UNIVERSITY OF NEWCASTLE UPON TYNE

ORGANISATIONAL PERFORMANCE AND HUMAN RESOURCE MANAGEMENT

By

Sarah Bridges

A THESIS

Submitted to the University of Newcastle Upon Tyne
in fulfilment of the requirements for
the degree of Doctor of Philosophy

Department of Economics, University of Newcastle Upon Tyne

2002

Acknowledgments

This PhD would not have been possible without the help and support of a large number of people, to which I will always be extremely grateful.

I would like to pay particular thanks to my supervisor, Dr Tim Barmby, for his constant encouragement. I am also extremely grateful to Les Prosser and everyone at HR Informatics, HSBC, Sheffield.

I would also like to thank my friends and colleagues at both Newcastle and Nottingham University, especially Ada, Gordon, Jonathan, Neil and Olga. Special thanks also go to Terry and my family.

Finally, I would like to dedicate this PhD to the memory of my Grandad, Frank Bridges.

Sarah Bridges
2002

Abstract

Over the last 20 years there has been a growth in the relative importance of personnel economics as an area of economics. However, due to a lack of suitable data most of the work in this area has been largely theoretical. It is only in the past decade that there has been a growth in the availability of firm-based data sets, making it possible for researchers to begin to test some of these ideas empirically.

This thesis analyses data from a rich source of monthly personnel and payroll records from a large banking sector firm. The data is confined to the organisation's U.K operations and is available over the period January 1989 to March 1997 (giving 99 monthly observations).

Although personnel data of this this sort is available for the U.S (see, for example, Baker, Gibbs and Holmstrom (1994) and Lazear (1999)), this is one of the first data sets of its kind to be available for the U.K. This thesis focues on three areas of personnel economics. It analyses the issues of promotion, absenteeism, and labour turnover, paying particular attention in all three cases to gender differences.

Contents

List of Tables

List of Figures

Chapter 1

Introduction

Lazear (2000) defines personnel economics as:

> ... the application of microeconomic principles to human resource issues that are of concern to most businesses.

Personnel economics thus encompasses topics such as hiring, firing, training, compensation schemes, job design, and worker evaluation. At some level these topics are familiar to mainstream economists. Standard production theory, for example, describes how much labour should be hired, how it should be combined with capital, and how its use varies with wages etc. However, it says little about how wages should be structured to motivate workers best, making it of little direct use to organisations and their managers. Lazear (2000) asserts that personnel economics attempts to use the tools of economics to fill this gap.

The growth of interest by economists into the internal workings of firms is, however, a relatively recent phenomenon. Most of the early work into personnel issues has been carried out by industrial psychologists and sociologists. However, a common criticism of much of this work is that it lacks a strong theoretical background on which to base results. Lazear (2000), for example, argues that:

> ... the approach taken by the non-economist was unsatisfactory. It was loose,

> unfocused, and *ad hoc*, and lacked the general rigorous framework to which economists have grown accustomed.

Despite this, due to a lack of suitable data most of the work undertaken in this area by economists has been largely theoretical. This is because until recently most of the data used by empirical economists came from labour market surveys that contained little firm-specific information, making inferences about personnel issues difficult to make. However, in the last decade there has been a growth in the availability of firm-based data sets, making it possible for researchers to begin to test some of these ideas empirically.

This thesis focuses on three areas of personnel economics. It examines the issues of promotion, absenteeism and labour turnover using data from the personnel and pay-roll records of a large banking sector firm. This data is confined to the organisation's U.K operations and is available over the period January 1989 to March 1997 (giving 99 monthly observations). Although personnel data of this sort is available for the U.S (see, for example, Baker, Gibbs and Holmstrom (1994) and Lazear (1999)), this is one of the first data sets of its kind to be available for the U.K.

Chapter 2 gives a detailed review of this data. It analyses the internal workings of the firm looking at the organisation's hierarchical structure, pattern of careers, ports of entry and exit and the structure of pay within the organisation.

An influential paper in setting the agenda in the area of personnel economics is Baker, Gibbs and Holmstrom (1994). They use data from the personnel records of a large U.S service sector firm over the period 1969 to 1988 to analyse the extent to which the arrangements in their organisation characterise an internal labour market.

Doeringer and Piore (1971) describe an internal labour market as:

> ... an administrative unit, such as a manufacturing plant, within which the pricing and allocation of labour is governed by a set of administrative rules and procedures.

It is distinguished from the external labour market, where price setting, allocation and training decisions are governed by economic variables, except at defined ports of

entry and exit. Doeringer and Piore (1971) argue that these rules and procedures give, in some ways, preferential treatment to 'insiders' over 'outsiders'. Workers in an internal labour market are, for example, shielded from the competitive influences of the external labour market except at defined ports of entry and exit.

Chapter 2 also replicates Baker, Gibbs and Holmstrom's (1994) analysis as far as possible in order to examine the extent to which their findings can be regarded as representative of large firms generally, and to what extent they are special. It should be noted that Chapter 2 draws heavily on work produced by Treble, van Gameren, Bridges and Barmby (2001).

The pattern of promotion within the organisation is analysed in Chapter 3. An outline of some of the economic theory surrounding promotion is presented in Section 3.2, while some of the empirical literature on promotion is reviewed in Section 3.3. As will be seen, a number of stylised facts emerge when looking at comparisons in human resource practices between countries, particularly between Japan and the U.S. For example, a common view when looking at the internal workings of a firm is that U.S and Japanese organisations differ in their policies towards promotion. Workers in the U.S tend to be highly mobile, moving between firms on a regular basis in search of better opportunities. Thus, in order to retain their most able workers U.S organisations tend to engage in promotion fast-tracking and hence target a few individuals early on for top careers (see Rosenbaum (1984), and Baker, Gibbs and Holmstrom (1994)). In contrast, tenure in large Japanese firms tends to be relatively long and Japanese employers often rely heavily on internal promotions to fill vacancies. Thus, fewer opportunities are available for workers, especially those in mid-career who leave the organisation, making a late selection approach to promotion a viable option. Workers, for example, in large Japanese firms are typically not differentiated from their cohort until they have been with their organisation for between 10 and 15 years, after which considerable career differentiation by ability usually occurs (see Aoki (1988)).

As will be seen, only a handful of studies have addressed the causes and consequences of promotion for the U.K. This chapter thus seeks to add to the limited body of information on promotion in the U.K by investigating whether there is any evidence of promotion fast-tracking within the large U.K banking sector organisation outlined in Chapter 2. A discrete-time proportional hazard based on the model proposed by Prentice and Gloeckler (1978) is used to study the time before promotion. This approach enables the baseline hazard to be estimated non-parametrically, and thus avoids any *a priori* assumptions being made about its shape.

The issue of worker absenteeism is addressed in Chapter 4. A review of the economic theory surrounding absence, and a summary of some of the empirical literature on absenteeism is presented in Sections 4.2 and 4.3, respectively. As will be seen, worker absenteeism is a serious economic problem resulting in the loss of a large number of working days and hence worker productivity and income each year. Vistnes (1997), for example, using data from the 1987 National Medical Expenditure Survey, finds that workers in the U.S missed approximately 385 million working days due to illness in 1987 (accounting for 1.9% of their scheduled work time). Similarly, evidence for the United Kingdom suggests that approximately 300 million working days were lost annually due to certified incapacity for work during the 1970s - in comparison, only approximately 8 million working days were lost annually over this period due to industrial disputes (Doherty (1979)). However, despite these large costs most of the early work on absenteeism has been carried out by industrial and organisational psychologists with little input from economists.

This chapter thus seeks to add to the growing body of economic research on worker absence by investigating some of the causes and consequences of absenteeism within our large U.K financial sector firm. In this chapter a dynamic model for discrete panel data, similar to that proposed by Heckman (1981a), is used to estimate the probability of absence using data from the organisation's daily absence records for 1992. The aim of this chapter is largely two fold:

First, it seeks to investigate the effect past absence has on current absence decisions. Since absenteeism is to some extent determined by the individual's state of health the worker's absence decision on a given day is unlikely to be independent of whether s/he was away from work the previous day. However, the effect past absence has on current absence decisions has been largely ignored in most economic studies on absence behaviour, or has been treated in a purely *ad hoc* manner. This is surprising given that in the few studies that account for past absence the largest and most significant coefficient is usually absence lagged one period. As will be seen in Chapter 4 ignoring the lag of absence also has important consequences for the significance of the remaining explanatory variables.

Second, this chapter seeks to add to the empirical evidence on gender differences and absenteeism. A common finding of many studies is that female workers are more likely to be absent from work than their male counterparts (see, for example, Paringer (1983), Allen (1984), Dunn and Youngblood (1986), Drago and Wooden (1992), Barmby, Orme and Treble (1991), and Brown, Fakhfakh and Sessions (1999)). However, at present there seems to be little agreement as to the main causes of these gender differences. There is, for example, some debate in the literature with respect to the effect dependents have on absenteeism among women. Leigh (1983) and Vistnes (1997) find that the presence of children under 6 years of age increases female absence, while Paringer (1983) finds that women with family responsibilities are less likely to be absent.

Chapter 5 examines the pattern of labour turnover within the firm. Again a brief outline of some of the economic theory surrounding labour turnover is presented in Section 5.2, and a review of the empirical evidence on labour turnover is outlined in Section 5.3. Although researchers have a long history of looking at worker separation behaviour in the U.S very little attention appears to have been paid by economists into the determinants of labour turnover in the U.K.

This chapter seeks to add to the empirical evidence on labour separation behaviour in the U.K by investigating some of the causes and consequences of labour turnover within our large banking sector firm outlined in Chapter 2. Again particular attention is paid

in this chapter to the effect gender has on labour turnover. A common finding of most of the empirical evidence for the U.S is that females are more likely to leave the firm than their male counterparts (see Viscusi (1980), Blau and Kahn (1981), Sicherman (1996) and Spurr and Sueyoshi (1993)). This chapter seeks to investigate whether a similar pattern of labour separation behaviour arises in the U.K.

Two modes of analysis are used in this chapter to analyse separation behaviour. Firstly, the incidence of separation is estimated using a random effects logistic model. Secondly, duration models with competing risks of exit due to quits, layoffs, or other reasons are used to estimate the hazard of separation.

Finally, the general concluding remarks to this thesis are presented in Chapter 6.

Chapter 2

Data

2.1 Introduction

Until recently most of the data used by economists came from labour market surveys that contained little firm-specific information, making inferences about the internal workings of firms difficult to make. As a result, most of the early work in the area of personnel economics has been largely theoretical. However, in the past decade there has been a growth in the availability and use of firm level data sets making it possible for economists to begin to test some of these theories empirically. For example, as mentioned earlier Baker, Gibbs and Holmstrom (1994) use data from the personnel records of a large U.S service sector firm over the period 1969 to 1988 to analyse the extent to which the arrangements in their organisation characterise Doeringer and Piore's (1971) definition of an internal labour market. Similarly, Lazear (1992) studies the internal workings of a large U.S corporation using data from the organisation's personnel records over a 13 year period, while Medoff and Abraham (1980) and Abraham and Medoff (1981) use data from the personnel records of two large U.S corporations to analyse the relationship between experience, performance ratings and labour earnings.

In a similar vein this thesis analyses data from the monthly personnel and payroll records of a large banking sector firm. This data is confined to the organisation's U.K op-

erations and is available over the period January 1989 to March 1997 (giving 99 monthly observations). Although the firm varies in size over this period overall it employs approximately 40,000 full-time employees and 20,000 part-time employees[1].

Each observation in the data set is identified via a unique staff identification number and contains details of the worker's job code, work unit code, salary, bonus, position in the hierarchy, date of entry into their current spell of employment, performance rating, partial post code of home and work, sex, age, marital status, number of children, ethnic origin, and some indicators of educational attainment.

The aim of this chapter is largely two fold. First, it gives a detailed description of the data used in this thesis. In doing so it analyses the firm's hierarchical structure, pattern of careers, ports of entry and exit, and the structure of pay. Second, it seeks to replicate, as far as possible, Baker, Gibbs and Holmstrom's (1994) analysis in order to examine the extent to which their findings can be regarded as representative of large firms generally and to what extent they are special. It should be noted that this chapter draws heavily on work produced by Treble, van Gameren, Bridges and Barmby (2001).

This chapter is organised as follows. Section 2.2 gives a brief overview of the hierarchical structure of the firm. Career patterns are discussed in Section 2.3. Section 2.4 examines the structure of pay within the firm, while implications for future work and the conclusions are given in Section 2.5.

2.2 Hierarchical Structure

The firm has an explicit hierarchical structure in which workers can be assigned to one of 12 levels or grades; grades 2 to 6 represent the clerical grades while grades 7 to 13 represent the management grades.

Tables 2.1 and 2.2[2] examine the transitions between all grades in the hierarchy over

[1]It should be noted that the data used in this thesis is confined to the organisation's full-time workers.

[2]These tables show transitions between all hierarchical grades, including entry and exit, over the period 1989 to 1997 (annual, January to January). The numbers show the movements between the old

the period 1989 to 1997. These transitions are year on year giving 348,738 person-year transitions. As can be seen in Tables 2.1 and 2.2 these transitions highlight an important difference between the clerical and management grades. According to these tables the clerical grades appear to be more in the nature of training grades where promotion is largely automatic once certain targets have been met; 52% of workers are, for example, promoted from grade 2 to 3. It is only in the transition from grade 5 to 6 that the promotion rate for the clerical staff falls to a level similar to that for the managerial grades. Thus, grades 2 to 4 can be thought of as being the training grades and grades 5 to 6 the main clerical grades.

There is also a distinct difference in promotion rates throughout the management grades. From grade 5 onwards the hierarchy is tapered so that the number of employees in each grade is always less than the number in the next lower grade. Not surprisingly, this causes the promotion rate to fall as workers enter the upper areas of management. Promotions from grades 7 and 8 are, for example, awarded to approximately 9% of the employees in those grades. However, promotions are harder to come by for individuals in the upper management grades at rates of approximately 5% for those transitions from grades 9 and 10, and at rates of just under 2% for the grades above that.

It should be noted that although Table 2.1 shows a promotion rate of 26.8% from grade 2 to 4, analysis of the monthly data reveals that almost all workers progress through the hierarchy by passing through each grade; in this case via grade 3, but are promoted into grade 4 within the calendar year. Promotions of more than one grade at a time are thus relatively rare.

Demotions also appear to be relatively rare. As can be seen in Table 2.2 the maximum demotion affects individuals in grade 8, where over the period 1989 to 1997 1.4% of workers in grade 8 were demoted to grade 7.

Individuals can also be assigned to three other grades (grades 1, 98, and 99) which

---

grade (or entry) and the new grade (or exit) as a percentage of the number of employees in the old grade. A dot (.) indicates that the move never occurs, while 0.0 implies a percentage smaller than 0.05.

do not appear to be part of the conventional hierarchy. Grades 98 and 99 appear to be some sort of 'unclassified' state that is sometimes assigned to new entrants before they are given a normal grade. Some employees do, however, remain in these grades throughout their entire life with the firm. Grade 1 also appears to be an unusual grade that does not fit the organisation's hierarchical structure. The level of employment in grade 1 fluctuates widely, and in relation to the rest of the hierarchy individuals in this grade can earn significant salaries.

These three unusual grades are grouped together and given the category 'other' in this analysis. As can be seen in Table 2.2 very few individuals move from the main hierarchy i.e., grades 2 to 13, to 'other'. Workers do, however, leave 'other' to join grades 2 to 13.

2.2.1 Stability of the Hierarchy

Over the period January 1989 to March 1997 the number of full-time individuals employed by the firm declined by approximately 20%, from 45,500 to 34,900. Figure 2.1 plots entry and exit rates over this period and shows that the decline in the size of the organisation has been generated, in the main, by a significant fall in the entry rate between 1990 and 1992. Since that time both the entry and exit rates have increased to a level above their 1990 rates, indicating that there has been a subsequent increase in labour turnover.

Figure 2.2 plots the change in employment between 1989 and 1997 and shows that the overall change in employment has been due mainly to a decline in the training and clerical grades (grades 2 to 6), while the number of employees in the management grades has remained fairly constant over time and their proportions have increased.

Finally, Figures 2.3, 2.4 and 2.5 depict the size of the grades in 1989, 1993 and 1997, respectively and show that despite the decline in the number of individuals in the clerical grades the relative structure of the rest of the hierarchy has remained remarkably stable over time.

	New Grade					
Old Grade	Exit	2	3	4	5	6
Entry	.	7.1	16.6	24.4	13.1	8.0
2	17.6	1.7	52.0	26.8	1.5	0.2
3	.	15.1	.	35.2	48.1	1.4
4	11.1	0.0	0.1	70.2	18.0	0.5
5	9.4	0.0	0.0	1.0	79.8	8.7
6	7.4	.	.	0.0	1.1	83.5
7	9.6	.	.	0.0	0.1	1.3
8	9.6	.	.	.	0.0	0.1
9	10.7	.	.	.	.	0.0
10	13.0	.	.	.	.	.
11	13.2	.	.	.	.	.
12	17.2	.	.	.	.	.
13	24.1	.	.	.	.	.
Other	14.4	.	.	0.8	2.5	4.3
Total	9.2	0.5	3.0	15.6	25.1	17.7

Source: Treble, van Gameren, Bridges and Barmby (2001).

Table 2.1: Transition Matrix between Grades in the Hierarchy - Clerical Grades.

	New Grade								Sample
Old Grade	7	8	9	10	11	12	13	Other	Size
Entry	11.1	3.6	2.3	1.1	0.4	0.0	0.0	12.4	25297
2	.	.	.	.	.	.	.	0.1	2887
3	0.0	.	.	.	.	.	.	0.0	13182
4	0.1	.	.	.	.	.	.	0.1	57266
5	0.6	0.0	0.0	.	.	.	.	0.4	91266
6	7.8	0.0	0.0	.	.	.	.	0.1	60773
7	79.7	8.9	0.3	0.0	.	.	.	0.0	48382
8	1.4	79.9	8.7	0.3	0.0	.	.	.	23262
9	0.1	1.0	83.0	5.0	0.1	.	.	0.0	14593
10	.	0.0	0.7	80.9	5.3	0.1	.	0.0	5199
11	.	.	.	0.2	84.7	2.0	.	.	1610
12	.	.	.	.	.	80.9	1.9	.	309
13	.	.	.	.	.	.	74.1	1.9	54
Other	8.4	2.3	1.4	1.1	0.7	0.3	0.1	63.7	4658
Total	13.6	6.9	4.3	1.5	0.5	0.1	0.0	1.9	348738

Source: Treble, van Gameren, Bridges and Barmby (2001).

Table 2.2: Transition Matrix between Grades in the Hierarchy - Management Grades.

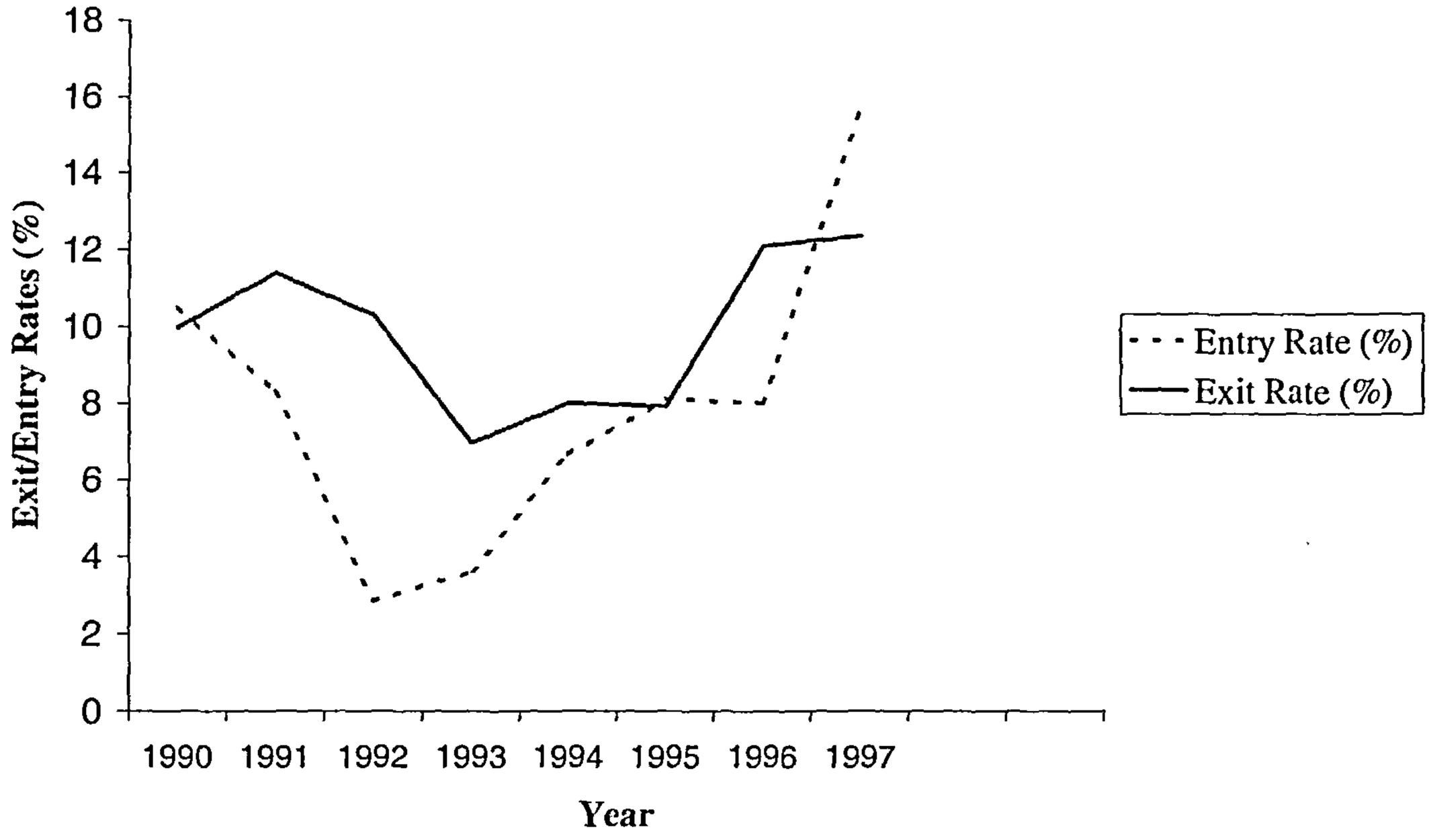

Figure 2-1: Exit/Entry Rates (%).

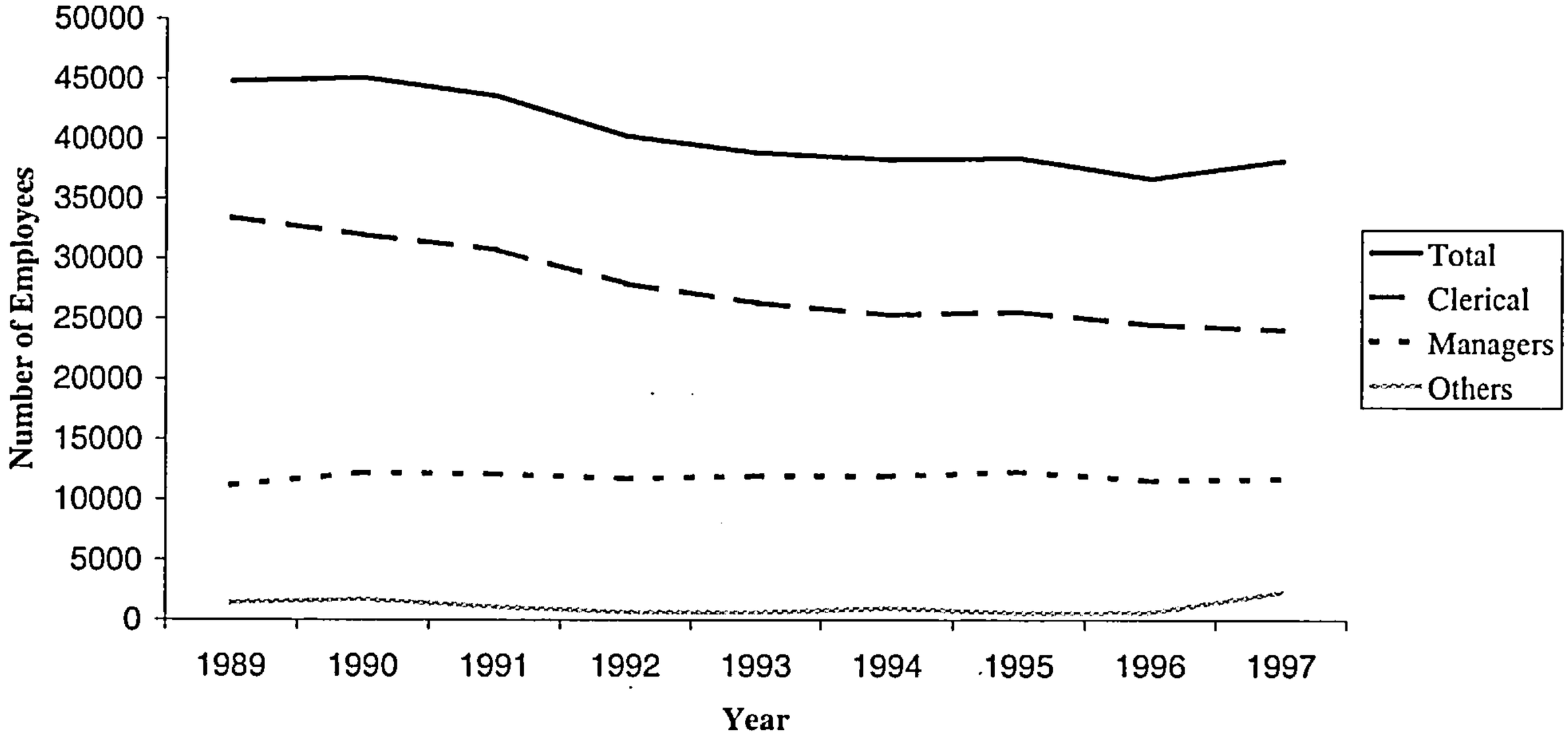

Figure 2-2: Number of Employees - All Years.

2.3 Careers, Entry and Exit

As mentioned earlier Doeringer and Piore (1971) describe an internal labour market as:

> ... an administrative unit, such as a manufacturing plant, within which the pricing and allocation of labour is governed by a set of administrative rules and procedures.

According to Doeringer and Piore (1971) the internal labour market gives, in some ways, preferential treatment to 'insiders' over 'outsiders' and tends to bias decisions in favour of 'insiders' when jobs open up in the hierarchy. They argue that except at defined ports of entry and exit, jobs within an internal labour market tend to be filled internally through promotions and lateral transfers, so giving employees some protection from the competitive influences of the external labour market.

This section analyses the extent to which careers in our large financial sector firm characterise Doeringer and Piore's (1971) definition of an internal labour market, and

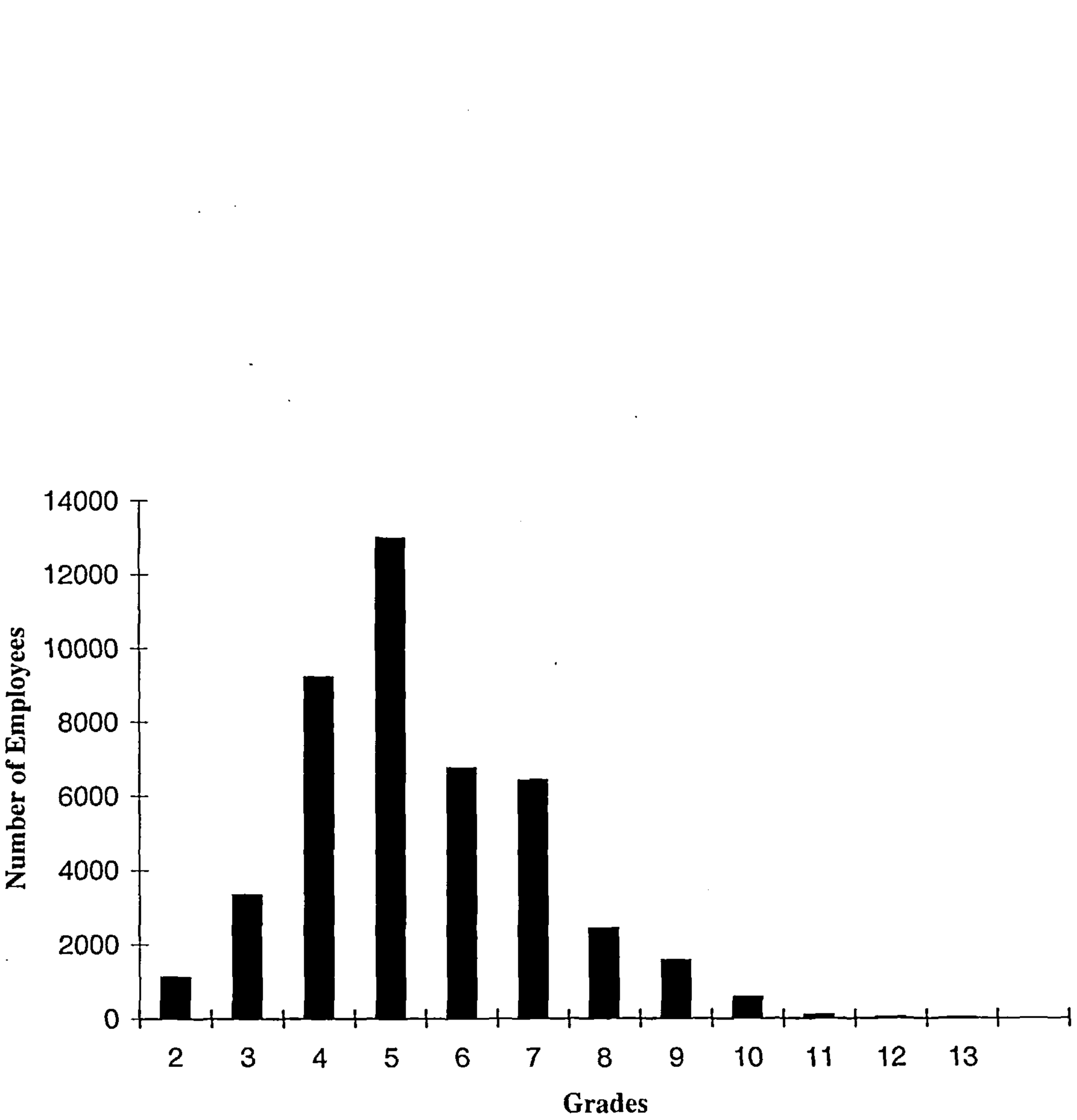

Figure 2-3: Number of Employees - 1989.

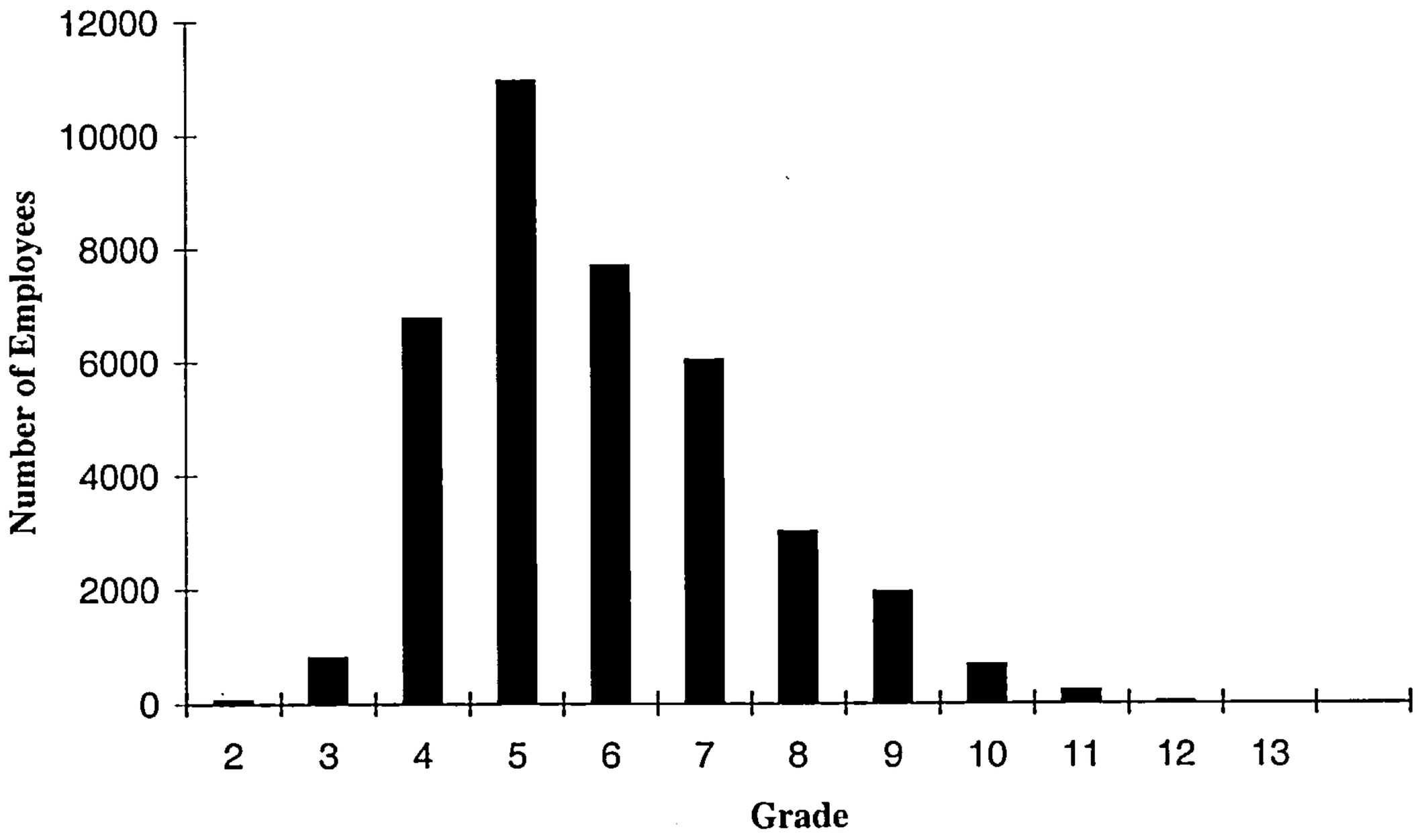

Figure 2-4: Number of Employees - 1993.

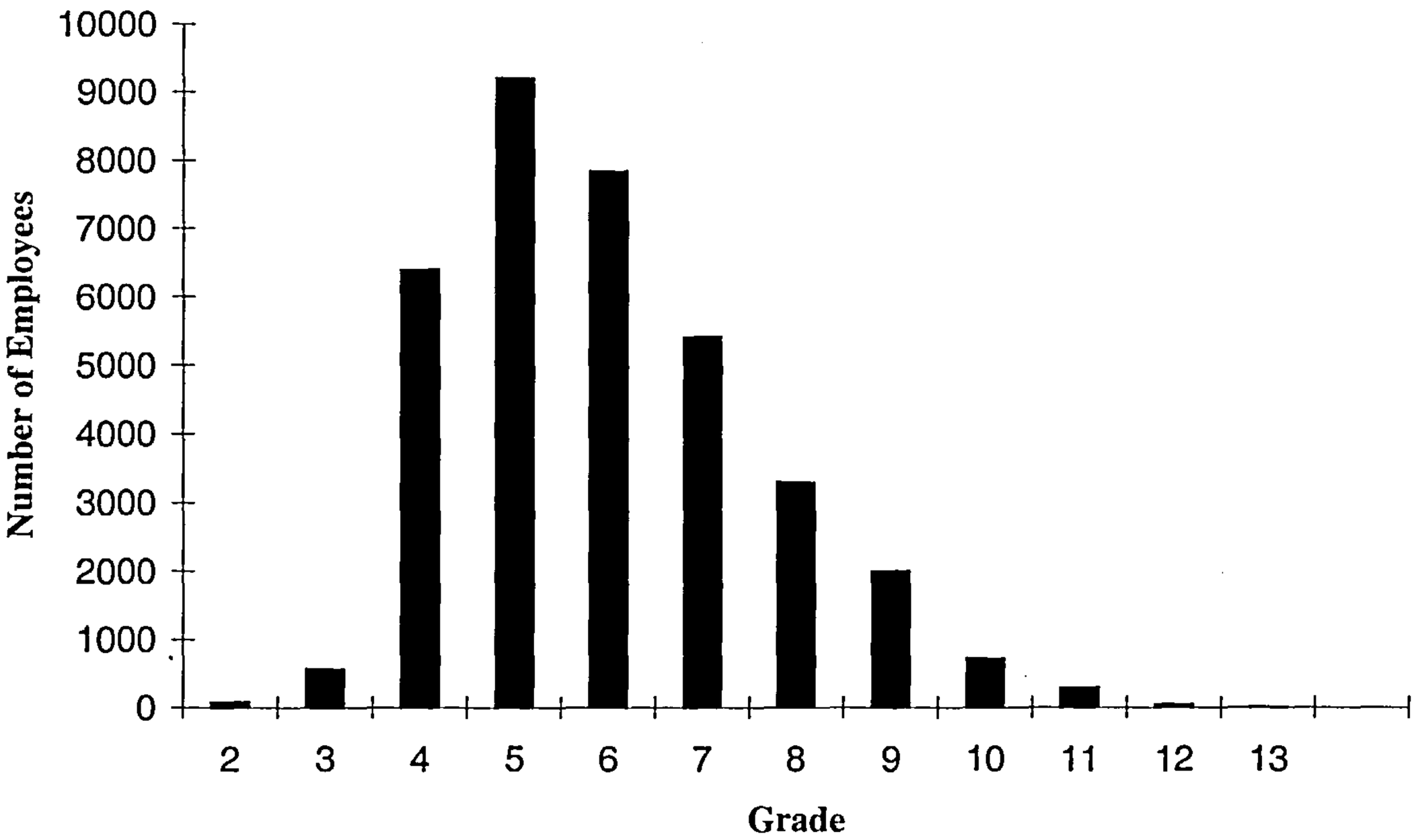

Figure 2-5: Number of Employees - 1997.

the degree to which they mimic the pattern of careers outlined in Baker, Gibbs and Holmstrom (1994).

2.3.1 Career Lengths

According to Doeringer and Piore (1971) the internal labour market guarantees employees a certain degree of job security and career progression. Employees do not move from job to job in a firm by competing in a series of spot markets, but have careers that tend to follow more or less defined paths in the organisation. Doeringer and Piore (1971) assert that career paths in an internal labour market tend to be relatively stable over time resulting in long term worker-firm attachments.

Table 2.3 presents some statistics on the career length, age, entry, exit and promotion rates of new entrants to the firm[3]. The top portion of the table shows the length of career those entering the organisation between January 1989 and March 1992 have with the firm stratified by the grade at which they entered the organisation[4]. The results presented in Table 2.3 suggest that, in line with the argument outlined above, careers in the organisation tend to be relatively long. For example, 49.8% of those individuals who entered the firm in grade 6 between January 1989 and March 1992 stayed with the organisation for more than 5 years. In contrast, the career length of those workers who entered higher up the firm's hierarchy tends to be relatively shorter. For example, only 26.1% of those who entered the organisation in grades 10 to 13 stayed with the firm for more than 5 years. Such a finding can be explained, in part, by the fact that the employees who entered higher up the organisation's hierarchy tended to be older when they joined the firm. For example, the average age of new hires to grade 8 was 31.8 years, compared with only 19 years for new entrants to grade 2. Baker, Gibbs and Holmstrom

[3]The top portion of the table analyses those individuals who entered the grade from outside between January 1989 and March 1992. The middle panel uses all those individuals who entered the firm (at any grade) between January 1989 and March 1992, and who are subsequently promoted into the grade up to March 1997. The bottom panel uses all workers in the firm between January 1989 and March 1997.

[4]Individuals who entered the firm between January 1989 and March 1992 are chosen to enable longer careers to be analysed without censoring the sample.

	Grade									
	2	3	4	5	6	7	8	9	10-13	Other
No. of outside entrants to grade	2424	2426	1923	859	698	882	349	242	99	171
Percent with 1 year careers	19.3	22.2	23.6	16.9	11.5	16.9	15.8	16.5	13.1	22.2
Percent with 2 year careers	9.9	9.4	8.7	9.1	10.5	17.0	18.9	18.2	25.3	20.5
Percent with 3 year careers	6.3	5.3	5.9	5.8	9.6	10.3	12.9	12.4	15.2	11.7
Percent with 4 year careers	3.5	4.4	4.7	7.9	9.6	8.3	8.3	10.7	15.2	11.1
Percent with 5 year careers	6.0	5.0	4.7	7.8	9.0	7.1	6.3	8.3	5.1	5.3
Average age of new hires	19.0	20.3	29.7	28.2	26.5	30.0	31.8	32.6	38.5	26.7
No. promoted into grade	0	1942	3337	2450	1047	875	517	228	352	12
Average age of those promoted into grade	N/A	19.1	21.1	26.3	27.9	27.1	30.3	32.2	34.8	31.6
Percent of all entrants into grade who were outside hires	77.2	36.7	26.3	11.8	9.9	18.5	9.7	11.8	12.2	21.9
Promotion Rate (%) per year	80.6	49.7	18.7	9.8	7.9	9.3	9.0	5.2	1.9	21.9
Exit Rate (%) per year	17.6	15.1	11.1	9.4	7.4	9.6	9.6	10.7	13.3	14.4

Source: Treble, van Gameren, Bridges and Barmby (2001).

Table 2.3: Career and Level Characteristics.

(1994) produce a similar table and also find evidence of long and varied careers within their organisation.

2.3.2 Ports of Entry and Exit

Doeringer and Piore (1971) assert that the degree of openness between the internal and external labour market is measured by the proportion of ports of entry and exit, and the restrictiveness of the entry criteria. They identify two extreme types of internal labour markets; closed and open. Workers in a closed internal labour market are hired almost exclusively into lower positions in the hierarchy, while all the remaining vacancies tend to be filled from the inside. At the opposite extreme is the open internal labour market where all vacancies are filled externally. Although the latter reassembles an external labour market Doeringer and Piore (1971) argue that its administrative rules and procedures guarantee that it is still an internal labour market. Not surprisingly, most internal labour markets lie somewhere between these two extreme examples.

The bottom portion of Table 2.3 looks for the existence of ports of entry and exit by examining what fraction of those individuals who move into a grade are promoted from inside rather than hired from outside the firm, and by looking at exit rates across grades. From this it can be seen that grade 2 appears to be a port of entry; 77.2% of those individuals who entered the grade between January 1989 and March 1997 do so from outside. There also appears to be a relatively high entry level at other points in the hierarchy, with the rate of entry into a grade from outside never falling below 9.7%. These results thus imply substantial impact of the external market on the firm.

Baker, Gibbs and Holmstrom (1994) produce a similar table and find comparable results. For instance, in line with Table 2.3 they show that their level 1 appears to be a port of entry; 98.6% of the individuals who entered this level do so from the outside. They also find evidence of substantial entry at all other levels. For example, over 25% of those entering levels 2 to 4 are recruited from outside.

Table 2.3 also identifies a distinction in entry rates between the staff and management

grades. Entry levels fall as one moves through the staff grades; from 77.2% in grade 2 to 9.9% in grade 6. However, entry levels appear to be u-shaped in the management grades. External entry is relatively high at the lowest rung of the management hierarchy; 18.5% at grade 7. It then falls before rising again at the top and is 12.2% in grades 10 to 13.

There is even less evidence in Table 2.3 for ports of exit. Exit rates are relatively uniform across all grades in the hierarchy, never rising above 17.6%. Baker, Gibbs and Holmstrom (1994) find a similar result.

2.3.3 New Hires Versus Incumbents

Table 2.3 also shows that, not surprisingly, the average age of the workers rise with grade. This is true for both new entrants and those promoted into the grade from within. Average age is, however, generally lower for new entrants than those promoted into a grade suggesting, in line with Doeringer and Piore's (1971) description of an internal labour market, that 'insiders' receive preferential treatment over 'outsiders'.

Table 2.4 looks more closely at the career attainment of new hires and incumbents[5]. The top portion of the table compares the career progression of those hired into grade 5 from outside (new hires) with those promoted into grade 5 from within (incumbents) over the period January 1989 to March 1992. Relative performance is judged in terms of the proportion of these two groups that exit grade 5 (and successive grades) over the next 5 years.

According to these results new entrants generally appear to be more successful in their careers with the firm than incumbents. As can be seen, after 1 year 93.78% of surviving incumbents were still in grade 5, compared with only 80.91% of surviving new hires. After 5 years this figure had fallen to 60.46% for surviving incumbents and 42.23% for surviving new hires. Promotions in this organisation are clearly not restricted to

[5]The table shows the career performance of those individuals who entered grade 5 between January 1989 and March 1992 as a percentage of those workers who entered grade 5 over this period and remained in the firm.

