^* < 1$ turns out to be crucial for several important predictions in search theory. For example, Burdett (1981) shows that a fully predicted improvement of labor market conditions (such as a rightward shift in the c.d.f. of wage offers) will unambiguously decrease the expected duration of unemployment only if $\partial\tilde{w}/\partial w^* < 1$. This is also demonstrated by Flinn and Heckman (1983). Barlow and Proschan (1975) give examples of density functions with this property.

³ A similar problem has been investigated by Hey and McKenna (1979). Some properties of the problem are also spelled out in Holmlund and Lang (1983). Cf. also Burdett (1978).

⁴ The analysis follows Holmlund and Lang (1983). For more details, see that paper. Cf. also Wilde (1979).

⁵ It can be shown that the acceptance wage falls below the worker's current full wage (i.e., $w^* < y$) if there are no moving costs. The difference between the full wage and the acceptance wage may be interpreted as the maximum "price" the worker is willing to pay for participation in the "job change lottery".

⁶ See Appendix to Holmlund and Lang (1983).

⁷ The discussion draws heavily on Mincer (1978).

⁸ Seater's (1977) "unified model of consumption, labor supply and job search" predicts that search will eventually fall as time goes by although the behavior is ambiguous during the early part of the lifecycle.

Chapter 4

¹ LAS is short for "Lagen om anställningsskydd" (the employment security legislation).

² A familiar message of some versions of job search theory is that unperceived wage inflation will decrease quits. In Alchian's (1971) version, for instance, this hypothesis is put forward as an important explanation of unemployment inflow. The idea is that unexpected wage increases (decreases) will make the individual less (more) inclined to quit into the unemployment pool; hence one interpretation of the cyclical unemployment fluctuations is obtained. Alchian's story has been subject to various criticisms. It should be noted that the hypothesis relies on some questionable assumptions, among them that quits generally are associated with unemployment inflow, and that on-the-job search is not possible. Less restrictive assumptions will make the postulated relationship less obvious.

³ The strong inverse relationships between layoff probabilities and tenure are documented in the official report that proposes the employment security legislation. See SOU 1973:7.

⁴ No end-point constraints were imposed in these initial experiments.

⁵ SNI 38 according to the Swedish industry classification (manufacture of metal products, machinery, electrical equipment, transportation equipment and optical equipment). The data refer to plants whose reports to SCB constitute the source for the published aggregate turnover statistics.

⁶ Seater's model of "Job search and vacancy contacts" portrays job search as a process of visiting firms to check for vacancies. Given this setting, it is not surprising to find that "the number of vacancy contacts is related inversely to travel time" (Seater, 1979).

⁷ For studies that account for the simultaneous determination of quits and wages, see Pencavel (1972) or Shorey (1980).

⁸ The applied estimation procedure is admittedly crude, since we are dealing with both heteroscedasticity and a limited dependent variable. The third column in Table 4.5, valid for firms where $QR > 0$, indicates a wage elasticity around -1 whereas the first column, pertaining to firms where $QR > 0$, implies an elasticity around -0.5. Note that the wage elasticity, η , for a function of the form

$$QR = X\beta + \gamma \ln w$$

is given as $\eta = \gamma/\overline{QR}$, if calculated at the average quit rate ($\overline{QR}$).

⁹ Source: Official statistics of Sweden, Industry (SCB).

¹⁰ There are no satisfactory data on local unemployment rates available for 1968. We used the average of regional unemployment rates (A-regions) for the period 1970-73. In no case we found significant effects. This is certainly unexpected, but may be due to the lack of good unemployment data. In the estimations we present, no unemployment variable is included.

Chapter 5

¹ Source: Springfeldt et al. (1976). A moving distance exceeding 50 kilometers was chosen as a definition of migration between local labor markets.

² According to Vuksanovic (1979), p. 52, the quality of the variable pertaining to length of residence in the current locality is questionable. However, it has been suggested that the errors are of minor importance for those who reported in-migration during the last few years before the survey in 1974. Note that "locality" is subjectively defined here, not necessarily corresponding to county or commune.

³ The variable "locational changes 1968-74" is only given for the responding spouse of the household. Thus it equals one for families where at least one spouse had moved between 1968-74.

⁴ In this sample the husband's income was greater than the wife's for about 90 percent of the families.

Chapter 7

¹ Methodologically, our approach is similar to the paper by Willis and Rosen (1979) on education and self-selection and to Lee's analysis (1978) of unionism and wage rates. A recent application of the methodology to analyze migration is provided by Robinson and Tomes (1982). See also Heckman (1979) for a general discussion of self-selection problems in econometric models.