Current Grade	New hire/ Incumbent	Years since entering Grade 5				
		1	2	3	4	5
2	New hire	.	.	.	.	.
	Incumbent	.	0.02	.	.	.
3	New hire	0.13	.	.	.	.
	Incumbent	0.02	0.03	0.02	.	.
4	New hire	.	0.24	0.40	0.89	1.01
	Incumbent	0.95	1.07	1.17	1.41	1.61
5	New hire	80.91	65.41	53.39	48.44	42.23
	Incumbent	93.78	84.48	76.23	68.16	60.46
6	New hire	12.90	18.51	22.58	24.22	27.87
	Incumbent	4.65	12.84	18.95	23.64	27.84
7	New hire	2.28	13.52	21.12	21.40	21.11
	Incumbent	0.27	1.19	3.22	6.09	9.24
8	New hire	.	0.37	0.93	3.27	6.08
	Incumbent	.	.	.	0.22	0.56
9	New hire	0.13	.	.	0.15	0.68
	Incumbent	.	.	.	.	0.02
Other	New hire	3.63	1.95	1.59	1.63	1.01
	Incumbent	0.32	0.36	0.41	0.48	0.28
Grade (average)	New hire	5.03	5.39	5.61	5.70	5.86
	Incumbent	5.03	5.13	5.23	5.33	5.45
Grade (variance)	New hire	0.91	0.96	1.02	1.09	1.10
	Incumbent	0.34	0.48	0.59	0.69	0.75
Exit Rate (%)	New hire	17.52	11.43	8.39	10.62	12.17
	Incumbent	4.56	6.70	7.07	6.49	7.34
N	New hire	902	927	822	753	674
	Incumbent	6488	6196	5782	5374	5025

Source: Treble, van Gameren, Bridges and Barmby (2001).

Table 2.4: Career Attainment: New Hires Versus Incumbents Promoted into Grade 5.

incumbents, which implies that the level of firm-specific human capital is not the only deciding factor in the firm's promotion decisions. However, as can be seen by looking at the summary statistics at the bottom of Table 2.4 although, on average, new hires attain a slightly higher grade than incumbents, their outcomes are more variable. Exit rates also appear to be higher for new hires than incumbents. For example, after 1 year 17.52% of remaining new hires have left the firm, compared with only 4.56% of incumbents.

Baker, Gibbs and Holmstrom (1994) produce a similar table, but find slightly different results. They compare new hires at level 2 with those promoted into level 2 from within and find that although new hires are initially promoted more rapidly than incumbents, overall incumbents tend to achieve a higher grade, on average, than new hires. For example, they find that after 2 years 19% of new hires had been promoted to level 3, compared with only 16% of incumbents. However, after 5 years 33.3% of new hires remained in level 2, compared with only 23.7% of incumbents. In contrast, in line with Table 2.4 Baker, Gibbs and Holmstrom (1994) find that outcomes are more variable for new hires than those promoted into level 2 from within.

Baker, Gibbs and Holmstrom (1994) also compare the career performance of new hires and incumbents to level 3. Again they find that while average level attainment is slightly higher for those promoted into level 3, outcomes are more variable for new entrants than incumbents. From this they assert that observing incumbents in their prior grade with the firm is a more effective screen than the hiring process.

Baker, Gibbs and Holmstrom (1994) also find that exit rates show a similar pattern to those in Table 2.4. However, after 7 years this relationship changes and incumbents begin to have a higher exit rate than new entrants. Due to a lack of available data it is not possible for this finding to be investigated in this analysis.

2.3.4 Timing of Adjacent Promotions

The nature of the screening process can also provide useful information on the pattern of promotion within the firm. For example, Baker, Gibbs and Holmstrom (1994) assert

Years in Previous Grade	Statistic	Years in Current Grade						
		1	2	3	4	5	5	7
1	Promotion Rate (%)	19.89	28.31	21.41	11.92	15.11	12.11	9.11
	Exit Rate (%)	10.54	13.36	9.59	11.13	7.68	9.62	9.75
	Number of Workers	3625	2522	1471	1015	781	603	472
2	Promotion Rate (%)	7.73	13.50	14.37	10.17	13.36	11.45	8.15
	Exit Rate (%)	6.86	9.23	6.19	7.80	8.17	8.42	7.67
	Number of Workers	3132	2675	2067	1642	1347	1057	847
3	Promotion Rate (%)	4.16	9.54	10.59	7.95	10.18	8.09	7.94
	Exit Rate (%)	5.57	8.92	6.64	9.14	6.96	9.42	10.17
	No. of Workers	2334	2107	1718	1422	1179	977	806
4	Promotion Rate (%)	3.02	7.31	7.01	5.74	8.50	7.35	6.78
	Exit Rate (%)	4.60	8.40	9.41	5.96	6.50	5.88	9.83
	No. of Workers	696	643	542	453	400	340	295
5	Promotion Rate (%)	1.45	3.07	7.51	5.31	4.52	4.62	4.62
	Exit Rate (%)	3.78	7.06	8.87	4.49	7.24	6.67	10.40
	No. of Workers	344	326	293	245	221	195	173
6	Promotion Rate (%)	3.05	5.43	7.32	2.99	9.92	3.85	4.17
	Exit Rate (%)	3.55	5.43	10.98	6.72	4.13	3.85	9.38
	No. of Workers	197	184	164	134	121	104	96
7+	Promotion Rate (%)	2.39	3.12	2.91	3.42	2.66	2.17	3.18
	Exit Rate (%)	3.37	9.47	8.19	7.28	5.16	7.04	10.54
	No. of Workers	919	866	757	673	601	554	503
Total	Promotion Rate (%)	9.90	14.69	12.66	8.36	10.54	8.43	7.02
	Exit Rate (%)	7.20	10.09	7.70	8.36	7.10	8.22	9.46
	No. of Workers	11247	9323	7012	5584	4650	3830	3192

Table 2.5: Promotion and Exit Rates - All Workers.

that if the purpose of promotion is to sort individuals on the basis of their ability then those promoted quickly once should be promoted quickly again. Alternatively, if firm-specific human capital accumulation is important for promotion, and individuals learn at approximately the same rate, then those promoted quickly once will have accumulated less firm-specific human capital and so will have to wait longer for their next promotion.

Baker, Gibbs and Holmstrom (1994) investigate this issue by examining the relationship between the time to promotion from level 1 to level 2 versus the time to promotion/exit from level 2, and find evidence of promotion fast-tracking within their firm. In other words, those promoted quickly at one level tend to be promoted more often and more quickly at the next level.

In a similar way, Table 2.5 investigates the existence of promotion fast-tracking within our large financial sector firm[6]. However, it considers transitions between all grades, rather than just the level 1 to level 2 transitions which Baker, Gibbs and Holmstrom (1994) focus on. As can be seen in Table 2.5, in line with Baker, Gibbs and Holmstrom (1994), looking down columns the promotion rate tends to fall as the time spent by workers in their previous grade increases, thereby providing some preliminary evidence for the existence of promotion fast-tracking within the firm.

Table 2.5 also quite surprisingly finds evidence of a fast-track exit effect in which the very individuals who were targeted for rapid promotion also appear to be the ones most likely to leave the firm. Baker, Gibbs and Holmstorm (1994) find a similar result and argue that such a finding could be the result of some high ability workers not being optimally employed by the organisation, or that the firm may not be paying individuals according to their expected marginal products.

The results reported in Table 2.5 are explored further in Chapter 3. In particular, it investigates whether the fast-track effects identified in Table 2.5 survive after controlling for other factors, such as human capital effects.

---

[6]The table shows promotion and exit rates by time in the current grade, versus the time spent by workers in their previous grade.

2.4 Wages and the Hierarchy

The second major aspect of Doeringer and Piore's (1971) description of an internal labour market relates to wages and how they are determined in an internal labour market. Doeringer and Piore (1971) assert that wages in an internal labour market are not set on an individual basis, but are determined by a set of administrative rules and procedures that assign wages to jobs. According to Doeringer and Piore (1971):

> The process of job evaluation consists in rating a job in each of the following categories and adding the points across categories to determine point totals. This is typically done once for all jobs ... when a job evaluation plan is first introduced. Jobs are then re-evaluated only when they are thought for one reason or another to have changed. New jobs are, of course, evaluated when they are introduced. The job-evaluation point totals serve as a device for arranging jobs in a pay hierarchy (page 67).

This section examines the structure of pay within our large financial sector organisation in order to examine the extent to which it fits Doeringer and Piore's (1971) description of an internal labour market, and the degree to which it is similar to that outlined in Baker, Gibbs and Holmstrom (1994). Basic pay is set at a competitive market-related level, and is reviewed annually, and upon promotion and demotion etc. Although the basic component of the worker's pay is not linked to performance the employees receive an annual bonus that is based on their annual performance and the performance of the unit to which they are assigned[7].

[7]The way pay is set in the firm is largely in accordance with the findings of Brown (1990). He shows that, in line with predictions, due to the high costs of monitoring, large firms make a significantly greater use of standard rate pay than pay schemes that link the majority of pay directly to output/performance.

2.4.1 Pay Ranges and Grades

Figures 2.6, 2.7 and 2.8 plot the mean annual basic salary over the period January 1989 to March 1997 for workers in the clerical, lower management and upper management grades, respectively. As can be seen from these figures promotion appears to be the main way of obtaining salary advancement within the firm. Not surprisingly, individuals in the higher grades earn on average more than those in the lower grades. Baker, Gibbs and Holmstrom (1994) produce a similar figure and find comparable results.

Figure 2.6 also shows that the mean wage differentials between the clerical grades remain approximately the same over time. However, as can be seen in Figures 2.7 and 2.8 the same does not appear to be true for the management grades. Here there has been an increase in the mean wage differential between the lowest and highest management grades. In fact, between January 1989 and March 1997 workers in the lowest management grades experienced a slight fall in their real wages, while those in grade 13 received an approximate 25% increase in their real wages.

Figures 2.9 and 2.10 plot the relationship between salary and grade in a typical year, 1990, for both the clerical and managerial grades, respectively. As can be seen the relationship between salary and grade is clearly convex; mean pay in grade 12 is, for example, approximately 15 times greater than mean pay in grade 5 (the lowest non-training grade). Baker, Gibbs and Holmstrom (1994) find a similar result. Such a finding is in line with many incentive-based theories e.g., tournament theory (see Lazear and Rosen (1981) and Rosen (1986))[8]. Figures 2.9 and 2.10 also show that there appears to be substantial overlap of pay between grades. Pay is thus not determined solely by grade and consequently promotion is not the only means of salary advancement in the firm. Again, Baker, Gibbs and Holmstrom (1994) find comparable results.

Table 2.6 examines the relationship between wages and grade in more detail. Baker, Gibbs and Holmstrom (1994) estimate four wage regressions comparing the explanatory power of human capital variables (education and tenure, with demographic control) and

[8]A more detailed analysis of tournament theory is presented in Chapters 3 and 4.

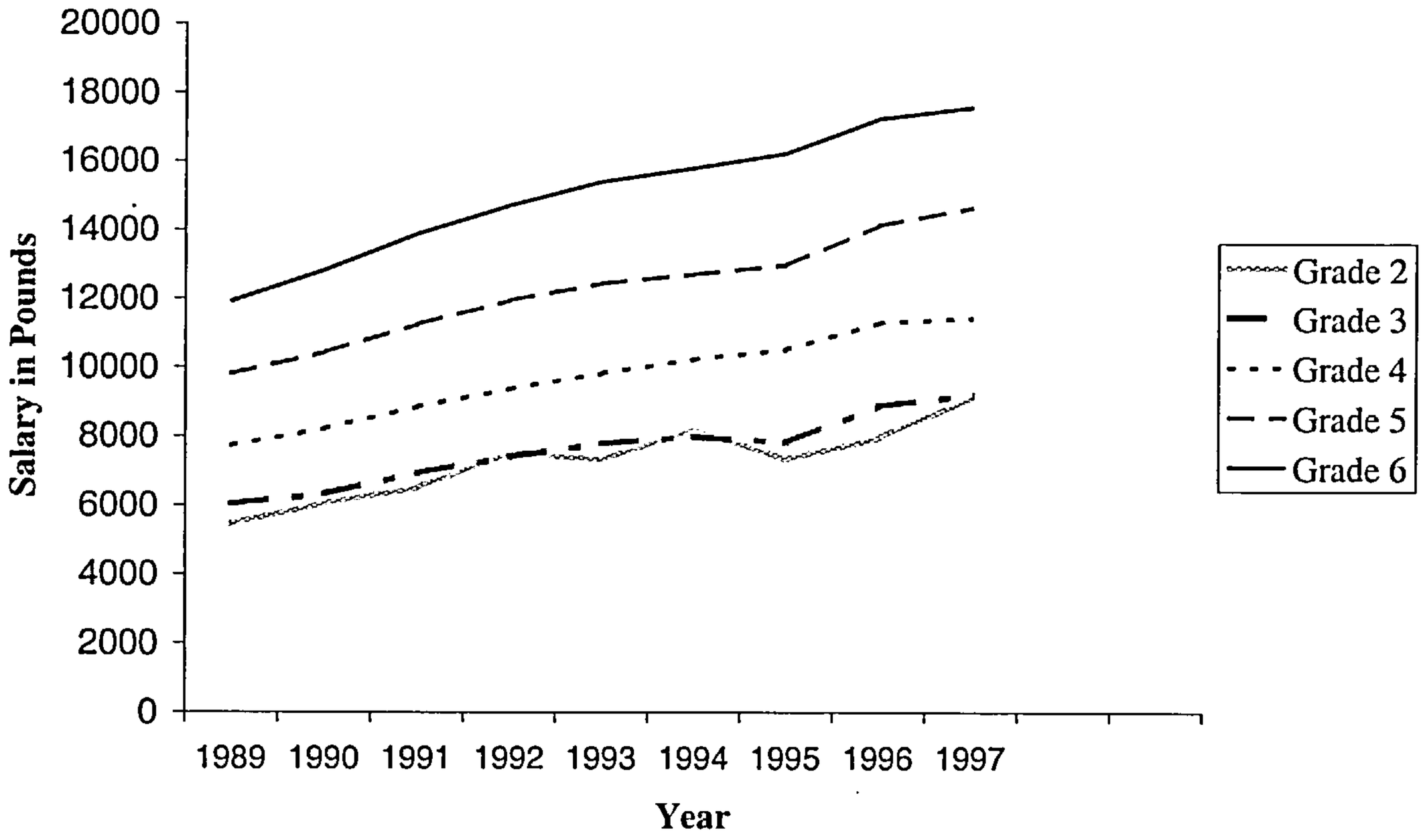

Figure 2-6: Mean Annual Salary - Clerical Grades.

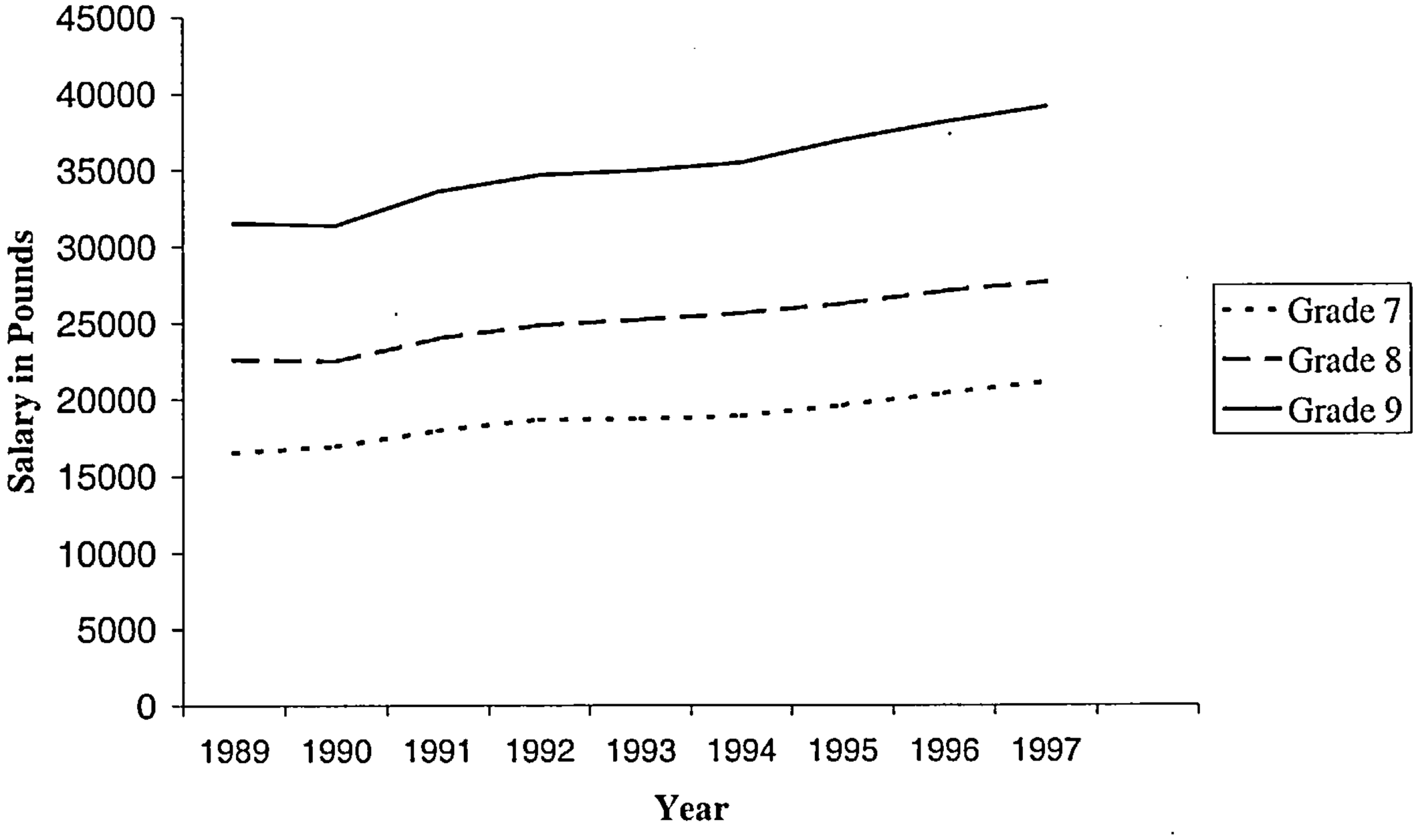

Figure 2-7: Mean Annual Salary - Lower Management Grades.

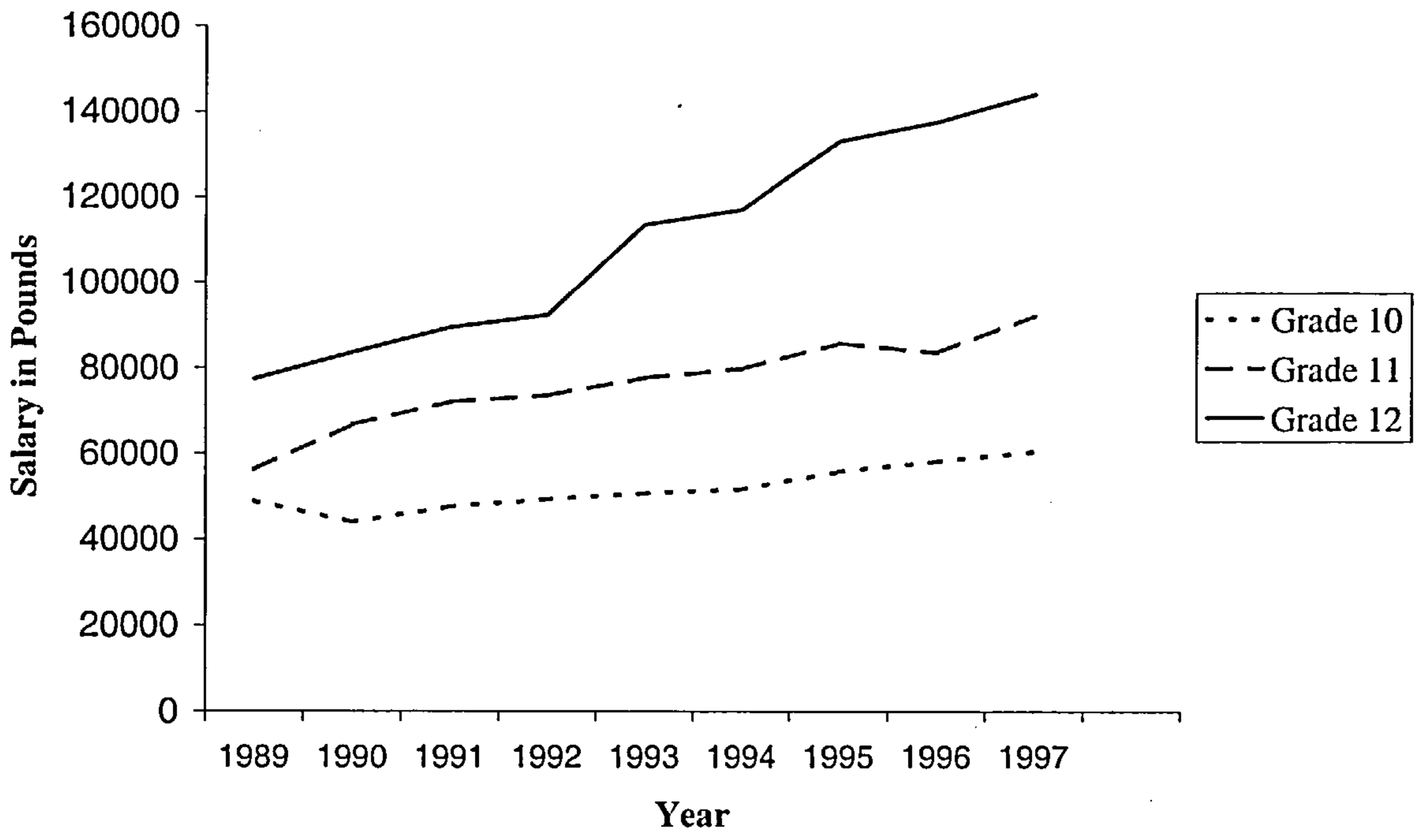

Figure 2-8: Mean Annual Salary - Upper Management Grades.

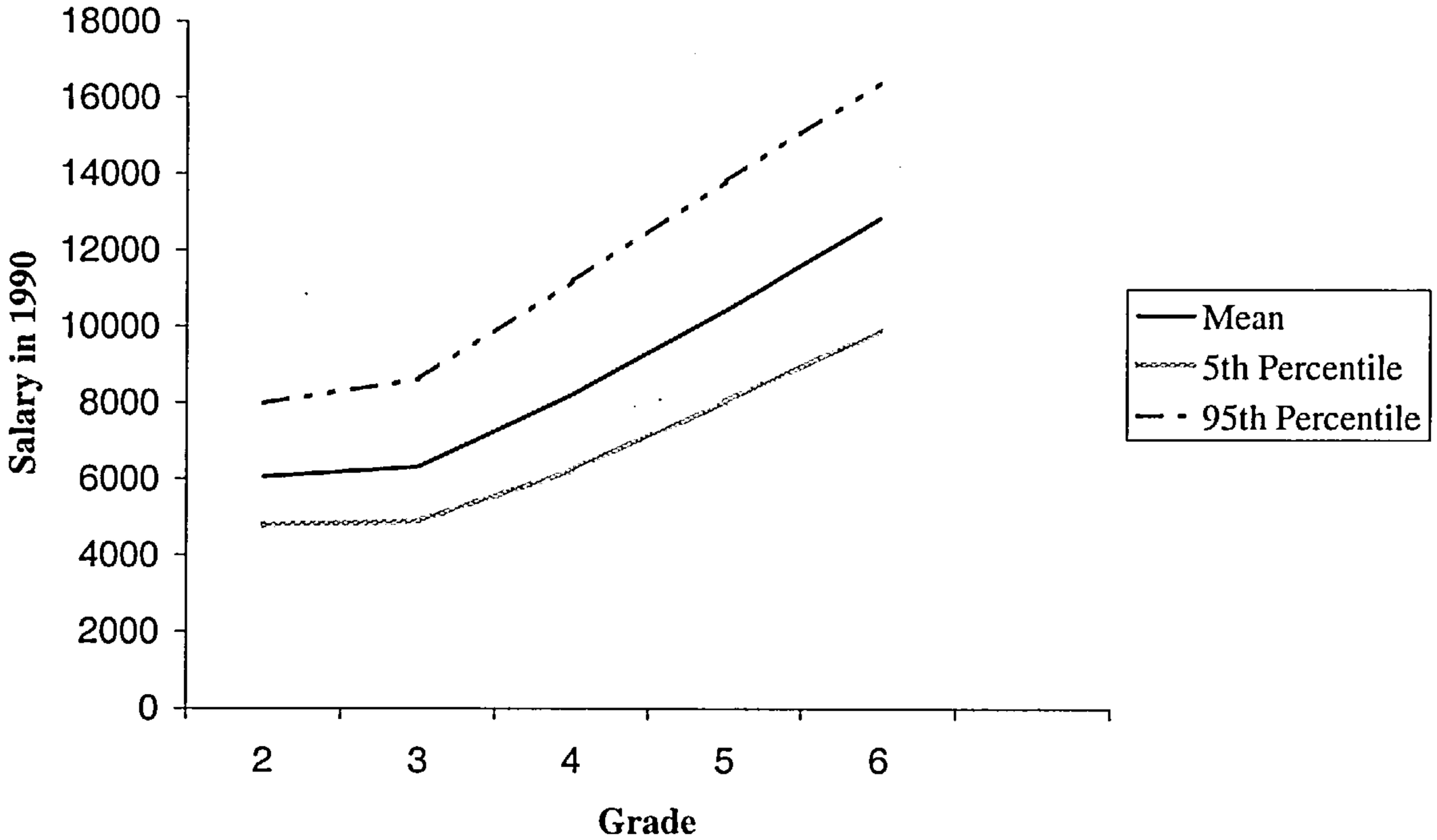

Figure 2-9: Salary Ranges in 1990 - Clerical Grades.

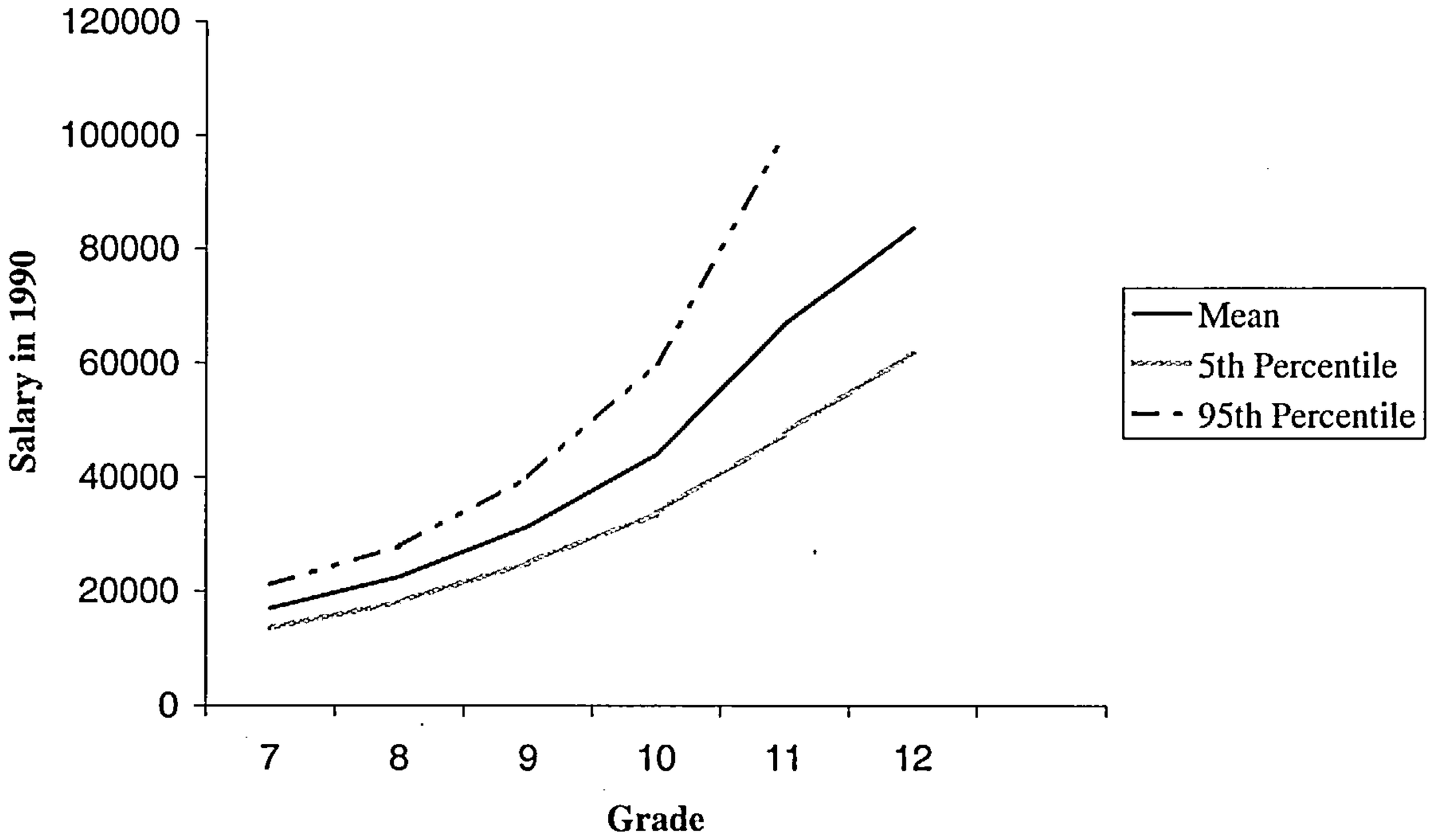

Figure 2-10: Salary Ranges in 1990 - Management Grades.

level (grade) dummies. From this they show that human capital variables explain about 35% of the variance in salary, while level dummies are much more important accounting for nearly 68% of the variance in salary.

Table 2.6 replicates these wage regressions as far as possible[9]. However, the education variables used in this study are not as detailed as Baker, Gibbs and Holmstrom's (1994), and only include dummies for degree (= 1 if the individual has a degree) and professional qualification (= 1 if the individual has a professional qualification). As can be seen in Table 2.6 human capital variables account for 57% of the variance in salary. However, in line with Baker, Gibbs and Holmstrom (1994) grade dummies are much more powerful accounting for 90% of the variance in salary.

2.4.2 Pay Premiums

Baker, Gibbs and Holmstrom (1994) argue that if wages are determined by levels (grades) then workers should earn large pay premiums upon promotion. Table 2.7 investigates this relationship in more detail. The middle three columns of Table 2.7 calculate the percentage mean change in real salary (across years) for those individuals who stay where they are, are demoted, or promoted, relative to the mean rise (that year) of all individuals who do not change grade. As can be seen in Table 2.7 there are premiums for promotions and a small negative premium for demotions. Table 2.7 shows that on average promotions result in a 11.9% rise in salary while demotions result in a 2.6% fall in salary.

The final column of Table 2.7 shows the average (across years) percentage difference in mean salary between grades. As can be seen, the difference in average salary between grades is always greater than the average premiums individuals earn on promotion into the grade. For example, mean pay is, on average, 25.6% higher in grade 4 than grade 3. However, the promotion premiums workers earn upon changing grade accounts, on

[9]The dependent variable in all these regressions is the log of total salary (including bonus pay). The first three regressions are pooled cross-sections over 1989 to 1997, while the final regression shows a single cross-section for 1989. Standard errors are in parenthesis.

Independent Variables	1989-1997 Pooled Regressions			1989
	Human Capital	Levels	Combined	Cross-Section
Year Dummies	Yes	Yes	Yes	No
Sex Dummy	Yes	No	Yes	Yes
Intercept	8.91	8.52	8.49	8.70
	(0.003)	(0.003)	(0.003)	(0.01)
Degree	0.65	.	0.09	0.10
	(0.003)	.	(0.002)	(0.004)
Professional Qualification	0.05	.	-0.05	-0.05
	(0.002)	.	(0.0008)	(0.002)
Tenure	0.04	.	0.03	0.03
	(0.0004)	.	(0.0002)	(0.0005)
Tenure Squared	-0.0004	.	-0.0005	-0.0004
	(0.00001)	.	(5.24e-06)	(0.00002)
Grade 4	.	0.34	0.26	0.17
		(0.003)	(0.003)	(0.01)
Grade 5	.	0.59	0.43	0.35
		(0.003)	(0.003)	(0.01)
Grade 6	.	0.79	0.59	0.50
		(0.003)	(0.003)	(0.01)
Grade 7	.	1.05	0.85	0.80
		(0.003)	(0.003)	(0.01)
Grade 8	.	1.34	1.11	1.07
		(0.004)	(0.003)	(0.01)
Grade 9	.	1.67	1.43	1.40
		(0.004)	(0.003)	(0.01)
Grade 10	.	2.14	1.90	1.85
		(0.004)	(0.004)	(0.01)
Grade 11	.	2.73	2.48	2.50
		(0.006)	(0.005)	(0.02)
Grade 12	.	3.02	2.77	2.70
		(0.01)	(0.01)	(0.04)
R-squared	0.57	0.90	0.92	0.94
R-squared regression w/o year dummies	0.51	0.82	0.87	.
N	180251	180251	180251	20226
Dependent Mean	9.6	9.6	9.6	9.5

Source: Treble, van Gameren, Bridges and Barmby (2001).

Table 2.6: Effects of Human Captial and Hierarchical Levels on Current Salary.

Grade	% salary premium on Stay	Demotion	Promotion	% diff. in mean pay across levels
2	3.7	3.6	N/A	N/A
3	1.9	-1.4	0.9	6.4
4	0.9	-0.2	16.2	25.6
5	0.3	-0.4	10.6	25.5
6	-0.3	-7.2	8.0	23.0
7	-1.4	-4.7	19.3	24.5
8	-1.5	-4.0	10.3	32.4
9	0.5	-5.3	14.4	41.1
10	-0.8	-5.0	9.5	46.7
11	-1.5	N/A	4.5	53.2
12	1.2	N/A	5.3	39.2
13	0.2	N/A	4.6	71.7
2-13	0.0	-2.6	11.9	

Source: Treble, van Gameren, Bridges and Barmby (2001).

Table 2.7: Salary Premiums by Type of Job Transistion and Across Levels.

average, for only 16.2% of this change in salary. Thus, promotion premiums explain only part of the difference in pay between grades. Baker, Gibbs and Holmstrom (1994) produce a similar table and find comparable results.

It should be noted that for promotions to grades 4, 5 and 7 the proportion of the total pay differential obtained on promotion is large in comparison to other promotions in this firm and relative to Baker, Gibbs and Holmstrom's (1994) results. Thus, as conjectured earlier, promotions to grades 4 and 5 are more standards based than others, while promotion to grade 7 represents a promotion to the first management grade and is thus rewarded by a large increase in salary.

Tables 2.8 and 2.9 examine the distribution of pay for promotees in salary deciles[10]. It

[10]Salary deciles are calculated within each hierarchical grade and year. The difference in the number of observations before and after promotion arises because of missing salary data.

examines where promotees come from in the pay distribution in their prior job and where they go to in the pay distribution in their new job. If the grades were non-overlapping intervals of salary, such that a grade number simply indicated a range of compensation, then grade would be determined by pay. Baker, Gibbs and Holmstrom (1994) suggest that if this were the case then individuals would always be promoted out of the top decile and into the bottom decile of successive grades. Tables 2.8 and 2.9 show that there are wide variations in which deciles employees come from and go to. For example, only 6.6% of workers promoted into grade 3 are from the top decile of their previous salary range, while 12.1% are from the lowest decile. However, in the management grades there appears to be a slight tendency for individuals to be promoted from the higher end of their previous salary range. For example, 37.4% of workers promoted into grade 10 are from the top decile of their previous salary range. There also appears to be a small tendency for promotees to enter their new grade at the lower end of the salary range; 33.8% of workers promoted into grade 5, for example, entered at the lowest salary decile.

Baker, Gibbs and Holmstrom (1994) produce a similar table and find broadly comparable results. In particular, they observe wide variations in which deciles employees come from and go to. Nevertheless, they also find that there is a slight tendency for workers to be promoted from the top decile of their previous salary range into the lower end of their new salary range.

Table 2.10 compares the pattern of exit by grade and salary decile[11]. It shows that there are statistically significant variations in exit rates between deciles, although a clear overall pattern is difficult to ascertain. However, as can be seen in Table 2.10 the exit rates for the management grades 8 to 10 appear to be increasing with the salary deciles within each grade. This suggests that there could be some promotion bottlenecks within the organisation, causing workers who are tired of waiting for promotion to leave the firm.

[11] Annual percentage exit rates are shown in this table. Deciles are calculated within each hierarchical grade and year. The last column shows χ^2 statistics for the hypothesis that exit rates for all deciles in a grade are the same. Critical values for the χ^2-test are 21.67 at the 1% and 16.92% at the 5% significance level.

Promotion	Statistic	N	Percentage in each salary decile				
			Bottom	2nd	3rd	4th	5th
Grade 2 to Grade 3	Decile before promotion	1502	12.1	12.3	10.7	11.2	10.5
	Decile after promtion	1500	16.4	13.8	9.5	11.4	15.9
Grade 3 to Grade 4	Decile before promotion	6317	8.5	9.6	11.2	10.4	11.8
	Decile after promotion	6298	33.4	10.4	13.3	5.9	5.4
Grade 4 to Grade 5	Decile before promotion	10200	5.5	8.5	9.9	11.4	12.9
	Decile after promotion	10165	33.8	16.8	11.7	9.2	8.2
Grade 5 to Grade 6	Decile before promotion	7859	9.8	10.3	10.0	9.3	9.2
	Decile after promotion	7820	30.2	17.8	16.3	13.0	7.8
Grade 6 to Grade 7	Decile before promotion	4673	16.0	17.0	12.1	9.1	8.6
	Decile after promotion	4663	28.7	18.5	10.4	13.6	12.7
Grade 7 to Grade 8	Decile before promotion	4260	6.2	4.6	7.2	7.8	8.4
	Decile after promotion	4244	29.1	14.8	13.3	13.2	6.4
Grade 8 to Grade 9	Decile before promotion	1983	3.9	3.9	5.2	6.8	9.0
	Decile after promotion	1984	25.8	20.7	15.6	8.2	7.8
Grade 9 to Grade 10	Decile before promotion	696	0.9	1.0	1.9	2.6	3.9
	Decile after promotion	701	20.5	17.1	12.6	10.1	8.8
Grade 10 to Grade 11	Decile before promotion	260	0.4	0.8	0.8	2.3	3.7
	Decile after promotion	263	15.5	13.2	7.9	9.7	11.8
Grade 11 to Grade 12	Decile before promotion	28	0.0	0.0	3.6	14.3	10.7
	Decile after promotion	27	11.1	22.2	33.3	18.5	1.9

Source: Treble, van Gameren, Bridges and Barmby (2001).

Table 2.8: Distribution of Pay for Promotees in Salary Deciles Before and After Promotion - Lower Deciles.

Promotion	Statistic	N	Percentage in each salary decile				
			6th	7th	8th	9th	Top
Grade 2 to	Decile before promotion	1502	10.6	9.7	8.7	7.7	6.6
Grade 3	Decile after promtion	1500	10.0	6.6	6.2	6.5	3.6
Grade 3 to	Decile before promotion	6317	11.1	9.3	9.7	10.1	8.2
Grade 4	Decile after promotion	6298	6.7	5.4	13.1	3.6	2.7
Grade 4 to	Decile before promotion	10200	11.3	10.3	9.9	11.7	8.4
Grade 5	Decile after promotion	10165	7.2	5.7	2.9	2.7	1.9
Grade 5 to	Decile before promotion	7859	10.4	10.0	11.0	11.9	8.1
Grade 6	Decile after promotion	7820	4.8	2.9	3.2	2.6	1.3
Grade 6 to	Decile before promotion	4673	7.9	8.4	7.3	6.7	6.9
Grade 7	Decile after promotion	4663	7.1	3.5	2.3	1.7	1.5
Grade 7 to	Decile before promotion	4260	10.0	10.0	13.0	14.1	18.7
Grade 8	Decile after promotion	4244	6.3	5.2	3.5	3.0	5.3
Grade 8 to	Decile before promotion	1983	9.8	11.9	10.6	16.1	22.7
Grade 9	Decile after promotion	1984	6.3	3.3	2.7	2.7	7.0
Grade 9 to	Decile before promotion	696	7.7	11.8	12.8	20.1	37.4
Grade 10	Decile after promotion	701	6.3	4.0	5.0	6.3	9.3
Grade 10 to	Decile before promotion	260	6.7	7.1	16.5	29.1	32.7
Grade 11	Decile after promotion	263	8.9	10.5	6.5	8.1	7.9
Grade 11 to	Decile before promotion	28	20.7	6.1	14.3	19.6	10.7
Grade 12	Decile after promotion	27	4.4	0.7	1.9	5.9	0.0

Source: Treble, van Gameren, Bridges and Barmby (2001).

Table 2.9: Distribution of Pay for Promotees in Salary Deciles Before and After Promotion - Upper Deciles.

Grade	N	Exit rate in each decile										χ^2
		Bottom	2nd	3rd	4th	5th	6th	7th	8th	9th	Top	value
2	2887	13.6	13.7	14.3	14.8	19.7	19.1	21.3	19.8	19.4	20.4	14.1
3	13042	10.8	11.0	10.0	14.7	17.1	15.9	18.8	19.3	16.9	15.8	87.6
4	56772	10.0	10.1	10.6	10.5	12.0	11.7	11.6	12.2	11.2	9.5	40.0
5	90721	9.6	9.9	10.7	10.5	9.7	9.1	9.1	8.3	8.0	9.2	65.3
6	60331	7.5	7.8	7.5	6.4	6.7	7.3	6.9	8.1	8.2	7.8	25.1
7	47983	13.6	8.3	6.9	7.1	9.0	8.5	9.9	9.9	10.8	12.2	205.1
8	22958	7.8	7.0	7.9	8.1	8.1	9.7	10.1	11.6	11.7	14.4	116.7
9	14285	6.7	7.2	9.6	9.2	10.4	11.9	10.4	11.9	13.8	15.7	92.7
10	4925	13.4	10.9	9.6	13.7	11.5	12.0	16.5	11.8	14.0	16.1	17.0
11	1497	14.8	13.2	12.0	11.5	15.0	16.0	8.9	10.7	10.1	15.2	7.3
12	263	23.1	19.6	13.7	27.6	7.1	6.4	6.0	11.1	27.4	13.8	9.1
Total	320109	12.0	11.4	11.3	10.2	8.7	7.8	7.8	8.5	9.1	11.7	796.5

Source: Treble, van Gameren, Bridges and Barmby (2001).

Table 2.10: Exit Rate in each Decile.

Baker, Gibbs and Holmstrom (1994) produce a similar table, but find little significant variation in exit rates across salary deciles within their organisation.

2.4.3 'Green Card' Effects

Finally, Table 2.11 examines what Baker, Gibbs and Holmstrom (1994) term 'Green Card' effects[12]. Many organisations have explicitly set guidelines/rules that impose bounds on pay increases. For example, Baker, Gibbs and Holmstrom (1994) report that the firm studied in their paper issues guidelines on pay progression based on performance relative to some reference group, and the worker's performance ratings[13]. These guidelines are examples of the kinds of administrative rules and procedures that an internal labour

[12]The table shows the mean percentage salary rise in 1989 constant pounds by performance rating in the same period. Performance is rated on a scale from 1 (worst) to 5 (best).

[13]These rules are printed on green cards, hence the term 'Green Card' effects.

market might operate to determine pay progression in the organisation. Although no such explicit rules exist within our large financial sector firm, this table is still replicated in order to examine whether the effects operate implicitly.

As in Baker, Gibbs and Holmstrom (1994) each employee is placed in a salary quartile prior to each pay rise. Table 2.11 thus presents the mean percentage real rise in salary stratified by the quartile of pay versus the employee's performance rating in each period. In Baker, Gibbs and Holmstrom (1994) the rules operate in such a way that they tend to generate pay compressions within grades. Table 2.11 finds a similar result for workers in the staff grades. For example, employees in the higher quartiles tend to receive smaller pay increases than those in the lower quartiles. However, in contrast to Baker, Gibbs and Holmstrom (1994) there is evidence of pay dispersion in the management grades and workers in the higher quartiles tend to receive bigger pay increases than those in the lower quartiles. If the main means of pay progression within the firm is by winning promotion tournaments high pay spreads might induce less co-operative behaviour and a 'too high' degree of competition among the workers. However, one way round this problem is to give individual rewards, such as bonuses, which is what occurs in this firm.

Level	Salary Quartile	Performance Rating				
		1-2	3	4	5	1-5
3	Top	2.0	3.6	4.5	3.4	4.0
	3rd	2.7	3.8	4.9	4.7	4.3
	2nd	1.7	4.6	5.9	7.6	5.1
	Bottom	1.5	5.7	6.7	8.8	5.9
	N	98	2527	1561	111	4297
4	Top	3.2	3.8	3.4	1.8	3.3
	3rd	1.8	2.6	2.8	3.6	2.8
	2nd	3.4	3.8	4.5	5.4	4.2
	Bottom	1.2	4.5	5.3	5.8	4.9
	N	456	16454	18609	3368	38887
5	Top	1.4	2.2	2.6	2.1	2.3
	3rd	2.8	2.8	2.2	3.1	2.6
	2nd	2.1	3.1	3.8	4.2	3.6
	Bottom	3.7	4.1	4.1	4.4	4.1
	N	382	20110	35344	14544	70380
6	Top	1.0	1.5	2.1	1.7	1.8
	3rd	0.6	1.9	1.9	1.9	1.9
	2nd	1.4	2.1	2.9	4.3	3.0
	Bottom	2.3	3.4	4.1	4.5	3.9
	N	239	10496	22144	15368	48247
7	Top	-1.4	0.8	3.8	4.0	1.5
	3rd	-2.5	0.6	2.3	3.2	0.9
	2nd	-1.7	0.8	4.2	3.0	1.4
	Bottom	0.7	1.0	2.6	3.6	1.2
	N	1044	24741	5859	567	32211
8	Top	-1.2	0.9	4.0	4.8	1.9
	3rd	-2.5	0.4	2.4	3.5	1.0
	2nd	-1.9	0.6	2.6	4.6	1.1
	Bottom	-1.7	0.7	2.3	4.5	1.1
	N	397	11283	4358	398	16436
9	Top	-0.2	0.9	5.1	5.2	3.1
	3rd	-0.8	1.8	3.2	4.7	2.5
	2nd	-1.5	0.9	2.6	3.8	1.6
	Bottom	-0.4	0.5	2.2	3.0	1.0
	N	186	6000	3926	436	10548

Source: Treble, van Gameren, Bridges and Barmby (2001).

Table 2.11: 'Green Card' Effects of Relative Salary in Title on Raises, by Performance Rating.

Level	Salary Quartile	Performance Rating				
		1-2	3	4	5	1-5
10	Top	-0.5	0.9	8.5	24.5	7.7
	3rd	-18.4	-0.6	2.0	5.3	1.1
	2nd	-5.5	-0.6	2.0	6.1	0.7
	Bottom	-4.2	-0.5	-0.1	3.5	-0.3
	N	26	1621	1587	196	3430
2-12	Top	-1.7	0.7	4.8	3.3	2.1
	3rd	-0.1	1.4	2.5	2.3	2.0
	2nd	2.8	3.0	3.3	3.2	3.2
	Bottom	2.2	3.9	4.1	4.1	4.0
	N	2834	93528	94214	35133	255709

Source: Treble, van Gameren, Bridges and Barmby (2001).

Table 2.12: 'Green Card' Effects of Relative Salary in Title on Raises, by Performance Rating, cont'd.

2.5 Conclusion

This chapter gives a detailed analysis of the large U.K financial sector firm used in this thesis. It examines the organisation's hierarchical structure, pattern of careers, ports of entry and exit, and the structure of pay. It also seeks to replicate Baker, Gibbs and Holmstrom's (1994) analysis as far as possible in order to gauge the extent to which their findings can be regarded as characteristic of large firms generally, and to what extent they are specific. Although the two organisations operate in different countries, with different employment law, regulations and educational systems the results reported in this chapter show that the structure of the two firms are, nevertheless, remarkably similar.

The first section of this chapter examines the pattern of careers within our large financial sector organisation and finds that the firm, like Baker, Gibbs and Holmstrom's (1994), has an explicit hierarchical structure that is relatively stable over time. Workers in our large financial sector firm can be assigned to one of 13 levels or grades; grades 2 to 6 are the main clerical grades, and grades 7 to 13 the main management grades.

In line with Baker, Gibbs and Holmstrom (1994) there is also evidence that the internal labour market is allocating workers to jobs in the firm. Careers in this firm,

for example, tend to be relatively long and demotions are rare. There is, however, no evidence in either organisation to support the idea of defined ports of entry and exit; entry and exit can occur at all grades/levels.

Employers in both organisations also tend to use lower level job performance to learn about the innate abilities of their workers and use this information in their subsequent promotion decisions. Such an inference is supported by the existence of fast-track promotion effects in which those promoted quickly at one grade/level tend to be promoted more often and more quickly at the next grade/level. There is also, quite surprisingly, evidence of a fast-track exit effect in both firms in which the very individuals who are targeted for rapid promotion also appear to be the ones most likely to leave the organisation. Baker, Gibbs and Holmstrom (1994) argue that such a finding could be the result of their so-called 'Green Card' effects. In other words, administrative constraints in the way pay is awarded may prevent the firm from giving their best workers large enough pay rises to retain them.

The second section of this chapter examines the structure of pay within our large financial sector organisation and finds, in line with Doeringer and Piore's (1971) description of an internal labour market, that pay is not determined solely on an individual basis but is strongly related to the grade the worker is in. Baker, Gibbs and Holmstrom (1994) find a similar result. In both firms, the relationship between salary and grade is also clearly convex, as many incentive-based theories e.g., tournament theory (see, for example, Lazear and Rosen (1981)) would suggest.

Although, there are many similarities between the two organisations important differences do arise. Exit rates in our large financial sector firm are, for example, more variable than in Baker, Gibbs and Holmstrom's (1994). The hierarchy also changes its structure more markedly in this organisation than in Baker, Gibbs and Holmstrom's (1994), with the management grades becoming proportionately more important over the period studied. In addition, in Baker, Gibbs and Holmstrom (1994) the rules operate in such a way that they tend to generate pay compressions within grades. However, in our

firm evidence of pay compressions within grades is only true for the staff grades. In the management grades workers in the higher quartiles tend to receive bigger pay increases than those in the lower quartiles.

In summary, the findings presented in this chapter and in Baker, Gibbs and Holmstrom (1994) together suggest that many of the characteristics of internal labour markets are reflected in organisational data of this type. However, there are also sufficient differences between the two firms to suggest that other complexities exist that are not covered by the internal labour market model. In particular, although careers within the firm are important, jobs are filled from outside the hierarchy sufficiently frequently to suggest that the internal labour market is not fully insulated from competitive pressures.

Chapter 3

Promotion

3.1 Introduction

A number of stylised facts emerge when looking at comparisons in human resource practices between countries, particularly between Japan and the U.S. For example, a common view when looking at the internal workings of a firm is that U.S and Japanese organisations differ in their policies towards promotion. Workers in the U.S tend to be highly mobile, moving between firms on a regular basis in search of better opportunities. Consequently, in order to retain their most able workers U.S organisations tend to engage in promotion fast-tracking and hence target a few individuals early on for top careers (see Rosenbaum (1984) and Baker, Gibbs and Holmstrom (1994)). In contrast, tenure in large Japanese firms tends to be relatively long and Japanese employers often rely heavily on internal promotions to fill vacancies. Thus, fewer opportunities are available for workers, especially those in mid-career who leave the organisation, making a late selection approach to promotion a viable option. Employees, for example, in large Japanese firms are typically not differentiated from their cohort until they have been with their organisation for between 10 and 15 years after which time considerable differentiation by ability usually occurs (see Aoki (1988)).

As will be seen in Section 3.3 only a handful of studies have addressed the causes and

consequences of promotion in the U.K. This chapter thus seeks to add to the limited body of information on promotion in the U.K by investigating whether there is any evidence of promotion fast-tracking within our large U.K financial sector firm. A discrete-time proportional hazard based on the model proposed by Prentice and Gloeckler (1978) is used to study the time to promotion. This approach enables the baseline hazard to be estimated non-parametrically, and thus avoids any *a priori* assumptions being made about its shape.

This chapter is organised as follows. Section 3.2 provides a summary of some of the economic theory on promotion. Section 3.3 reviews some of the economic evidence on promotion. A description of the data being used is given in Section 3.4, while the model and the remaining empirical results are reported in Sections 3.5 and 3.6, respectively. Finally, implications for future work and the conclusions are discussed in Section 3.7.

3.2 Theoretical Framework

The economic theory surrounding promotion can be split into three broad categories. It can be modelled in terms of a learning mechanism, an incentive device, or human capital accumulation. This section considers each of these categories briefly in turn.

3.2.1 Learning Hypothesis

Suppose that individual productivity is determined by a time invariant characteristic, ability, which is gradually revealed over time. The learning hypothesis suggests that promotion to higher ranks in the hierarchy arises from the repeated observation and evaluation of worker performance by employers. Firms use lower-level job performance to learn about the innate abilities of their employees and use this information in their subsequent promotion decisions.

The speed with which a worker is promoted thus depends to some extent on how much information competing firms have about the individual's ability. Waldman (1984), for example, argues that while information on ability levels will in general only be directly revealed to the current employer, competing organisations can, however, use the informational content of the worker's job to derive information on ability. According to Waldman (1984), under spot contracting, this can lead to an inefficient assignment of individuals to jobs and under promotion. When a worker is promoted it signals information to competing firms that s/he is of a higher ability, which in turn often forces the firm to pay the individual a correspondingly higher wage in order to retain them. However, Waldman (1984) argues that for those employees who are only slightly more productive in the new job the increase in productivity caused by efficient placement may not be enough to compensate the organisation for the necessary increase in wages. As a result, there is an incorrect assignment of workers to jobs as these individuals remain inefficiently employed in jobs which do not maximise their output.

Waldman (1984) also argues that the extent of this incorrect assignment of employees to jobs is negatively related to the level of firm-specific human capital. He asserts that in the case of perfect general training the wage offered by competing firms is driven so high that only workers of the very highest ability can be assigned to the job.

In addition, Waldman (1984) finds that an inefficient assignment of employees to jobs can still occur, although are less likely, when the assumption of spot contracting is relaxed and employers are able to commit themselves to a wage schedule for subsequent periods in advance.

The incorrect assignment of individuals to jobs takes the form of delayed promotion in Bernhardt (1995). Bernhardt (1995) makes the same assumptions as Waldman (1984) regarding information on ability. In other words, he assumes that while information about the worker's ability will generally only be directly revealed to the current employer, competing firms can, nevertheless, use the informational content of the individual's job

to derive information on ability. Berhnardt (1995) argues that an employee should only be promoted if the increase in productivity caused by efficient placement exceeds the loss of the organisation's private information. He asserts that the lower is the worker's perceived ability to the market, the greater is the incentive for employers to exploit their private information by failing to promote such individuals as quickly as is socially optimal. Consequently, equally (or more) able workers from a less productive (e.g., uneducated) group will tend to get promoted less frequently than those from a more productive (e.g., educated) group.

Bernhardt (1995) also uses this asymmetry of information between the incumbent firm and the labour market to explain promotion fast-tracking. Targeting individuals for promotion at lower levels in the hierarchy identifies them to competing organisations as being from a more skilled group. The private information about these workers is consequently not as valuable to current employers, making it optimal for the firm to continue to target such individuals for rapid promotion ahead of less quickly promoted workers who may now exhibit more promise.

Firms and their Workers

In the learning models discussed so far individuals tend to be largely passive and do not make any strategic decisions regarding their careers. Prendergast (1992), however, assumes a more active role for employees in his model of promotion. He investigates how employers provide workers with incentives to accumulate firm-specific capital when the skills collected cannot be contracted upon, and when individuals can only be compensated for the collection of skills by promotion. Prendergast (1992) considers two scenarios: (i) the employer has private information about the worker's promotion prospects and (ii) both the employer and the worker are uncertain about the individual's promotion prospects.

In his first scenario two separate assumptions regarding wage payments are made. First, the firm is assumed to have discretion over the wages it pays in any job. Second,

collective bargaining agreements are assumed to determine the wage that must be paid in any job, so that the organisation cannot tailor its wage offers to match ability levels. Prendergast (1992) shows that if the firm has discretion over wages it can credibly signal to workers that they are able by paying them a higher wage before they collect any skills. Alternatively, he shows that if the organisation is constrained to offer a single wage to individuals in a given job it can signal credibility to workers that they are able by promoting them to a more difficult task, even though they may not yet be sufficiently qualified for that task. However, while intensively training a few employees may encourage them to exert greater effort it can also cause overlooked workers to become discouraged. As a result, Prendergast (1992) argues that if maintaining incentives among low ability employees is important the firm may choose not to reveal any information to workers about their promotion prospects.

In Prendergast's (1992) second scenario both the employer and the worker are uncertain about the individual's promotion prospects. Here two employees are assumed to compete against one another for promotion. Again, Prendergast (1992) argues that intensively training the high ability worker may harm incentives since it makes the promotion race less close, thereby reducing the incentives for both employees to exert as much effort collecting skills. In contrast, he shows that providing more training to the low ability individual makes the promotion race close, thereby maximising both workers' incentives to accumulate firm-specific skills.

Thus, in both scenarios revealing information to individuals about their promotion prospects can result in a loss of incentives to train among workers who are perceived to have no promotion prospects. This is in contrast to Waldman (1984) and Bernhardt (1995) where the cost of revealing information to employees about their ability is in the form of an increased market wage. Prendergast's (1992) notion of a corporate fast-track also differs from that of Bernhardt (1995). As outlined above he shows that in order to induce workers to train employers must credibly signal to them that they are able. Thus, in Prendergast (1992) employers implement a fast-track through wage increases or rapid

promotion of their most able employees.

Prendergast (1992) uses his findings to explain why promotion patterns in the U.S differ from those in Japan. Compared to the United States career development in Japanese firms tends to be seniority orientated with limited fast-tracking and a late selection approach to promotion (see Baker, Gibbs and Holmstrom (1994) and Aoki (1988)). Prendergast (1992) asserts that these different promotion patterns arise due to variations in production methods between the two countries. He argues that the returns to intensively training stars depends on the extent to which authority is centralised within the organisation. In firms where decision-making is highly centralised and most important decisions are made by senior managers, little efficiency is lost if low ability workers become discouraged. However, in organisations where decision-making is highly decentralised and important decisions can be made lower down the hierarchy, maintaining incentives among the less able becomes more important. Prendergast (1992) asserts that since decision-making in Japanese firms tends to be more decentralised than in U.S organisations this may help to explain why maintaining incentives among low ability workers appears to be more important in Japanese firms.

Prendergast (1992) argues that another reason for the difference in promotion patterns between Japan and the U.S may arise due to differences in the labour market between the two countries. In markets such as the U.S where turnover among workers is common, job offers received from competing firms (or the response of their employers to these bids) reveals valuable information to individuals about their performance. However, in Japan fewer opportunities are available for workers in mid-career who leave their jobs. As a result, employers in Japan are unlikely to face the same pressure from competing firms about their workers, so enabling them to continue to adopt a late selection approach to promotion.

3.2.2 Incentive Schemes

In practice a wide variety of incentive schemes are used by employers to motivate their workers. These mechanisms largely differ depending on whether they focus on the individual's absolute or relative performance. Simple piece rate schemes are, for example, based on the worker's absolute performance and link pay and promotion directly to the individual's output. As a result, employees need not be working with anyone else to be motivated by such schemes.

Employers can also induce effort by focusing on the worker's relative performance. Lazear (1995) argues that relative compensation schemes often have a number of advantages over absolute compensation schemes. Firstly, it is often easier and less costly for employers to observe and measure relative performance. Secondly, by concentrating on relative performance these schemes difference out random shocks that are beyond the individual's control. For example, if the economy is in a recession rewarding workers on their performance relative to that of their fellow peers will eliminate the common effect the recession has on their performance.

Tournament Theory

Tournament theory is an example of an incentive structure based on the individual's relative performance (see Lazear and Rosen (1981)). The essence of a tournament is that workers compete against one another for a prize, which in the case of the firm is usually in the form of a promotion to a relatively better paid position.

Tournament theory has a number of essential features. Firstly, the structure and number of jobs in the hierarchy are assumed to be relatively fixed, with wages being assigned to jobs (not individuals) in advance. Consequently, the wages that the winner of the tournament receives will be independent of the amount by which his/her performance exceeds that of the other workers.

Secondly, assignment to a job is based on relative rather than absolute performance. Thus, individuals may get promoted not necessarily because they are good but because

they are better than the other workers (even if the other employees are good).

Another feature of tournament theory is that the effort with which the individual pursues a promotion is positively related to the size of the salary increase that comes with the promotion. There is, however, a limit as to how big this pay spread can be. This is because there comes a point where the additional compensation needed to induce workers to exert extra effort would not be justified by the incremental output associated with that effort. A related point is that the high salaries among, for example, company directors do not necessarily reflect the value of their marginal products, but acts as an incentive for these individuals and for all other employees to work hard when they are lower down the hierarchy. Thus, company directors do not necessarily earn high salaries because they are more productive in these jobs, but because this type of pay structure makes them more productive over their entire working lives.

The mathematics behind tournament theory can be seen by looking at Lazear and Rosen's (1981) rank-order tournament model. Consider a tournament comprising of two-players (denoted by j and k) where the winner receives the higher fixed prize, W_{l+1}, and the loser receives the lower fixed prize, W_l. Then, $W_{l+1} - W_l$ represents the prize spread. The output of worker i can then be written as:

$$q_i = \mu_i + \varepsilon_i, \qquad i = j, k \tag{3.1}$$

where μ_i is the level of effort and ε_i is a random luck component. Worker i's optimisation problem is to choose the level of effort, μ_i, that maximises his/her expected utility. In other words:

$$\max_{\mu_i} W_{l+1}P + W_l(1-P) - C(\mu_i), \qquad i = j, k \tag{3.2}$$

where P is the probability of winning the contest and $C(\mu_i)$ is the cost function for effort,

with $C', C'' > 0$.

The first-order condition is:

$$(W_{l+1} - W_l)\frac{\delta P}{\delta \mu_i} - C'(\mu_i) = 0 \tag{3.3}$$

The probability that worker j wins the contest against an identical opponent k is given by:

$$P = \text{prob}(q_j > q_k) = \text{prob}(\mu_j - \mu_k > \varepsilon_k - \varepsilon_j) = G(\mu_j - \mu_k) \tag{3.4}$$

where G(.) is the cumulative distribution function for $\varepsilon_k - \varepsilon_j$. It follows from this that:

$$\frac{\delta P}{\delta \mu_j} = \frac{\delta G(\mu_j - \mu_k)}{\delta \mu_j} = g(\mu_j - \mu_k) \tag{3.5}$$

where g(.) is the probability density function for $\varepsilon_k - \varepsilon_j$. If the workers are identical they are assumed to supply the same amount of effort i.e., $\mu_j^* = \mu_k^*$ and equation (3.3) thus becomes:

$$(W_{l+1} - W_l)g(0) = C'(\mu_i) \tag{3.6}$$

It follows from equation (3.6) that since $C'(\mu_i)$ is monotonically increasing in μ higher pay spreads are associated with higher levels of effort. Another implication of equation (3.6) is that as luck becomes less important $g(0)$ increases causing the amount of effort exerted for any given pay spread to rise.

Lazear (1995) argues that the incentive effects of pay are particularly important when comparing compensation structures across countries or industries. In line with the model

outlined above he asserts that riskier industries should have larger pay spreads than less risky industries in order to induce workers to exert the appropriate level of effort.

Similarly, Chiang and Gort (1998) argue that managers of the same ability may exhibit differing levels of risk aversion that causes them to assess their chances of promotion differently, which in turn may influence their choice of hierarchical compensation structure. From this they argue that firms where the likelihood of promotion is a relevant attribute of the job are likely to attract the more optimistic and less conservative employees.

Internal versus External Promotions

A common finding of many studies is that firms tend to fill higher positions through internal promotions, rather than recruiting from outside. Chan (1996), for example, using data from the Fortune 100 firms finds that of the 84 individuals who were promoted to C.E.O since 1984 only 11 were hired from outside the organisation.

Chan (1996) analyses the choice between promotion from within and external recruitments, and in doing so extends the basic tournament model in order to make a distinction between internal promotion and recruitment from outside. Opening up jobs to competition from outside reduces an existing employee's chance of winning the contest, and with it his/her incentive to exert effort and compete. One way of maintaining incentives would be to increase the size of the pay spread. However, as outlined above there is a limit as to how big this pay spread can be. Accordingly, Chan (1996) suggests an alternative tournament structure in which the pay spread is constrained and a handicap is given to the internal candidate. He argues that by making the expected returns at the margin large enough the firm can induce efficient effort from its employees even if the pay spread is constrained.

Chan (1996) also shows that this handicap can be either positive or negative depending on the quality of the internal candidate; inferior internal workers are often given a positive handicap to prevent them from giving up altogether, while those of high abilities are given a negative handicap in order to induce them to exert effort. From this

he argues that on average internal promotions will occur more frequently than external recruitment, and that the quality of the external recruits is significantly greater than that of internal workers who fail to win the contest.

Biased Contests

Meyer (1991) considers a firm's promotion decision between two workers (i and j) where the individuals are assumed to be strategically passive and where differences in ability are initially unobserved by both the workers and the organisation.

In considering which individual to promote the firm is assumed to use the information about the worker's ability generated during a fixed number of observation periods (contests). However, the outcome of these contests are coarse in the sense that only rank-order information about the individual's ability is assumed to be available to the organisation. The quality of the firm's promotion decisions are also constrained by the fact that output is a noisy indicator of ability. However, at the start of each period the organisation is assumed to be able to adjust the rules that determine whether worker i or j wins the contest without cost. Thus, instead of individual i being declared the winner whenever worker i's output exceeds j's output, individual i can be declared the winner as long as his/her output does not fall short of worker j's by more than some amount c, where c is freely chosen by the firm.

With this in mind, Meyer (1991) shows that in order to maximise the likelihood of promoting the more able individual, later contests should be biased in favour of those who were more successful in the earlier contests. In particular, she shows that in a sequence of two contests in order to promote the more able worker the second contest should be biased in favour of the winner of the first.

An intuitive idea behind biased contests can be seen by considering the following scenario. Suppose there are two contests and the employer is seeking to promote one of two employees. Not surprisingly, s/he will want to promote the more able of the two workers, since the more able individual will usually be more productive in the higher level

job. In a sequence of two contests if one worker wins both contests then the promotion decision is clear. However, if one individual wins the first contest, and the other worker wins the second contest then the cumulative performance of the two employees is the same, and the employer effectively has no information about who to promote. One way round this problem is for the employer to bias the outcome of the second contest in favour of the winner of the first contest. Now the outcome of the second contest is informative (in a way that it wasn't before), and if the loser of the first contest wins the second the optimal decision would be to promote that worker since they have effectively had to overcome a higher hurdle.

3.2.3 Human Capital Accumulation

Another way of explaining promotion is in terms of human capital accumulation. In other words, the promotion of employees to jobs that require more complex skills depends on the accumulation of firm-specific human capital. Ariga, Ohkusa and Brunello (1997) argue that if these skills are developed through on-the-job training, company seniority should have an important role to play in the organisation's promotion decisions. For example, in firms where there is a high correlation between skills in lower and upper rank positions, experience within the hierarchy should be an important determinant of promotion decisions; innate talent or comparative advantage at the start of the individual's career should be less important. Ariga, Brunello and Ohkusa (1997) show that in firms such as these training is provided internally in order to ensure that the accumulation of human capital is consistent with the promotion ladder, and under these circumstances the optimal promotion policy is clearly one of late selection. On the other hand, they assert that if the organisation's hierarchy consists of a disjoint set of jobs, where there is little correlation between skills in lower and upper rank positions, experience within the hierarchy is no longer the most important determinant for promotion decisions. Ariga, Brunello and Ohkusa (1997) find that firms such as these do not tend to focus on internal training since the skills necessary to perform these jobs are often developed in the market

place. They assert that in these organisations the optimal promotion policy is that of early selection.

3.2.4 Other Theories on Promotion

Gender Differences

A common finding in the empirical literature is that males fare better in the labour market than females. While pay within a particular grade in a firm is usually the same for both men and women, promotion rates and levels of training tend to be lower for females than males. Lazear (1995) and Lazear and Rosen (1990) argue that these gender differences are not the result of discrimination, but arise because women often have greater non-market opportunities (such as work in the home) than men. They assert that since females are more likely than males to leave the organisation in order to pursue these non-market activities, employers will be more reluctant to invest in their skills, thereby making it more difficult for them to be promoted into the higher-paying jobs. Similarly, Becker (1985) argues that married women earn less than married men because they have a greater role to play in the home than men. He asserts that household responsibility affects the careers of married women by decreasing the amount of time they spend in the labour market and discouraging their investment in market human capital.

An outline of Lazear's (1995) version of this model is presented below. Lazear (1995) uses a two period model for his analysis where there are only two groups of workers; males and females. The two groups of workers have the same distribution of ability, however, outside opportunities are assumed to differ. The value of non-market activities (to the individuals), m, tends to be higher for women than men. As shown in Figure 3.1, the distribution of outside opportunities for males, $F_M(m)$, is thus stochastically dominated by the distribution function for females, $F_F(m)$, i.e., $F_M(m) > F_F(m), \forall\, m > 0$.

When workers join the firm in period 1 they are hired into one of two jobs; A or B. Job A requires investment from the individuals, while job B requires no investment. It should be noted that ability, b, is known to everyone at the time of hiring. The output

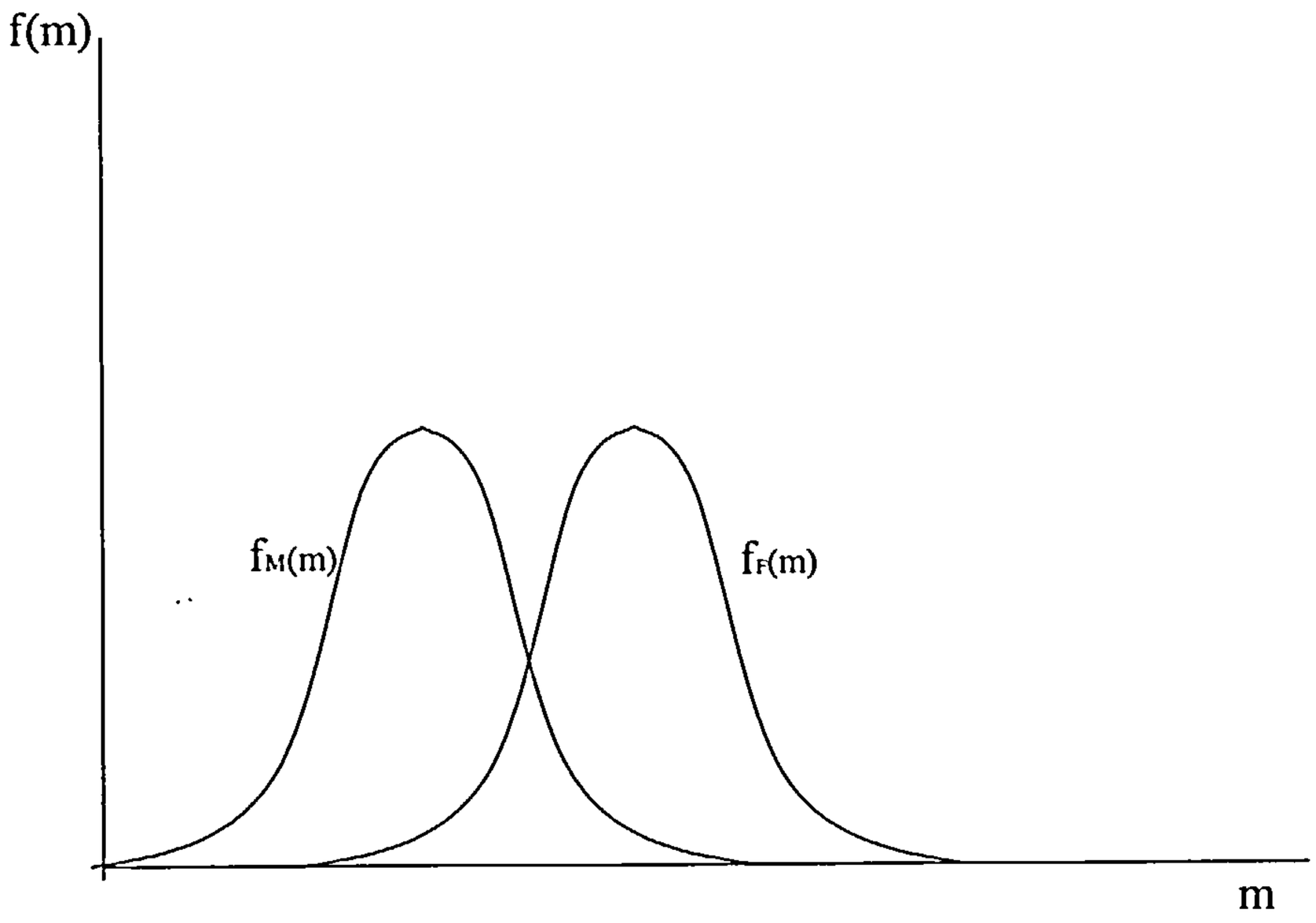

Figure 3-1: Distribution of Outside Opportunities.

from jobs A and B is as follows:

$$\left.\begin{aligned} q_1^B &= b \\ q_2^B &= b \\ q_1^A &= \gamma_1 b \\ q_2^A &= \gamma_2 b \end{aligned}\right\} \tag{3.7}$$

where q_1^B, for example, represents the output of a worker with ability, b, who is assigned to job B in period 1. The parameters γ_1 and γ_2 are determined exogenously, with $\gamma_1 < 1 < \gamma_2$. $\gamma_1$is less than γ_2 because job A requires investment from the employees. Also, since $\gamma_1 < 1$ the higher productivity in period 2 will be at the expense of lower productivity in period 1. There is thus an investment cost to hiring a worker to do job A.

In this model individuals always work in period 1. However, whether they remain with the firm during period 2 depends on their wage in this period, and the value of their alternative use of time, m, both of which are realised at the start of period 2. Workers in period 2 are paid a wage equal to their output in this period. Thus, $W_2^A = b\gamma_2$ and $W_2^B = b$, where W_2^A and W_2^B are the period 2 wages in jobs A and B, respectively.

The lifetime expected output of a worker with ability, b, who is recruited to job B in period 1 is:

$$b + b\int_0^b dF + \int_b^\infty m dF \tag{3.8}$$

where F is the distribution of m. Individuals in job B remain with the firm in period 2 if their wage in this period, b, is greater than their alternative use of time, m. From equation 3.8 this occurs with probability $\int_0^b dF$ causing a level of output b to be produced. Similarly, m is greater than b with probability $\int_b^\infty dF$ causing workers to accept their alternative use of time, m.

The lifetime expected output of an individual with ability, b, who is recruited to job A in period 1 is:

$$b\gamma_1 + b\gamma_2 \int_0^{b\gamma_2} dF + \int_{b\gamma_2}^{\infty} m dF \tag{3.9}$$

where F is the distribution of m. Again, workers in job A remain with the firm in period 2 if their wage in this period, $b\gamma_2$, is greater than their alternative use of time, m. From equation 3.9 this occurs with probability $\int_0^{b\gamma_2} dF$ causing a level of output $b\gamma_2$ to be produced. Similarly, $m > b\gamma_2$ with probability $\int_{b\gamma_2}^{\infty} dF$ causing workers to accept their alternative use of time, m.

The difference between equations 3.8 and 3.9 can be written as:

$$D(b) = -b(1-\gamma_1) + b\gamma_2 F(b\gamma_2) - bF(b) + \int_{b\gamma_2}^{\infty} m dF - \int_b^{\infty} m dF \tag{3.10}$$

After integrating by parts and re-arranging equation 3.10 becomes:

$$\begin{aligned} D(b) &= -b(1-\gamma_1) + b\gamma_2 F(b\gamma_2) - bF(b) + [mF(m) - \int F(m)]_{b\gamma_2}^{\infty} \\ &\quad -[mF(m) - \int F(m)d(m)]_b^{\infty} \\ &= -b(1-\gamma_1) + \int_b^{b\gamma_2} F(m)d(m) \end{aligned} \tag{3.11}$$

Equation 3.11 is plotted in Figure 3.2. As can be seen it starts at zero, falls, before rising and crossing the horizontal axis at some point $b = B^*$.

It is clear from Figure 3.2 that if the individual's ability is less than B^*, $D(b)$ will be negative and so it is efficient for the worker to be assigned to job B. Alternatively, for individuals whose ability is greater than B^*, $D(b)$ will be positive, and so it is efficient for the worker to be assigned to job A.

Since in this analysis the distribution functions are different for men and women,

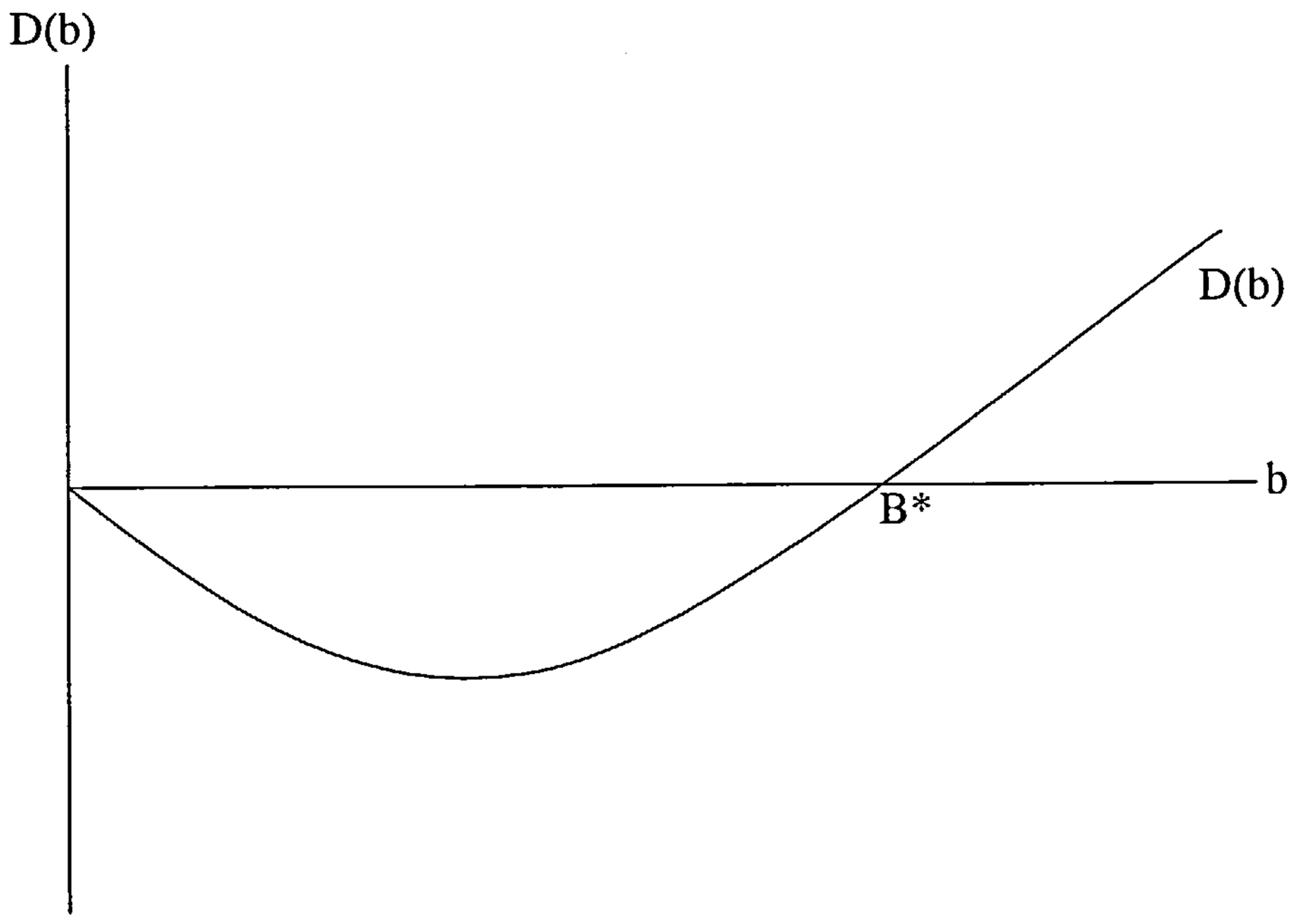

Figure 3-2: Difference in Expected Output for Workers in Jobs A and B.

Lazear (1995) argues that the point at which $D(b) = 0$ will vary by gender. In this case the distribution of outside opportunities for males is dominated by that for females. It follows from this that women will have to exceed a higher level of B^* than men in order to be hired into the higher-level job. Since the cut off ability level in job A is higher for females than males these findings also imply that average ability levels in both jobs will be higher for women than men. Consequently, since it is harder for woman to be assigned to the high ability job their earnings will, on average, be lower than that of men.

Lazear's (1995) analysis also indirectly provides another explanation for corporate fast-tracking. Since human capital is at least partly firm-specific as individuals invest more in their jobs the value of their time with the organisation will increase relative to their outside opportunities. As a result, they are less likely to leave the firm, thereby making additional investment in their skills even more profitable. It follows from this that workers who are given the opportunity for investment early on in their careers are likely to be given additional opportunities for investment, and hence promotion throughout their working lives with the organisation.

3.3 Literature Review

Due to a lack of suitable data most of the work in the area of personnel economics has been largely theoretical. It is only in recent years that data sets have emerged which have allowed some of these ideas to be tested empirically. As a result, the empirical literature in the area of promotion is still relatively scarce. In particular, only a handful of researchers have addressed the causes and consequences of promotion for the U.K. With this in mind, this section gives a brief review of the empirical literature on promotion.

3.3.1 Speed of Promotion

As mentioned earlier a number of stylised facts emerge when looking at differences in human resource practices between counties, particularly between Japan and the U.S. For

example, a common view when looking at the internal workings of a firm is that U.S and Japanese organisations differ in the speed with which they promote their workers. U.S firms tend to engage in promotion fast-tracking in which those promoted quickly at one grade/level tend to get promoted more often and more quickly from the next grade/level. Japanese companies, on the other hand, tend to adopt a late selection approach to promotion.

As previously mentioned, an influential paper in setting the agenda in the area of personnel economics is Baker, Gibbs and Holmstrom (1994). Using data from the personnel record of their large U.S service sector firm they examine the pattern of careers within their organisation and in doing so find evidence of promotion fast-tracking. They investigate the transition of workers moving through the firm's hierarchy from level 1 to level 2 and find that those promoted quickly from level 1 to level 2 are again likely to be promoted quickly from level 2. Baker, Gibbs and Holmstrom (1994) also find evidence of a fast-track exit effect in which those promoted quickly into level 2 appear to be more likely to leave the firm than all other individuals. They argue that such a finding could be the result of some high ability workers not being optimally employed by the firm, or that the organisation may not be paying some employees according to their expected marginal products. Rosenbaum (1984) also uses data from the personnel records of a large U.S firm and finds similar evidence of an early selection approach to promotion.

In contrast, workers in large Japanese firms are typically not differentiated from their cohort until they have been with their organisation for between 10 and 15 years, after which time significant career differentiation by ability usually occurs (see Aoki (1988)). It should, however, be noted that most of this empirical evidence from Japan tends to concentrate on large, old, established organisations operating in either the banking or mature manufacturing sectors. One possible exception to this is Ariga, Ohkusa and Brunello (1997) who examine the career history of more than 5000 employees in a large Japanese company that is relatively young, profitable and high tech. Using data from the firm's personnel records over the period 1971 to 1994 they find evidence of promotion

fast-tracking, a result which is clearly at odds with much of the prevailing Japanese evidence, and which persists even after controlling for time invariant individual effects, such as innate individual ability.

3.3.2 Gender and Promotion

Most of the empirical work on promotion examines, in some way, the relationship between gender and promotion. The conventional view on this issue is that female workers are less likely to be promoted than their male counterparts. This finding is often explained in terms of a 'glass ceilings' story, whereby discrimination in the market place means that there is a point within the hierarchy beyond which women are unable to pass. However, as shown in Section 3.2.4 Lazear (1995) and Lazear and Rosen (1990) assert that these gender differences are not the result of discrimination, but arise because females often have better non-market opportunities than males. They argue that since women workers are more likely than men to leave the firm in order to pursue these non-market activities, employers are reluctant to invest in their skills, thereby making it more difficult for them to be promoted.

Cannings (1988) using data gathered in 1983 on a large Canadian firm finds that females have a lower probability of promotion than their male counterparts. She arges that:

> ...their (women's) disadvantage is not primarily the result of differential probability 'returns' to particular acquired attributes, such as level of education, but, rather, the result of being born female.

Jones and Makepeace (1996) compare the promotion process for males and females using personnel data on a sample of full-time workers from a large U.K financial sector firm taken in September 1988. They show that although men and women tend to receive the same pay in each grade, differentials in earnings between males and females arise due to differences in the distribution of men and women across grades. For example,

they find that 85% of the females in their sample are employed in the low-paying clerical grades, compared with only 40% of males. In contrast, they show that only 1% of the women in their sample have a managerial job, compared with 25% of men.

Jones and Makepeace (1996) use this data to estimate male/female promotion thresholds using an ordered probit model. They control for individual and employment effects and find that when women are treated as men the proportion of females in the lower clerical grades falls, while the proportion in the higher grades tends to rise. The proportion of women in the managerial grades, for example, rises from just under 1% to approximately 3%. However, this proportion rises to 20% if females are assumed to have the same mean work experience as males. The mean level of service among men in their data is 16.6 years, compared with only 7.6 years for that of women. Thus, the shorter tenure among female workers clearly has an important role to play in explaining the lack of women in the higher managerial grades.

To examine this interpretation more closely they decompose the mean grade of males and females into their explained and unexplained parts. From this they conclude that between 69% and 87% of the variance in grades between men and women can be explained by differences in their characteristics, with the remaining variance being due to their different treatment.

Similarly, Pudney and Shields (2000) uses data from a 1994 survey of NHS nursing staff and an ordered probit to examine the promotion process for nurses. They find that after controlling for the endogeneity of participation and training history, male nurses tend to get promoted more quickly than female nurses (representing between £35,000 and £48,000 in additional earnings over an entire career).

Audas, Barmby and Treble (1997) use data from the administrative records of the large U.K financial sector firm outlined in Chapter 2 to investigate gender differentials in pay and promotion. Like Jones and Makepeace (1996) they find that although males and females tend to receive the same pay within each grade, pay differentials arise due to differences in the distribution of men and women between grades. They use a Cox

proportional hazard model to estimate the hazard of promotion and find that women have a lower likelihood of promotion than men in each grade, except for promotion from grade 9 upwards.

Winter-Ebmer and Zweimüller (1997) using data from the 1983 Austrian microcensus and an ordered probit find that in contrast to many theoretical models on promotion, only a small part of the unequal distribution of men and women in the hiearchy can be explained by the fact that women have a comparative advantage in outside opportunities. In addition, they find that work experience is not rewarded in the same way for women as it is for men, and show that females have to be of a higher ability than their male counterparts in order to be promoted.

McCue (1996) uses data from the Michigan Panel Study on Income Dynamics (PSID) over the period 1976 to 1988 in her study on promotions and wage growth. She estimates the hazard of promotion separately for a cross-classification of males, females, whites, and non-whites and finds that the hazard of promotion for single white women is not significantly different from that of white men.

Similarly, Booth, Francesconi and Frank (1998) using data from the British Household Panel Survey (BHPS) over the period 1991 to 1995 finds that gender has no significant effect on the probability of promotion. They also examine the relationship between promotion and wages, and after controlling for individual and employment characteristics find that while promoted women may at first gain the same wage increases as promoted men, females do not continue to benefit from wage increases to the same extent as males. Booth, Francesconi and Frank (1998) conclude that such a finding is consistent with their so called 'sticky floors' model of promotion. In other words, although women are just as likely as men to get promoted they find it harder to rise through the pay scales after promotion than their male counterparts.

3.3.3 Other Personal Characteristics and Promotion

Francesconi (1999) also uses data from the first five waves (1991 to 1995) of the BHPS in his study on promotion. He uses both a probit and a non-parametric hazard to estimate some of the determinants of promotion and finds that after controlling for unobserved heterogeneity being married (or cohabiting) and having fewer young children has a positive and significant effect on both the probability and hazard of promotion for males and females. Booth, Francesconi and Frank (1998), not surprisingly, find a similar result. In contrast, McCue (1996) finds that for women being married has a negative and significant effect on the hazard of promotion, but is insignificant for men.