² This particular form of mobility cost function is suggested by Robinson and Tomes (1982).

³ Mincer (1974).

⁴ Wu (1973).

⁵ Jacobsson (1976).

Chapter 8

¹ The model has been outlined and used for policy simulations in Holmlund (1980). It has some resemblance to the RASST-model (Race, Age, Sex, Search, Turnover) developed at the Urban Institute. For a presentation of that model, see Smith (1977) and Toikka et al. (1977).

² Parsons (1973), Barron (1975), Axelsson & Löfgren (1977), Björklund & Holmlund (1981) and Chapter 4, this volume.

³ Cf Seater (1979).

⁴ One of the first theoretical treatments of labor as a "quasi-fixed" factor is found in Oi (1962). See also Salop (1973). Empirical studies of the actual magnitudes of labor adjustment costs seem to be fairly few. For some information, see Myers (1969) and Holt et al. (1966).

⁵ Labor adjustment costs will not necessarily imply labor hoarding for a price-taking firm; in fact, a price decrease would lead to an increase in average productivity. The Salop-model - among others - has this implication. We still appear to have no satisfactory theoretical treatment of labor hoarding.

⁶ See, e.g., Brechling (1965).

⁷ This assumption follows Fair (1969) and is implicit in Brechling's model (1965), where the wage bill is minimized with respect to workers and hours per worker.

⁸ In some preliminary regressions the actual level of future sales was also included as a representation of expected sales (assuming perfect foresight). The variable did not turn out to be significant. For different empirical results here, see Fair (1971). The reader may wonder why inventories are absent from (8.4); it is reasonable to assume that the actual level of inventories will affect production negatively, ceteris paribus. The reason for the specification is that no monthly inventory data are available and the construction of monthly inventory stocks from available indexes for sales and production seem to be beyond the main scope of this study.

⁹ This point has been stressed by Charles Holt at several occasions; see, e.g., Holt and David (1966).

¹⁰ See "Utredningen om förbättrad platsinformation" (AMS, 1974). It should be noted that compulsory notification of vacancies was introduced successively in the late 70s, mostly outside the estimation period for this model.

¹¹ For a formal analysis of the determinants of the firm's optimal recruitment standards, see Pissarides (1976).

¹² (8.21) is an approximation since those who are entering as well as leaving unemployment within the same month are disregarded.

¹³ The procedure can be viewed as a second best solution, motivated by the absence of satisfactory flow data. The IU- and P-variables are theoretical constructs, unobserved in our data, but useful as tools for obtaining a final estimating equation.

¹⁴ See Chapter 2, this volume. For some U.S. evidence, see Mattila (1974).

¹⁵ There are theoretical arguments - and U.S. empirical evidence - indicating that quits into unemployment will rise with the number of vacancies. See Barron and McCafferty (1977).

¹⁶ Note that P includes labor force exits as well as the transitions from unemployment to employment. No particular hypothesis is offered concerning the determinants of the exit component.

¹⁷ Fair (1969) and (1971).

¹⁸ Holmlund (1980) and (1981).

¹⁹ Some adjustment of the reported data has been imposed in order to obtain consistency over time. Adjustments have been made for employment, total hours and vacancies, due to changes in statistics. Unemployment data from the Labor Force Surveys are available for only 4 months per year before 1970 (February, May, August, September). We have estimated the values of the missing data in 1969 by using unemployment rates for insured blue-collar workers. Consistency between employment flows and stock changes have, furthermore, been imposed via minor modifications of the reported flow data. This is described in Appendix B.

²⁰ The expression for future labor requirements was approximated by a geometric average for three future months.

²¹ The estimation of the equation for filled and canceled vacancies produced results similar to those for hirings according to establishment data. One difference is that the variable reflecting future labor requirements, $\ln(N_{t+1}^*/N_{t-1})$, is significant (and retained) only in the hiring equation. A time trend was, moreover, found significant in the PFCV equation.

²² For a layoff study with similar results on this point, see Barth (1971).

²³ The variable reflecting future hours requirements was less successful in this restricted form and was therefore excluded.

²⁴ The performance of the model turned out to be slightly better with output endogenous, which might be due to large measurement errors in the output data itself.

²⁵ Björklund (1978).

²⁶ Björklund (1978).

Appendix B

¹ The construction of such a series is not without problem, since some changes in samples have taken place. We have used another data source (SOS: Industri) in order to chain the employment figures of 1973 (and previous years) to the monthly index of employed workers that begins in January 1974.

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