A few studies have also examined the effect race has on promotion. Booth, Francesconi and Frank (1998), for example, find that non-whites are less likely to be promoted than whites. Similarly, McCue (1996) finds that non-whites have a lower hazard of promotion than their white male counterparts. Pudney and Shields (2000) shows that in the U.K nursing profession whites have better promotion prospects than their black or Asian counterparts. In addition, Pudney and Shields (2000b) using the same data set finds that white nurses are likely to get promoted more quickly than all other workers (representing £40,000 in additional earnings over their entire career).

McCue (1996) also examines the effect education has on promotion. She finds that being a high school dropout has a negative and significant effect on the hazard of promotion for white men and black women, but is insignificant for white women and black men. She also finds that being a college graduate only has a significant effect on the hazard of promotion among white men, and even then it is not significant across all specifications. Similarly, Booth, Francesconi and Frank (1998) find that education has little effect on the individual's chance of promotion. However, Francesconi (1999) finds that for workers aged 35 or less educational qualifications have a positive and significant effect on the probability of promotion among male workers. In addition, Wise (1975) using data from individuals working in a large U.S manufacturing company in 1968 finds that education has a positive and significant effect on the probability of promotion.

3.3.4 Job Characteristics and Promotion

Francesconi (1999) also examines the effect job characteristics have on promotion. He finds that workers who are employed in large firms and have a managerial position have a significantly higher probability and hazard of promotion than all other employees. Similarly, Francesconi (1999) finds that individuals who work large amounts of overtime also have a higher incidence and hazard of promotion. He finds this effect to be stronger for females than males and argues that since men tend to work longer hours than women this may simply reflect the fact that males find it more difficult to work any extra hours through overtime.

In contrast, Francesconi (1999) finds that individuals who work part-time have a lower probability and hazard of promotion than their full-time counterparts. He finds this result to be greater among males than females and asserts that this may arise due to the fact that part-time work tends to be more common among women than men.

Francesconi (1999) also examines the effect human capital variables such as tenure and work experience have on promotion behaviour. He finds that work experience has a strong positive effect on the probability of promotion for females but not males. However, this positive effect declines with experience and disappears altogether for women aged 35 or over. In contrast, Francesconi (1999) finds that tenure with the firm is significant for males but not females. He finds evidence of an inverse u-shaped relationship between job tenure and the probability of promotion for men; between 2 and 6 years tenure has a strong positive effect on the probability of promotion, which then tapers off at higher levels of firm tenure.

McCue (1996) also examines the effect experience and tenure has on promotion. She finds evidence of a significant and negative relationship between experience and the hazard of promotion. McCue (1996) also finds that tenure has a significant effect on the hazard of promotion. She finds that the hazard of promotion is higher for those individuals whose position in the firm has changed at least once.

Variable	Description
M.J	time in current grade (months)
J.D	time in previous grade (months)
Sex	= 1 if female, 0 otherwise
Tenure	time spent in the firm (years)
Grade 1 - Grade 13	0-1 dummies for the worker's grade
Rate 1 - Rate 5	0-1 dummies for the worker's performance rating
Rate 6	= 1 if worker is unrated, 0 otherwise
Professional Qualification	= 1 if have a professional qualification, 0 otherwise
Degree	= 1 if have a degree, 0 otherwise
Age	age of individual (years)
Married	= 1 if married, 0 otherwise

Table 3.1: Variable Names and Definitions - Promotion.

3.4 Data

This chapter uses data from the personnel records of our large U.K financial sector firm to analyse the pattern of promotion within the organisation. In particular, it investigates the existence of promotion fast-tracking within the firm and examines whether the speed of an individual's previous promotion affects their duration in the next grade.

The analysis reported in this chapter focuses on the full-time workers who were promoted during 1989[1]; 11,247 workers were promoted in 1989, 5,093 men and 6,154 women. A full definition of the variables and summary statistics of the sample are given in Tables 3.1 and 3.2, respectively. It should be noted that individuals with missing values in any of the variables are dropped from the data set.

[1]This enables duration in the previous grade to be calculated (since the date of entry into a grade is known) and also allows duration in the grade workers were promoted to in 1989 (known as the current grade) to be built up from the point of promotion.

Variable Name	Mean	Std Deviation
M.J	43.008	32.056
J.D	29.074	31.329
Sex	0.551	0.497
Tenure	10.093	8.022
Grade 1	0	0
Grade 2	0	0
Grade 3	0.138	0.345
Grade 4	0.181	0.385
Grade 5	0.219	0.414
Grade 6	0.148	0.355
Grade 7	0.109	0.311
Grade 8	0.113	0.316
Grade 9	0.054	0.227
Grade 10	0.025	0.155
Grade 11	0.012	0.111
Grade 12	0.0009	0.031
Grade 13	0.0002	0.014
Rate 1	0.002	0.046
Rate 2	0.013	0.114
Rate 3	0.330	0.470
Rate 4	0.357	0.479
Rate 5	0.096	0.295
Rate 6	0.200	0.400
Professional Qualification	0.236	0.425
Degree	0.089	0.285
Age	30.313	9.376
Married	0.483	0.500

Table 3.2: Summary Statistics - Promotion (Full Sample).

3.4.1 Promotion Patterns

Initial evidence for the existence of promotion fast-tracking is found in Table 3.3, which depicts the time to promotion from the previous grade versus the time to promotion/exit from the current grade. This table is similar in structure to one produced by Baker, Gibbs and Holmstrom (1994). However, it considers transitions between all grades, rather than just the level 1 to level 2 transitions which Baker, Gibbs and Holmstrom (1994) focus on.

Looking down columns the promotion rate tends to fall as the time spent by workers in their previous grade increases. Consider, for example, the group of workers who spent 3 years in their current grade before being promoted or leaving the firm. These workers had a 21.41% chance of promotion after spending 1 year in their previous grade, compared to a promotion chance of 14.37% after spending 2 years in their previous grade. Those promoted quickly at one level clearly appear to be promoted more quickly at the next, thereby providing some preliminary evidence for the existence of promotion fast-tracking within the firm.

The exit rate also tends to fall as the time spent by workers in their previous grade increases. Consider again the group of individuals who spent 3 years in their current grade. After spending 1 year in their previous grade there was a 9.59% chance that these workers would leave the firm, compared to an exit rate of 6.19% after spending 2 years in their previous grade. Consequently, the very individuals who are targeted for quick promotion also appear to be the ones most likely to leave the firm. One possible explanation for this fast-track exit effect is that targeting a few workers for rapid promotion reveals information to the market about their performance causing them to attract better jobs elsewhere. Baker, Gibbs and Holmstrom (1994) find similar results and argue that such a finding could be the result of some high ability workers not being optimally employed by the firm.

Tables 3.4 and 3.5 depict promotion and exit rates for male and female workers, re-

Years in Previous Grade	Statistic	Years in Current Grade 1	2	3	4	5	6	7
1	Promotion Rate (%)	19.89	28.31	21.41	11.92	15.11	12.11	9.11
	Exit Rate (%)	10.54	13.36	9.59	11.13	7.68	9.62	9.75
	No. of Workers	3625	2522	1471	1015	781	603	472
2	Promotion Rate (%)	7.73	13.50	14.37	10.17	13.36	11.45	8.15
	Exit Rate (%)	6.86	9.23	6.19	7.80	8.17	8.42	7.67
	No. of Workers	3132	2675	2067	1642	1347	1057	847
3	Promotion Rate (%)	4.16	9.54	10.59	7.95	10.18	8.09	7.94
	Exit Rate (%)	5.57	8.92	6.64	9.14	6.96	9.42	10.17
	No. of Workers	2334	2107	1718	1422	1179	977	806
4	Promotion Rate (%)	3.02	7.31	7.01	5.74	8.50	7.35	6.78
	Exit Rate (%)	4.60	8.40	9.41	5.96	6.50	5.88	9.83
	No. of Workers	696	643	542	453	400	340	295
5	Promotion Rate (%)	1.45	3.07	7.51	5.31	4.52	4.62	4.62
	Exit Rate (%)	3.78	7.06	8.87	4.49	7.24	6.67	10.40
	No. of Workers	344	326	293	245	221	195	173
6	Promotion Rate (%)	3.05	5.43	7.32	2.99	9.92	3.85	4.17
	Exit Rate (%)	3.55	5.43	10.98	6.72	4.13	3.85	9.38
	No. of Workers	197	184	164	134	121	104	96
7+	Promotion Rate (%)	2.39	3.12	2.91	3.42	2.66	2.17	3.18
	Exit Rate (%)	3.37	9.47	8.19	7.28	5.16	7.04	10.54
	No. of Workers	919	866	757	673	601	554	503
Total	Promotion Rate (%)	9.90	14.69	12.66	8.36	10.54	8.43	7.02
	Exit Rate (%)	7.20	10.09	7.70	8.36	7.10	8.22	9.46
	No. of Workers	11247	9323	7012	5584	4650	3830	3192

Table 3.3: Promotion and Exit Rates - All Workers.

spectively. Both tables display some evidence for the existence of fast-track promotion and exit effects. However, perhaps surprisingly, women promoted after a year in their previous grade always have a higher promotion rate from their current grade than men. Consider, for example, the group of individuals who spent 2 years in their current grade. After spending 1 year in their previous grade female workers had a 31.09% chance of promotion, compared to a promotion chance of 24.40% for their male counterparts. The initial fast-track effects thus appear to be more pronounced for women than men. However, as time in the previous grade increases the promotion rate for male workers tends to dominate that for female workers.

Looking across columns in Tables 3.3, 3.4 and 3.5 also provides some interesting results. Holding time in the previous grade constant there appears to be a number of so-called 'windows of opportunity' at which workers can be promoted from their current grade. For example, looking across columns in Table 3.3 the rate of promotion for workers who spent 4 years before promotion in their previous grade fluctuates up and down and reaches a peak at 2 and 5 years, respectively.

3.5 Empirical Specification

The results reported in Section 3.4.1 clearly require further examination. Most importantly, it is necessary to investigate whether there is any evidence of promotion fast-tracking after controlling for other factors. The fast-track effects identified in Tables 3.3 to 3.5 could, for example, simply be the result of human capital effects. In other words, if workers differ in terms of human capital then those high ability individuals promoted quickly once will also have more chance of being promoted quickly again.

3.5.1 Discrete-time Proportional Hazard

In order to investigate these effects further a discrete-time proportional hazard based on the model proposed by Prentice and Gloeckler (1978) is used to study the time before

Years in Previous Grade	Statistic	Years in Current Grade 1	2	3	4	5	6	7
1	Promotion Rate (%)	19.42	24.40	19.60	9.53	11.73	11.44	6.45
	Exit Rate (%)	10.31	13.82	7.56	11.02	6.67	7.52	7.26
	No. of Workers	1493	1049	648	472	375	306	248
2	Promotion Rate (%)	10.13	14.85	15.25	9.90	14.63	9.68	6.67
	Exit Rate (%)	8.06	8.81	5.77	7.18	6.72	4.93	5.33
	No. of Workers	1638	1340	1023	808	670	527	450
3	Promotion Rate (%)	5.65	9.66	12.64	8.30	9.48	8.03	7.44
	Exit Rate (%)	6.17	9.17	5.35	8.89	5.90	6.77	7.94
	No. of Workers	1150	1014	823	675	559	473	403
4	Promotion Rate (%)	4.46	9.92	9.41	5.62	10.91	9.35	9.32
	Exit Rate (%)	5.58	6.61	2.48	1.69	4.85	5.76	5.93
	No. of Workers	269	242	202	178	165	139	118
5	Promotion Rate (%)	0.85	2.63	9.52	4.55	4.88	2.60	2.86
	Exit Rate (%)	2.54	5.26	6.67	2.27	1.22	6.49	7.14
	No. of Workers	118	114	105	88	82	77	70
6	Promotion Rate (%)	2.56	5.41	7.35	3.51	12.96	0	4.55
	Exit Rate (%)	2.56	2.70	8.82	1.75	3.70	2.22	6.82
	No. of Workers	78	74	68	57	54	45	44
7+	Promotion Rate (%)	1.44	2.74	3.08	4.51	2.43	2.15	2.43
	Exit Rate (%)	3.75	8.51	5.82	2.63	3.24	9.44	13.11
	No. of Workers	347	329	292	266	247	233	206
Total	Promotion Rate (%)	10.62	14.25	13.60	8.22	10.69	8.00	6.24
	Exit Rate (%)	7.66	9.80	5.92	7.19	5.67	6.50	7.54
	No. of Workers	5093	4162	3161	2544	2152	1800	1539

Table 3.4: Promotion and Exit Rates - Male Workers.

Years in Previous Grade	Statistic	Years in Current Grade 1	2	3	4	5	6	7
1	Promotion Rate (%)	20.22	31.09	22.84	14.00	18.23	12.79	12.05
	Exit Rate (%)	10.69	13.03	11.18	11.23	8.62	11.78	12.50
	No. of Workers	2132	1473	823	543	406	297	224
2	Promotion Rate (%)	5.09	12.13	13.51	10.43	12.11	13.21	9.82
	Exit Rate (%)	5.56	9.66	6.61	8.39	9.60	11.89	10.33
	No. of Workers	1494	1335	1044	834	677	530	397
3	Promotion Rate (%)	2.70	9.42	8.72	7.63	10.81	8.13	8.44
	Exit Rate (%)	4.98	8.69	7.82	9.37	7.90	11.90	12.41
	No. of Workers	1184	1093	895	747	620	504	403
4	Promotion Rate (%)	2.11	5.74	5.59	5.82	6.81	5.97	5.08
	Exit Rate (%)	3.98	9.48	13.53	8.73	7.66	5.97	12.43
	No. of Workers	427	401	340	275	235	201	177
5	Promotion Rate (%)	1.77	3.30	6.38	5.73	4.32	5.93	5.83
	Exit Rate (%)	4.42	8.02	10.11	5.73	10.79	6.78	12.62
	No. of Workers	226	212	188	157	139	118	103
6	Promotion Rate (%)	3.36	5.45	7.29	2.60	7.46	6.78	3.85
	Exit Rate (%)	4.20	7.27	12.50	10.39	4.48	5.08	11.54
	No of Workers	119	110	96	77	67	59	52
7	Promotion Rate (%)	2.97	3.35	2.80	2.70	2.82	2.18	3.70
	Exit Rate (%)	3.15	10.06	9.68	10.32	6.50	5.30	8.75
	No of Workers	572	537	465	407	354	321	297
Total	Promotion Rate (%)	9.31	15.06	11.89	8.49	10.41	8.82	7.74
	Exit Rate (%)	6.82	10.33	9.17	9.34	8.33	9.75	11.25
	No. of Workers	6154	5161	3851	3040	2498	2030	1653

Table 3.5: Promotion and Exit Rates - Female Workers.

promotion. This approach enables the baseline hazard to be modelled flexibly and thus avoids any restrictive parametric assumptions being made about its shape. Imposing a restrictive parametric specification on the shape of the hazard can, potentially, bias the estimated effects, particularly those of the time varying economic variables and the baseline hazard (Narendranathan and Stewart (1993)).

The estimation approach used here first involves formulating the continuous time hazard for individual i at time t, which is the instantaneous rate at which individual i will transit out of grade g to grade $g+l$ $(l>0)$ at time dt after t. Thus:

$$\lambda_i(t) = \lim_{dt \to 0} \frac{\Pr(t \leq T_i \leq t+dt | T_i \geq t)}{dt} \tag{3.12}$$

where T_i is a random variable representing spell length. In this analysis the cumulative distribution function (CDF) measuring the probability that individual i will have left the firm by time t is given by:

$$F_i(t) = \Pr(T_i < t) \tag{3.13}$$

and its corresponding density function is: $f_i(t) = dF_i(t)/dt$.

Similarly, the probability that this observed duration T_i is completed at or after time t is given by:

$$S_i(t) = \Pr(T_i \geqslant t) = 1 - F_i(t) \tag{3.14}$$

By the law of conditional probability:

$$\Pr(t \leq T_i \leq t+dt | T_i \geq t) = \frac{\Pr((t \leq T_i \leq t+dt) \cap (T_i \geq t))}{\Pr(T_i \geq t)}$$

$$= \frac{\Pr(t \leq T_i \leq t+dt)}{\Pr(T_i \geq t)} \tag{3.15}$$

In terms of the distribution function equation 3.15 can be written as:

$$\text{Prob}(t \leq T_i \leq t+dt | T_i \geq t) = \frac{F_i(t+dt) - F_i(t)}{1 - F_i(t)}$$

Dividing by dt and letting dt go to zero to get the hazard gives:

$$\lambda_i(t) = \lim_{dt \to 0} \frac{F_i(t+dt) - F_i(t)}{dt} \cdot \frac{1}{1 - F_i(t)}$$

$$= F_i'(t) \cdot \frac{1}{1 - F_i(t)} = \frac{f_i(t)}{1 - F_i(t)} \tag{3.16}$$

It follows from this that:

$$\int_0^t \lambda_i(u)du = \int_0^t \frac{f_i(u)}{1 - F_i(u)}du = [-\ln(1 - F_i(u))]_0^t = -\ln(1 - F_i(t)) \tag{3.17}$$

and so equation 3.14 becomes:

$$S_i(t) = 1 - F_i(t) = \exp(-\int_0^t \lambda_i(u)du) \tag{3.18}$$

A convenient specification for $\lambda_i(t)$ is the proportional hazard model:

$$\lambda_i(x_i, t) = \lambda_o(t) \exp(x_i(t)'\beta) \tag{3.19}$$

where $\lambda_o(t)$ is the baseline hazard, and $x_i(t)'$ is a vector of explanatory variables with unknown coefficients, β. It is called a proportional hazard because the explanatory variables have the effect of multiplying the hazard function by a scale factor $\exp(x_i(t)'\beta)$ which does not depend on duration, t.

The probability of being promoted by $t+1$ given that the spell was uncompleted at time t is given by the discrete-time hazard, $h_i(t)$. Thus:

$$h_i(t) = \text{Prob}(T_i < t+1 | t \leqslant T_i) = \frac{\Pr((T_i < t+1) \cap (T_i \geq t))}{\Pr(T_i \geq t)}$$

$$\begin{aligned} &= \frac{F_i(t+1) - F_i(t)}{1 - F_i(t)} \\ &= \frac{S_i(t) - S_i(t+1)}{S_i(t)} \\ &= 1 - \frac{\exp(-\int_0^{t+1} \lambda_i(u)du)}{\exp(-\int_0^{t} \lambda_i(u)du)} \end{aligned}$$

$$= 1 - \exp(-\int_t^{t+1} \lambda_i(u)du) \tag{3.20}$$

Combining (3.19) and (3.20) gives:

$$h_i(t) = 1 - \exp(-\int_t^{t+1} \lambda_o(u) \exp(x_i(u)'\beta) du)$$

$$= 1 - \exp[-\exp(x_i(t)'\beta) + \gamma(t))] \tag{3.21}$$

where $\gamma(t) = \ln \int_t^{t+1} \lambda_0(u) du$.

In this approach the baseline hazard is allowed to vary flexibly over time. The elements of $\gamma(t)$ thus consist of a set of dummy variables designed to capture time in the current spell.

The model is fitted by maximum likelihood methods. The probability of observing a completed spell for individual i of length T_i is given by:

$$\text{Prob}(T_i = t) = h_i(t) \prod_{j=1}^{t-1} (1 - h_i(j)) \tag{3.22}$$

and the probability of observing an uncompleted spell for individual i is given by:

$$\text{Prob}(T_i > t) = \prod_{j=1}^{t} (1 - h_i(j)) \tag{3.23}$$

Hence the log-likelihood function for a sample of n individuals can be written as:

$$\ln L(\beta) = \sum_{i=1}^{n} c_i \ln h_i(t) \prod_{j=1}^{t-1} (1 - h_i(j)) + \sum_{i=1}^{n} (1 - c_i) \prod_{j=1}^{t} (1 - h_i(j)) \tag{3.24}$$

where $c_i = 1$ if the ith spell is uncensored.

The model discussed so far is based on the assumption of homogeneity of the survival

distribution across individuals. However, if this assumption is incorrect, and if systematic individual differences remain in the distribution after the observed effects have been controlled for, problems can arise in interpreting the data. Uncontrolled heterogeneity can, for example, lead to misleading inferences being made about both duration dependence and the effect the explanatory variables have on the model.

Meyer (1990) controls for heterogeneity by conditioning the model on an individual's unobserved characteristics, ε_i. The proportional hazard function, $\lambda_i(x_i,t)$, thus becomes:

$$\lambda_i(t) = \varepsilon_i \lambda_0 \exp(x_i'(t)\beta) \tag{3.25}$$

The conditional survivor function is of the form:

$$S_i(t \mid \varepsilon) = \exp[-\varepsilon_i \exp(x_i'(t)\beta + \gamma(t))] \tag{3.26}$$

and the marginal survivor function can be written as:

$$\begin{aligned} S(t) &= \text{Expected value over } \varepsilon \text{ of } S(t \mid \varepsilon) \\ &= \int_0^\infty S(t \mid \varepsilon) f(\varepsilon) d\varepsilon \end{aligned} \tag{3.27}$$

In this analysis the random variable, ε, is assumed to be gamma-distributed with density function:

$$f_\varepsilon(\varepsilon) = \frac{\theta}{\Gamma(\alpha)} (\theta\varepsilon)^{\alpha-1} \exp^{-\alpha\varepsilon} \tag{3.28}$$

The expected value and variance of the gamma-distributed random variable is given by,

$E(\varepsilon) = \frac{\alpha}{\theta}$ and $\text{var}(\varepsilon) = \frac{\alpha}{\theta^2}$, respectively. If $E(\varepsilon) = 1$ and $\text{var}(\varepsilon) = \frac{1}{\alpha} = \sigma^2$ the marginal survival function becomes:

$$S(t) = [1 + \sigma^2 \exp(x_i'(t)\beta + \gamma(t))]^{-\frac{1}{\sigma^2}} \tag{3.29}$$

and:

$$h_i(t) = 1 - \exp[-\exp(x_i(t)'\beta) + \gamma(t) + \log(\varepsilon_i)] \tag{3.30}$$

The corresponding log-likelihood function can be written as:

$$\ln L(\beta) = \sum_{i=1}^{n} \ln(1 - c_i)A_i + c_i B_i \tag{3.31}$$

where $A_i = 1 + \sigma^2 \sum_{j=1}^{t} \exp(x_i(t)'\beta + \gamma(t))^{-\frac{1}{\sigma^2}}$

and $B_i = \left\{1 + \sigma^2 \sum_{j=1}^{t-1} \exp(x_i(t)'\beta + \gamma(t))\right\}^{-\frac{1}{\sigma^2}} - A_i$ if $t > 1$

$B_i = 1 - A_i$ if $t = 1$.

3.5.2 Weibull Specification

The most commonly used parametric specification for the baseline hazard is Weibull in form. Thus:

$$\lambda_0(t) = \alpha t^{\alpha - 1} \tag{3.32}$$

where λ_0, $\alpha > 0$. $\lambda_0(t)$ is increasing in duration if $\alpha > 1$, decreasing in duration if $\alpha < 1$,

and reduces to the constant exponential case if $\alpha = 1$.

Using a Weibull specification the discrete-time baseline hazard is of the form:

$$\gamma(t) = g_t(\alpha, \beta_0) = \ln(\int_t^{t+1} \alpha u^{\alpha-1} \exp \beta_0 du) \qquad (\alpha > 0)$$

$$= \beta_0 + \ln\{(t+1)^\alpha - t^\alpha\} \qquad (3.33)$$

where $g_t(\alpha, \beta_0)$ denotes the vector of this function at each of the discrete points.

For comparison purposes a minimum χ^2 distance test similar to that used by Han and Hausman (1990) and Narendranathan and Stewart (1993) is used to determine whether the discrete-time Weibull is consistent with the estimates from the unconstrained model.

Suppose the vector $\widehat{\gamma}$ contains the estimates of the baseline hazard pararmeters from the flexible discrete-time

Then $\widehat{\gamma}$ will be asymptotically normally distributed with a mean of γ and variance Ω. Thus:

$$\widehat{\gamma} \sim aN(\gamma, \Omega) \qquad (3.34)$$

where Ω is the appropriate block of the inverse of the information matrix. The minimum distance estimates for α and β_0 are obtained by minimising W. Thus:

$$\min_{\alpha,\beta_0}(W) = (\widehat{\gamma} - g(\alpha, \beta_0))' \widehat{\Omega}^{-1} (\widehat{\gamma} - g(\alpha, \beta_0)) \qquad (3.35)$$

Under the null of a Weibull specification W is asymptotically distributed as a χ^2 with $k-2$ degrees of freedom, where k is the number of estimated baseline hazard parameters in $\widehat{\gamma}$.

3.6 Empirical Results

The sample used to estimate the discrete-time proportional hazard outlined in Section 3.5 is estimated using 7,239 of the full-time workers (3,447 men and 3792 women) who were promoted in 1989. It should be noted that individuals who leave the firm after 1989 without being promoted are not included in the estimation. In this analysis the duration variable is the time spent by workers before promotion in the grade they were promoted to in 1989. Summary statistics of this restricted sample are given in Table 3.6[2].

The explanatory variables in the specification of the hazard of promotion includes a variable measuring time in the previous grade (J.D). The estimated parameter on this variable will reflect the existence of a correlation between hazards of promotion in any two successive grades in the hierarchy in a simpler way than a fully bivariate model of joint hazards.This variable is used to investigate the existence of promotion fast-tracking within the firm with a negative sign on its coefficient indicating the presence of fast-tracking. In other words, the shorter the time spent by workers in their previous grade the more likely they are to be promoted from their current grade.

Other covariates include a set of grade dummies (base case is grade 1 to 3) to measure how the hazard of promotion changes as the individual moves through the hierarchy. Since from grade 5 onwards the number of individuals in each grade is always less than the number in the next lower level the promotion rate should fall as the worker enters the management grades.

A set of dummy variables are also used to capture performance evaluations (base case is rate 1 to 3). Workers are evaluated approximately every 6 months. Five different performance evaluations are possible: 'Outstanding' (5) is the best, followed by 'Very Good' (4), 'Satisfactory' (3), 'Not Fully Effective' (2), and 'Unsatisfactory' (1), respectively. In practice, employees rarely receive evaluations that are below 'Satisfactory'. At any one time there are quite a large number of employees who have no rating. This may arise

[2]It should be noted that since information on the number of children is only available from 1992 onwards, no control for the presence of children can be made in the following regression equation.

Variable	Mean	Std. Deviation
M.J	47.203	34.021
J.D	27.606	29.151
Age	25.764	7.580
Tenure	5.939	6.356
Grade 1	0	0
Grade 2	0	0
Grade 3	0.161	0.368
Grade 4	0.175	0.380
Grade 5	0.211	0.408
Grade6	0.156	0.363
Grade 7	0.111	0.314
Grade 8	0.112	0.315
Grade 9	0.047	0.211
Grade 10	0.019	0.136
Grade 11	0.008	0.088
Sex	0.524	0.499
Rate 1	0.001	0.024
Rate 2	0.006	0.080
Rate 3	0.298	0.457
Rate 4	0.396	0.489
Rate 5	0.112	0.316
Rate 6	0.185	0.389
Professional Qualification	0.274	0.446
Degree	0.083	0.276
Married	0.451	0.498

Table 3.6: Summary Statistics - Promotion (Restricted Sample).

due to a lag between a hire or promotion and the first appraisal in the new job. A value of 6 is given to these employees.

Finally controls are included for tenure with the firm, educational attainment, gender (base case is male), marital status (base case is single) and age.

In addition to these explanatory variables a set of 8 dummy variables (one for each year it is possible to spend in the current grade) are included in the hazard as elements of $\gamma(t)$ to capture duration effects.

Maximum likelihood estimates for the discrete-time proportional hazard are given in Table 3.7. Columns I and II of Table 3.7 report the results for the standard model, while columns III and IV report the results for the flexible baseline hazard model after controlling for heterogeneity. The coefficient on the gamma-distributed variance is significant, and the analysis of the result that follows thus focuses on the estimates of the model with heterogeneity.

Figure 3.3 plots the estimated baseline hazard. In order to make the results more meaningful the baseline hazard is scaled to represent the characteristics of an 'average' person[3]. The hazard appears to fluctuate up and down and reaches a peak at 2 and 5 years, respectively. Such a finding is in line with the results reported in Section 3.4.1 and appears to indicate the presence of a number of so-called 'windows of opportunity' at which workers can be promoted from their current grade.

As can be seen the hazard appears to fluctuate up and down and reaches a peak at 2 and 5 years, respectively. Such a finding is in line with the results reported in Section 3.4.1 and appears to indicate the presence of a number of so-called 'windows of opportunity' at which workers can be promoted from their current grade.

As can be seen in Table 3.7 the coefficient on the variable of interest, J.D, is negative and significant, indicating that the shorter the time spent by workers in their previous grade the more likely they are to be promoted from their current grade. The promotion

[3]In other words, the continuous covariates are set to their sample means, and the dummies are set to represent an 'average' person.

Variable	Non-Parametric Specification without unobserved heterogeneity		with Gamma - heterogeneity	
	Coefficient	t-ratio	Coefficient	t-ratio
Constant	–3.561	-41.102	-3.653	-38.242
J.D	–0.004	-4.616	-0.004	-4.451
Grade 4	–0.850	–17.737	–0.836	-16.328
Grade 5	-1.032	-18.906	-1.024	-17.730
Grade 6	-0.892	-13.488	-0.870	-12.406
Grade 7	–1.170	-15.960	-1.115	-14.015
Grade 8	–0.685	-8.033	–0.611	-6.540
Grade 9	–1.043	–9.383	-0.987	-8.237
Grade 10	–0.818	-5.469	-0.763	-4.799
Grade 11	–1.987	-7.563	–2.002	-7.369
Rate 4	0.406	10.859	0.422	10.718
Rate 5	0.602	11.999	0.611	11.542
Rate 6	2.055	44.403	2.248	30.699
Tenure	-0.054	–10.729	-0.058	-10.661
Sex	–0.210	-6.696	–0.214	-6.389
Married	-0.379	-10.729	–0.402	-10.574
Age	-0.009	–2.331	–0.009	-2.336
Degree	0.061	0.980	0.073	1.080
Professional Qualification	0.040	0.999	0.056	1.304
Dur 2	1.028	23.302	1.147	20.287
Dur 3	0.956	18.706	1.108	16.350
Dur 4	0.686	11.443	0.858	10.986
Dur 5	0.970	16.315	1.160	14.334
Dur 6	0.761	11.135	0.970	10.644
Dur 7	0.639	8.487	0.860	8.707
Dur 8	0.570	6.063	0.803	6.945
Gamma Variance	-	-	0.101	3.369
Log-likelihood	-48954.546		-24470.475	
Number of Observations	7239		7239	

Table 3.7: Maximum Likelihood Estimates of Duration in Grade.

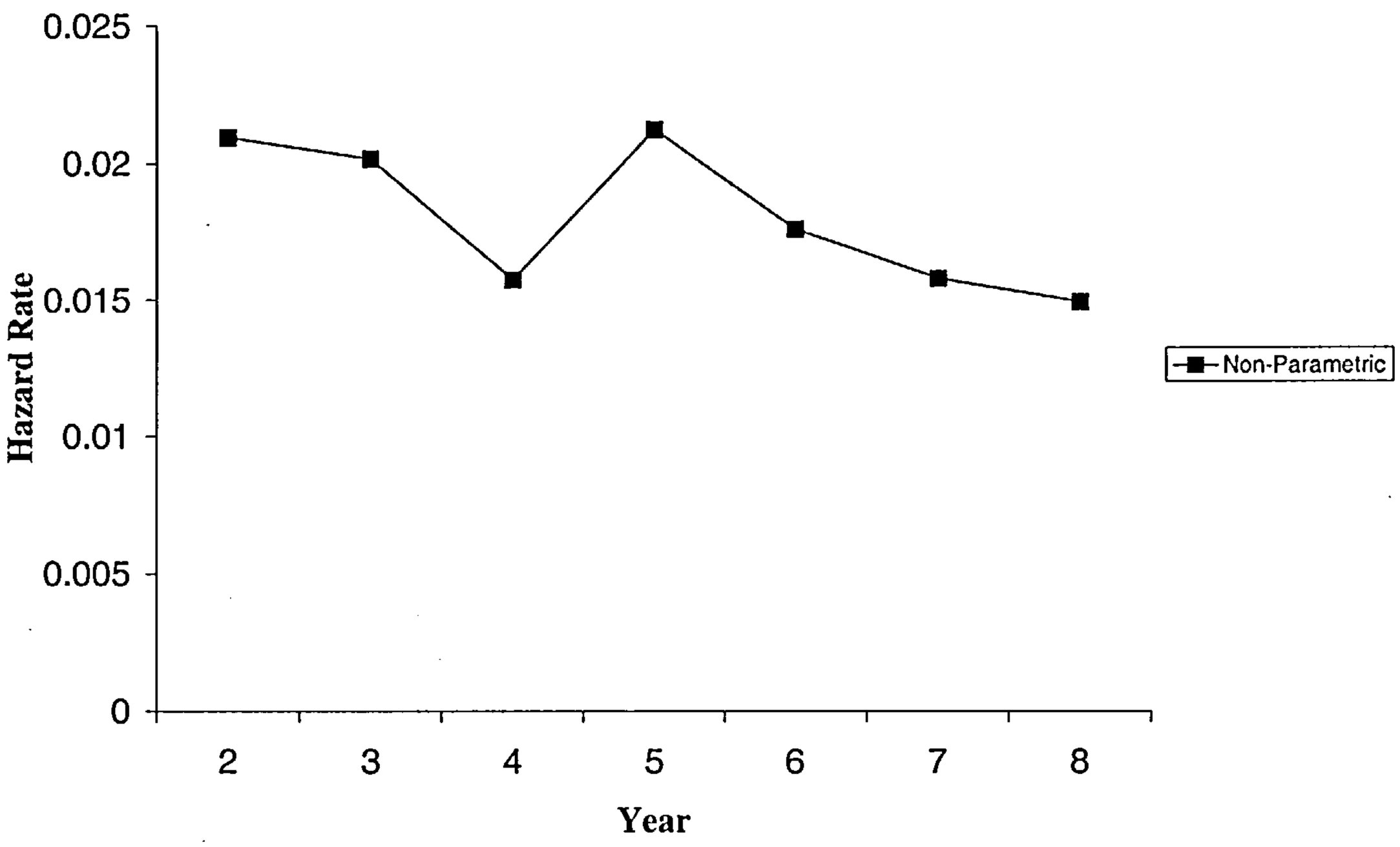

Figure 3-3: Non-Parametric Baseline Hazard.

fast-track effects identified in Tables 3.3 to 3.5 thus appear to survive after controlling for other factors.

Other interesting results include the negative and significant coefficients on the grade dummies. The hazard of promotion fluctuates up and down as the individual moves through grades 2 to 6 (the clerical grades). However, from grade 8 onwards (the management grades) the coefficients on the grade dummies have a downward trend, and so, not surprisingly, gaining promotion gets increasingly difficult as the individual enters the upper areas of management.

The coefficient on the gender dummy is also negative and significant indicating that female workers have a lower chance of promotion than their male counterparts. Such a finding is in line with the results of most other studies (e.g., Cannings (1988), Jones and Makepeace (1996), Pudney and Shields (2000)).

In contrast, the variables measuring tenure with the firm and age both have a negative effect on the hazard, indiciating that the longer a worker has been with the organisation or the older they are the lower is their chance of promotion. Such a result is in line with the early selection approach to promotion employed by this firm.

Finally, the dummy variable for marital status is negative and significant, indicating that married people are less likely to be promoted than single people.

As mentioned in the previous section, the commonly used Weibull specification only allows for monotonically increasing or decreasing hazards over time. A minimum distance test to determine whether a Weibull specification is consistent with the estimates from the unconstrained model (after controlling for unobserved heterogeneity) gives a $\chi^2(5)$ statistic of 12. This exceeds the critical value of 11.07 at the 5% level, so rejecting the null hypothesis of a Weibull specification. The Gauss program used to carry out this test is outlined in the appendix to this chapter.

3.7 Conclusion

This chapter investigates the pattern of promotion within the large U.K banking sector firm outlined in Chapter 2. In particular it finds evidence of promotion fast-tracking in which those targeted for quick promotion lower down the hierarchy are more likely to be targeted for rapid promotion further up the hierarchy than all other workers.

These findings contribute to the debate on the economics of promotion in at least two ways:

Firstly, previous papers have found inter-country differences in promotion patterns, especially between Japan and the U.S. This study is one of the first to address the issue of promotion for a U.K firm and provides preliminary evidence that U.K organisations adopt similar fast-track promotion patterns to their U.S counterparts.

Secondly, a number of theoretical models can be used to explain promotion fast-tracking e.g., human capital models, biased contests (Meyer(1991)), and the optimal setting of promotion criteria in the face of differing outside opportunities (Lazear (1995)). However, the results reported in this paper, using duration models of time to promotion, produce similar findings to Ariga, Ohkusa and Brunello (1997) and show that fast-tracking survives even after controlling for the effects of human capital. Barmby and Bridges (2002) discusses ways of analysing the personnel data from our large financial sector firm in order to cast light on some theories of promotion. The paper finds preliminary evidence that the firm may optimally bias contests to increase the probability of promoting the most able individual.

This chapter also investigates some of the causes and consequences of promotion within our large U.K financial sector firm. The results show that workers who have a long tenure with the firm, are older, have a low performance rating and are in an upper management grade have a lower hazard of promotion than all other workers. These findings also add to the limited empirical evidence on gender differences and promotion and show that in line with the conventional view on promotion females are less likely to be promoted than their male counterparts.

3.8 Appendix

Gauss program used to carry out the minimum distance χ^2 test:

```
x={0.03 0.024 0.024 0.024 0.024 0.025 0.025,
0.024 0.038 0.027 0.028 0.027 0.028 0.028,
0.024 0.027 0.05 0.03 0.03 0.03 0.031,
0.024 0.028 0.03 0.048 0.031 0.032 0.033,
0.024 0.027 0.03 0.031 0.071 0.033 0.034,
0.025 0.028 0.03 0.032 0.033 0.09 0.036,
0.025 0.028 0.031 0.033 0.034 0.036 0.085};

gam={0.160,0.020,-0.281,0.149,-0.326,-0.389,0.241};

y=inv(x);

library pgraph;

graphset;

a = seqa(1,2,3)';

b = seqa(1,2,3);

c = w(a,b);

contour(a,b,c);

proc w(a,b);

local v, w, g;

g=z(a,b);

v=(gam-g);

w=(v'*y*v);

retp(w);

print w;

endp;

proc z(a,b);
```

```
local g, t, alpha;
g=zeros(7,1);
t=1;
do while t <= 8;
t=t+1;
alpha=exp(b);
g=a+ln((t+1)^alpha-(t)^alpha);
endo;
retp(g);
endp;
```

Chapter 4

Worker Absenteeism

4.1 Introduction

Worker absenteeism is a serious economic problem resulting in the loss of a large number of working days and hence worker productivity and income each year. Vistnes (1997), for example, using data from the 1987 National Medical Expenditure Survey finds that workers in the U.S missed approximately 385 million working days due to illness in 1987 (accounting for 1.9% of their scheduled work time). Similarly, evidence for Canada shows that 2.9 million individuals were absent from work during an average week in 1987 (Akyeampong (1988)), while in the United Kingdom approximately 300 million working days were lost annually due to certified incapacity for work during the 1970s[1] (Doherty (1979)). In more recent work, Barmby, Ercolani and Treble (1999), using data from the Labour Force Survey and General Household Survey, estimated an absence rate for the U.K that averaged approximately 3.2% per annum over the period 1989 to 1997.

Despite these large costs most of the early work on absenteeism has been carried out by industrial and organisational psychologists who typically regarded absence as a withdrawal response to a negative work environment (see Steers and Rhodes (1978) and

[1]In contrast, only approximately 8 million working days were lost annually over this period due to industrial disputes.

Fichman (1984) for a review of this literature).

The 1980s, however, saw a surge of interest by economists into the causes and consequences of worker absenteeism. In most of these studies the decision to be absent from work has been modelled as a labour supply phenomenon on behalf of workers (see Allen (1981a), and Dunn and Youngblood (1986)). In this model the potential for absence arises because workers are usually constrained to supply a fixed amount of labour within a given time frame. However, treating absence purely as a supply-side problem ignores the role employers may play in managing absence. As a result, some researchers have attempted to take labour demand aspects into consideration in their models of absence. Allen (1981b, 1983), for example, tries to take labour demand into account in his model of absence by treating absenteeism as a non-pecuniary characteristic of the employment contract.

This chapter seeks to add to the growing body of economic research on worker absence by investigating some of the determinants of absenteeism within our large U.K financial sector firm. In this study a dynamic model for discrete panel data, similar to that proposed by Heckman (1981a), is used to estimate the probability of absence for a random sample of workers who were continuously employed by the firm in 1992. The aim of this chapter is largely two fold:

First, it seeks to investigate the effect past absence has on current absence decisions. Since absence is to some extent determined by the individual's state of health the worker's absence decision on a given day is unlikely to be independent of whether s/he was away from work the previous day. Despite this, most analyses on absence behaviour tend to either ignore the effect past absence has on current choices, or address the issue in a purely *ad hoc* manner. This is surprising given that in the studies that account for past absence (see, for example, Barmby, Orme and Treble (1995)) the largest and most significant coefficient is usually absence lagged 1 period. As will be seen, ignoring the lag of absence also has important consequences for the significance of the remaining explanatory variables.

Second, this chapter seeks to add to the empirical evidence on gender differences and absenteeism. A common finding of many studies is that female workers are more likely to be absent from work than their male counterparts (see, for example, Paringer (1983), Allen (1984), Dunn and Youngblood (1986), Drago and Wooden (1992), Barmby, Orme and Treble (1991), and Brown, Fakhfakh and Sessions (1999)). However, at present there seems to be little agreement as to the main causes of these gender differences. There is, for example, some debate in the literature with respect to the effect dependents have on absenteeism among females. Leigh (1983) and Vistnes (1997) find that the presence of children under 6 years of age increases female absence, while Paringer (1983) finds that women with family responsibilities are less likely to be absent. There is a similar debate over the effect of age; Leigh (1983) finds that age has no significant effect on female absenteeism, while Paringer (1983) finds evidence of a strong positive relationship between age and the level of absence, which is greater for males than for females.

This chapter is organised as follows. Section 4.2 provides a summary of some of the economic theory on absence. Section 4.3 reviews some of the empirical evidence on absence. A description of the data and the empirical model being estimated is given in Sections 4.4 and 4.5, respectively. Key empirical results are reported in Sections 4.6 and 4.7, while implications for future work and the conclusions are discussed in Section 4.8.

4.2 Theoretical Framework

4.2.1 Labour Supply Approach

As mentioned above the decision to be absent from work is often modelled in terms of a standard neo-classical model of labour supply (see, for example, Allen (1981a), Dunn and Youngblood (1986), and Vistnes (1997)). In this model the potential for absence arises because workers are usually constrained to supply a fixed amount of labour within a given time period. Such constraints arise because employers usually have an interest in how many hours their employees work and specify these hours in an employment contract.

For example, workers on an assembly line are usually contracted to work a fixed number of hours in order to ensure optimal manning levels. Thus, a lack of information by employers about their workers' preferences, technological and institutional requirements, as well as the high costs of search may cause some individuals to accept jobs where the number of hours they are contracted to work exceeds their desired number of hours. When employees are contracted to work for more than their desired number of hours given wages they have an incentive to consume more leisure, and one way of doing this is by being absent from work.

As well as setting the number of hours individuals must work employment contracts also tend to specify the particular hours they must work. Thus, even if employees are contracted to work their desired number of hours, absenteeism may still arise if highly attractive/important alternative events (e.g., a doctor's appointment or an important family occasion) occur during their contracted working hours. Similarly, leisure time often becomes more attractive the longer an employee is ill as the need for rest and recuperation becomes increasingly necessary.

Allen (1981a) presents this idea in a more formal setting. In this framework the worker's preferences are assumed to be represented by a twice-differentiable utility function of the form:

$$U = U(C, L) \tag{4.1}$$

where C is consumption and L is leisure time.

The firm imposes a penalty, D, on unscheduled absences. Thus:

$$D = D(t^a) \tag{4.2}$$

where $D' > 0$, $D(0) = 0$ and t^a represents time absent from work. This penalty could,

for example, take the form of a fine, dismissal, a decreased probability of being promoted or a reduction in the probability of receiving a pay rise.

In addition, workers are assumed to be endowed with a stock of time, T. Thus:

$$T = t^c + t^l + t^a \tag{4.3}$$

where t^c indicates contracted hours, and t^l represents leisure time when $t^a = 0$ ($t^a + t^l = L$).

Individuals are also assumed to spend all their income and thus the budget constraint facing each worker is of the form:

$$C = N + w(t^c - t^a) - D(t^a) \tag{4.4}$$

where N is unearned income, and w is the real wage.

Now the individual's problem is to maximise his/her utility subject to the constraints outlined above. Substituting equations (4.3) and (4.4) into (4.1) and differentiating with respect to t^a produces the first-order utility maximising condition:

$$\frac{dU}{dL} - \frac{dU}{dC}(w + D') = 0 \tag{4.5}$$

It follows from this that a worker will be absent on a given day only if the rise in utility obtained through increased leisure is greater than the fall in utility that arises due to the resultant loss in current and future earnings.

Allen's (1981a) labour/leisure model of absence yields a number of predictions. Assuming absence (like leisure) is a normal good:

1. The relationship between wages and absence is *a priori* indeterminate due to conflicting income and substitution effects. An increase (decrease) in the wage rate

produces an income effect that increases (decreases) the tendency to be absent, and a substitution effect that decreases (increases) the tendency unequivocally.

2. The pure income effect produces a positive relationship between non-labour income and absenteeism, and a negative relationship between the penalty associated with absenteeism and the level of absence.

3. The relationship between contracted hours and absenteeism is positive given the assumption of a diminishing marginal utility of leisure.

Allen (1981a) and Vistnes (1997) also examine the effect sick pay has on absence behaviour. They include a dummy variable for sick pay, S, in the worker's budget constraint and so equation (4.4) becomes:

$$C = R + w(t^c - (1 - S)t^a) - D(t^a) \tag{4.6}$$

where S is a dummy variable that takes the value 1 if a worker has sick leave benefits and is 0 otherwise. The first-order utility maximising condition facing each worker is now of the form:

$$\frac{dU}{dL} - D'\frac{dU}{dC} = 0 \tag{4.7}$$

It follows from this that unless higher penalties for absence are imposed on workers with sick leave benefits the level of absence will always be greater in firms that provide sick pay than in those which do not. In addition, the effect of a change in wages on absence behaviour is now unambiguously positive since there is no longer a substitution effect.

4.2.2 Hedonic Wage Model

As mentioned previously the potential for absence can only arise if workers are obliged to supply a certain amount of labour within a given time period. Observed absence is thus necessarily conditioned by the individual's employment contract. However, treating absence purely as a supply-side problem on behalf of workers ignores the role employers may play in managing absence.

Firms find absenteeism costly since it disrupts work schedules resulting in the loss of a large number of working days and hence worker productivity and income each year. Employers are thus unlikely to stand by and do nothing if faced with a frequently absent work-force and may, for example, employ more stringent absence control measures (such as increased monitoring, fines, inducements and even threats of dismissal) or make their contracts more flexible (by, for example, introducing flexi-time schemes, and part-time work) in an attempt to reduce the level of absence. It follows from this that interpreting absenteeism purely as a supply-side phenomenon may lead to an important identification problem, making it difficult to separate the changes in absence which arise due to demand-side effects (i.e., the efforts of employers) from those which arise due to changes in the behaviour of employees (see Barmby, Orme and Treble (1991)).

Allen (1981b, 1983) attempts to take labour demand aspects into account in his model of absence by treating absenteeism as a non-pecuniary characteristic of the employment contract. He argues that employers adjust their compensation and personnel policies in order to attain an optimal level of absence. Using Rosen's (1974) hedonic pricing framework Allen (1981b, 1983) asserts that it is possible to derive an offer curve for each employer reflecting the firm's trade-off between wages and absence at each level of profit. He argues that in organisations where the cost of absence is relatively high (low) employers offer compensation packages that pay higher (lower) wages in return for lower (higher) levels of absence. In addition, Allen (1981b, 1983) asserts that in the long run there should be a unique offer curve for each employer reflecting the trade-off that prevails in the market between wages and absence at zero profits.

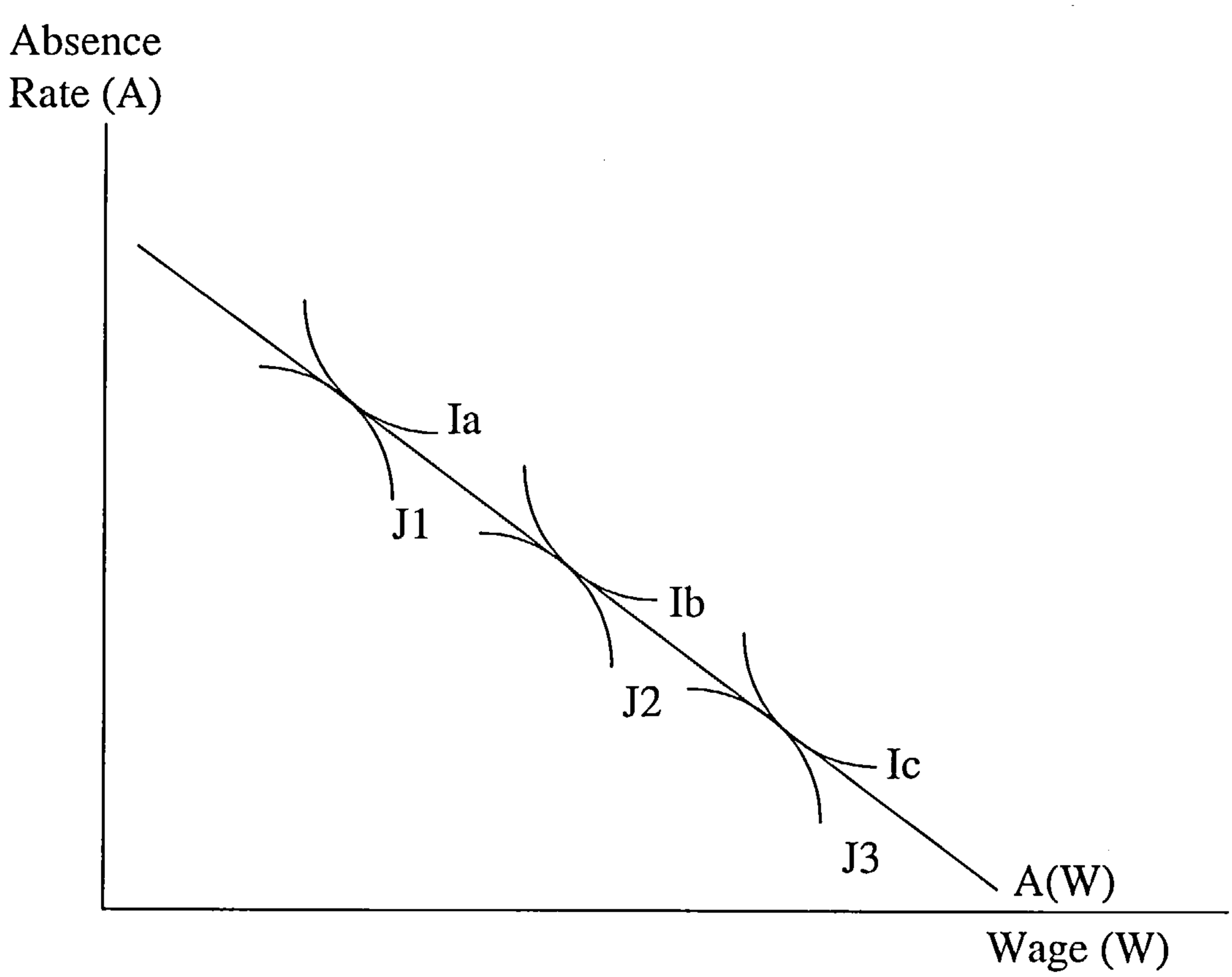

Figure 4-1: Market Trade-off between Wages and Absence Rates.

Figure 4.1 depicts the wage-absence offer curves for three such firms denoted by J1, J2 and J3, respectively. The envelope of this family of curves (represented by $A(w)$) reflects the trade-off prevailing in the market between wages and absence. Similarly, Allen (1981b, 1983) asserts that for each individual a family of indifference curves between wages and absence can also be derived.

Workers are then assumed to select the job with the combination of wages and absence that maximises their utility. As can be seen in Figure 4.1 this occurs at the point where the individual's indifference curve is tangential to $A(w)$. Workers who prefer more absence and a lower wage (e.g., individual a with indifference curve Ia), not surprisingly, opt for jobs with employers who find absence relatively inexpensive (such as firm 1). In contrast, those who prefer a high wage and lower absence (e.g., individual c with indifference curve Ic) seek employment with those firms who find absence relatively costly (such as firm 3). Since workers make a trade-off between wages and absence when choosing a job the wage/absence correlation in this framework is unambiguously negative.

4.2.3 Reservation Sickness Model

Barmby, Sessions and Treble (1994) take explicit account of the worker's state of health in their model on absence. A simplified version of this framework is presented below.

In this model utility is assumed to be an increasing function of income, leisure, and a decreasing function of the worker's state of health. Thus:

$$U = U(C, L, \alpha) \tag{4.8}$$

where U represents the individual's utility, C is consumption, L is leisure time, and α is a random variable representing the worker's state of health. The parameter, α, is assumed to be randomly distributed over the interval $[0, 1]$ with individuals valuing leisure or recuperation time more highly as α tends to 1, and valuing consumption (work) more

highly as α tends to 0. Workers are also assumed to sign an enforceable employment contract that pays a wage, w, for hours of work, h. In addition, a firm financed sick pay scheme which pays sick pay at a rate $s < w$ is available to all individuals whose level of sickness is greater than or equal to some exogenously defined minimum α^s i.e., for whom $\alpha \geq \alpha^s$. Assuming a linear functional form for the utility function, the utility the individual obtains from work and absence is as follows:

$$U_W = (1 - \alpha)w + \alpha(T - h) \tag{4.9}$$

$$U_A = (1 - \alpha)s + \alpha T \tag{4.10}$$

where U_W is the utility from work, U_A is the utility from absence, and T is total time.

From equations 4.9 and 4.10 a reservation level of sickness, α^*, can be calculated at which the worker is indifferent between work and absence. At this point the utility s/he gets from work is equal to the utility which s/he gets from leisure i.e., $U_W(\alpha^*) = U_A(\alpha^*)$. Thus:

$$\alpha^* = \frac{w - s}{w - s + h} \tag{4.11}$$

Realisations of sickness greater than α^* induce the individual to be absent from work. Conversely if $\alpha < \alpha^*$ the employee maximises his/her utility by attending work. It follows from equation 4.11 that the reservation level of sickness is a positive function of wages, and negatively related to sick pay and contracted hours. Thus, an increase (decrease) in wages or a decrease (increase) in sick pay or contracted hours causes the reservation level of sickness to increase (decrease), thereby causing the level of absence to fall (rise).

4.3 Literature Review

As mentioned earlier, despite the large costs that are associated with absenteeism until recently very little attention has been paid by economists into the causes and consequences of worker absenteeism. This section thus gives a brief review of some of the empirical literature on absence. As will be seen, the majority of these studies use a model for absenteeism based on the traditional labour/leisure framework outlined in Section 4.2.1.

4.3.1 Absenteeism and Contracts

As mentioned in Section 4.2.1 in the labour/leisure model of absence, individuals absent themselves in an attempt to maximise their utility and hence move to the point where their marginal rate of substitution of consumption for leisure (MRS) is equal to their marginal wage. Dunn and Youngblood (1986) test this idea using individual data from a utility company, and an empirical measure of each worker's MRS. They estimate an equation of the form:

$$\text{Absence} = a + b(\text{MRS} - \text{Marginal Wage}) + \sum c_i Z_i \tag{4.12}$$

where a, b, and c are the parameters to be estimated and Z_i is a vector of socio-economic variables. Using a tobit analysis they find evidence of a positive and significant relationship between absence and the difference between the individual's marginal rate of substitution and his/her marginal wage for both medical and non-medical absence.

Barmby, Orme and Treble (1995) using data from two manufacturing plants in the U.K and a logit analysis also find that wages have a negative and significant effect on the probability of absence, even after controlling for unobserved effects. Similarly, Drago and Wooden (1992), Chaudhury and Ng (1992), and Kenyon and Dawkins (1989) find evidence of a negative and significant relationship between wages and absence.

Allen (1981a) uses data from the 1972 to 1973 Quality of Employment Survey in the

U.S in his study on absence. He analyses a sample of workers who self-report the number of days they were away from work in the two weeks prior to being interviewed. Using a logit analysis he finds evidence of a negative and significant relationship between wages and absence, but only after excluding personal characteristics, industry dummies and occupation dummies. Allen (1981a) also estimates these equations separately for blue and white collar workers and finds that a negative and significant wage effect is only present for the blue collar subgroup; wages are insignificant for white collar workers.

In contrast, Winkler (1980) finds that a significant positive relationship exists between wages and absenteeism, while both Doherty (1979) and Leigh (1991) find that wages have no statistically significant effect on absence behaviour.

The effect sick pay has on absence behaviour has also been examined in a multitude of studies. Vistnes (1997) estimates both a logit and a truncated negative binomial model and finds that neither wages or paid sick leave have a significant effect on absence behaviour. However, she finds that for females paid sick leave and the interaction between paid sick leave and the log of wages is jointly significant and has a positive effect on the probability of absence. Vistnes (1997) argues that for women the presence of paid sick leave increases her probability of absence by approximately 5.6%[2]. In contrast, Doherty (1979) and Leigh (1991) find that paid sick leave has no significant effect on absence behaviour.

Although an employment contract usually specifies which and how many hours an individual must work, employers can potentially induce their workers to supply more labour by paying an overtime premium for hours worked in excess of their contracted hours. The effect overtime has on absence behaviour is, however, *a priori* ambiguous. On the one hand, within the labour/leisure model of absence paying individuals a wage premium for overtime introduces a non-convexity into the worker's budget constraint. This may increase the utility of those who work overtime inducing them to supply more labour and thereby causing the level of absence to fall. In contrast, the income effect

[2]This figure is calculated using the mean value of after tax wages for women.

together with the assumption of diminishing marginal utilities of leisure suggests that the relationship between overtime hours and labour absence should be positive.

Kenyon and Dawkins (1989) using data from the Australian Bureau of Statistics over the period 1966 to 1984 find evidence of a negative and significant relationship between average hours of overtime per employee (one of their proxies for overtime) and absence. According to their results increasing overtime per employee by an hour should reduce absence by between 300 and 400 workers per day. In contrast, Chaudhury and Ng (1992) using Canadian firm-level data finds that overtime has an insignificant effect on absence behaviour.

It is apparent from the above analysis that overtime partly affects absence by altering the length of the working day. A related point therefore concerns the effect the availability of part-time work has on absence behaviour. Chaudhury and Ng (1992) investigate the relationship between part-time employment and absence and find absenteeism to be lower in firms employing a higher proportion of part-time workers. They find the elasticity of working days lost with respect to part-time individuals to be approximately 0.2. From this they argue that if the average organisation in their sample increased the proportion of part-time workers it employed from 11.88% to 23.76% the number of working days lost per employee would fall from 6.22 days to 4.97 days. Similarly, Barmby, Orme and Treble (1995) and Drago and Wooden (1992) find that full-time workers have a higher probability of absence than their part-time counterparts.

A number of reasons can be used to explain these findings. First, since part-time employees work fewer hours than their full-time counterparts they tend to derive less utility from an additional unit of leisure obtained through absenteeism. Second, part-time individuals tend to experience greater work schedule flexibility than full-time employees making it less necessary for them to be absent from work in order to pursue non-market related activities. In addition, Chaudhury and Ng (1992) argue that since part-time work is often less secure than full-time employment, part-time employees may face a greater penalty for not attending work when scheduled to do so.

4.3.2 Absence and other Job Characteristics

Another finding of many studies is that workers in large firms are more likely to be absent than those in smaller organisations. Barmby and Stephan (2000), for example, investigate the relationship between firm size and absence using data from the German Socio-Economic Panel over the period 1984 to 1990 (excluding 1989). They estimate a random effects regression for a cross classification of male, female, blue, and white collar workers and show that firm size has a positive and significant effect on absence for blue collar workers and white collar females; but is insignificant for white collar males. Barmby and Stephan (2000) also estimate a model of absence using data from the Hannover Panel, which contains information on approximately 1000 firms in the German manufacturing sector, and find similar evidence of a positive and significant relationship between firm size and absence.

Allen (1981b) using data from the American Paper Institute for 1976 also shows that firm size has a positive and significant effect on the probability of absence. Vistnes (1997) finds that being female in a small firm (i.e., one with less than 10 employees) reduces both their probability of absence, and the length of this absence once they are away from work compared with women in larger firms (i.e., ones with more than 500 individuals). In contrast, she finds that for males being in a small firm has a negative and significant effect on their probability of absence, but has an insignificant effect on the length of this absence once they are away from work.

A number of explanations can be used to illustrate these findings. First, it is frequently argued that individuals in larger firms experience a greater sense of alienation than those in smaller organisations, making them less loyal to their employers and therefore more likely to be absent from work. Second, Barmby and Stephan (2000) assert that larger firms are often able to diversify their risk from absence more easily than smaller organisations. For example, given that large firms tend to employ more individuals than small firms they should find it easier to find capable replacements for absent workers. Finally, Vistnes (1997) argues that smaller organisations may offer their employees more

flexible working arrangements making it easier for them to take scheduled time off work, and also asserts that these findings could reflect the lower occupational injury rates in small firms than in large firms.

Another variable thought to affect absenteeism is the worker's tenure with the firm. Leigh (1986) finds evidence of a positive and significant relationship between tenure and absenteeism. He argues that the longer workers spend with the firm the more secure they should feel in their jobs and hence should be less worried about the consequences of absenteeism. In contrast, Vistnes (1997) finds that tenure with the firm has a positive and significant effect on the probability of absence for males, but is insignificant for females. She argues that for males increased tenure with the organisation could be acting as a proxy for greater job satisfaction and loyalty to the firm, hence giving rise to this negative relationship between tenure and absence.

A number of studies have also sought to investigate the differences in absence that arise due to occupation. For example, a common view in many studies is that white-collar workers are less likely to be absent from work than their blue-collar counterparts. Drago and Wooden (1992) argue that such a finding could arise since white-collar jobs tend to involve less dangerous working environments and greater flexibility to engage in necessary non-work activities during the day.

4.3.3 Absence and Unions

The effect unions have on absence has also been examined in a number of studies. Since grievance procedures are often more structured in unionised firms, unions may increase absence since they make it more difficult for employers to penalise those individuals who are frequently absent from work (Allen (1981b), (1984)). In addition, Allen (1984) asserts that union guidelines often give managers in union plants less flexibility to tailor work schedules to match individual preferences. On the other hand, Allen (1984) argues that employees in union plants often have a stronger 'voice' thereby reducing unsatisfactory working conditions and hence absenteeism. For example, union contracts often mandate

that higher wage premiums are paid for overtime, shift-work and weekend work. Allen (1984) asserts that this will tend to reduce the amount of work that takes place at unsociable hours thereby increasing scheduling flexibility and reducing absence. *A priori,* the effect of unionisation is therefore ambiguous.

Vistnes (1997) finds that union membership increases both the probability that a man will be absent, and the length of this absence once he is away from work, but is insignificant for women. She argues that in addition to the reasons outlined above unionisation may also be more representative of firms in hazardous industries so the union variable captures, to some extent, the risk associated with the worker's job.

Allen (1984) estimates the difference in absence rates between union and non-union workers using three different data sets; the pooled May 1973-1978 Current Population Survey, the 1973 Quality of Employment Survey (QES), and the first five waves of the Panel Survey of Income Dynamics. Using a logit analysis he finds that union members are more likely to be absent from work than non-union members.

Chaudhury and Ng (1992) also find that unionisation increases the total number of days lost due to absenteeism. In contrast, Allen (1981b) using data from the American Paper Institute for 1976 finds that union membership has an insignificant effect on the probability of absence.

4.3.4 Absenteeism and Personal Characteristics

Another important explanatory variable in most studies on absence is the worker's gender. A common finding of many of these studies is that female workers are more likely to be absent from work than their male counterparts (see, for example, Paringer (1983), Allen (1984), Dunn and Youngblood (1986), Drago and Wooden (1992), Barmby, Orme and Treble (1991), and Brown, Fakhfakh and Sessions (1999)).

Youngblood (1984) attributes these findings to the fact that women are more likely to take time off work due to illness than men. A common view in the empirical literature is that females invest more in their health than males. They are, for example, more

likely to visit the doctor than men and tend to make better use of preventative and other medical services than their male counterparts. In a similar vein, Leigh (1983) finds that women are more sensitive than men to absence inducing events such as a lack of sleep.

In addition, many researchers argue that the higher rate of absence among females may arise because women often have a greater role to play in the home than men. It follows from this that women may be absent from work more frequently than men while ill in order to reduce their recovery time from illness since for females ill health affects both their home and market production. In addition, since women tend to assume responsibility for the children within a household their absence may also correspond to times when their children are ill so that they can look after them.

Vistnes (1997) investigates the determinants of some of these gender differences on absence behaviour and finds that the presence of children under 6 years of age increases both the probability that a woman will be absent and the length of her absence once she is away from work; Leigh (1983) finds a similar result.

In contrast, both Vistnes (1997) and Leigh (1983) find that the presence of young children has no effect on male absence behaviour. However, Vistnes (1997) finds that for men who are already absent from work the presence of children in day care has a positive and significant effect on the length of their absence. From this she argues that the behaviour of men with children in day care (e.g., single fathers, and husbands whose wives work) more closely mirrors that of working women with children than that of other men as far as home production and care giving responsibilities are concerned.

In contrast, Paringer (1983) finds that family responsibilities lead to a reduction in absence, especially among women. Using data from the 1974 Household Interview Survey in the U.S she finds that married women with families are less likely to be absent from work than unmarried women. Paringer (1983) argues that the dual responsibility married women with children have as both home producers and labour market participants may cause them to invest more in their health, so reducing their absence from work due to illness.

Many studies on absence also find that married people are less likely to be absent from work than single people (see Allen (1984), Leigh (1986)). Married people may, for example, be under greater financial pressure than single people making them more likely to attend work.

Another variable that is often thought to be associated with absenteeism is the age of the worker. The relationship between the individual's age and absenteeism is, however, *a priori* indeterminate. On the one hand, age may act as a proxy for the health of the worker, and so firms with older employees may experience higher levels of absence as a result of health related problems. Paringer (1983), for example, finds evidence of a strong positive relationship between age and the level of absence. She finds this effect to be more pronounced for males than females, and argues that such a finding may arise because women tend to invest more in their health than men, thereby resulting in a slower depreciation of their health stock as they age.

The age of the individual may also be acting as a proxy for attitude towards work. Brown, Fakhfakh, and Sessions (1999) using data from a panel of French firms over the period 1981 to 1991 finds that younger workers (those under 35) are more likely to be absent from work than older workers (those over 50). They argue that younger employees maybe less attached to their firms and workgroups and have fewer financial and family commitments than older workers, making them more likely to change jobs and hence search for new employment by taking time off work. Similarly, Delgado and Kneisner (1997) find that firms whose workers are 10% older than average have between 5% and 9% fewer short-term absence spells. Allen (1984), Leigh (1986), Dunn and Youngblood (1986) and Vistnes (1997) also find evidence of a negative relationship between age and absence.

In contrast, Allen (1981a) finds evidence of a non-linear relationship between age and absence. He shows that the relationship between age and absence initially rises with age before falling for those aged 35 and over. Similarly, VandenHeuvel and Wooden (1995) finds evidence of a u-shaped relationship between age and absence for men. However,

they find that for women age has an insignificant effect on attendance behaviour.

However, not all researchers agree that demographic characteristics are good determinants of absence. Allen (1981a) finds:

> Except for a positive correlation between absenteeism and family size among married (spouse present) women and a positive female coefficient in the blue collar equation, there is no sizable or significant relationship between work attendance and variables reflecting household composition, race, or education.

Barmby and Treble (1991) find that personal characteristics such as gender, age and marital status have no significant effect on the probability of absence, and emphasize the importance of contractual considerations in determining absence behaviour. Similarly, both Kenyon and Dawkins (1989) and Chaudhury and Ng (1992) find sex and age to be insignificant in their studies on absence.

4.3.5 Absence and Health Status

Since absence is to some extent determined by illness, the worker's state of health is another important variable in most studies on absenteeism.

Allen (1981a) includes a health evaluation variable in his study on absence and finds that absence is significantly higher among individuals who claim to be in poor health; Paringer (1983) finds a similar result.

Vistnes (1997) takes a closer look at the worker's state of health in her study on absence and includes five general measures to capture the individual's state of health in her estimations. These are: the number of self-reported chronic conditions, the worker's self–perceived health status, the number of medical events experienced in 1987 (including the number of ambulatory visits, the number of drugs prescribed, and the number of emergency visits), whether the person smokes, and whether the individual is obese.

She finds that variables measuring self-reported health status and the number of medical events experienced in 1987 are significant predictors of the probability of absence.

For example, she finds that those who view their health status as being excellent or good have a significantly lower probability of absence relative to those who describe their health status as fair or poor. In addition, she shows that the number of ambulatory visits and visits to an emergency room also have a significant positive effect on the probability of absence. However, the magnitude of the effect of ambulatory visits is greater for males than females. Vistnes (1997) argues that since men are often more reluctant to visit the doctor than women, a visit to hospital in an ambulance could be the result of a more serious medical complaint for males than females. Out of the remaining health status variables included in the logit, smoking, obesity, the number of chronic conditions, and the number of prescription medicines have a positive and significant effect on the probability of absence for women, but are insignificant for men.

Vistnes (1997) finds that health status measures also have an important role to play in explaining the length of absence. For example, she finds that self-reported health status has a positive effect on the number of days lost from work for females, but is insignificant for males. In addition, she shows that in line with the findings of her logit analysis the number of ambulatory visits and visits to an emergency room also have a significant and positive effect on the length of absence.

4.4 Data

The data used in this study is drawn partly from the absence records of the large U.K financial sector firm outlined in Chapter 2. This absence data is available over the period April 1991 to February 1994 (35 months) and for each individual contains a daily record of any absence, and the reason for this absence (which may include illness, family care, personal leave, and jury duty, among other things). As mentioned earlier monthly personnel data is also available over this period which provides information on the worker's personal and job characteristics (including, gender, martial status, number of children, education, tenure with the firm, pay and grade within the organisational

Variable	Description
Absence	= 1 if absent, 0 otherwise
Ablag1 - Ablag14	0, 1 absence lag dummies
Grade1 - Grade13	0, 1 grade dummies
Management	= 1 if in grades 7-11, 0 otherwise
Tenure	individual's tenure with the firm (years)
Annsal	individual's annual salary
Degree	= 1 if have a degree, 0 otherwise
Professional Qualification	= 1 if have a professional qualfication, 0 otherwise
Age	age of individual (years)
Married	= 1 if married, 0 otherwise
Children	= 1 if have children, 0 otherwise

Table 4.1: Variable Names and Definitions - Absence.

hierarchy).

The analysis reported here focuses on a random sample of 3,737 individuals, 1,685 men and 2,052 women who were continually employed by the firm during 1992. There are 254 scheduled working days during this period (assuming that the individuals work a 5 day week, not including Public and Bank holidays), giving 427,934 person-day observations for males and 521,166 person-day observations for females.

As mentioned earlier, each worker in the organisation is identified via a unique staff identification number. Using this identification number it is possible to merge the information from the payroll data with the information from the attendance records with monthly precision. All individuals with missing values in any of the variables are dropped from the data. A full definition of the variables, and summary statistics of the sample are given in Tables 4.1 and 4.2, respectively.

In this sample a total of 29,486 working days were lost due to absence in 1992. The women in this sample were absent for a total of 20,988 days, compared with 8,498 days for that of men. In addition, 925 workers (301 females and 624 males) were not absent at

all during 1992, while 1 man was absent for a total of 168 days and 1 woman was absent for a total of 228 days. This results in an absent rate of 4.03% for females compared with only 1.99% for that of males.

As shown in Section 4.3.4 a common finding of many of the empirical studies on absence is that there are gender differences in absence behaviour. Tables 4.3 and 4.4 show the distribution of absence rates for both men and women by grade and age, respectively. As can be seen in Table 4.3 in each age group females have a higher absence rate than their male counterparts. Looking at the distribution of absence rates by grade produces a similar result. Apart from grades 2 and 3, in all other grades females have a higher absence rate than their male counterparts. However, for both males and females the absence rate in the management grades (grades 7 onwards) tends to be lower than those in the clerical grades. This could reflect the fact that managers are likely to have more flexible employment contracts than staff.

4.4.1 Absence Procedures

The absence procedures adopted by the firm are relatively straightforward. Employees are able to self-certify themselves absent for the first 7 days of any absence spell. However, for absence that exceeds (or is likely to exceed) 1 week a medical statement from the individual's doctor is required.

The organisation also has some absence control mechanisms in place in order to monitor and control the level of absence. For example, under certain circumstances employees maybe required to give permission for the firm to contact their doctor, and/or maybe required to visit the organisation's medical adviser. As a deterrent against long periods of absence the firm may also reduce the individual's annual leave entitlement on a pro-rata basis in line with their attendance during that year. Finally, disciplinary action maybe sort if the organisation considers the explanation given by the individual for his/her absence to be false.

Variable	Males		Females	
	Mean	Std. Deviation	Mean	Std. Deviation
Absence	0.020	0.140	0.040	0.197
Ablag 1-Ablag 14	0.020	0.140	0.040	0.197
Grade 1	0.013	0.114	0.010	0.101
Grade 2	0.0006	0.024	0.0003	0.018
Grade 3	0.017	0.129	0.028	0.164
Grade 4	0.118	0.322	0.223	0.416
Grade 5	0.146	0.353	0.429	0.495
Grade 6	0.182	0.386	0.219	0.413
Grade 7	0.233	0.423	0.063	0.243
Grade 8	0.151	0.358	0.018	0.132
Grade 9	0.094	0.292	0.007	0.083
Grade 10	0.034	0.181	0.002	0.040
Grade 11	0.010	0.102	0	0
Grade 12	0.0006	0.024	0	0
Grade 13	0	0	0	0
Management	0.523	0.499	0.090	0.285
Tenure	14.768	9.206	10.033	6.862
Basic Pay	20326.19	11804.90	12839.46	4128.54
Degree	0.085	0.279	0.025	0.157
Professional Qualification	0.516	0.500	0.098	0.297
Age	36.076	9.733	30.780	8.388
Married	0.621	0.485	0.487	0.500
Kid	0.660	0.946	0.182	0.505

Table 4.2: Summary Statistics - Absence.

Age Group	Absence Rate	
	Males	Females
17-29	2.034	4.049
30-39	1.851	3.779
40-49	1.932	4.276
>50	2.573	5.447

Table 4.3: Absence Rate by Age.

Grade	Absence Rate (%)	
	Males	Females
1	3.615	4.058
2	0	0
3	4.359	3.671
4	2.509	4.730
5	2.841	4.314
6	2.344	3.468
7	1.680	2.413
8	1.385	2.415
9	0.908	2.529
10	1.052	0.242
11	0.425	N/A
12	0	N/A

Table 4.4: Absence Rate by Grade.

4.4.2 Sick Pay

During periods of authorised sickness the firm continues to pay workers along the following lines[3]:

- Full time employees

Service in years	Maximum period of normal pay granted
Less than 2	8 weeks (40 working days)
2, but under 3	16 weeks (80 working days)
3 but under 5	26 weeks (130 working days)
5 and over	52 weeks (260 working days)

Note: 'Service in years' refers to continuous service at 6th April each year. 'Maximum period' is the maximum granted in any one year starting at 6th April whether absence is owing to a single illness or a number of illnesses.

[3]Under the Percentage Threshold Scheme the firm may, in some months, be entitled to reimbursement from the government for some of the sick pay it has paid.

4.5 Empirical Specification

The firm's daily absence records enable an event history for each worker to be constructed consisting of binary outcomes, $y_{it,}$, such that:

$$y_{it} = \begin{cases} 1 \text{ if indivdual } i \text{ is absent} \\ 0 \text{ otherwise} \end{cases} \tag{4.13}$$

$i = 1, ..., N$, $t = 1, ..., T_i$, where i is the individual, and t are the time subscripts.

It should be noted that when constructing an event history of daily absence outcomes, the only information that is known with any certainty are the days an individual is absent from work each week, and the number of hours they are contracted to work; no information is available on the actual days they are scheduled to work.

For the most part the full-time employees in this sample work a standard 35 hour week, 7 hours per day (including a 1 hour unpaid lunch break) Monday to Friday inclusive. However, certain parts of the organisation open for extended trading hours, which usually includes Saturdays. Saturday working is decided on a rotational basis, and as well as a Saturday working fee, time off in lieu is granted to all full-time employees who work this day. In addition, with the exception of Public and Bank holidays, no information is available on the days workers take off for holidays. According to the organisation's rules and regulations, individuals are required to take a minimum of 2 working weeks of their annual leave as consecutive weeks.

Thus, while the event histories for each employee will usually accurately record the days s/he is contracted to work they will in some places, most notably during the summer months, misreport the days the individual is scheduled to work.

4.5.1 Model

This study uses a dynamic model for discrete panel data similar to that proposed by Heckman (1981a) to investigate the incidence of absence. In this model the probability

that an individual i is absent ($y_{it} = 1$) can be written as a latent variable model of the form:

$$y_{it}^{*} = \beta' X_{it} + \sum_{l=1}^{t-1} \gamma_l y_{i,t-l} + v_{it} \tag{4.14}$$

such that:

$$P(y_{it} = 1) = P(y_{it}^{*} > 0) = F(\beta' X_{it} + \sum_{l=1}^{t-1} \gamma_l y_{i,t-l}) \tag{4.15}$$

where F(.) is the cumulative distribution function (CDF) corresponding to the error term, v_{it}. The error term, v_{it}, is assumed to be independent of the vector of explanatory variables, X_{it}, and is independently distributed over i. The set of parameters, β, capture the effect the explanatory variables, X_{it}, have on the decision to be absent, and the coefficients, γ_l, capture the effect experience of the event l periods ago has on current choices. A full description of the variables used in this model is given in Table 4.1.

Maximum likelihood estimates of the parameters in the above specification are obtained by maximising the following likelihood function. In its general form this likelihood function can be written as:

$$L(\xi) = \prod_{i=1}^{N} \prod_{t=1}^{T_i} F(\xi' Z_{it})^{y_{it}} [1 - F(\xi' Z_{it})]^{1-y_{it}} \tag{4.16}$$

where $\xi' Z_{it} = \beta' X_{it} + \sum_{l=1}^{t-1} \gamma_l y_{i,t-l}$. Using a logistic specification for $F(.)$ this becomes:

$$L(\xi) = \prod_{i=1}^{N} \prod_{t=1}^{T_i} \left(\frac{\exp(\xi' Z_{it})}{1 + \exp(\xi' Z_{it})} \right)^{y_{it}} \left(1 - \frac{\exp(\xi' Z_{it})}{1 + \exp(\xi' Z_{it})} \right)^{1-y_{it}}$$

$$= \prod_{i=1}^{N} \prod_{t=1}^{T_i} \frac{\cdot \exp(\xi' Z_{it})^{y_{it}}}{1 + \exp(\xi' Z_{it})} \tag{4.17}$$

4.5.2 Heterogeneity

Since data is not available on all the variables that may affect absence behaviour some account for unobserved heterogeneity in the model specified above needs to be made. This can be achieved by decomposing the error term, v_{it}, in the following way:

$$v_{it} = \sigma \alpha_i + u_{it} \tag{4.18}$$

where α_i captures time invariant individual specific effects, and u_{it} is independently distributed over i. Now, the probability that a worker is absent can be written as:

$$P(y_{it} = 1) = P(y_{it}^* > 0) = F(\xi' Z_{it} + \sigma \alpha_i) \tag{4.19}$$

In this model the individual specific effects, α_i, are treated as random variables[4] representing the extent to which the intercept of the ith individual differs from the overall intercept. One way of estimating such a model is to assume that the unobserved components, α_i, are independent of the observed regressors, and are a random sampling from a distribution with a probability density function $h(\alpha)$ in the population. The unobserved components can then be integrated out of the likelihood to form the marginal likelihood in the following way:

[4]If the individual specific effects, α_i, are treated as fixed then the intercept is assumed to be different for each of the N individuals. As well as the computational problem of having to run a regression containing an extra N variables, the main disadvantage of the fixed effects approach compared to the random effects approach is that unless T tends to infinity maximisation of the fixed effects likelihood function gives inconsistent estimates (e.g., Chamberlain (1980)).

$$L(\xi) = \prod_{i=1}^{N} \int_{-\infty}^{\infty} \prod_{t=1}^{T_i} F(\xi' Z_{it} + \sigma\alpha)^{y_{it}} [1 - F(\xi' Z_{it} + \sigma\alpha))^{1-y_{it}} h(\alpha) d\alpha \tag{4.20}$$

Under weak regularity conditions maximisation of this likelihood function gives consistent (as N tends to ∞) estimates of ξ. Using a logistic distribution for the cumulative distribution function this becomes:

$$L(\xi) = \prod_{i=1}^{N} \int \prod_{t=1}^{T_i} \frac{(\exp(\xi' Z_{it} + \sigma\alpha))^{y_{it}}}{1 + \exp(\xi' Z_{it} + \sigma\alpha)} h(\alpha) d\alpha \tag{4.21}$$

The unobserved term is assumed to be normally distributed $N(0, 1)$ in the population, and equation 4.21 is estimated using SABRE software developed by Barry, Francis and Davies (1990).

4.5.3 Initial Conditions

Another potential problem with the model outlined above is that the presence of lagged variables raises the issue of initial conditions, which if ignored can lead to bias in panel estimates (see Hsiao (1989)). In dealing with this problem one of two assumptions are typically invoked (Heckman (1981b)). Either:

- the initial conditions or relevant pre-sample history of the sample is assumed to be exogenous or,
- the process is assumed to be in equilibrium.

For the first assumption to hold the process under analysis has to be either observed from the beginning or the disturbance terms have to be serially independent. However, the data used in this study is not sampled from the start, and the disturbance terms are unlikely to be serially independent. The initial conditions in this model are thus unlikely

to be exogenous. The second assumption is also difficult to meet in this study due to the presence of time-varying exogenous covariates.

Under these circumstances the endogenous variables in this analysis are likely to lead to inconsistent estimates. However, Hsiao (1986) and Davies, Elias and Penn (1992) argue that as $T \rightarrow \infty$ this inconsistency disappears. Thus, since T in this model is large ($T = 254$), the bias created by the presence of the lagged variables is unlikely to be very large. Barmby, Orme and Treble (1995) make a similar assumption in their work. See Heckman (1981b) and Orme (1997) for Monte Carlo evidence of this[5].

4.6 All Workers

4.6.1 Independent Variables

The explanatory variables in the empirical analysis include a set of lag dummies to measure the effect past absence has on current choices. Since absence is to some extent determined by the worker's state of health the individual's absence decision on a given day is unlikely to be independent of his/her past absence.

Financial characteristics are represented by the worker's annual salary, which is made up of basic pay plus a regional allowance. As shown in Section 4.3.1 in the traditional labour/leisure model of absence the relationship between wages and absence is *a priori* indeterminate due to conflicting income and substitution effects. However, both Barmby,

[5]It should be noted that Orme (1997) has also devised a way to check for this initial condition bias. He begins by assuming that the initial conditions can be modelled as: $y_{i0}^{*} = \lambda' z_i + \eta_i$ where z_i is a vector containing current and/or pre-sample values of the regressors. Assuming bivariate normality between α_i and η_i Orme (1997) shows that $E(\alpha_i|y_{i0}) = \rho E(\eta_i|y_{i0})$, and $E(\eta_i|y_{i0}) = e_{i0}$, where $e_{i0} = (2y_{i0} - 1)\phi(\lambda' z_i)/\Phi(\{2y_{i0} - 1\}\lambda' z_i)$, with $\phi(.)$ and $\Phi(.)$ being the standard normal distribution and density function, respectively; e_{i0} is a Probit generalised error. It follows from this that: $\sigma\alpha_i = \sigma\rho e_{i0} + v_i$. Substituting this into equation 4.19 would yield: $y_{it}^{*} = \xi' Z_{it} + \rho\sigma e_{i0} + v_i + \varepsilon_{it}$ in which $\delta = \sigma\rho$, and v_i is uncorrelated with the initial observation y_{i0}.

This approach provides bias-corrected maximum likelihood estimators. However, the results only hold when ρ is small. Nevertheless, Orme (1997) argues that at the very least this method enables us to assess the potential inconsistency that may result if the initial conditions problem is ignored. Both Aralampalam, Booth and Taylor (2001), and Audas, Barmby, and Treble (1997) adopt this approach in their work.

Sessions and Treble's (1994) reservation sickness model and Allen's (1981b, 1983) hedonic interpretation of absence as an 'agreeable' job attribute, predict that wages will have a negative effect on absence behaviour.

The effect bonus pay has on absence is also examined in this analysis. The size of the workers' annual bonuses are based on their twice-yearly performance evaluations and the performance of the unit to which they are assigned. Therefore, one would expect the relationship between bonus and absence behaviour to be negative. In other words, the higher the bonus the more committed employees are likely to be towards their jobs and so are less likely to be absent from work. However, this raises an important endogeneity problem since the negative relationship between absence and bonus could also arise if workers were rewarded for lower absence rates by receiving a bigger bonus.

In addition, a dummy variable indicating whether the individual is a member of staff or management is included to account for the effect contractual flexibility has on the decision to be absent. Brown, Fakhfakh, and Sessions (1999) argue that the relationship between absence and the level of supervision is *a priori* indeterminate. On the one hand, they assert that close supervision may reduce the potential for workers to act on their own initiative, causing the level of job satisfaction to fall and absence to rise. Alternatively, they argue that close supervision may allow managers to get to know their employees better leading to a more efficient allocation of tasks within the firm, thereby causing the level of job satisfaction to rise and absence to fall.

Tenure with the firm is also included as a regressor in the following empirical analysis. On the one hand, as noted by Leigh (1986), the longer workers spend with the firm the more secure they should feel in their jobs and hence should be less worried about the consequences of increased absenteeism. Alternatively, increased tenure with the organisation may act as a proxy for greater job satisfaction and loyalty to the firm, giving rise to a negative relationship between tenure and absence.

The effect educational attainment, such as whether the individual has a degree (base case is no degree) or a professional qualification (base case is no professional qualification)

is also investigated. It should, however, be noted that in most studies education has been found to have an insignificant effect on absence behaviour (see Allen (1981a), Wilson and Peel (1991) and Vistnes (1997)).

Finally, in line with other studies, controls for personal characteristics such as marital status (base case is single), age, and the presence of children (base case is no children) are also made. As shown in Section 4.3.4 a common finding of many studies is that married people are more likely to be absent from work than single people, while the effect children, and age has on the level of absence is *a priori* indeterminate.

4.6.2 Empirical Results

The logistic model outlined in Section 4.5.1 is estimated separately for both males and females. Maximum likelihood estimates of the logistic for absence lagged 7 days are presented in Tables 4.5 and 4.6 for men and women, respectively. For comparison purposes maximum likelihood estimates of the logistic for absence lagged 6 days to absence lagged 0 days are presented in Appendix A. Columns I and II of these tables report the results for the standard logistic, while columns III and IV report the results for the logistic after allowing for heterogeneity.

As can be seen in Tables 4.5 and 4.6 the coefficients on the significant lag dummies are positive, indicating that workers who have experienced a spell of absence in the past have a higher probability of absence than those who have not experienced the event. The results show that the predicted probability of absence for a 'representative' male worker[6] increases from 0.009 if the individual was not absent at all in the last 7 days to 0.830 if he was absent for the whole 7 days. Similarly, the predicted probability of absence increases from 0.013 if a 'representative' female worker[7] was not absent at all in the past

[6]In this analysis a 'representative' male worker is defined as someone with the average male basic pay, bonus pay, tenure, and age, who is a member of staff, has no degree, professional qualification or children, and is single.

[7]In this analysis a 'representative' female worker is defined as someone with the average female basic pay, bonus pay, tenure, and age, who is a member of staff, has no degree, professional qualification or children, and is single.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.817	-68.785	-4.727	-4.633
Ablag 7	0.554	5.890	0.285	3.101
Ablag 6	0.668	6.252	0.519	5.049
Ablag 5	0.148	1.469	0.086	0.882
Ablag 4	0.426	4.677	0.339	3.806
Ablag 3	0.146	1.889	0.084	1.092
Ablag 2	0.404	6.560	0.354	5.708
Ablag 1	4.925	118.367	4.613	105.754
Basic Pay	$-0.105\text{x}10^{-4}$	-4.137	$-0.128\text{x}10^{-4}$	-3.536
Bonus Pay	$-0.147\text{x}10^{-4}$	-2.055	$-0.840\text{x}10^{-5}$	-1.271
Tenure	0.009	2.737	0.010	1.972
Management	-0.257	-5.980	-0.245	-3.985
Degree	$-0.709\text{x}10^{-3}$	-0.010	0.041	0.427
Professional Qualification	-0.220	-5.775	-0.224	-3.933
Age	0.002	0.832	0.004	0.962
Married	-0.059	-1.364	-0.052	-0.860
Children	0.004	0.207	0.003	0.109
Log-likelihood	-20949.570		-20696.885	
Number of Observations	1685		1685	

Table 4.5: Maximum Likelihood Estimates of Logistic Analysis (7 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.316	-84.397	-4.357	-54.321
Ablag 7	0.641	13.306	0.430	8.937
Ablag 6	0.307	5.498	0.202	3.665
Ablag 5	0.313	5.753	0.246	4.604
Ablag 4	0.143	2.800	0.084	1.660
Ablag 3	0.433	9.639	0.367	8.213
Ablag 2	0.385	10.504	0.344	9.301
Ablag 1	4.242	165.241	4.056	153.674
Basic Pay	$0.307\text{x}10^{-5}$	0.734	$0.947\text{x}10^{-5}$	1.426
Bonus Pay	$-0.231\text{x}10^{-3}$	-4.434	$-0.280\text{x}10^{-3}$	-3.692
Tenure	-0.006	-3.041	-0.007	-2.165
Management	-0.142	-2.427	-0.191	-2.156
Degree	-0.229	-2.844	-0.183	-1.488
Professional Qualification	-0.108	-2.929	-0.146	-2.570
Age	$-0.945\text{x}10^{-3}$	-0.576	$-0.888\text{x}10^{-3}$	-0.340
Married	0.066	3.090	0.067	2.066
Children	0.011	0.565	0.018	0.579
Log-likelihood	-47136.882		-466764.468	
Number of Observations	2052		2052	

Table 4.6: Maximum Likelihood Estimates of Logistic Analysis (7 Lags) - Females.

7 days to 0.802 if she was absent for the whole 7 days.

Two explanations exist for this empirical regularity; true 'state' dependence and 'spurious' state dependence (Heckman (1981a)).

True 'state' dependence depicts a situation where past experience of the event has a genuine behavioural effect on current choices, in the sense that an otherwise identical individual who has experienced the event in the past will behave differently from one who has not experienced the event. Since absence is to some extent determined by the worker's state of health, which is unlikely to be an independent realisation in each time period, 'state' dependence is likely to be a feature of this data.

The existence of time persistent unobserved effects can also lead to 'spurious' state dependence. Under these circumstances, past experience may appear to be a determinant of future experience simply because it acts as a proxy for these temporally persistent unobserved effects. The results reported in Appendix A show that the size of the coefficients on the lag dummies are slightly smaller after controlling for unobserved effects. This implies that the effect past absence has on current choices is to some extent overestimated in a model that neglects heterogeneity, since part of the relationship between past absence and current choices arises due to 'spurious' state dependence.

Barmby, Orme and Treble (1995) and Barmby, Bojke and Treble (1997) using data from the daily absence records of a large U.K manufacturing firm in 1988 also examine the effect past absence has on current choices. Barmby, Orme and Treble (1995), for example, include a dummy variable for absence lagged 1 period in their empirical specification, and using a logistic analysis find that the lag of absence has a positive and significant effect on the probability of absence. In addition, they also find that the existence of unobserved effects appears to accentuate the structural influence lagged absence has on current choices, with the coefficient on the lag of absence falling in value once unobserved effects have been controlled for. Barmby, Bojke and Treble (1997) include 5 lag dummies in their logistic specification and find a similar result.

Despite these findings, overall very few other economic studies appear to have exam-

ined the effect past absence has on current absence decisions. This is surprising given that in this and other studies that account for the lag of absence the largest and most significant coefficient is usually absence lagged 1 period. Also, as can be seen in Appendix A the significance and relative importance of some of the other explanatory variables appears to decline once some account is made for the lag of absence. For example, for men bonus pay, age and the dummy variable for marital status are significant when no account is made of lag structure, but become insignificant once absence lagged 1 period is included in the specification. Similarly, for women basic pay, having a degree and the presence of children are significant when no account is made of lag structure, but again become insignificant once absence lagged 1 period is included in the specification.

Other explanatory variables also have an important role to play on the probability of absence. In line with the findings of other studies (see, for example, Drago and Wooden (1992), Chaudhury and Ng (1992), and Kenyon and Dawkins (1989)) basic pay has a negative and significant effect on the probability of absence for males. However, its effect on female absence behaviour is largely insignificant. In contrast, bonus pay has a negative and significant effect on the probability of absence for women in all specifications, but is insignificant for men. This raises an important endogeneity problem for women since, as mentioned earlier, the negative relationship between absence and bonus pay could arise if females were rewarded for lower absence rates by receiving a higher bonus.

The coefficient on the management dummy is also negative and significant, indicating that managers are less likely to be absent from work than staff. For example, for males the predicted probability of absence decreases by 22.22% (from 0.009 to 0.007) if the 'representative' male worker goes from being a member of staff to management. Similarly, for females the predicted probability of absence decreases by 15.38% (from 0.013 to 0.011) when a woman enters the management grades. Such a finding is in line with expectations reflecting the fact that managers are likely to have more flexible employment contracts than staff.

For females tenure with the firm also has a negative and significant effect on the

probability of absence in all specifications. However, the effect is only slight. The results show that a 20% increase in tenure would cause the female absence rate to fall by 1.54% (from 0.0130 to 0.0128). In contrast, tenure has a slight positive and significant effect on male absence behaviour, and the results show that a 20% increase in tenure would cause the probability of absence for a 'representative' male worker to increase by 2.20% (from 0.0091 to 0.0093).

Important differences between men and women also emerge when looking at the effect personal characteristics have on absence behaviour. For females having a degree has a negative and significant effect on the probability of absence, but is insignificant for males. In contrast, for both men and women having a professional qualification has a negative and significant effect on the probability of absence.

Finally, the dummy variable for marital status is positive and significant for females, but insignificant for males. For women the results show that the predicted probability of absence increases by 6.15% (from 0.0130 to 0.0138) when a female gets married. Such a finding indicates that married women are more likely to be absent from work than single women and could reflect the dual role females usually experience in both the home and work. Married women may, for example, be more likely to be absent from work than single women in order to engage in non-market activities (e.g., child care).

4.7 Pay Spread and Absence Behaviour

In comparison to Section 4.6 this section pays particular attention to the incentive effects remuneration has on absence behaviour. Audas, Barmby and Treble (2000) use data from the administrative personnel records of the large U.K financial sector firm outlined in Chapter 2 to investigate how workers respond to remuneration differences and luck in the promotion system. They use absence as a proxy for effort and find that individuals respond to larger pay spreads (which in their analysis is made up of the employee's basic salary spread and bonus spread) by working harder. This section extends one

aspect of Audas, Barmby and Treble's (2000) analysis and decomposes pay spread into its component parts in order to investigate the effect basic salary spread and bonus spread individually has on absence behaviour. The effect lag structure has on these results is also examined.

4.7.1 Model

Audas, Barmby and Treble (2000) base their results on Lazear and Rosen's (1981) tournament model. As mentioned in Chapter 3 the essence of a tournament is that workers compete against one another for a fixed prize, which in the case of a firm is usually in the form of a promotion to a relatively better paid position. Consider again a tournament comprising of two-players (denoted by j and k) where the winner receives the fixed prize, W_{l+1}, and the loser receives the fixed prize, W_l, $W_{l+1} > W_l$. As before the optimal supply of effort for individual i is given by:

$$(W_{l+1} - W_l)\frac{\delta P}{\delta \mu_i} = C'(\mu_i) \qquad i = j, k \tag{4.22}$$

and the probability that worker j wins in a contest against an identical opponent k is given by:

$$P = \text{prob}(q_j > q_k) = \text{prob}(\mu_j - \mu_k > \varepsilon_k - \varepsilon_j) = G(\mu_j - \mu_k) \tag{4.23}$$

where G(.) is the cumulative distribution function for $\varepsilon_k - \varepsilon_j$. It follows from this that:

$$\frac{\delta P}{\delta \mu_j} = \frac{\delta G(\mu_j - \mu_k)}{\delta \mu_j} = g(\mu_j - \mu_k) \tag{4.24}$$

where g(.) is the probability density function for $\varepsilon_k - \varepsilon_j$. In equilibrium the effort levels

of the two individuals are assumed to be the same i.e., $\mu_j^* = \mu_k^*$ and at this point equation (4.22) becomes:

$$(W_{l+1} - W_l)g(0) = C'(\mu_i) \qquad i = j, k \tag{4.25}$$

As mentioned before since $C'(\mu_i)$ is monotonically increasing in μ the effort with which workers pursue their promotion increases with the size of the pay spread, $W_{l+1} - W_l$. Another implication of equation (4.25) is that the smaller is the importance of luck, the greater is the amount of effort used by employees to win their promotion contest.

4.7.2 Data and Variables

In this analysis, as in Audas, Barmby and Treble (2000), the impact of the promotion system on the supply of effort is measured using the absence rate as a proxy for effort. As before a logistic mixture model is used to estimate the probability of absence, such that:

$$y_{it} = \begin{cases} 1 \text{ if indivdual } i \text{ is absent} \\ 0 \text{ otherwise} \end{cases} \tag{4.26}$$

$i = 1, ..., N$, $t = 1, ..., T_i$, where i is the individual, and t are the time subscripts.

The explanatory variables in this analysis are the same as those included in the model outlined in the previous section, with one exception. In this analysis the difference in mean basic pay between workers in grade l and grade $l + 1$ (i.e., the basic pay spread), and the difference in mean bonus pay between employees in grade l and grade $l + 1$ (i.e., the bonus spread) are used as the compensation variables. As mentioned in Section 4.7.1 tournament theory suggests that the relationship between absence and remuneration spread should be negative; higher pay spreads should be associated with higher effort levels through the convexity of the cost function.

As outlined in Chapter 2 the firm has an explicit hierarchical structure in which workers can be assigned to one of 12 levels or grades; grades 2 to 6 represent the clerical grades, while grades 7 to 13 represent the management grades. However, since promotion in grades 2 to 4 is geared more to attainment of a standard than to demonstrating superiority over rivals when constructing remuneration spreads the individuals in these grades are dropped from the analysis. Workers can also be assigned to three other grades (grades 1, 98 and 99) which do not appear to be part of the conventional hierarchy. Individuals in these grades are thus not included in the resulting logistic model. Finally, since grades 11 to 13 are so sparsely populated workers in these grades are also ignored in the following analysis. Consequently, the data set outlined in Section 4.4 is restricted to individuals in grades 5 to 10 as in Audas, Barmby and Treble (2000), with the information on employees in grade 11 being included to define the prize for individuals in grade 10.

4.7.3 Empirical Results

The logistic model outlined in Section 4.5.1 is again estimated separately for both males and females. Maximum likelihood estimates of the logistic for absence lagged 7 days are presented in Tables 4.7 and 4.8 for men and women, respectively. Again for completeness maximum likelihood estimates of the logistic for absence lagged 6 days to absence lagged 0 days are presented in Appendix B. Columns I and II of these tables report the results for the standard logistic, while columns III and IV report the results for the logistic after controlling for heterogeneity.

These results again highlight the importance of controlling for lag structure. As can be seen in Appendix B, in the absence of lag structure bonus spread has a negative and significant effect on the probability of absence. However, once absence lagged 1 day is included in the analysis, bonus spread no longer has a significant effect on absence behaviour. In contrast, for both males and females basic pay spread has an insignificant effect on the probability of absence in all specifications.

As mentioned earlier, Audas, Barmby and Treble (2000) find that even after con-

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-5.165	-40.520	-5.079	-28.342
Ablag 7	0.538	4.830	0.262	2.412
Ablag 6	0.735	5.804	0.580	4.799
Ablag 5	0.120	1.017	0.065	0.571
Ablag 4	0.446	4.180	0.358	3.438
Ablag 3	0.230	2.555	0.165	1.844
Ablag 2	0.371	5.203	0.322	4.474
Ablag 1	5.038	104.635	4.694	92.602
Pay Spread	$0.342\text{x}10^{-4}$	1.057	$0.262\text{x}10^{-4}$	0.586
Bonus Spread	$-0.146\text{x}10^{-3}$	-2.027	$-0.133\text{x}10^{-3}$	-1.347
Tenure	0.007	1.674	0.008	1.305
Management	-0.336	-3.889	-0.302	-2.516
Degree	0.023	0.332	0.061	0.625
Professional Qualification	-0.203	-4.857	-0.212	-3.485
Age	0.005	1.246	0.007	1.324
Married	-0.024	-0.511	-0.025	-0.383
Children	-0.005	-0.236	-0.005	-0.182
Log-likelihood	-15959.436		-15757.309	
Number of Observations	1409		1409	

Table 4.7: Maximum Likelihood Estimates of Logistic Anaysis (7 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.578	-23.199	-4.375	-13.971
Ablag 7	0.657	10.928	0.444	7.413
Ablag 6	0.361	5.179	0.253	3.699
Ablag 5	0.237	3.477	0.174	2.606
Ablag 4	0.197	3.094	0.137	2.178
Ablag 3	0.422	7.575	0.358	6.484
Ablag 2	0.447	9.830	0.409	8.970
Ablag 1	4.294	135.951	4.091	125.943
Pay Spread	0.719×10^{-4}	1.072	0.123×10^{-4}	0.116
Bonus Spread	-0.198×10^{-3}	-1.482	-0.747×10^{-4}	-0.356
Tenure	-0.004	-1.789	-0.003	-0.912
Management	-0.354	-2.042	-0.238	-0.870
Degree	-0.162	-1.977	-0.080	-0.636
Professional Qualification	-0.095	-2.369	-0.120	-1.968
Age	-0.832×10^{-3}	-0.409	-0.814×10^{-3}	-0.256
Married	0.102	3.993	0.094	2.456
Children	0.002	0.088	0.003	0.091
Log-likelihood	-31610.412		-31294.499	
Number of Observations	1471		1471	

Table 4.8: Maximum Likelihood Estimates of Logistic Analysis (7 Lags) - Females.

trolling for the lag of absence pay spread (a combination of basic pay spread and bonus spread) has the proposed negative and significant effect on effort levels. Thus, although the results outlined above show that the remuneration variables are not individually significant they do have a negative and significant effect when combined. It should, however, be noted that an important difference between the two analyses is that Audas, Barmby and Treble (2000) take explicit account of 'luck', while in the results outlined in Appendix B aside from controlling for unobserved effects no direct account is taken of the 'luck' component.

The effect the remaining explanatory variables have on the probability of absence are largely the same as those outlined in Section 4.6.2.

4.8 Conclusion

This chapter seeks to add to the growing empirical literature on absenteeism by investigating some of the determinants of absence within our large financial sector firm. In doing so it highlights the importance past absence has on current absence decisions and shows that in all specifications the largest and most significant coefficient is the lag of absence. The positive sign on this coefficient indicates that individuals who were away from work the previous day have a higher probability of absence than those who have not experienced the event. Such a result is in line with expectations since absence is to some extent determined by the worker's state of health. Despite these findings, only a handful of other studies (for example, Barmby, Orme and Treble (1995) and Barmby, Bojke and Treble (1997)) have so far addressed the effect lag structure has on absence behaviour.

These results also highlight the importance of controlling for unobserved effects. In particular, as a result of 'spurious' state dependence the effect past absence has on current choices is, to some extent, over-estimated in a model that neglects heterogeneity.

Finally, in line with the findings of many other studies on absence, comparing the results by gender and family situation important differences emerge between individuals

in the variables which affect their absence behaviour. In particular, marital status is positive and significant for females, but insignificant for males. As mentioned earlier, such a finding indicates that married women are more likely to be absent from work than single women and could reflect the dual role females usually experience in both the home and work.

4.9 Appendix A

Maximum likelihood estimates of the logistic analysis for both men and women for absence lagged 7 days to absence lagged 1 day are presented below. In this section financial characteristics are represented by the worker's annual salary (comprising of the individual's basic pay and a regional allowance), and bonus pay.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.823	-68.890	-4.731	-45.861
Ablag 6	1.047	12.589	0.702	8.441
Ablag 5	0.186	1.852	0.102	1.049
Ablag 4	0.441	4.862	0.344	3.867
Ablag 3	0.157	2.031	0.087	1.125
Ablag 2	0.408	6.639	0.355	5.717
Ablag 1	4.930	118.604	4.615	105.752
Basic Pay	$-0.105\text{x}10^{-4}$	-4.136	$-0.130\text{x}10^{-4}$	-3.556
Bonus Pay	$-0.150\text{x}10^{-4}$	-2.071	$-0.832\text{x}10^{-5}$	-1.257
Tenure	0.009	2.818	0.010	1.980
Management	-0.253	-5.906	-0.246	-3.957
Degree	-0.007	-0.099	0.040	0.415
Professional Qualification	-0.223	-5.857	-0.229	-3.957
Age	0.002	0.889	0.004	0.966
Married	-0.062	-1.452	-0.052	-0.860
Children	0.003	0.167	0.003	0.095
Log-likelihood	-20966.498		-20701.614	
Number of Observation	1685		1685	

Table 4.9: Maximum Likelihood Estimates of Logistic Analysis (6 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.316	-84.475	-4.362	-53.358
Ablag 6	0.715	15.614	0.462	9.999
Ablag 5	0.370	6.869	0.278	5.243
Ablag 4	0.170	3.331	0.097	1.927
Ablag 3	0.445	9.935	0.370	8.304
Ablag 2	0.395	10.784	0.348	9.425
Ablag 1	4.245	165.680	4.053	153.713
Basic Pay	$0.275\text{x}10^{-5}$	0.659	$0.962\text{x}10^{-5}$	1.421
Bonus Pay	$-0.229\text{x}10^{-3}$	-4.408	$-0.282\text{x}10^{-3}$	-3.722
Tenure	-0.006	-2.912	-0.007	-2.176
Management	-0.145	-2.480	-0.195	-2.177
Degree	-0.222	-2.761	-0.181	-1.456
Professional Qualification	-0.112	-3.046	-0.152	-2.599
Age	$-0.730\text{x}10^{-3}$	-0.446	$-0.773\text{x}10^{-3}$	-0.290
Married	0.068	3.199	0.069	2.067
Children	0.010	0.513	0.018	0.564
Log-likelihood	-47221.867		-46715.200	
Number of Observations	2052		2052	

Table 4.10: Maximum Likelihood Estimates of Logistic Analysis (6 Lags) - Females.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.822	-68.922	-4.737	-44.376
Ablag 5	0.930	11.727	0.557	6.978
Ablag 4	0.495	5.483	0.371	4.178
Ablag 3	0.176	2.283	0.091	1.180
Ablag 2	0.418	6.818	0.357	5.732
Ablag 1	4.934	118.923	4.612	105.637
Basic Pay	$-0.104\text{x}10^{-4}$	-4.135	$-0.136\text{x}10^{-4}$	-3.619
Bonus Pay	$-0.155\text{x}10^{-4}$	-2.113	$-0.804\text{x}10^{-5}$	-1.211
Tenure	0.010	3.005	0.010	1.992
Management	-0.250	-5.858	-0.251	-3.916
Degree	-0.021	-0.301	0.040	0.400
Professional Qualification	-0.229	-6.022	-0.242	-4.000
Age	0.003	0.955	0.004	0.974
Married	-0.071	-1.649	-0.053	-0.853
Children	0.002	0.096	0.001	0.046
Log-likelihood	-21039.608		-20735.327	
Number of Observations	1685		1685	

Table 4.11: Maximum Likelihood Estimates of Logistic Analysis (5 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.317	-84.623	-4.368	-52.454
Ablag 5	0.843	19.440	0.562	12.762
Ablag 4	0.223	4.417	0.125	2.497
Ablag 3	0.469	10.520	0.380	8.552
Ablag 2	0.400	10.958	0.348	9.434
Ablag 1	4.254	166.338	4.054	153.817
Basic Pay	0.278×10^{-5}	0.668	0.987×10^{-5}	1.450
Bonus Pay	-0.227×10^{-3}	-4.396	-0.285×10^{-3}	-3.793
Tenure	-0.006	-2.850	-0.008	-2.230
Management	-0.153	-2.610	-0.203	-2.217
Degree	-0.216	-2.696	-0.179	-1.414
Professional Qualification	-0.110	-3.005	-0.155	-2.592
Age	-0.557×10^{-3}	-0.341	-0.684×10^{-3}	-0.248
Married	0.071	3.348	0.071	2.084
Children	0.008	0.423	0.017	0.535
Log-likelihood	-47337.916		-46763.576	
Number of Observations	2052		2052	

Table 4.12: Maximum Likelihood Estimates of Logistic Analysis (5 Lags) - Females.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.828	-69.093	-4.748	-43.315
Ablag 4	1.163	16.914	0.731	10.270
Ablag 3	0.220	2.878	0.109	1.421
Ablag 2	0.423	6.920	0.355	5.705
Ablag 1	4.944	119.478	4.615	105.618
Basic Pay	$-0.106\text{x}10^{-4}$	-4.206	$-0.143\text{x}10^{-4}$	-3.718
Bonus Pay	$-0.159\text{x}10^{-4}$	-2.139	$-0.776\text{x}10^{-5}$	-1.165
Tenure	0.010	3.203	0.011	2.003
Management	-0.244	-5.717	-0.253	-3.840
Age	0.003	1.088	0.004	1.018
Degree	-0.038	-0.557	0.037	0.366
Professional Qualification	-0.234	-6.188	-0.254	-4.023
Married	0.078	-1.812	-0.053	-0.830
Children	$-0.182\text{x}10^{-4}$	-0.001	$-0.799\text{x}10^{-4}$	$0.272\text{x}10^{-2}$
Log-likelihood	-21103.807		-20758.682	
Number of Observations	1685		1685	

Table 4.13: Maximum Likelihood Estimates of Logistic Analysis (4 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.320	-84.920	-4.378	-51.201
Ablag 4	0.767	19.845	0.477	11.565
Ablag 3	0.520	11.752	0.407	9.195
Ablag 2	0.423	11.624	0.358	9.698
Ablag 1	4.257	166.999	4.051	153.830
Basic Pay	$0.253\text{x}10^{-5}$	0.610	$0.995\text{x}10^{-5}$	1.443
Bonus Pay	$-0.228\text{x}10^{-3}$	-4.422	$-0.291\text{x}10^{-3}$	-3.905
Tenure	-0.006	-2.743	-0.008	-2.291
Management	-0.157	-2.685	-0.208	-2.223
Degree	-0.206	-2.596	-0.176	-1.361
Professional Qualification	-0.112	-3.078	-0.164	-2.655
Age	$-0.806\text{x}10^{-4}$	-0.050	$-0.313\text{x}10^{-3}$	-0.109
Married	0.075	3.510	0.073	2.086
Children	0.006	0.283	0.016	0.475
Log-likelihood	-47514.523		-46841.424	
Number of Observations	2052		2052	

Table 4.14: Maximum Likelihood Esitmates of Logistic Analysis (4 Lags) - Females.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.848	-69.468	-4.774	-41.888
Ablag 3	1.043	17.674	0.566	9.026
Ablag 2	0.458	7.501	0.368	5.895
Ablag 1	4.947	119.925	4.613	105.387
Basic Pay	$-0.107\text{x}10^{-4}$	-4.270	$-0.152\text{x}10^{-4}$	-3.849
Bonus Pay	$-0.173\text{x}10^{-4}$	-2.223	$-0.756\text{x}10^{-5}$	-1.124
Tenure	0.011	3.549	0.011	2.000
Management	-0.233	-5.493	-0.257	-3.710
Degree	-0.066	-0.951	0.034	0.318
Professional Qualfication	-0.241	-6.387	-0.272	-3.963
Age	0.004	1.386	0.005	1.108
Married	-0.091	-2.136	-0.053	-0.799
Children	-0.002	-0.108	-0.002	-0.072
Log-likelihood	-21234.777		-20808.657	
Number of Observations	1685		1685	

Table 4.15: Maximum Likelihood Estimates of Logistic Analysis (3 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.328	-85.288	-4.394	-49.922
Ablag 3	1.064	31.167	0.702	19.573
Ablag 2	0.460	12.725	0.375	10.170
Ablag 1	4.271	168.338	4.055	154.103
Basic Pay	$0.204\text{x}10^{-5}$	0.493	$0.971\text{x}10^{-5}$	1.388
Bonus Pay	$-0.228\text{x}10^{-3}$	-4.452	$-0.295\text{x}10^{-3}$	-4.009
Tenure	-0.005	-2.551	$-0.842\text{x}10^{-2}$	-2.321
Management	-0.162	-2.777	-0.212	-2.210
Degree	-0.191	-2.419	-0.170	-1.285
Professional Qualification	-0.117	-3.217	-0.176	-2.772
Age	$0.517\text{x}10^{-3}$	0.319	$0.221\text{x}10^{-3}$	0.073
Married	0.080	3.758	0.076	2.099
Children	0.003	0.177	0.015	0.429
Log-likelihood	-47700.038		-46905.986	
Number of Observations	2052		2052	

Table 4.16: Maximum Likelihood Estimates of Logistic Analysis (3 Lags) - Females.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.875	-70.011	-4.793	-40.667
Ablag 2	1.165	25.049	0.698	13.780
Ablag 1	4.965	120.915	4.624	105.413
Basic Pay	-0.109×10^{-4}	-4.389	-0.165×10^{-4}	-4.069
Bonus Pay	-0.187×10^{-4}	-2.341	-0.743×10^{-5}	-1.097
Tenure	0.013	4.136	0.012	2.157
Management	-0.218	-5.192	-0.254	-3.518
Degree	-0.102	-1.464	0.029	0.265
Professional Qualification	-0.255	-6.800	-0.307	-4.111
Age	0.005	1.721	0.005	1.058
Married	-0.109	-2.580	-0.049	-0.711
Children	-0.005	-0.265	-0.004	-0.112
Log-likelihood	-21382.348		-20848.092	
Number of Observations	1685		1685	

Table 4.17: Maximum Likelihood Estimates of Logistic Analysis (2 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.343	-86.006	-4.436	-47.851
Ablag 2	1.167	41.670	0.787	26.191
Ablag 1	4.296	170.766	4.066	154.747
Basic Pay	0.650×10^{-6}	0.157	0.845×10^{-5}	1.172
Bonus Pay	-0.224×10^{-3}	-4.407	-0.299×10^{-3}	-4.156
Tenure	-0.004	-2.117	-0.009	-2.301
Management	-0.173	-2.981	-0.214	-2.131
Degree	-0.158	-2.030	-0.154	-1.117
Professional Qualification	-0.128	-3.538	-0.201	-3.028
Age	0.002	1.190	0.002	0.571
Married	0.088	4.175	0.078	2.038
Children	-0.880×10^{-3}	-0.045	0.013	0.371
Log-likelihood	-48152.193		-47088.730	
Number of Observations	2052		2052	

Table 4.18: Maximum Likelihood Estimates of Logistic Analysis (2 Lags) - Females.

Logistic Specification				
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.936	-71.532	-4.818	-40.655
Ablag 1	5.689	187.994	5.009	146.170
Basic Pay	-0.116×10^{-4}	-4.729	-0.191×10^{-4}	-4.776
Bonus Pay	-0.203×10^{-4}	-2.413	-0.672×10^{-5}	-0.977
Tenure	0.015	4.967	0.016	2.904
Management	-0.200	-4.826	-0.240	-3.353
Degree	-0.158	-2.251	0.022	0.185
Professional Qualification	-0.277	-7.482	-0.385	-5.684
Age	0.007	2.484	0.004	0.896
Married	-0.127	-3.053	-0.029	-0.429
Children	-0.006	-0.332	-0.002	-0.061
Log-likelihood	-21688.843		-20940.175	
Number of Observations	1685		1685	

Table 4.19: Maximum Likelihood Estimates of Logistic Analysis (1 Lag) - Males.

Logistic Specification

	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.360	-87.201	-4.507	-46.614
Ablag 1	5.010	261.206	4.499	216.074
Basic Pay	$-0.366\text{x}10^{-5}$	-0.892	$0.363\text{x}10^{-5}$	0.488
Bonus Pay	$-0.205\text{x}10^{-3}$	-4.118	$-0.297\text{x}10^{-3}$	-4.253
Tenure	-0.002	-1.127	-0.009	-2.173
Management	-0.175	-3.056	-0.184	-1.779
Degree	-0.096	-1.271	-0.122	-0.907
Professional Qualification	-0.160	-4.443	-0.245	-3.621
Age	0.004	2.735	0.005	1.428
Married	0.104	5.028	0.079	1.917
Children	-0.007	-0.388	0.014	0.391
Log-likelihood	-48982.188		-47418.304	
Number of Observations	2052		2052	

Table 4.20: Maximum Likelihood Estimates of Logistic Analysis (1 Lag) - Females.

Logistic Specification

	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-3.857	-79.395	-4.067	-44.778
Basic Pay	-0.152×10^{-4}	-7.694	-0.247×10^{-4}	-6.159
Bonus Pay	-0.818×10^{-4}	-5.484	-0.116×10^{-4}	-1.510
Tenure	0.019	9.030	0.029	7.328
Management	-0.301	-9.299	-0.109	-1.956
Degree	-0.317	-5.618	-0.028	-0.171
Professional Qualification	-0.417	-15.446	-0.243	-4.879
Age	0.013	7.171	0.006	1.953
Married	-0.219	-7.164	-0.137	-2.465
Children	-0.017	-1.217	0.033	1.016
Log-likelihood	-40882.782		-33492.322	
Number of Observations	1685		1685	

Table 4.21: Maximum Likelihood Estimates of Logistic Analysis (0 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-3.268	-87.979	-4.086	-52.269
Basic Pay	-0.719×10^{-5}	-2.280	0.177×10^{-4}	2.660
Bonus Pay	-0.366×10^{-3}	-7.627	-0.263×10^{-3}	-4.491
Tenure	-0.003	-2.152	-0.017	-5.442
Management	-0.263	-5.868	-1.029	-12.833
Degree	-0.114	-1.928	0.816	9.257
Professional Qualification	-0.253	-9.105	-0.508	-10.107
Age	0.006	5.459	0.021	9.376
Married	0.177	11.419	0.204	5.552
Children	-0.010	-0.711	-0.080	-3.531
Log-likelihood	-87561.028		-74023.710	
Number of Observations	2052		2052	

Table 4.22: Maximum Likelihood Estimates of Logistic Analysis (0 Lags) - Females.

4.10 Appendix B

Again maximum likelihood estimates of the logistic analysis for males and females for absence lagged 7 days to absence lagged 1 day are presented below. However, in this section financial characteristics are represented by pay spread and bonus spread.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-5.170	-40.596	-5.083	-28.099
Ablag 6	1.109	11.367	0.750	7.717
Ablag 5	0.153	1.297	0.078	0.683
Ablag 4	0.464	4.356	0.363	3.494
Ablag 3	0.241	2.675	0.168	1.869
Ablag 2	0.374	5.245	0.322	4.466
Ablag 1	5.045	104.862	4.696	92.601
Pay Spread	$0.343\text{x}10^{-4}$	1.065	$0.256\text{x}10^{-4}$	0.567
Bonus Spread	$-0.146\text{x}10^{-3}$	-2.033	$-0.132\text{x}10^{-3}$	-1.330
Tenure	0.007	1.744	0.008	1.317
Management	-0.334	-3.870	-0.302	-2.491
Degree	0.018	0.253	0.060	0.609
Professional Qualification	-0.206	-4.927	-0.217	-3.515
Age	0.005	1.274	0.007	1.306
Married	-0.028	-0.588	-0.025	-0.380
Children	-0.006	-0.273	-0.005	-0.186
Log-likelihood	-15970.852		15760.178	
Number of Observations	1409		1409	

Table 4.23: Maximum Likelihood Estimates of Logistic Analysis (6 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.597	-23.348	-4.388	-13.818
Ablag 6	0.778	13.681	0.521	9.095
Ablag 5	0.300	4.443	0.210	3.175
Ablag 4	0.223	3.518	0.150	2.389
Ablag 3	0.435	7.828	0.363	6.568
Ablag 2	0.455	10.041	0.413	9.060
Ablag 1	4.297	136.337	4.089	125.989
Pay Spread	0.776×10^{-4}	1.160	0.157×10^{-4}	0.146
Bonus Spread	-0.212×10^{-3}	-1.588	-0.839×10^{-4}	-0.394
Tenure	-0.004	-1.689	-0.003	-0.898
Management	-0.369	-2.137	-0.250	-0.900
Degree	-0.155	-1.892	-0.077	-0.607
Professional Qualification	-0.098	-2.447	-0.122	-1.947
Age	-0.672×10^{-3}	-0.331	-0.734×10^{-3}	-0.227
Married	0.104	4.108	0.095	2.447
Children	0.001	0.041	0.003	0.074
Log-likelihood	-31667.745		-31321.135	
Number of Observations	1471		1471	

Table 4.24: Maximum Likelihood Estimates of Logistic Analysis (6 Lags) - Females.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-5.170	-40.663	-5.086	-27.196
Ablag 5	0.949	10.187	0.569	6.098
Ablag 4	0.516	4.869	0.389	3.747
Ablag 3	0.266	2.962	0.175	1.946
Ablag 2	0.385	5.412	0.323	4.472
Ablag 1	5.048	105.121	4.693	92.454
Pay Spread	$0.348\text{x}10^{-4}$	1.082	$0.230\text{x}10^{-4}$	0.496
Bonus Spread	$-0.147\text{x}10^{-3}$	-1.605	$-0.129\text{x}10^{-3}$	-1.267
Tenure	0.007	1.875	0.008	1.327
Management	-0.334	-3.882	-0.304	-2.426
Degree	0.005	0.073	0.058	0.572
Professional Qualification	-0.211	-5.053	-0.230	-3.594
Age	0.005	1.343	0.007	1.263
Married	-0.037	-0.770	-0.025	-0.365
Children	-0.007	-0.357	-0.006	-0.215
Log-likelihood	-16030.088		-15788.254	
Number of Observations	1409		1409	

Table 4.25: Maximum Likelihood Estimates of Logistic Analysis (5 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.601	-23.505	-4.399	-13.612
Ablag 5	0.818	15.034	0.532	9.644
Ablag 4	0.285	4.520	0.183	2.945
Ablag 3	0.462	8.346	0.375	6.795
Ablag 2	0.461	10.197	0.414	9.081
Ablag 1	4.304	136.840	4.089	126.032
Pay Spread	0.793×10^{-4}	1.192	0.182×10^{-4}	0.166
Bonus Spread	-0.213×10^{-3}	-1.192	-0.918×10^{-4}	-0.424
Tenure	-0.004	-1.638	-0.004	-0.921
Management	-0.382	-2.221	-0.262	-0.930
Degree	-0.149	-1.835	-0.073	-0.564
Professional Qualification	-0.096	-2.413	-0.121	-1.856
Age	-0.557×10^{-3}	-0.274	-0.669×10^{-3}	-0.200
Married	0.110	4.321	0.098	2.466
Children	-0.528×10^{-3}	-0.022	0.002	0.044
Log-likelihood	-31756.213		-31360.921	
Number of Observations	1471		1471	

Table 4.26: Maximum Likelihood Estimates of Logistic Analysis (5 Lags) - Females.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-5.177	-40.774	-5.090	-26.467
Ablag 4	1.202	14.895	0.760	9.135
Ablag 3	0.313	3.507	0.194	2.167
Ablag 2	0.391	5.519	0.321	4.443
Ablag 1	5.059	105.620	4.697	92.424
Pay Spread	0.351×10^{-4}	1.097	0.191×10^{-4}	0.399
Bonus Spread	-0.148×10^{-3}	-2.083	-0.123×10^{-3}	-1.181
Tenure	0.008	2.042	0.008	1.348
Management	-0.330	-3.849	-0.299	-2.318
Degree	-0.012	-0.167	0.054	0.516
Professional Qualification	-0.217	-5.203	-0.244	-3.678
Age	0.005	1.419	0.007	1.242
Married	-0.044	-0.929	-0.024	-0.339
Children	-0.009	-0.448	-0.007	-0.240
Log-likelihood	-16078.556		-15806.105	
Number of Observations	1409		1409	

Table 4.27: Maximum Likelihood Estimates of Logistic Analysis (4 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coeffiicient	t-ratio
Constant	-4.620	-23.754	-4.418	-13.423
Ablag 4	0.843	16.980	0.517	10.121
Ablag 3	0.516	9.398	0.403	7.344
Ablag 2	0.482	10.699	0.423	9.272
Ablag 1	4.309	137.406	4.087	126.043
Pay Spread	0.835×10^{-4}	1.264	0.216×10^{-4}	0.194
Bonus Spread	-0.221×10^{-3}	-1.673	-0.102×10^{-3}	-0.466
Tenure	-0.004	-1.590	-0.004	-0.968
Management	-0.398	-2.330	-0.276	-0.961
Degree	-0.142	-1.753	-0.071	-0.541
Professional Qualification	-0.098	-2.465	-0.123	-1.801
Age	-0.145×10^{-3}	-0.072	-0.386×10^{-3}	-0.111
Married	0.114	4.498	0.101	2.462
Children	-0.002	-0.096	-0.641×10^{-3}	-0.016
Log-likelihood	-31862.159		-31405.511	
Number of Observations	1471		1471	

Table 4.28: Maximum Likelihood Estimates of Logistic Analysis (4 Lags) - Females.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-5.207	-41.185	-5.207	-41.185
Ablag 3	1.172	17.162	1.172	17.162
Ablag 2	0.427	6.044	0.427	6.044
Ablag 1	5.065	106.101	5.065	106.101
Pay Spread	0.364×10^{-4}	1.145	0.364×10^{-4}	1.145
Bonus Spread	-0.152×10^{-3}	-2.147	-0.152×10^{-3}	-2.147
Tenure	0.009	2.296	0.009	2.296
Management	-0.325	-3.812	-0.325	-3.812
Degree	-0.039	-0.542	-0.039	-0.524
Professional Qualification	-0.222	-5.346	-0.222	-5.346
Age	0.006	1.692	0.006	1.692
Married	-0.059	-1.254	-0.059	-1.254
Children	-0.011	-0.556	-0.011	-0.556
Log-likelihood	-16179.916		-16179.916	
Number of Observations	1409		1409	

Table 4.29: Maximum Likelihood Estimates of Logistic Analysis (3 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.643	-23.936	-4.435	-13.201
Ablag 3	1.095	25.855	0.722	16.233
Ablag 2	0.526	11.742	0.444	9.754
Ablag 1	4.323	138.533	4.091	126.258
Pay Spread	$0.866\text{x}10^{-4}$	1.314	$0.218\text{x}10^{-4}$	0.193
Bonus Spread	$-0.229\text{x}10^{-3}$	-1.737	$-0.108\text{x}10^{-3}$	-0.485
Tenure	-0.003	-1.496	-0.004	-1.022
Management	-0.413	-2.426	-0.283	-0.965
Degree	-0.127	-1.583	-0.067	-0.504
Professional Qualification	-0.101	-2.549	-0.129	-1.758
Age	$0.434\text{x}10^{-3}$	0.216	$0.337\text{x}10^{-4}$	$0.922\text{x}10^{-2}$
Married	0.122	4.806	0.104	2.467
Children	-0.004	-0.169	-0.004	-0.089
Log-likelihood	-31997.480		-31454.826	
Number of Observation	1471		1471	

Table 4.30: Maximum Likelihood Estimates of Logistic Analysis (3 Lags) - Females.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-5.256	-41.787	-5.090	-24.431
Ablag 2	1.228	22.807	0.726	12.306
Ablag 1	5.084	-2.326	4.709	92.179
Pay Spread	0.407×10^{-4}	1.294	-0.521×10^{-5}	-0.103
Bonus Spread	-0.163×10^{-3}	-2.326	-0.820×10^{-4}	-0.737
Tenure	0.011	2.861	0.011	1.550
Management	-0.322	-3.813	-0.258	-1.874
Degree	-0.079	-1.080	0.045	0.390
Professional Qualification	-0.237	-5.748	-0.306	-4.197
Age	0.007	1.992	0.007	1.087
Married	-0.081	-1.717	-0.006	-0.077
Children	-0.015	-0.741	-0.012	-0.364
Log-likelihood	-16318.310		-15886.861	
Number of Observations	1409		1409	

Table 4.31: Maximum Likelihood Estimates of Logistic Analysis (2 Lags) - Males.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.709	-24.473	-4.500	-12.808
Ablag 2	1.261	36.659	0.869	23.541
Ablag 1	4.353	140.815	4.105	126.918
Pay Spread	0.986×10^{-4}	1.508	0.276×10^{-4}	0.237
Bonus Spread	-0.258×10^{-3}	-1.972	-0.130×10^{-3}	-0.560
Tenure	-0.003	-1.309	-0.462×10^{-2}	-1.060
Management	-0.457	-2.701	-0.310	-1.014
Degree	-0.097	-1.222	-0.060	-0.436
Professional Qualification	-0.109	-2.770	-0.140	-1.617
Age	0.002	0.908	0.130×10^{-2}	0.321
Married	0.134	5.339	0.108	2.409
Children	-0.009	-0.385	-0.933×10^{-2}	-0.219
Log-likelihood	-32307.992		-31580.414	
Number of Observations	1471		1471	

Table 4.32: Maximum Likelihood Estimates of Logistic Analysis (2 Lags) - Females.

Logistic Specification				
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-5.354	-43.080	-5.073	-23.675
Ablag 1	5.855	168.357	5.113	128.412
Pay Spread	0.500×10^{-4}	1.620	-0.214×10^{-4}	0.405
Bonus Spread	-0.187×10^{-3}	-2.711	-0.562×10^{-4}	-0.475
Tenure	0.014	3.618	0.014	2.057
Management	-0.329	-3.973	-0.230	-1.631
Degree	-0.138	-1.893	0.049	0.401
Professional Qualification	-0.259	-6.376	-0.373	-4.953
Age	0.009	2.583	0.005	0.709
Married	-0.106	-2.292	0.026	0.336
Children	-0.016	-0.780	-0.017	-0.491
Log-likelihood	-16572.566		-15960.426	
Number of Observations	1409		1409	

Table 4.33: Maximum Likelihood Estimates of Logistic Analysis (1 Lag) - Males.

Logistic Specification

	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.869	-25.654	-4.755	-12.971
Ablag 1	5.131	218.451	4.585	178.729
Pay Spread	0.133×10^{-3}	2.056	0.725×10^{-4}	0.599
Bonus Spread	-0.343×10^{-3}	-2.656	-0.245×10^{-3}	-1.015
Tenure	-0.001	-0.650	-0.005	-1.026
Management	-0.546	-3.277	-0.444	-1.356
Degree	-0.037	-0.484	-0.046	-0.344
Professional Qualification	-0.137	-3.510	-0.115	-1.010
Age	0.004	2.109	0.005	1.027
Married	0.157	6.318	0.109	2.201
Children	-0.018	-0.761	-0.019	-0.434
Log-likelihood	-32949.200		-31845.720	
Number of Observations	1471		1471	

Table 4.34: Maximum Likelihood Estimates of Logistic Analysis (1 Lag) - Females.

Logistic Specification

	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.435	-48.769	-4.682	-26.872
Pay Spread	0.916×10^{-4}	3.670	0.507×10^{-4}	1.464
Bonus Spread	-0.327×10^{-3}	-5.856	-0.279×10^{-3}	-3.548
Tenure	0.017	6.536	0.042	9.191
Management	-0.558	-8.493	-0.469	-4.898
Degree	-0.261	-4.511	0.361	2.646
Professional Qualification	-0.385	-13.349	-0.307	-5.789
Age	0.018	7.620	0.010	2.073
Married	-0.168	-5.085	-0.332	-5.336
Children	-0.044	-2.959	0.049	1.703
Log-likelihood	-32268.669		-25892.929	
Number of Observations	1409		1409	

Table 4.35: Maximum Likelihood Estimates of Logistic Analysis (0 Lags) - Males.

Logistic Specification

	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-4.184	-30.408	-4.184	-30.408
Pay Spread	0.270×10^{-3}	0.770	0.270×10^{-3}	0.770
Bonus Spread	-0.701×10^{-3}	-7.244	-0.701×10^{-3}	-7.244
Tenure	-0.002	-0.947	-0.002	-0.947
Management	-1.006	-8.351	-1.006	-8.351
Degree	-0.005	-0.083	-0.005	-0.083
Professional Qualification	-0.210	-7.035	-0.210	-7.035
Age	0.006	4.265	0.006	4.265
Married	0.266	14.438	0.266	14.438
Children	-0.027	-1.580	-0.027	-1.580
Log-likelihood	-60309.542		-60309.542	
Number of Observations	1471		1471	

Table 4.36: Maximum Likelihood Estimates of Logistic Analysis (0 Lags) - Females.

Chapter 5

Turnover

5.1 Introduction

The pattern of labour turnover in the U.K has been investigated extensively in a number of studies. Booth, Francesconi and Garcia-Serrano (1999), for example, investigate job mobility and job tenure using work history data from the British Household Panel Survey over the period 1915 to 1990. They find that, on average, individuals in Britain hold 5 jobs during their working life. They show this job changing to be greatest among young workers who are still in the process of finding a good lifetime job match and find that half of all job changes take place during the first 10 years of the individual's working life. Similarly, Gregg and Wadsworth (1995) using data from the Labour Force Survey for the years 1975, 1984, 1989, and 1993 finds that over half of all job changes take place before the age of 30.

In contrast, evidence for the U.S suggests that the number of jobs held by workers in the U.S is approximately double the number held by those in the U.K. Hall (1982), for example, using data from the Current Population Survey finds that the average individual in the U.S holds approximately 10 jobs during their lifetime. However, in line with the results outlined above he shows that this job changing is most intense among young workers, and finds that by the age of 24 individuals have on average experienced 4 out

of the 10 jobs they will hold during their entire career. Hall (1982) shows that between the ages of 25 and 39 an average of 4 job changes take place, while from 39 onwards, when near lifetime work is characteristic, on average less than 3 more job changes occur. Similarly, Topel and Ward (1992) using data from the Longitudinal Employee-Employer data file between 1957 and 1972 finds that by the tenth year of entry into the labour market over half of young men in the U.S have held 6 or more jobs, while over a third have held 8 jobs or more.

This chapter uses data from the personnel and payroll records of the large U.K financial sector organisation outlined in Chapter 2 to investigate the separation behaviour of new entrants i.e., those workers who entered the firm between January 1989 and March 1997. The aim of this chapter is to again look at gender differences in order to examine whether males and females differ in the factors that affect their turnover behaviour. Two modes of analysis are used to examine this behaviour; the incidence of separation is estimated using a random effects logistic model and duration models with competing risks of exit due to quits, layoffs or 'other reasons' are used to estimate the hazard of separation.

This chapter is organised as follows. Section 5.2 provides a summary of some of the economic theory behind labour turnover. Section 5.3 reviews some of the empirical evidence on labour turnover. A description of the data and model being used is given in Sections 5.4 and 5.5, respectively. Key empirical results are reported in Section 5.6, while implications for future work and the conclusions are presented in Section 5.7.

5.2 Theory

5.2.1 Matching Models

In these models turnover occurs as a result of the arrival of new information about the worker's current job match, or because of the arrival of new information about an alternative job. The most widely cited job matching model is Jovanovic (1979), the main

points of which are outlined below.

Jovanovic (1979) makes three assumptions in his job matching theory of labour turnover. First, workers are assumed to have different levels of productivity in different jobs, and have differing levels of productivity when performing the same task. Second, contracts are assumed to be made with workers on an individual basis enabling employers to award a higher relative wage to those workers who match their jobs well. Third, both employers and employees are assumed to have imperfect information about the allocation of workers to their optimal task. The quality of the job match is thus unknown to both employers and employees at the time of hiring.

The essence of Jovanovic's (1979) model is that over time both employers and employees learn about the quality of the job match. It follows from this that individuals will only remain on jobs in which their productivity is revealed to be relatively high, and leave jobs in which their productivity is revealed to be relatively low.

Jovanovic (1979) also predicts that the relationship between the hazard of separation and tenure is non-monotonic. In other words, as both employees and employers learn more about the quality of the job match the hazard of separation should rise as poorly matched workers leave the organisation. However, as tenure increases only the well-matched individuals remain with the firm causing the hazard of hazard of separation to fall.

5.2.2 Human Capital Theory

Human capital theory also provides important insights into labour turnover. Investment in human capital can take two forms; general or specific. General training tends to increase the productivity of workers not only in the organisation providing the training, but also in all other firms. Specific training, on the other hand, tends to raise the individual's productivity more in the firm providing the training than elsewhere. It should be noted that whether training is general or specific affects who bears the cost of this investment, which in turn has implications for labour turnover behaviour.

The issue of who bears the costs in the case of general training is relatively straightforward. Since general training increases the marginal product of workers not only in the organisation providing the training but also in all other firms, employers are unwilling to bear the costs of this investment and pay the worker a competitive wage during and after training in case the worker leaves before the firm can reap the benefits of its investment. The costs of general training are thus borne by the worker.

The case of who bears the costs of specific training is less straightforward. Employers are again unwilling to bear the total costs of this training in case the workers leave before the firm can reap the benefits of its investment. Similarly, since the skills the employees acquire during specific training are difficult to re-employ elsewhere workers are also unwilling to bear the total costs of this training. Under these circumstances, the costs and returns are usually shared (although not necessarily equally) between the employees and the firm. Workers may, for example, be paid more than their marginal product while training but paid less than their marginal product after training.

From this both Becker (1962) and Parsons (1972) argue that labour turnover is likely to be lower in firms with large investments in firm-specific human capital than in organisations with no training or just general training. They assert that since the costs of any investment in firm-specific capital are usually borne by both workers and the firm, employees should have less of an incentive to quit and firms ought to have less of an incentive to lay them off if both parties are to reap the returns from their investments.

Consider, for example, a firm which experiences an unexpected fall in demand for its product, the rest of the economy being unaffected. Becker (1962) argues that since the marginal product of workers without specific training i.e., the untrained or those with just general training is initially equal to wages, a fall in demand should cause these workers to be laid off in order to prevent their marginal product from falling below wages. In contrast, since the marginal product of workers with specific training is initially greater than wages (as it must be if the firm is to reap any returns from its investment) Becker (1962) and Parsons (1972) assert that providing the decline in demand does not cause

the individual's marginal product to fall below wages the firm has no incentive to layoff these workers. The organisation would, in fact, suffer a capital loss if such workers were permanently lost to the firm. Similarly, Becker (1962) argues that if the decline in demand were to push the marginal product of workers with specific training below wages, these individuals would only be laid off if the decline in demand were thought to be permanent. Any worker laid off by the firm would seek employment elsewhere causing the firm's investment in the individual to be lost forever. It follows from this that the larger the organisations's investment in a worker the lower is the firm's incentive to lay him/her off.

Becker (1962) also extends his analysis to cover general declines in demand where wages are sticky and remain at their initial level. He argues that under these circumstances the above conditions would still hold, but with one notable exception. During a general decline in demand the firm would have a greater incentive to layoff workers with specific training than when it alone experiences a fall in demand, since during a general downturn workers with specific training are less likely to find employment elsewhere.

The analysis so far has concentrated on layoffs. Becker (1962) nevertheless asserts that similar reasons can be used to show that compared with other workers the quit rate of specifically trained workers is also relatively low and fluctuates less during the business cycle. In other words, since the marginal product of workers with specific training is initially greater than wages, the earnings that could be received elsewhere would have to be greater than this initial difference in order to induce individuals to quit.

Scoones and Bernhardt (1998) explore the accumulation of human capital further and examine the employee's decision to invest in firm-specific capital or general capital. As mentioned above, since the skills the employees acquire during specific training are difficult to re-employ elsewhere standard theory suggests that workers should be unwilling to invest in firm-specific capital unless higher wages are guaranteed by long-term contracts. However, Scoones and Bernhardt (1998) show that with asymmetric information workers may choose to invest in firm-specific capital rather than general capital even without

long-term contracts.

They argue that before a worker is promoted only the individual's present employer knows the worker's ability, and so the employer does not have to compensate the individual fully for his/her ability. However, in order to exploit this ability, the employee must be promoted. As mentioned in Chapter 3, when a worker is promoted it signals information to competing firms that s/he is of a higher ability, leading to a wage increase. Scoones and Bernhardt (1998) assert that since by investing in firm-specific skills a worker increases his/her likelihood of promotion, which in turn ensures higher wages, workers maybe willing to forgo general capital investment for specific investment.

5.3 Literature Review

This section gives a brief review of some of the empirical literature on the causes and consequences of labour turnover. It should be noted that although, as shown in the introduction to this chapter, the pattern of labour turnover in the U.K has been investigated in a number of studies very little attention has been paid by U.K economists into the determinants of labour turnover. This is in contrast to the U.S where researchers appear to have a long history of looking at worker separation behaviour.

5.3.1 Kaplan-Meier Estimates

Most studies on labour turnover tend to begin their empirical analysis by conducting a preliminary graphical analysis of the raw data by plotting the Kaplan-Meier estimates of the hazard of separation[1]. A common finding of many of these studies is that the Kaplan-Meier estimates are low during the initial stages of the contract, before rising and then beginning to fall slightly as tenure increases. Such a finding lends some support to the

[1]Suppose the sample contains n observations and the exit times are ordered so that $T_1 < T_2 < ... < T_k$. As a result of censoring and ties in the durations the number of completed durations k is usually less than n. The Kaplan-Meier estimator $\widehat{\lambda}(T_j)$ is derived by taking the number of spells completed at time T_j, h_j and dividing by the number of spells neither completed or censored before duration T_j denoted by the risk set, n_j. Thus:

job matching models of labour turnover (see, for example, Jovanovic (1979)) outlined in Section 5.2. In other words, as both employees and employers learn more about the quality of the job match the hazard of separation should rise as poorly matched workers leave the organisation. However, as tenure increases, only the well-matched individuals remain with the firm and so the hazard of separation ought to fall slightly.

Booth, Francesconi and Garcia-Serrano (1999) plot the Kaplan-Meier estimates by gender for workers in their first and fifth job, respectively. They find that the hazard of separation rises during the first 12 to 24 months of a job, before declining thereafter across all reasons for leaving, which in their data set is split into quits, layoffs and 'other reasons'[2].

Sicherman (1996) using data from the personnel records of a large U.S insurance company over the period 1971 to 1980 finds that the empirical hazard of quitting increases during the first 2 months of tenure with the firm, before declining at a decreasing rate thereafter. In addition, he finds the decline in the hazard to be greater for females than males, although the hazard rate remains higher for women than men at every level of firm tenure. Farber (1994) using data from the NLSY finds a similar result.

In contrast, Lane and Parkin (1998) using data from the personnel records of 2123 partners from the accountancy firm Ernst and Young over the period October 1989 to March 1991 finds that the empirical hazard of quitting does not peak until the individual has been a partner for approximately 6 years, while the hazard of termination does not reach a peak until the worker has been a partner for at least 10 years. Similarly, Spurr and Sueyoshi (1993) using data from two cohorts of U.S lawyers between 1969 and 1983 finds evidence of a peak exit rate of between 6 and 7 years.

$$\hat{\lambda}(T_j) = \frac{h_j}{n_j} \tag{5.1}$$

[2]In their analysis 'other reasons' includes termination of contract, bad health, retirement, pregnancy, family care, national service, and full-time education.

5.3.2 Job Characteristics and Turnover

The effect financial compensation has on labour turnover has also been examined in a number of studies. In most of these studies evidence of a negative and significant relationship between financial compensation and labour turnover is common.

Blau and Kahn (1981) use data from the National Longitudinal Survey of Labour Market Experience (NLS) over the period 1969 to 1972 to examine the effect financial compensation has on labour turnover. They include two variables measuring financial compensation in their analysis; the worker's current wages and the median earnings in the individual's occupational category. Using a probit analysis they show that both current wages and median earnings have a negative and significant effect on the probability of quitting.

As mentioned earlier, the larger the amount of specific human capital the less likely the worker is to quit or be laid off. Blau and Kahn (1981) argue that the financial compensation variables maybe acting as a proxy for the total amount of accumulated specific capital, giving rise to this negative relationship between earnings and labour turnover. In addition, they assert that aside from this human capital interpretation a number of other reasons can be used to explain this finding. For example, they argue that a higher current wage, ceteris paribus, may signify a higher transitory wage relative to the median earnings in the individual's occupational category. From this they assert that the higher the worker's current wage, all else equal, the lower the individual's incentive to search and hence the probability s/he will find a better job elsewhere is reduced. In addition, they argue that, controlling for other factors, the higher is the median earnings in the worker's occupational category the higher will be the individual's permanent earnings on a particular job, so reducing the probability of quitting.

Similarly, Viscusi (1980) using data from the University of Michigan Panel Study of Income Dynamics over the period 1975 to 1976 finds that wages have a negative and significant effect on the probability of quitting. Viscusi (1980) also estimates his quit equation using the difference between the worker's actual and predicted wages (i.e., the

'wage gap') as the measure of compensation and finds similar evidence of a negative and significant relationship between the 'wage gap' and the probability of quitting. Such a finding is in line with expectations, indicating that individuals with a large wage gap should be less likely to quit since they are being paid more than their predicted wage.

In addition, Dolton and von der Klaauw (1995) examine the turnover behaviour of teachers in the U.K using data from a survey of individuals who graduated in 1980. They estimate a proportional hazard and find that the higher are the teacher's relative earnings the less likely they are to leave the profession. According to their results, a 10% increase in relative monthly earnings should cause the probability of exit at 5 years of tenure to fall by 9%. Dolton and von der Klaauw (1999) also uses the same data set to estimate a competing risk model of exit and finds that the higher the teacher's wage the less likely they are to leave teaching for career or family reasons.

Lazear (1999) using data from the personnel records of a large U.S financial sector firm over the period 1986 to 1994 also investigates the effect financial compensation has on labour turnover behaviour. He estimates both a logit and a proportional hazard model and again finds evidence of a negative and significant relationship between total compensation and labour turnover. In contrast, Lazear (1999) finds that comparable salary, which measures the salary from jobs that are comparable to the one held, has a positive and significant effect on both the probability and hazard of separation. From this he concludes that individuals higher up the hierarchy are more likely to exit the firm than all other workers. However, within a given grade the more highly paid, and presumably better-suited employees, are the ones more likely to remain on the job.

In contrast, Wilson and Peel (1991) using data from 52 engineering and metal working firms over the period 1983 to 1984 estimate several alternative specifications of a quit equation regression, and find that in all specifications real wages have an insignificant effect on quit behaviour. Similarly, Lindeboom and Theeuwes (1991) using data from two waves of a Dutch panel survey of individuals in 1985 and 1986 find that wages tend to have an insignificant effect on labour separation behaviour.

As seen in Section 5.3.1 another variable that has an important impact on labour turnover is the worker's tenure with the firm. In line with the findings outlined in the previous section Viscusi (1980), for example, shows that a dummy variable measuring tenure with the firm of a year or less has a positive and significant effect on the probability of quitting, which is greater for females than males. He argues that in addition to Jovanovic's (1979) job matching model of labour turnover a number of other reasons can be used to explain this finding. Viscusi (1980) asserts that employees with low tenure may not have had time to accumulate much firm-specific human capital, making it easier for them to change jobs than those who have substantial experience and seniority with the organisation. In addition he argues that since workers with a high propensity to quit are more likely to quit the firm early, the tenure dummy may also be reflecting this self-selection phenomenon. He asserts that it could, for example, be capturing women who work for short periods of time out of economic necessity.

Sicherman (1996) also investigates the effect tenure has on labour turnover and finds evidence of a negative relationship between tenure and the hazard of quitting for all market-related reasons[3], which is stronger for women than men. He finds that at low levels of tenure the hazard of quitting is initially greater for females than males, while for women with more than 5 years of experience females are less likely to quit than males.

Similarly, Light and Ureta (1990) using data from the National Longitudinal Surveys of Labor Market Experience (NLS) find evidence of a negative relationship between tenure and the probability of separation, regardless of gender, cohort, and race. They assert that:

> ... If this means that workers are finding and locking into good jobs, then it is good news for men and women alike.

Similarly, Meitzen (1986) using data from the Employment Opportunities Pilot Programs (EOPP) Employers' Survey in the U.S and a continuous time hazard finds that

[3]These include higher earnings, better working conditions, greater opportunities, nearer home or better transportation, and more interesting or suitable job.

for males the hazard of quitting declines with tenure. For females he finds that the hazard of quitting increases with tenure. From this Meitzen (1986) concludes that the job-matching process operates in a different way for women. He argues that since women do not usually have continuous labour force attachment due to family and other committments, they may not have very well devleoped labour market preferences or expectations. Meitzen (1986) argues that, under these circumstances, women may require more on-the-job learning in order to establish their labour market preferences, and until this process is complete a decision on the quality of the job match and quitting cannot be made. In addition, Meitzen (1986) argues that women may only become aware of various types of sex discrimination after being on the job for a while.

Other job characteristics also affect labour turnover behaviour. Spurr and Sueyoshi (1993), for example, estimate various duration models for two cohorts of U.S lawyers, and find that in both cohorts employment in a small town and firm size has a negative and significant effect on the hazard of separation. These results no doubt reflect the relative availability of alternative employment for lawyers in large towns, and the greater opportunities for career progression that present themselves in larger organisations. In contrast, Wilson and Peel (1991) find that firm size has an insignificant effect on quit behaviour.

The effect unions have on quit rates has also been examined in a number of studies. Freeman and Medoff (1984), for example, find evidence of a strong negative correlation between unionisation and quits, supporting their exit-voice trade off. According to this argument unions increase the productivity of their members by providing a direct path through which workers can voice their discontent to management thereby reducing voluntary turnover (or quit rates). Similarly, Wilson and Peel (1991) find that in all specifications the presence of a union has a negative and significant effect on average quit rates.

In addition, Wilson and Peel (1991) find that profit-sharing and share ownership schemes also have a consistent negative and significant impact on quits in all specifica-

tions. It has been argued that profit-related pay and share ownership schemes reduce quits through their impact on employee commitment (Florkowski (1987)), employee involvement and satisfaction (Long (1980)), and employees' psychological and financial motivation (Hammer, Landau, and Stern (1988)). Interestingly, they find that of the two schemes, share options have the strongest impact on quit behaviour. For example, they find that share ownership schemes lead to a reduction in quits of between 2% and 2.5%, compared to a reduction of between 1% and 2% for profit-sharing schemes.

Finally, Lindeboom and Theeuwes (1991) find significantly higher escape rates for workers who are in a job that requires managerial skills.

5.3.3 Gender Differences and Turnover

Another important explanatory variable in most studies on labour turnover is the individual's gender. A common finding of many of these studies is that females tend to have relatively weak job attachments and are thus more likely to leave the firm than their male counterparts.

Viscusi (1980), for example, finds that women have higher predicted quit rates than men. However, he finds that if females are assumed to have the same type of jobs, firm tenure and live in the same region as males (but have their own personal and quit equation coefficients) then most of these differences are eliminated. Similarly, Sicherman (1996) finds that although women have a higher hazard of departure[4] than men once grade level and time spent in different grade levels have been controlled for this gender gap is cut by more than half. In addition, as outlined above Sicherman (1996) finds that although at low levels of tenure the hazard of quitting for all market related reasons is higher for females than males, among workers with more than 5 years seniority women are less likely to quit than men.

Similarly, Blau and Kahn (1981) using data from the National Longitudinal Surveys of Labor Market Experience (NLS) over the period 1970 to 1971 finds that females have

[4]Departures includes all reasons excluding death.

higher predicted quit rates than males. They also examine the importance differences in characteristics between men and women have on quit rates, and find that when the male values of the explanatory variables are substituted into the female probit functions the predicted quit rates of women fall below that of men. Similar results are found when the female values of the explanatory variables are substituted into the male probit functions.

Blau and Kahn (1981) also consider the extent to which the differences in quit rates between men and women arise due to differences in labour market opportunities as opposed to personal characteristics. They find that if females are assumed to have the job characteristics of the average male worker, but have their own personal characteristics (that includes tenure with the firm) predicted quit rates for women will be less than those for men. Blau and Kahn (1981) argue that this finding may in part be a reflection of sex discrimination in the labour market.

Light and Ureta (1990) also use data from the National Longitudinal Surveys of Labor Market Experience (NLS) in their study on labour turnover. However, in contrast to Blau and Kahn (1981) their sample is observed over a longer period of time. The women in their sample are followed from 1968 to 1985, and the men from 1966 to 1981. In order to control for different birth cohorts, Light and Ureta (1990) define an 'early' cohort consisting of those individuals who were born between 1944 and 1947, and a 'late' cohort comprising of those workers who were born between 1951 and 1954. They estimate proportional hazard models for all job separations among continuously employed individuals[5], and use these estimates to calculate the implied probabilities that their 'modal'[6] worker will leave his/her job in the next 6 months, conditional on different levels of current tenure[7]. Light and Ureta (1990) evaluate these probabilities in 1970 to 1971 for the 'early' cohort and in 1976 to 1977 for the 'late' cohort. They show that for employees in the earlier cohort the probability of separation is lower for females than

[5]Their sample thus excludes workers who are quitting their jobs in order to leave the labour force.

[6]Light and Ureta (1992) define their 'modal' worker as being married, living in an SMSA, a high school graduate, and deemed to be a stayer for unobserved reasons.

[7]The probabilities are evaluated at the cohort mean values of the hourly wage, the unemployment rate, and prior experience.

males (regardless of race and current tenure). Light and Ureta (1990), for example, find that white women have a 10.3% chance of leaving their jobs in the first 6 months, compared with 16.7% for that of men. In contrast, for individuals in the later cohort the probability of separation is higher for females than males (regardless of race and current tenure).

Spurr and Sueyoshi (1993) estimate several alternative specifications of the hazard function in their study on labour turnover and find that in all specifications being a woman has a positive and significant effect on the hazard of separation, which changes little over time. They argue that in addition to economic discrimination a number of other possible explanations can be used to explain these findings. Spurr and Sueyoshi (1993), for example, argue that since females tend to have better non-market opportunities (for example, in household production) relative to their market opportunities than males, women maybe more likely to leave than males to leave the firm in order to purse these non-market activities. In addition, they assert that the higher separation among females may also arise due to a change in their partner's job. Spurr and Sueyoshi (1993) argue that since women often tend to earn less than men, females maybe forced to leave the firm for the sake of their partner's career if he is transferred or takes a job in a different location. Lindeboom and Theeuwes (1991) also find that females are more mobile than males.

Booth, Francesconi and Garcia-Serrano (1999) use a Cox proportional hazard with competing risks of exit due to quits, layoffs, and 'other reasons' to estimate some of the determinants of job separation in their study on labour turnover. They find that women are significantly less likely than men to be laid off, but are significantly more likely than males to leave their jobs for 'other reasons'. However, while women in their first job are statistically less likely than men to quit, Booth, Francesconi and Garcia-Serrano (1999) find no statistically significant gender difference in quit behaviour for workers in their fifth job.

Booth, Francesconi and Garcia-Serrano (1999) also combine separations due to quits

and 'other reasons' into one category in order to examine the effect gender has on worker-initiated separations. They find that gender has no significant effect on the hazard of worker-initiated separations from the first job, but they show that for individuals in their fifth job females are significantly more likely than males to initiate a separation. Booth, Francesconi and Garcia-Serrano (1999) also interact gender with labour market entry dates and find that for workers in their first job, women entering the labour market before 1951 are significantly less likely than men to initiate a separation, while females in later cohorts are significantly more likely to initiate a separation. However, they find that for individuals in their fifth job women entering the labour market prior to 1951 are significantly less likely to initiate a separation, while gender has no significant effect on the hazard of worker-initiated separations for workers entering the labour market after 1951. Wilson and Peel (1991) also find that gender has no significant effect on quit behaviour.

5.3.4 Other Personal Characteristics and Turnover

Another variable that is often thought to be associated with labour turnover is the employee's age. A common finding of many of these studies is that age has a negative effect on labour turnover. Viscusi (1980), for example, finds evidence of a negative and significant relationship between age and the probability of quitting. He argues that since the returns to worker mobility fall with age this may cause older individuals to be less likely to leave the firm than younger workers.

Similarly, Lindeboom and Theeuwes (1991) find that the young experience relatively high job-to-job mobility, whereas job-to-job transitions are relatively rare for the elderly. They argue that such a finding could reflect the 'job shopping' phase individuals go through at the beginning of their careers. Lazear (1999) also finds evidence of a negative and significant relationship between age and the probability of separation, and Meitzen (1986) finds that age has a negative effect on the hazard of quitting which is stronger for females than males.

In contrast, Booth, Francesconi and Garcia-Serrano (1999) finds that age has a positive and significant effect on the hazard of separation for 'other reasons' (which includes retirement and bad health). In addition, they show that age at the start of the fifth job has a positive and significant effect on the likelihood of being laid off.

The effect race has on labour turnover has also been examined in a number of studies. It should, however, be noted that the relationship between race and separation behaviour is often regarded as being *a priori* ambiguous. Viscusi (1980), for example, argues that while discrimination in the firm may increase the worker's incentive to leave, discrimination in the market may make it more difficult for the individual to find a new job thereby increasing his/her incentive to stay.

Viscusi (1980) examines the effect race has on the probability of quitting, and finds that non-whites are statistically less likely to leave the firm than whites. Booth, Francesconi and Garcia-Serrano (1999) also include a dummy variable for race in their study on labour turnover and find that non-white males are significantly less likely than white males to quit their first job, while non-white females are significantly more likely than white women to leave for 'other reasons'. In contrast, they show that for workers in their fifth job race has no statistically significant effect on the hazard of separation.

Another variable that is included in most studies on labour turnover is the individual's educational attainment. Again the relationship between education and labour turnover is often viewed as being *a priori* indeterminate. Sicherman (1999), for example, asserts that on the one hand education may increase labour turnover if it causes more highly educated workers to attract better jobs elsewhere. Alternatively, he argues that education may also reduce worker separation behaviour if it enables better educated employees to receive more firm-specific training.

Viscusi (1980) finds that the effect years of schooling has on the probability of quitting is mixed. He finds that for females schooling has a positive and significant effect on the probability of quitting across both specifications (i.e., in both the wage-gap quit equation and the wage-quit equation), while for males schooling is only significant in the wage-gap

quit equation where it has a negative effect on the probability of quitting.

Sicherman (1996) also examines the effect years of schooling has on the likelihood of separation, and finds evidence of a non-monotonic relationship between schooling and the hazard of quitting for all market-related reasons, which is stronger for women than men. He finds that at low levels, schooling has a negative effect on the hazard of quitting, while for females with more than 5 years of schooling and for males with schooling of 11 years or more, it has a positive effect on the hazard of quitting.

In addition, Sicherman (1996) investigates the effect an additional year of schooling has on the likelihood of separation for each of the different reasons for departure (these derivatives are calculated at both 12 and 16 years of schooling) and finds that schooling has a strong positive effect on quitting to take a job that offers better opportunities, and a negative effect on quitting for health and personal reasons. He also shows that for men schooling has a negative effect on the likelihood of dismissal, while for women schooling has a negative effect on the likelihood of leaving for non-market reasons, including illness in the family and household duties.

Booth, Francesconi and Garcia-Serrano (1999) also include variables measuring highest educational attainment in their study on labour turnover. They find that workers with higher educational levels are significantly less likely to be laid off from their first job, but are significantly more likely to leave their first job for 'other reasons'. However, they find that while men with a degree are significantly more likely to quit, educational qualifications have no significant effect on the quit behaviour of women workers. In addition, Booth, Francesconi and Garcia-Serrano (1999) finds that for individuals in their fifth job the only educational variable to have a statistically significant impact are A-levels, which for males have a positive and significant effect on the hazard of being laid off.

Spurr and Sueyoshi (1993) find that in all specifications the quality of the lawyer's school, and HONORS (an indicator of academic distinction) have a negative effect upon job exit. Similarly, Lindeboom and Theeuwes (1991) find that workers with an extended primary education have a significantly lower hazard of separation.

5.3.5 Career Mobility and the Labour Market

On a related issue, Sicherman and Galor (1990) examines the effect variables such as schooling and tenure have on occupational mobility (both within and across firms). Using data on male heads of households they estimate a multinomial logit that distinguishes between three career decisions; the individual moves to a higher level occupation across organisations, the worker gets promoted to a higher level occupation within the same firm, or the individual stays where s/he is. They find that when no control is made for occupation of origin, schooling has a negative effect on career mobility (both within and across firms). Such a finding is in line with their predictions indicating that since better educated workers are often able to start their working life further up the organisational hierarchy their careers are likely to involve fewer occupation changes (both within and across firms) than those of less educated workers. In addition, they find that after controlling for occupation of origin schooling has a positive effect on career mobility (both within and across firms). Such a finding is again in line with their expectations indicating that given an occupation of origin, educated individuals are more likely to move to a higher-level occupation than all other workers.

Sicherman and Galor (1990) also examine the effect time in the labour market (experience) and tenure with the firm has on career mobility. They find that time in the labour market has a negative effect on career mobility, and that with higher levels of experience mobility is more likely to occur within firms than across them. In addition, they show that tenure with the firm has a positive effect on the probability of promotion. Such a finding is in line with their expectations indicating that skills and experience gained in previous occupations increase the probability that a worker will move to a higher level occupation.

Dolton and Kidd (1988) using data from the 1980 cohort of male U.K grades drawn from the 1987 Department of Employment Survey examines the interrelationship between a worker's investment in training and his/her career decisions. They estimate a multinominal logit in which four occupational/career decisions can be made; the individ-

ual can stay in the same job without being promoted, be promoted in the first job and stay in that job, move to a different job in the same occupation, or move to a different occupation. According to their results workers who stay in the same firm are more likely to invest in firm-specific human capital than all other workers. In contrast, they find that individuals who change jobs or occupations are more likely to invest in general human capital than all other workers.

5.4 Data

This chapter uses data from the personnel and payroll records of the large U.K financial sector firm outlined in Chapter 2 to investigate some of the causes and consequences of labour turnover. In this organisation all individuals who exit the organisation are asked to cite their main reason for leaving. Eleven distinct exit codes are used to record the worker's reason for departure, and in this study these codes are split into three categories; quits (q), layoffs (l) and 'other reasons' (o). Following McLaughlin (1991) and Booth, Francesconi and Garcia-Serrano (1999) quits are defined as worker-initiated separations, and layoffs as firm-initiated separations. As in Booth, Francesconi and Garcia-Serrano (1999) 'other reasons' includes end of temporary contract, ill health, retirement and pregnancy. It should be noted that in this analysis exit code data is only available for those individuals who left the firm between January 1989 and February 1994, but as will be seen it nevertheless provides an important insight into the differences between males and females in their reason for departure.

This study uses the data outlined above to analyse the turnover behaviour of new entrants i.e., those individuals who entered the firm between January 1989 and March 1997. Approximately 20,256 workers entered the firm over this period; 8,667 men and 11,589 women. A full-definition of the variables and summary statistics of the sample are given in Tables 5.1 and 5.2, respectively. Summary statistics of the workers who joined the firm between January 1989 and February 1994 (the period over which exit code data

is available) are presented in Table 5.3. It should be noted that individuals with missing values in any of the variables are dropped from the sample.

Table 5.4 reports the distribution of each reason for departure by men and women over the period January 1989 to February 1994. As can be seen, females account for 59.664% of total separations, while males account for only 40.336%. For both men and women the main reason for leaving the firm is quits. Voluntary departures account for 75.781% of separations for males and 67.852% of separations for females. Involuntary separations, on the other hand, account for 23.021% of separations for men and 23.662% of separations for women, while not surprisingly, 'other reasons' (which includes pregnancy) accounts for 8.486% of departures among females and only 1.198% for males.

5.5 Empirical Specification

Two modes of analysis are used in this chapter to analyse the turnover behaviour of new entrants. Firstly, as in Lazear (1999) the incidence of separation is estimated using a logistic model. Secondly, following Booth, Francesconi and Garcia-Serrano (1999), a proportional hazard with competing risks of exit due to quits (q), layoffs (l) and 'other reasons' (o) is used to estimate the hazard of separation.

5.5.1 Logistic Model

Following Lazear (1999) each person-month is treated as a distinct observation and the probability that individual i leaves the firm in a given month ($d_{it} = 1$) is written as a latent variable model of the form:

$$d_{it}^{*} = \beta' X_{it} + v_{it} \tag{5.2}$$

where:

Variable	Description
Tenure	worker's tenure with the firm
Salary	worker's salary
Grade 1	= 1 if worker is in grade 1, 0 otherwise
Grade 2	= 1 if worker is in grade 2, 0 otherwise
Grade 3	= 1 if worker is in grade 3, 0 otherwise
Grade 4	= 1 if worker is in grade 4, 0 otherwise
Grade 5	= 1 if worker is in grade 5, 0 otherwise
Grade 6	= 1 if worker is in grade 6, 0 otherwise
Grade 7	= 1 if worker is in grade 7, 0 otherwise
Grade 8	= 1 if worker is in grade 8, 0 otherwise
Grade 9	= 1 if worker is in grade 9, 0 otherwise
Grade 10	= 1 if worker is in grade 10, 0 otherwise
Grade 11	= 1 if worker is in grade 11, 0 otherwise
Grade >12	= 1 if worker is in grade 12, or 13, 0 otherwise
Other	= 1 if worker is in grade 1, 98, or 99, 0 otherwise
Rate 1	= 1 if performance rating is 1, 0 otherwise
Rate 2	= 1 if performance rating is 2, 0 otherwise
Rate 3	= 1 if performance rating is 3, 0 otherwise
Rate 4	= 1 if performance rating is 4, 0 otherwise
Rate 5	= 1 if performance rating is 5, 0 otherwise
Rate 6	= 1 if unrated, 0 otherwise
Date Hired	date individual joined the firm
Married	= 1 if worker is married, 0 otherwise
Degree	= 1 if worker has a degree, 0 otherwise
Professional Qualification	= 1 if worker has a professional qualification, 0 otherwise
Age	age when worker entered the firm

Table 5.1: Variable Names and Definitions - Turnover.

	Males		Females	
Variable	Mean	Std. Deviation	Mean	Std. Deviation
Tenure	29.261	23.439	31.722	24.300
Salary	17181.200	14196.42	11528.100	5977.502
Management	0.405	0.491	0.105	0.307
Rate 1	0.003	0.055	0.001	0.037
Rate 2	0.020	0.139	0.007	0.085
Rate 3	0.300	0.458	0.279	0.449
Rate 4	0.151	0.358	0.205	0.403
Rate 5	0.022	0.147	0.028	0.166
Rate 6	0.492	0.500	0.473	0.499
Married	0.307	0.461	0.289	0.453
Degree	0.160	0.367	0.067	0.251
Professional Qualification	0.060	0.238	0.042	0.200
Age	28.205	8.175	26.095	7.596
Number of Observations	8667		11589	

Note: Means are computed on all available person-months
(276,717 for males and 396,770 for females).

Table 5.2: Summary Statistics - Turnover (Full Sample).

	Males		Females	
Variable	Mean	Std. Deviation	Mean	Std. Deviation
Tenure	21.228	15.207	22.300	15.337
Salary	15395.890	12376.810	10078.370	5152.020
Management	0.380	0.486	0.088	0.284
Rate 1	0.003	0.053	0.002	0.040
Rate 2	0.006	0.076	0.001	0.033
Rate 3	0.272	0.445	0.226	0.418
Rate 4	0.146	0.353	0.197	0.398
Rate 5	0.019	0.137	0.025	0.158
Rate 6	0.554	0.497	0.549	0.498
Married	0.277	0.448	0.243	0.429
Degree	0.139	0.346	0.057	0.231
Professional Qualification	0.046	0.209	0.029	0.169
Age	25.062	8.056	22.910	7.382
Number of Observations	5037		7125	

Note: Means are computed on all available person-months
(135,555 for males and 212,195 for females).

Table 5.3: Summary Statistics - Turnover (Restricted Sample).

Exit Reason	Male (%)	Female (%)	Total (%)
1. Voluntary Departure			
Voluntary	75.781	67.852	71.050
Total	75.781	67.852	71.050
2. Involuntary Departure			
Involuntary	16.823	12.500	14.244
Business Sold	1.927	1.549	1.702
Change of Contract	2.396	8.099	5.798
End of Temporary Contract	1.875	1.514	1.660
Total	23.021	23.662	23.403
3. Other			
Involuntary - Health	0.052	0.141	0.105
Pregnancy	0	6.338	3.782
Voluntary - Health	0.625	1.690	1.261
Retirement	0.365	0.282	0.315
Death	0.156	0.035	0.084
Total	1.198	8.486	5.546
All	40.336	59.664	100
Number of Observations	1920	2840	4760

Table 5.4: Distribution of Reasons for Exit by Gender.

$$d_{it} = \begin{cases} 1 \text{ if } d_{it}^* > 0 \\ 0 \text{ otherwise} \end{cases} \tag{5.3}$$

$i = 1, ..., N$, $t = 1, ..., T_i$ where i is the individual and t are the time subscripts. The set of parameters, β, capture the effect the vector of explanatory variables, X_{it}, have on the worker's separation decision. A full description of the variables used in this model are given in Table 5.1. The error term, v_{it}, is an independent realisation of a random variable with cumulative distribution function (CDF) $F(.)$. The probability of separation can thus be written as:

$$P(d_{it} = 1) = P(d_{it}^* > 0) = F(\beta' X_{it}) \tag{5.4}$$

Maximum likelihood estimates of the parameters in the above specification are obtained by maximising the following likelihood function. In its general form this likelihood function can be written as:

$$L(\beta) = \prod_{i=1}^{N} \prod_{t=1}^{T_i} F(\beta' X_{it})^{y_{it}} [1 - F(\beta' X_{it})]^{1-y_{it}} \tag{5.5}$$

Using a logistic specification for $F(.)$ this becomes:

$$L(\beta) = \prod_{i=1}^{N} \prod_{t=1}^{T_i} \left(\frac{\exp(\beta' X_{it})}{1 + \exp(\beta' X_{it})} \right)^{y_{it}} \left(1 - \frac{\exp(\beta' X_{it})}{1 + \exp(\beta' X_{it})} \right)^{1-y_{it}}$$

$$= \prod_{i=1}^{N} \prod_{t=1}^{T_i} \frac{\exp(\beta' X_{it})^{y_{it}}}{1 + \exp(\beta' X_{it})} \tag{5.6}$$

Since data is not available on all the variables that may affect turnover behaviour, some account for unobserved heterogeneity in the model specified above needs to be made. As outlined in Chapter 4 this can be achieved by decomposing the error term, v_{it}, in the following way:

$$v_{it} = \alpha_i + u_{it} \tag{5.7}$$

where u_{it} is independently distribution over i and α_i captures time invariant individual specific effects. Now, the probability of separation can be written as:

$$P(y_{it} = 1) = P(y_{it}^* > 0) = F(\beta' X_{it} + \alpha_i) \tag{5.8}$$

The inclusion of α_i allows workers who are identical in terms of their observed characteristics to differ systematically in their response probabilities. As before the individual specific effects, α_i, are treated as random, representing the extent to which the intercept of the ith worker differs from the overall intercept. One way of estimating such a model is to assume that the unobserved components, α_i, are independent of the observed regressors, and are a random sampling from a distribution with a probability density function $h(\alpha)$ in the population. The unobserved components can then be integrated out of the likelihood to form the marginal likelihood in the following way:

$$L(\beta) = \prod_{i=1}^{N} \int_{-\infty}^{\infty} \prod_{t=1}^{T_i} F(\beta' X_{it} + \alpha)^{y_{it}} [1 - F(\beta' X_{it} + \alpha)]^{1-y_{it}} h(\alpha) d\alpha \tag{5.9}$$

Under weak regularity conditions maximisation of this likelihood function gives consistent (as N tends to ∞) estimates of β. Using a logistic distribution for the cumulative distribution function equation 5.20 becomes:

$$L(\beta) = \prod_{i=1}^{N} \int_{-\infty}^{\infty} \prod_{t=1}^{T_i} \frac{(\exp(\beta' X_{it} + \alpha_i))^{y_{it}}}{1 + \exp(\beta' X_{it} + \alpha_i)} h(\alpha) d\alpha \tag{5.10}$$

In this model the incidental parameters, α_i, are assumed to be normally distributed $N(0,1)$ in the population, and equation 5.21 is estimated using SABRE software developed by Barry, Francis and Davies (1990).

5.5.2 Hazard Model

A cox proportional hazard model is also used to estimate the hazard of separation. Thus:

$$\lambda(x,t) = \lambda_0(t) \exp(x(t)'\beta) \tag{5.11}$$

where $\lambda_0(t)$ is the baseline hazard, and $x(t)'$ is a vector of explanatory variables with unknown coefficients, β. It is called a proportional hazard because the explanatory variables have the effect of multiplying the hazard function by a scale factor $\exp(x(t)'\beta)$ that does not depend on duration, t.

Cox's (1972) partial likelihood approach provides a convenient way of estimating β without having to specify a functional form for the baseline hazard, $\lambda_0(t)$. Suppose that the sample contains n distinct exit times that are ordered so that $T_1 < T_2 < ... < T_n$, and for any time, T_i, the risk set, R_i, represents all individuals whose exit time is at least T_i (in other words, for every individual j in the risk set R_i, $t_j \geq T_i$). Assuming that there are no censoring or ties in the durations the conditional probability that individual i completes a spell at duration T_i can be written as:

$$\text{Prob}[t_j = T_i | \text{risk set}_i] = \frac{\lambda_0(t) \exp(x_i'\beta)}{\sum_{j \epsilon R_i} \lambda_0(t) \exp(x_j'\beta)} \tag{5.12}$$

This expression reduces to:

$$\frac{\exp(x_i'\beta)}{\sum_{j\epsilon R_i}\exp(x_j'\beta)} \tag{5.13}$$

and the resulting partial log-likelihood function becomes:

$$\ln L = \sum_{i=1}^{n}[x_i'\beta - \sum_{j\epsilon R_i} x_j'\beta)] \tag{5.14}$$

where the unknown parameters are estimated by maximum likelihood.

It should be noted that both censoring and ties can be easily dealt with in this partial likelihood framework. For example, an individual whose spell is censored between t_j and t_{j+1} is included in the risk set, R_i, for ordered, completed exit times T_1 through to T_j but not in any others. Ties in the durations are handled by including a contribution to the likelihood for each of the tied observations, using the same observations in the risk set, R_i, for each.

Competing Risks

The model discussed so far specifies the determinants of a single risk, that of leaving the firm. However, as mentioned earlier for some of the workers who left the firm between January 1989 and February 1994 their reason for departure is also recorded. In this analysis a Cox proportional hazard with competing risks of exit due to quits (q), layoffs (l) and 'other reasons' (o) is used to estimate whether workers who cite different reasons for departure also exhibit different behavioural characteristics.

Suppose again that T is the individual's tenure with the firm at the time of departure and there are K possible reasons for leaving that are labelled with the subscript k, where $k = 1, 2, ..., K$. As before the hazard function is denoted by $\lambda(t)$ and the probability

density and survival functions are denoted by $f(t)$ and $S(t)$, respectively. Lancaster (1990) argues that one way of estimating a model with competing risks is to assume that for each individual their observed duration is determined by whichever of the $\{T_k\}$ is the least. Then the hazard function with observed duration T_k can be written as:

$$\lambda_k = \lim_{dt \to 0} \frac{\Pr(t \leq T_k \leq t + dt | T \geqslant t)}{dt} \tag{5.15}$$

where:

$$S_k(t) = \Pr(T_k \geqslant t) \tag{5.16}$$

and:

$$f_k(t) = \lambda_k(t) \exp\left\{ - \int_o^t \lambda_k(u) du - \sum_{j=1, j \neq k} \int_0^t \lambda_j(u) du \right\} dt$$

$$= \lambda_k \exp\left\{ - \sum_{j=1}^{K} \int_0^t \lambda_j(u) du \right\} dt$$

by independence of the $\{T_k\}$:

$$= \lambda_k \exp\left\{ - \sum_{j=1}^{K} \int_0^t \lambda_j(u) du \right\} dt \tag{5.17}$$

From this it can be seen that observations which exit due to a destination other than k are treated as censored at the point of completion.

Now the proportional hazard model can be written as:

$$\lambda_k(x,t) = \lambda_{0k}(t)\exp(x'\beta_k) \tag{5.18}$$

and the resulting partial log-likelihood is:

$$\ln L = \sum_{i=1}^{n}[x_i'\beta_k - \sum_{i\epsilon R_i} x_j'\beta] \tag{5.19}$$

5.6 Empirical Results

5.6.1 Independent Variables

The explanatory variables in the models outlined above include a variable measuring the worker's monthly salary, which is made up of the individual's basic pay, a regional allowance and a performance related bonus. As shown in Section 5.3.2 evidence of a negative and significant relationship between financial components and labour turnover is common (see, for example, Blau and Kahn (1981) and Viscusi (1980)).

A dummy variable indicating whether the individual is a member of staff or management is included to account for the effect position in the hierarchy has on labour separation behaviour, and a set of dummy variables are included to capture performance effects (base case is rate 1 to 3). Lazear (1999) finds that both workers further up the hierarchy and better performers are less likely to separate than all other employees.

In line with Lazear (1999) date of hire is also included as a regressor in the empirical analysis. Lazear (1999) finds that surprisingly date of hire has a negative and significant effect on the probability of separation, indicating that those who have been hired most recently are less likely to leave the firm than all other workers.

The effect educational attainment such as whether the individual has a degree (base

case is no degree) or a professional qualification (base case is no professional qualification) is also investigated. The relationship between education and labour turnover is, however, *a priori* indeterminate. As mentioned earlier, Sicherman (1996) asserts that on the one hand education may increase labour turnover if it causes more highly educated workers to attract better jobs elsewhere. Alternatively, he argues that education may also reduce labour separation behaviour if it enables better educated workers to receive more firm-specific training.

Finally, controls are made for personal characteristics such as martial status (base case is single) and age.

5.6.2 Logistic Results

Maximum likelihood estimates of the logistic regression for males and females are given in Tables 5.5 and 5.6, respectively. Columns I and II of Tables 5.5 and 5.6 report the results for the standard logistic, while columns III and IV report the results for the logistic after controlling for heterogeneity.

Comparing the results by gender both striking similarities and important differences emerge between men and women in the variables which affect their probability of departure.

As can be seen, for both males and females the coefficient on the management dummy is positive and significant, indicating that individuals higher up the hierarchy are more likely to leave the firm than all other workers. In contrast, for both men and women the coefficients on the performance ratings are negative and significant with a downward trend, indicating that better performers are less likely to leave the firm than other workers[8]. Lazear (1999) reports a similar result and argues that it may reflect the fact that at least part of what is measured by the firm's performance ratings is firm-specific. For both males and females having a professional qualification also has a negative and significant effect on the probability of separation. Such a finding is in line with expectations indi-

[8]This downward trend is only slight for females.

cating that the quality of the job match is likely to improve if the worker has a relevant professional qualification.

Important differences between men and women, however, emerge when looking at the effect salary has on the probability of separation. According to these results salary is only significant for men where in line with the findings outlined in Section 5.3.2 it has a negative effect on the probability of separation. As mentioned earlier, Blau and Kahn (1981), for example, argue that the financial compensation variables maybe acting as a proxy for the total amount of accumulated specific capital, giving rise to this negative relationship between wages and labour turnover. In other words, as noted in the theory section on human capital and turnover the larger the amount of specific human capital the less likely the worker is to quit or be laid off (see, for example, Becker (1962) and Parsons (1972)).

Other differences between males and females emerge when looking at the effect personal characteristics have on the probability of separation. In particular, for women being married has a positive and significant effect on the probability of separation, but has a negative and significant effect on separation behaviour for men. This could reflect the differing roles males and females tend to play in the home. Married women may, for example, be more likely to leave the firm than single women in order to engage in non-market opportunities (e.g., child care). In contrast, married men have traditionally been regarded as the main wage earners within a household, which may make them less willing than single men to leave a relatively stable working environment.

Finally, age is positive and significant for females but surprisingly insignificant for males. Such a finding indicates that older women are more likely to leave the firm than younger women. This result may arise because older workers tend to be more likely to be laid off or to leave the labour market entirely (due to ill health, retirement etc) than younger employees. This issue is returned to in the competing risks model estimated in the next section.

	Logistic Specification			
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-5.227	-22.277	-3.990	-12.768
Salary	-0.282×10^{-5}	-1.807	-0.331×10^{-5}	-1.718
Management	0.291	6.517	0.296	5.294
Rate 4	-0.441	-7.339	-0.433	-6.683
Rate 5	-0.774	-4.677	-0.712	-4.056
Rate 6	0.011	0.288	-0.294	-6.112
Date Hired	0.753×10^{-4}	3.567	-0.217×10^{-4}	-0.792
Degree	-0.018	-0.381	-0.413×10^{-1}	-0.683
Professional Qualification	-0.534	-5.784	-0.475	-4.405
Age	0.005	1.818	0.003	0.755
Married	-0.155	-3.400	-0.125	-2.144
Log-likelihood	-19774.074		-19698.839	
Number of Observations	8667		8667	

Table 5.5: Maximum Likelihood Estimates of Turnover Model - Males.

Logistic Specification				
	Standard		Random Effects	
Variable	Coefficient	t-ratio	Coefficient	t-ratio
Constant	-5.913	-30.035	-4.513	-16.703
Salary	-0.126×10^{-4}	-3.618	-0.160×10^{-5}	-0.388
Managment	0.277	4.730	0.169	2.205
Rate 4	-0.478	-10.252	-0.506	-9.853
Rate 5	-0.498	-4.648	-0.518	-4.411
Rate 6	0.108	3.352	-0.270	-6.451
Date Hired	0.131×10^{-3}	7.270	0.161×10^{-5}	-0.065
Degree	0.075	1.265	0.031	0.384
Professional Qualification	-0.547	-5.922	-0.476	-4.235
Age	0.009	4.411	0.009	3.128
Married	0.216	6.408	0.382	8.568
Log-likelihood	-28044.105		-27886.532	
Number of Observations	11589		11589	

Table 5.6: Maximum Likelihood Estimates of Turnover Model - Females.

Variable	Cox Proportional Hazard Coefficient	t-ratio
Salary	-0.144×10^{-7}	-0.968
Management	0.298	6.737
Rate 4	-0.397	-6.617
Rate 5	-0.696	-4.208
Rate 6	-0.324	-7.308
Degree	-0.010	-0.206
Professional Qualification	-0.339	-3.630
Age	-0.001	-0.326
Married	-0.110	-2.432
Log-likelihood	-31459.103	
Number of Observations	8667	

Table 5.7: Maximum Likelihood Estimates of the Hazard of Departure - Males.

5.6.3 Hazard Results

The explanatory variables included in the Cox proportional hazard are the same as those in the logistic regression. Maximum likelihood estimates of the Cox proportional hazard for males and females are presented in Tables 5.7.and 5.8, respectively. The results reported in Tables 5.7 and 5.8 largely mimic (in both sign and significance) the results of the logistic models. For example, workers who are in a staff grade, have a professional qualification, and a high performance rating have a significantly lower hazard of separation than all other employees. Similarly, for women being married has a positive and significant effect on the hazard of separation, but has a negative and significant effect on the likelihood of separation for men. However, in contrast to the results outlined in the previous section salary has an insignificant effect on the hazard of separation. Similarly, the coefficient on age is also insignificant for both males and females.

Variable	Cox Proportional Hazard Coefficient	t-ratio
Salary	-0.114×10^{-7}	-0.374
Management	0.211	3.688
Rate 4	-0.432	-9.245
Rate 5	-0.415	-3.868
Rate 6	-0.365	-8.980
Professional Qualification	-0.353	-3.800
Age	0.002	1.106
Married	0.271	7.971
Log-likelihood	-46240.016	
Number of Observations	11589	

Table 5.8: Maximum Likelihood Estimates of the Hazard of Departure - Females.

Competing Risks Model As mentioned earlier for some of the individuals who left the firm between January 1989 and February 1994 their reason for departure is also recorded. For comparison purposes maximum likelihood estimates of the Cox proportional hazard for men and women over this restricted period are presented in Tables 5.9 and 5.10, respectively.

The results presented in these tables are, not surprisingly, similar (in both sign and significance) to the hazard results reported for the entire sample, but with one notable exception. In contrast to the previous results for both males and females, wages have a positive and significant effect on the hazard of separation, indicating that the higher the worker's salary the more likely s/he is to leave the firm. Since these employees have only been at the organisation for a short period of time (at most 4 years) they will not have accumulated much firm-specific human capital, which may make them less tied to the company than the individuals analysed in the full sample. Thus, instead of being a measure of firm-specific human capital the wage variable could, in this instance, be acting as a proxy for general human capital accumulation.

Variable	Cox Proportional Hazard Coefficient	t-ratio
Salary	$0.649x10^{-5}$	3.128
Management	0.087	1.323
Rate 4	-0.419	-4.743
Rate 5	-0.965	-3.416
Rate 6	-0.198	-3.055
Degree	-0.006	-0.092
Professional Qualification	-0.641	-3.862
Age	0.003	0.813
Married	-0.124	-1.872
Log-likelihood	-15291.020	
Number of Observations	5037	

Table 5.9: Maximum Likelihood Estimates of the Hazard of Departure (Restricted Sample) - Males.

Variable	Cox Proportional Hazard Coefficient	t-ratio
Salary	$0.131x10^{-4}$	2.966
Management	-0.002	-0.026
Rate 4	-0.346	-5.042
Rate 5	-0.171	-1.178
Rate 6	-0.343	-5.691
Professional Qualification	-0.490	-2.947
Age	0.004	1.361
Married	0.299	6.027
Log-Likelihood	-23905.434	
Number of Observations	7125	

Table 5.10: Maximum Likelihood Estimates of the Hazard of Departure (Restricted Sample) - Females.

The estimation results for the competing risks model for males and females are reported in Tables 5.11 and 5.12, respectively. Again most coefficients have the expected sign. However, since the coefficients are no longer restricted to be equal between the three risks, the findings differ slightly when compared with the single risk model.

In line with the previous results salary has a positive and significant effect on the hazard of quitting. Similarly, for men salary has a positive and significant effect on the layoff hazard. However, for both males and females, salary has an insignificant effect on the hazard of leaving for 'other reasons'.

Other significant results include the management dummy which has a positive and significant effect on the hazard of quitting for men, but a negative effect on the hazard of quitting for women. In addition, for females being a manager has a positive and significant effect on the hazard of being laid off.

Similarly, in line with the previous results for males the coefficients on the performance ratings have a negative and significant effect on the hazard of separation for quits and layoffs. For both men and women having a professional qualification also has a negative and significant effect on the hazard of separation for quits and layoffs. As mentioned earlier, these results may reflect the fact that better matched workers are less likely to leave the firm.

For females, marital status has a positive and significant effect on the hazard of separation for 'other reasons' (including pregnancy), but is insignificant for males. In contrast, being married has a negative and significant effect on the hazard of quitting for men but is insignificant for women. Such a finding again highlights the differing roles males and females tend to play in the home. As mentioned earlier, married women maybe more likely to leave the firm than single women in order to pursue non-market activities, and given these household commitments may also be more likely to be laid off than single women. In contrast, married men have traditionally been regarded as the main wage earners within a household, which may make them less willing than single men to leave a relatively stable working environment.

	Cox Proportional Hazard					
	Quit		Layoff		Other	
Variable	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
Salary	0.679×10^{-7}	2.741	0.793×10^{-7}	2.103	-0.399×10^{-4}	-1.086
Management	0.143	1.868	0.065	0.490	-0.627	-0.997
Rate 4	-0.323	-3.127	-0.677	-3.810	-0.544	-0.786
Rate 5	-0.761	-2.359	-1.789	-2.503	-0.515	-0.468
Rate 6	-0.154	-2.043	-0.304	-2.337	-0.540	-0.862
Degree	-0.032	-0.401	0.067	0.496	0.092	0.118
Prof. Qual.	-0.530	-2.874	-0.947	-2.463	-	-
Age	-0.009	-1.845	0.023	3.021	0.140	6.858
Married	-0.145	-1.850	0.004	0.032	-0.803	-1.511
Log-likelihood	-11643.962		-3447.889		-157.741	
No. of Obs.	1455		442		23	

Table 5.11: Maximum Likelihood Estimates of the Hazard of Departure: A Competing Risks Model - Males.

Finally, for females age has a positive and significant effect on the hazard of leaving for 'other reasons' (including pregnancy). However, for both males and females older workers are more likely than younger workers to be laid off, while for men they are also more likely to quit.

	Cox Proportional Hazard					
	Quit		Layoff		Other	
Variable	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
Salary	0.161×10^{-4}	2.917	0.781×10^{-7}	0.962	0.141×10^{-4}	0.776
Management	-0.175	-1.560	0.523	3.500	-0.660	-1.881
Rate 4	-0.382	-4.204	-0.259	-2.117	-0.418	-2.029
Rate 5	-0.274	-1.308	0.046	0.208	-0.688	-1.321
Rate 6	-0.286	-3.794	-0.369	-3.096	-0.680	-3.449
Degree	0.062	0.590	-0.314	-1.705	-0.535	-1.316
Prof. Qual.	-0.468	-2.363	-0.536	-1.565	-0.661	-0.918
Age	-0.681×10^{-3}	-0.174	0.022	4.202	-0.017	1.800
Married	-0.030	-0.453	0.559	5.986	1.728	10.891
Log-likelihood	-16355.391		-5492.163		-1938.829	
No. of Obs	1927		672		241	

Table 5.12: Maximum Likelihood Estimates of the Hazard of Departure: A Competing Risks Models - Females.

5.7 Conclusion

This chapter seeks to add to the limited empirical evidence on labour separation behaviour in the U.K by investigating some of the causes and consequences of labour turnover within our large U.K financial sector firm.

Exit code data which is available for those individuals who left the firm between January 1989 and February 1994 provides an important insight into some of the similarities and differences between males and females in their reason for departure. Women, for example, account for 59.664% of total separations over this period, compared with only 40.336% for that of men. From this voluntary departures account for 75.781% of separations for males and 67.852% of separations for females. Involuntary separations, on the other hand, account for 23.021% of separations for men and 23.662% of separations for women, while not surprisingly 'other reasons' (which includes pregnancy) accounts for 8.486% of departures among females and only 1.198% of departures among males.

To identify some of the determinant of labour turnover the incidence of separation is estimated using a random effects logistic and the hazard of separation is estimated using a Cox proportional hazard. The results show that in most specifications workers who are in a staff grade, have a professional qualification, and a higher performance rating have a significantly lower likelihood of separation than all other employees. These findings also highlight some important differences between men and women in the variables which affect their likelihood of separation. In particular, for females being married has a positive and significant effect on the likelihood of separation, but has a negative and significant effect on male separation behaviour. As mentioned earlier, this could reflect the differing roles men and women tend to play in the home. Married women may, for example, be more likely to leave the firm than single women in order to engage in non-market opportunities (e.g., child care). In contrast, married men have traditionally been regarded as the main wage earners within a household, which may make them less willing than single men to leave a relatively stable working environment.

For the workers who left the firm between January 1989 and February 1994 a Cox

proportional hazard with competing risks of exit due to quits (q), layoffs (l), and 'other reasons' (o) is also used to estimate whether workers who cite different reasons for departure also exhibit different behavioural characteristics. These results provide further support for the findings outlined above. In particular, they show that for females marital status has a positive and significant effect on the hazard of leaving for 'other reasons' (including pregnancy), but is insignificant for males. In contrast, being married has a negative and significant effect on the hazard of quitting for men, but is insignificant for women.

In line with Dolton and van der Klauuw (1999), who use a model suggested by Heckman and Singer (1984), an obvious extension to the work produced in this paper would be to control for unobserved heterogeneity in the competing risks model estimated in the previous section.

Chapter 6

Conclusion

This thesis uses data from the monthly personnel and payroll records of a large U.K banking sector firm to add to the limited body of empirical evidence in the area of personnel economics. In doing so it examines three broad fields of personnel economics: promotion, absenteeism and labour turnover. Although personnel data of this type has been available for other countries, especially the U.S (see, for example, Baker, Gibbs and Holmstrom (1994) and Lazear (1999)) this is one of the first data sets of its kind to be used to analyse the internal workings of a U.K firm.

A detailed review of this large U.K financial sector organisation is presented in Chapter 2. The personnel and payroll records used in this thesis are available over the period January 1989 to March 1997 (giving 99 monthly observations). Although the firm varies in size over this period overall it employs approximately 40,000 full-time workers and 20,000 part-time workers. Each observation in this data set is identified via a unique staff identification number and for each individual the personnel and payroll records contain details of the worker's job code, work unit code, salary, bonus, position in the hierarchy, date of entry into their current spell of employment, performance rating, partial post code of home and work, sex, age, marital status, number of children, ethnic origin, and some indicators of educational attainment.

Chapter 2 also examines the internal structure of the firm and finds that the organ-

isation has an explicit hierarchy in which workers can be assigned to one of 12 levels or grades; grades 2 to 6 represent the clerical grades, while grades 7 to 13 represent the management grades. Although the number of individuals employed in the clerical grades fell slightly between January 1989 and March 1997, the relative structure of the rest of the hierarchy has, nevertheless, remained remarkably stable over the period studied.

This chapter also investigates the extent to which the arrangements in our firm mimic those found in Baker, Gibbs and Holmstrom's (1994) influential paper in this area. Again it should be noted that the analysis outlined in this chapter draws heavily on work produced by Treble, van Gameren, Bridges and Barmby (2001).

Baker, Gibbs and Holmstrom (1994) use data from the personnel records of a large U.S service sector firm over the period 1969 to 1988 to analyse the extent to which the arrangements in their organisation characterise Doeringer and Piore's (1971) definition of an internal labour market. Despite the fact that the two firms operate in different countries, and the two sets of personnel records are available over different time periods the structure of the two organisations, nevertheless, appear to be remarkably similar.

As mentioned above our firm, like Baker, Gibbs and Holmstrom's (1994), has an explicit hierarchy which is relatively stable over time. In line with Doeringer and Piore's (1971) description of an internal labour market there is also evidence from both organisations that the internal labour market is allocating workers to jobs. Careers in both firms, for example, tend to be relatively long and demotions are rare. There is, however, no evidence in either organisation to support the idea of defined ports of entry and exit; entry and exit can occur at all grades/levels.

Employers in both firms also tend to use lower level job performance to learn about the innate abilities of their workers, and use this information in their subsequent promotion decisions. Such an inference is supported by the existence of promotion fast-tracking in both organisations, in which those promoted quickly at one grade/level are promoted more often and more quickly from the next grade/level.

Finally, in line with Doeringer and Piore's (1971) description of an internal labour

market there is evidence from both firms that wages are not determined solely on an individual basis but are strongly related to the grade the worker is in. The structure of pay is also convex within both organisations, as many incentive-based theories e.g., tournament theory (see Lazear and Rosen (1981) and Rosen (1986)) would suggest.

Although many similarities exist between the two firms important differences do, nevertheless, arise. Exit rates, for example, tend to be more variable in our large financial sector organisation than in Baker, Gibbs and Holmstrom's (1994). The hierarchy also changes its structure more markedly in this firm than in Baker, Gibbs and Holmstrom's (1994), with the management grades becoming proportionately more important over the period studied. Finally, in contrast to Baker, Gibbs and Holmstrom (1994), in this firm evidence of pay compressions within grades is only true for the staff grades. In the management grades workers in the higher quartiles tend to receive bigger pay increases than those in the lower quartiles.

Chapter 3 investigates some of the causes and consequences of promotion within our large U.K financial sector firm. In particular, it examines whether the promotion fast-track effects outlined above survive after controlling for other factors, such as human capital effects. Due to a lack of suitable data empirical research in this area is still relatively scarce. In particular, only a handful of studies have addressed the determinants of promotion for the U.K. Despite this, a number of stylised facts emerge when looking at comparisons in human resource practices between countries, especially between Japan and the U.S. For example, a common view when looking at the internal workings of a firm is that U.S and Japanese organisations differ in their policies towards promotion. U.S organisations tend to engage in promotion fast-tracking in which those promoted quickly at one grade/level tend to get promoted more often and more quickly from the next grade/level. Japanese companies, on the other hand, tend to adopt a late selection approach to promotion.

The analysis reported in this chapter uses a discrete-time proportional hazard based on the model proposed by Prentice and Gloeckler (1978) to study the time to promotion.

Among other things, these results show that time in the previous grade has a negative and significant effect on the hazard of promotion. In other words, the shorter the time spent by workers in their previous grade the more likely they are to be promoted from their current grade. Such a finding persists even after controlling for unobserved effects and provides further support for the existence of promotion fast-tracking within the firm.

This chapter makes a number of important contributions to the debate on the economics of promotion. First, it provides preliminary evidence that U.K organisations adopt similar fast-track promotion patterns to their U.S counterparts. Second, a number of theoretical models can be used to explain promotion fast-tracking e.g., human capital models, biased contests (Meyer(1991)), and the optimal setting of promotion criteria in the face of differing outside opportunities (Lazear (1995)). However, the results reported in this paper, using duration models of time to promotion, produce similar findings to Ariga, Ohkusa and Brunello (1997) and show that promotion fast-tracking survives even after controlling for human capital effects.

Chapter 3 also investigates some of the causes and consequences of promotion within our large U.K financial sector firm. The results show that individuals who have a long tenure with the firm, are older, have a low performance rating and are in an upper management grade have a lower hazard of promotion than all other workers. These findings also add to the limited empirical evidence on gender differences and promotion, and show that in line with the conventional view on promotion females are less likely to be promoted than their male counterparts.

The issue of absenteeism within this large financial sector firm is addressed in Chapter 4. Despite the large costs that are associated with absenteeism until recently very little attention has been paid by economists into the causes and consequences of absence. This chapter thus seeks to add to the growing empirical literature on absenteeism by investigating some of the determinants of absence within our large financial sector firm.

The analysis reported here uses a random effects logistic to estimate the incidence of absence for a random sample of 3,737 workers who were continuously employed by the firm

in 1992. In particular, these results highlight the importance past absence has on current absence behaviour. They show that in all specifications the largest and most significant coefficient is absence lagged 1 period. The positive sign on this coefficient indicates that, not surprisingly, individuals who were away from work the previous day have a higher probability of absence than all other workers. Despite these findings very few other studies appear to have addressed the effect past absence has on current choices. The results reported in this chapter also highlight the importance of controlling for heterogeneity and show that as a result of 'spurious' state dependence the effect past absence has on current choices is largely over-estimated in a model which neglects unobserved effects.

In addition, in line with the findings of many other studies on absence (see, for example, Bridges and Mumford (2001)) comparing the results by both gender and family situation some important differences emerge between individuals in the variables that affect their absence behaviour. In particular, the findings show that marital status is positive and significant for females, but insignificant for males. Such a finding indicates that married women are more likely to be absent from work than single women and could reflect the dual role females usually experience in both the home and work. Married women may, for example, be more likely to be absent from work than single women in order to engage in non-market activities (e.g., child care).

Finally, Chapter 5 uses data from the personnel and payroll records of our large U.K financial sector firm to investigate some of the causes and consequences of labour turnover. For those workers who left the firm between January 1989 and February 1994 the personnel files record the individual's main reason for leaving. In this study these codes are split into three distinct categories: quits (q), layoffs (l) and 'other reasons' (o). As in Booth, Francesconi and Garcia-Serrano (1999) 'other reasons' includes end of temporary contract, ill health, retirement and pregnancy.

Again, due to a lack of suitable data empirical research that looks at the determinants of worker separation behaviour for the U.K is still relatively scarce. This is in contrast to the U.S that appears to have a long history of looking at worker separation behaviour.

The pattern of labour turnover in the U.K has, however, been investigated extensively in a number of studies. Booth, Francesconi and Garcia-Serrano (1999), for example, find that on average individuals in Britain hold 5 jobs during their working life. In contrast, evidence for the U.S suggest that the number of jobs held is approximately double the number held by workers in the U.K. Hall (1982), for example, using data from the Current Population Survey finds that the average individual in the U.S holds approximately 10 jobs during their lifetime.

This chapter analyses the turnover behaviour of new entrants i.e., those individuals who entered the firm between January 1989 and March 1997. Two modes of analysis are used to examine the separation behaviour of new entrants. In line with Lazear (1999) the incidence of separation is estimated using a logistic model, and a proportional hazard model is used to estimate the hazard of separation. Then, following Booth, Francesconi and Garcia-Serrano (1999) a proportional hazard with competing risks of exit due to quits (q), layoffs (l) and 'other reasons' (o) is used to estimate the hazard of separation for those individuals who left the firm between January 1989 and February 1994 (the period over which exit code data is available).

The results show that in most specifications workers who are in a staff grade, have a professional qualification, and a higher performance rating have a significantly lower likelihood of separation than all other individuals. The findings also highlight important differences between men and women in the variables that affect their likelihood of separation. In particular, they show that for females being married has a positive and significant effect on the likelihood of separation, but has a negative and significant effect on male separation behaviour. This finding could again highlight the differing roles men and women tend to play in the home. Married women may, for example, be more likely to leave the firm than single women in order to engage in non-market opportunities (e.g., child care). In contrast, married men have traditionally been regarded as the main wage earners within a household, which may make them less willing than single men to leave a relatively stable working environment.

The competing risks Cox proportional hazard model provides further support for the findings outlined above. In particular, it shows that for females marital status has a positive and significant effect on the hazard of leaving for 'other reasons' (including pregnancy), but is insignificant for males. In contrast, the results show that being married has a negative and significant effect on the hazard of quitting for men, but is insignificant for women.

An obvious limitation of the work produced in this thesis is that it assumes that promotion and turnover are independent. This is obviously not always going to be the case. One way to extend the work produced in the thesis would be to estimate a competing risk model of duration in the grade, where individuals can leave the grade either due to promotion or because they exit the firm.

In summary, this thesis provides an indepth analysis of the internal workings of a large U.K financial sector firm. In doing so it makes a significant contribution to a field of research where the empirical evidence is still relatively scarce. In addition, by adding to the studies that use firm-level data of this kind it helps to address the extent to which previous findings can be thought of as representative of organisations generally, and in doing so helps to increase our understanding of how firms are organised.

Bibliography

[1] Abraham, K., and Medoff, J. (1981). 'Are Those Paid More Really More Productive? The Case of Experience', *Journal of Human Resources,* Vol. 16, pp. 186-216.

[2] Akyeampong, E. (1988). *Time Lost for Work for Personal Reasons*, The Labour Force, Statistics Canada: Labour and Household Surveys Analysis Division, May, pp. 89-121.

[3] Allen, S. G. (1981a). 'An Empirical Model of Worker Attendance', *Review of Economics and Statistics*, Vol. 63, pp. 77-87.

[4] Allen, S. G. (1981b). 'Compensation, Safety and Absenteeism: Evidence from the Paper Industry', *Industrial and Labor Relations Review*, Vol. 34, pp. 207-218.

[5] Allen, S. G. (1983). 'How Much Does Absenteeism Cost', *Journal of Human Resources*, Vol. 18(3), pp. 379-393.

[6] Allen, S. G. (1984). 'Trade Unions, Absenteeism and Exit Voice', *Industrial and Labor Relations Review*, Vol. 37(3), pp. 331-345.

[7] Aralampalam, W., Booth, A., and Taylor, M. (2000). 'Unemployment Persistence', *Oxford Economic Papers,* Vol. 52, pp. 24-50.

[8] Aoki, M. (1988). *Information, Incentives and Bargaining in the Japanese Economy,* Cambridge University Press.

[9] Ariga, K., Ohkusa, Y., and Brunello, G. (1997). 'Fast Track: is it in the Genes? The Promotion Policy of a Large Japanese Firm', Presented at the meeting of the European Association of Labour Economists, Aarhus, Denmark.

[10] Audas, R., Barmby, T., and Treble, J. (1997). 'Gender and Promotion in an Internal Labour Market', mimeo, Department of Economics, University of Newcastle upon Tyne.

[11] Audas, R., Barmby, T., and Treble, J. (2000). 'Luck, Effort and Reward in an Organisational Hierarchy', mimeo, Department of Economics, University of Newcastle upon Tyne.

[12] Baker, G., Gibbs, M., and Holmstrom, B. (1994). 'The Internal Economics of the Firm: Evidence from Personnel Data', *Quarterly Journal of Economics,* Vol. 109(4), pp. 881-919.

[13] Barmby, T., Bojke, C., and Treble, J. (1997). 'Worker Absenteeism: A Note on the Effect of Contract Structure', *Australian Journal of Labour Economics,* Vol 1(2), pp. 97-102.

[14] Barmby, T., Ercolani, M., and Treble, J. (1999). 'Sickness Absence in Great Britain: New Quarterly and Annual Series from the GHS and LFS 1971-1997'. *Labour Market Trends,* August, pp. 405-415.

[15] Barmby, T., Orme, C., and Treble, J. (1991). 'Worker Absenteeism: An Analysis using Microdata', *Economic Journal,* Vol. 101, pp. 214-229.

[16] Barmby, T., Orme, C., and Treble, J. (1995). 'Worker Absence Histories: A Panel Data Study', *Labour Economics,* Vol. 2, pp. 53-65.

[17] Barmby, T., Sessions, J., and Treble, J. (1994). 'Absenteeism, Efficiency Wages, and Shirking', Vol. 96(4), pp. 561-566.

[18] Barmby, T., and Stephan, G. (2000). 'Worker Absenteeism and Firm Size', *Manchester School,* Vol 68(5).

[19] Barmby, T., and Treble, J. (1991). 'Absenteeism in a Medium-Sized Manufacturing Plant', *Applied Economics*, Vol. 23, pp. 161-166.

[20] Barry, J., Francis, B., and Davies, R. (1990). 'SABRE: Software for the Analysis of Binary Recurrent Events', Centre for Applied Statistics, University of Lancaster, Lancaster.

[21] Becker, G. (1962). 'Investment in Human Capital: A Theoretical Analysis', *Journal of Political Economy,* Vol. 70(1), pp. S9-S49.

[22] Becker, G. (1985). 'Human Capital, Effort, and the Sexual Division of Labor', *Journal of Labor Economics,* Vol. 3(1), pp.S33-S58.

[23] Bernhardt, D. (1995). 'Strategic Promotion and Compensation', *Review of Economic Studies*, Vol.62, pp. 315-339.

[24] Blau, F., and Kahn, L. (1981). 'Race and Sex Differences in Quits by Young Workers', *Industrial and Labor Relations Review,* Vol. 34(4), pp. 563-577.

[25] Blau, F., and Light, A. (1992). 'Interpreting Panel Data on Job Tenure', *Journal of Labor Economics*, Vol. 10, No. 3 (July), pp. 219-257.

[26] Booth, A., Francesconi, M., and Frank, J. (1998). 'Glass Ceilings or Sticky Floors', *CEPR Discussion Paper,* No. 98/23.

[27] Booth, A., Francesconi, M., and Garcia-Serrano, C. (1999). 'Job Tenure and Job Mobility in Britain, *Industrial and Labor Relations Review,* Vol. 53(1), pp. 43-70.

[28] Bridges, S., and Mumford, K. (2001). 'Absenteeism in the U.K: A Comparison Across Genders', *Manchester School,* Vol. 69(3), pp. 276-284.

[29] Brown, C. (1990). 'Firm's Choice of Method of Pay', *Industrial and Labor Relations Review,* Vol. 43, pp. 165-182S.

[30] Brown, S., Fakhfakh, F., and Sessions, J. (1999). 'Absenteeism and Employee Sharing: An Empirical Analysis Based on French Panel Data, 1981-1991', *Industrial and Labor Relations Review,* Vol. 52(2), pp. 234-251.

[31] Cannings, K. (1988). 'Managerial Promotion: The Effects of Socialization, Specialization, and Gender', *Industrial and Labor Relations Review,* Vol. 42(1), pp. 77-88.

[32] Chamberlain, G. (1980). 'Analysis of Covariance with Qualitative Data', *Review of Economic Studies,* Vol. 67, pp. 225-238.

[33] Chan, W. (1996). 'External Recruitments versus Internal Promotion', *Journal of Labor Economics,* Vol. 14(4), pp. 555-570.

[34] Chaudhury, M., and Ng, I. (1992). 'Absenteeism Predictors: Least Squares, Rank Regressions, and Model Selection Results, *Canadian Journal of Economics*, Vol. 3, pp. 615-634.

[35] Chiang, S-H., and Gort, M. (1998). 'Personality Attributes and Optimal Hierarchical Compensation Gradients', *Journal of Economic Behavior and Organization,* Vol. 33, pp. 227-240.

[36] Cox, D. R. (1972). 'Regression Models and Life Tables' *Journal of the Royal Statistical Society,* Series B, Vol. 34, pp. 187-220.

[37] Davies, R., Elias, P., and Penn, R. (1992). 'The Relationship Between a Husband's Unemployment and his Wife's Participation in the Labour Force', *Oxford Bulletin of Economics and Statistics,* Vol. 54, pp. 145-171.

[38] Delgado, M., and Kniesner, T. (1997). 'Count Data Models with Variance of Unknown Form: An Application to a Hedonic Model of Worker Absenteeism', *Review of Economics and Statistics,* Vol. 79(1), pp. 41-49.

[39] Doeringer, P., and Piore, M. (1971). *Internal Labour Markets and Manpower Analysis*, Health Lexington Books.

[40] Doherty, N. A. (1979). 'National Insurance and Absence from Work', *Economic Journal,* Vol. 89, pp. 50-65.

[41] Dolton, P., and Kidd, M. (1998). 'Job Changes, Occupational Mobility and Human Capital Acquisition: An Empirical Analysis', *Bulletin of Economic Research,* Vol. 50(4), pp. 265-295.

[42] Dolton, P., and von der Klaauw, W. (1995). 'Leaving Teaching in the U.K: A Duration Analysis', *Economic Journal,* Vol. 105, pp. 431-444.

[43] Dolton, P, and von der Klaauw, W. (1999). 'The Turnover of Teachers: A Competing Risks Explanation', *Review of Economics and Statistics,* Vol. 81(3) pp. 543-552.

[44] Drago, R., and Wooden, M. (1992). 'The Determinants of Labor Absence: Economic Factors and Work Group Norms', *Industrial and Labor Relations Review,* Vol. 45, pp. 34-47.

[45] Dunn, L. F., and Youngblood, S. A. (1986). 'Absenteeism as a Mechanism for Approaching an Optimal Labour Market Equilibrium: An Empirical Study', *Review of Economics and Statistics*, Vol. 68, pp. 668-674.

[46] Farber, H. S. (1994). 'The Analysis of Interfirm Worker Mobility', *Journal of Labor Economics*, Vol. 12(4), pp. 554-594.

[47] Fichman, H. (1984). 'A Theoretical Approach to Understanding Employee Absence', in *Absenteeism: New Approaches to Understanding, Measuring, and Man-*

aging Employee Absence, edited by Goodman, P., and Atkin, R., pp. 1-46, San Francisco: Jossey-Bass Inc.

[48] Florkowski, G. (1987). 'The Organizational Impact of Profit-Sharing', *Academy of Management Review,* Vol. 12, pp. 662-631.

[49] Francesconi, M. (1999). 'Determinants of Promotion', *CEPR Discussion Paper.*

[50] Freeman, R., and Medoff, J. (1984). *What Do Unions Do?,* New York: Basic Books.

[51] Gregg, P., and Wadsworth, J. (1995). 'A Short History of Labour Turnover, Job Tenure, and Job Security, 1975-93', *Oxford Review of Economic Policy,* Vol. 11(1), pp. 73-90.

[52] Hall, R. (1982). 'The Importance of Lifetime Jobs in the United States Economy', *American Economic Review,* Vol. 72(4), pp. 716-724.

[53] Hammer, T., Landau, J., and Stern, R. (1988). 'Absenteeism When Workers Have a Voice: The Case of Employee Ownership', *Journal of Applied Psychology,* Vol. 62, pp. 319-327.

[54] Han, A., and Hausman, J. (1990). 'Flexible Parametric Estimation of Duration and Competing Risk Models', *Journal of Applied Econometrics,* Vol. 5, pp. 1-28.

[55] Heckman, J. (1981a). 'Statistical Models for Discrete Panel Data', in *Structural Analysis of Discrete Data with Econometric Applications,* edited by Manski, C. F., and McFadden D., pp. 114-178, Cambridge: MIT Press.

[56] Heckman, J. (1981b). 'The Incidental Parameters Problems and the Problem of Initial Conditions in Estimating a Discrete Time-Discrete Data Stochastic Process', in *Structural Analysis of Discrete Data with Econometric Applications,* edited by Manski, C. F., and McFadden D., pp. 179-195, Cambridge:) MIT Press.

[57] Heckman, J., and Singer, B. (1984). 'A Method for Minimising the Impact of Distributional Assumptions in Econometric Models for Duration Data', *Econometrica,* Vol. 52, pp. 271-320.

[58] Hsiao, C. (1989). *Analysis of Panel Data,* Cambridge University Press.

[59] Jones, D., and Makepeace, G. (1996). 'Equal Worth, Equal Opportunities: Pay and Promotion in an Internal Labour Market', *Economic Journal,* Vol. 106(435), pp. 401-409.

[60] Jovanovic, B. (1979). 'Job Matching and the Theory of Turnover', *Journal of Political Economy*, Vol. 87(5), pp. 972-990.

[61] Kenyon, P., and Dawkins, P. (1989). 'A Time Series Analysis of Labour Absence in Australia', *Review of Economics and Statistics*, Vol. 71(2), pp. 232-239.

[62] Lancaster, T. (1990). *The Econometric Analysis of Transition Data*, New York, Cambridge University Press.

[63] Lane, J., and Parkin., M. (1998). 'Turnover in an Accounting Firm', *Journal of Labor Economics,* Vol. 16(4), pp. 702-717.

[64] Lazear, E. (1989). 'Pay Equality and Industrial Policies', *Journal of Political Economy,* Vol. 97, pp. 561-580.

[65] Lazear, E. (1992). 'The Job as a Concept' in *Performance Measurement, Evaluation and Incentives*, edited by Bruns, W. Jr, pp. 183-215, Boston: Harvard Business School Press.

[66] Lazear, E. (1995). *Personnel Economics,* MIT Press: Boston.

[67] Lazear, E. (1999). 'Personnel Economics: Past Lessons and Future Directions', *Journal of Labor Economics,* Vol. 17(2), pp. 199-236.

[68] Lazear, E. (2000). 'The Future of Personnel Economics', *Economic Journal,* Vol. 110(467), pp. 611-639.

[69] Lazear, E., and Rosen, S. (1981). 'Rank-order Tournaments as Optimal Labor Contracts', *Journal of Political Economy,* Vol. 89, pp. 841-864.

[70] Lazear, E., and Rosen, S. (1990). 'Male-Female Wage Differentials in Job Ladders', *Journal of Labor Economics,* Vol. 8(2), pp. S106-S123.

[71] Leigh, J. P. (1983). 'Sex Differences in Absenteeism', *Industrial Relations,* Vol. 22(3), pp. 349-361.

[72] Leigh, J. P. (1986). 'Correlates of Absence from Work Due to Illness', *Human Relations,* Vol. 39, pp. 81-100.

[73] Leigh, J. P. (1991). 'Employee and Job Attributes as Predictors of Absenteeism in a National Sample of Workers: The Importance of Health and Dangerous Working Conditions', *Social Science and Medicine*, Vol. 33(2), pp. 127-137.

[74] Lindeboom, M., and Theeuwes, J. (1991). 'Job Duration in the Netherlands: The Co-Existence of High Turnover and Permanent Job Attachment', *Oxford Bulletin of Economics and Statistics,* Vol. 53(3), pp. 243-264.

[75] Light, A., and Ureta, M. (1990). 'Gender Differences in Wages and Job Tenure Among Continuously Employed Workers', *American Economic Review*, Vol. 80(2), pp. 293-297.

[76] Long, R. (1980). 'Job Attitudes and Organizational Performance Under Employee Ownership', *Academy of Management Journal,* Vol. 23, pp. 726-737.

[77] McCue, K. (1996). 'Promotions and Wage Growth', *Journal of Labor Economics,* Vol. 14(2), pp. 175-209.

[78] McLaughlin, K. (1991). 'A Theory of Quits and Layoffs with Efficient Turnover', *Journal of Political Economy,* Vol. 99(1), pp. 1-29

[79] Medoff, J., and Abraham, K. (1980). 'Experience, Performance and Earnings' *Quarterly Journal of Economics,* Vol. 95, pp. 703-736.

[80] Meizen, M. (1986). 'Differences in Male and Female Job-quitting Behaviour', *Journal of Labor Economics,* Vol. 4, pp. 151-167.

[81] Meyer, B. (1990). 'Unemployment Insurance and Unemployment Spells', *Econometrica,* Vol. 58(4), pp. 757-782.

[82] Meyer, M. (1991). 'Learning from Coarse Information: Biased Contests and Career Profiles', *Review of Economic Studies,* Vol 58, pp. 15-42.

[83] Narendranathan, W., and Stewart, M. (1993). 'Modelling the Probability of Leaving Unemployment: Competing Risk Models with Flexible Base-line Hazards,' *Applied Statistics,* Vol. 42(1), pp. 63-83.

[84] Orme, C. (1997). 'The Initial Conditions Problem and Two-Step Estimation in Discrete Panel Data Models', mimeo, School of Economic Studies, University of Manchester.

[85] Paringer, L. (1983). 'Women and Absenteeism: Health or Economics?', *American Economic Review,* Vol. 73, pp. 123-127.

[86] Parsons, D. (1972). 'Specific Human Capital: An Application to Quit Rates and Layoff Rates', *Journal of Political Economy,* Vol. 80(6), pp. 1120-1143.

[87] Prendergast, C. (1992). 'Career Development and Specific Human Capital Collection', *Journal of the Japanese and International Economies,* Vol. 6, pp. 207-227.

[88] Prentice, R., and Gloeckler, L. (1978). 'Regression Analysis of Grouped Survival Data with Application to Breast Cancer Data', *Biometrics,* Vol. 34, pp. 57-67.

[89] Pudney, S., and Shields, M. (2000). 'Gender and Racial Discrimination and Promotion for NHS Nurses', *Oxford Bulletin of Economics and Statistics,* Vol. 62, pp. 801-835.

[90] Pudney, S., and Shields, M. (2000b). 'Gender, Race, Pay and Promotion in the British Nursing Profession: Estimation of a Generalized Ordered Probit Model', *Journal of Applied Econometrics,* Vol. 15, pp. 367-399.

[91] Rosen, S. (1974). 'Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition', *Journal of Political Economy,* Vol 82(1), pp. 34-55.

[92] Rosen, S. (1986). 'Prizes and Incentives in Elimination Tournaments', *American Economic Review,* Vol. 76(4), pp. 701-715.

[93] Rosenbaum, J. (1984). *Career Mobility in a Corporate Hierarchy,* New York Academic Press.

[94] Scoones, D., and Bernhardt, D. (1998). 'Promotion, Turnover, and Discretionary Human Capital Acquisition', *Journal of Labor Economics,* Vol. 16, pp. 122-141.

[95] Sicherman, N. (1996). 'Gender Differences in Departures from a Large Firm', *Industrial and Labor Relations Review,* Vol. 49(3), pp. 484-505.

[96] Sicherman, N., and Galor, O. (1990) 'A Theory of Career Mobility', *Journal of Political Economy,* Vol. 98(1), pp. 169-192.

[97] Spurr, S., and Sueyoshi, G. (1993). 'Turnover and the Promotion of Lawyers: An Inquiry into Gender Differences', *Journal of Human Resources,* Vol. 29(3), pp. 813-842.

[98] Steers, R. M., and Rhodes, S. R. (1978). 'Major Influences on Employee Attendance: A Process Model', *Journal of Applied Psychology,* Vol. 63, pp. 391-407.

[99] Topel, R., and Ward, M. (1992). 'Job Mobility and the Careers of Young Men', *Quarterly Journal of Economics,* Vol. 107(429), pp. 439-479.

[100] Treble, J., van Gameren E., Bridges, S., and Barmby, T. (2001). 'The Internal Economics of the Firm: Further Evidence from Personnel Data', forthcoming *Labour Economics.*

[101] VandenHeuvel, A. and Wooden, M. (1995). 'Do Explanations of Absenteeism Differ for Men and Women', *Human Relations,* Vol. 48(11), pp. 1309-1329.

[102] Viscusi, K. (1980). 'Sex Differences in Worker Quitting', *Review of Economics and Statistics,* Vol. 62(3), pp. 388-398.

[103] Vistnes, J. P. (1997). 'Gender Differences in Days Lost from Work Due to Illness', *Industrial and Labor Relations Review,* Vol. 50(2), pp. 304-321.

[104] Waldman, M. (1984). 'Job Assignments, Signalling, and Efficiency', *Rand Journal of Economics,* Vol. 15(2), pp. 255-267.

[105] Wilson, N., and Peel, M. J. (1991). 'The Impact on Absenteeism and Quits of Profit-Sharing and other Forms of Employee Participation', *Industrial and Labor Relations Review,* Vol. 44(3), pp. 454-468.

[106] Winkler, D. (1980). 'The Effects of Sick-Leave Policy on Teacher Absenteeism', *Industrial and Labor Relations Review,* Vol. 33, pp. 232-240.

[107] Winter-Ebmer, R., and Zweimüller, J. (1997) 'Unequal Assignment and Unequal Promotion in Job Ladders', *Journal of Labor Economics,* Vol. 15(1), pp. 43-71.

[108] Wise, D. (1975), 'Personal Attributes, Job Performance, and the Probability of Promotion', *Econometrica,* Vol. 43, pp. 913-932.

[109] Youngblood, S. (1984). 'Work, Non-Work and Withdrawal', *Journal of Applied Psychology,* Vol. 49, pp. 106-117.