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The Absence Decision: 
A Theoretical and Empirical Analysis

By

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A Doctoral Thesis
Submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy

Department of Economics
Loughborough University
September 1995

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Abstract

Economists have been somewhat remiss in dealing with the issue of worker absence. This is surprising given the figures involved. In the year of the last miners' strike, 27 million working days were lost as a result of strike activity, a figure which pales by comparison with the 375 million working days lost on average as a result of absenteeism over the 1980's [Economic Trends]. Furthermore, a study by management consultants, Arthur Anderson, recently estimated the cost of absenteeism to the UK industry at £6 billion per year [The Independent, 22/10/91].

Despite all this, relatively little attention has been paid in the economic literature to either the causes and/or the effects of absenteeism. Nevertheless, the discipline has benefited from a basic yet rigorous theoretical structure founded on static neo-classical labour supply theory. The aim of this Thesis is to address two main weaknesses of the existing theory of absence behaviour.

Firstly, there is a distinct shortage of models which explicitly incorporate labour demand considerations and, consequently, ways in which employers might attempt to control absenteeism. Hence, emphasis in this Thesis is placed on the analysis of methods of absence control such as the provision of experience rated sick pay and overtime.

A second weakness of the existing theory concerns the somewhat limited 'static' approach which has generally been adopted in the economic literature. Thus, this Thesis acknowledges the role of risk and uncertainty in absence behaviour by setting the analysis within a dynamic framework.

The key objective of this Thesis is to explore the determinants of absence behaviour and identify ways in which contractual arrangements and, therefore, labour demand considerations manipulate the incentive to absent from the work place. The empirical analysis supports the hypothesis that observed absence behaviour is primarily influenced by the nature of the employment contract and, therefore, by the interaction of labour supply and labour demand.
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Worker absenteeism constitutes a significant loss of work-time and therefore has important implications for both household income and firm productivity. Empirical evidence from Doherty (1979), for example, shows that the loss in working days due to sickness absence in the United Kingdom over the 1970s was at least as great as that due to unemployment. Similar evidence is presented by Akyeampong (1988) for Canada. More recent evidence exploring the implications of lost working days is provided by a study undertaken by the management consultants, Arthur Anderson, who estimate the cost of absenteeism to UK industry at £6 billion per year [The Independent, 22/10/91]. Furthermore, the CBI (1994), which conducted a survey of 1.2 million employees from over 500 employers, discovered that 171 million days were lost through sickness absence in 1993, whilst only half a million days were lost due to industrial disputes. The cost of the working days lost due to absence, incurred by employers, was estimated at £11 billion in 1993 (£13 billion in 1992). It seems somewhat paradoxical, therefore, that both media and academic interest has focused on the analysis of industrial disputes rather than on absenteeism.

Despite all this relatively little attention has been paid in the economic literature to either the causes and/or the effects of absenteeism. This is in stark contrast to other disciplines in the social sciences such as the field of applied psychology where much research has been undertaken to determine the psychological aspects underpinning a worker’s decision to go absent. Steers and Rhodes (1978, 1984), for example, identify job dissatisfaction as the main psychological cause of worker absence. There has been, however, some interaction between the disciplines of economics and applied psychology. The notion of job satisfaction, for instance, has been incorporated into several economic analyses of absenteeism; using self-reported survey data Drago and Wooden (1992), for example, find that if job satisfaction is high, work group cohesion is associated with low absenteeism.2 This area is, however, problematic since concepts such as job satisfaction are difficult to define and measure.

1 This is despite the fact highlighted by Treble (1990) that interest in absenteeism dates back to the 1920s. Treble (1990) describes two studies in detail: Vernon and Bedford (1928) and Vernon et al (1931) both of which examine absenteeism in the coal industry. The results of these pioneering studies suggest that absenteeism is affected by sick pay schemes, rates of pay and working conditions.

2 Interest in recent years has been paid to profit-sharing and employee participation schemes, the potential benefits of which are argued to be increased morale, motivation and job satisfaction [Bell and Hanson (1984)]. The results of Peel and Wilson (1991) indicate that firms operating employee participation schemes experience lower than average absenteeism. Kahana and Weiss (1992), however, demonstrate within their dynamic theoretical framework that circumstances exist where members of labour managed firms will absent when it is optimal to work. The impetus behind
Furthermore, the applied psychology literature has been handicapped by a distinct lack of theoretical rigour. In comparison, the economic literature that does exist has benefited from a basic yet rigorous theoretical structure. In general, absenteeism has been modelled in the economic literature in the context of static neo-classical labour supply theory which is based on the individual's choice between income and leisure. The labour supply decision reached represents the solution to the individual's constrained utility maximisation problem [see Killingsworth (1983) for a comprehensive survey of this literature]. In the simple static labour supply model individuals are able to choose the amount of labour supplied subject to time constraints. If the individual is able to choose the exact amount of labour supplied then the concept of absenteeism does not exist. The potential for absenteeism emerges when workers are obliged to supply a certain amount of labour within a specified time period. As a consequence of such contractual obligations, individuals have an incentive to absent from the workplace if the contractual hours fixed by the employer exceed the level of labour supply which maximises the individual's utility.

This conventional approach to absenteeism relies almost exclusively on supply side modelling, i.e. modelling the response of an individual to a given employment contract. Hence the standard approach to modelling absence behaviour is concerned with voluntary as opposed to involuntary absence - absence is modelled as a conscious decision not to attend work as opposed to sickness absence wherein the individual is physiologically and/or psychologically unable to attend.

The contributions made by economists to the theory of absence are surveyed extensively in Chapter 2. The conventional labour supply approach to absence is set-out formally in Section 2.2 whilst Section 2.3 examines the ways in which economists have attempted to extend this basic model. The aim of the survey is to highlight weaknesses of the existing literature in order to illustrate the contribution to the analysis of absence behaviour made by this Thesis.

The general conclusion from Chapter 2 is that economists have made a somewhat limited contribution to the theoretical modelling of absence behaviour. To be specific, there are two fundamental weaknesses of the theory which can be identified. Firstly, there is a distinct shortage of models which explicitly incorporate labour demand considerations and, consequently, ways in which employers might attempt to control absenteeism. This lack is clearly surprising given that the interaction between supply and demand is central to economic analysis. Secondly, there is a widespread ignorance of the influence of risk and uncertainty on absence decisions which stems from the 'static' (i.e. single time period) approach which has

\[ \text{this result lies in the free riding problem redolent of an egalitarian division of profits throughout the work force regardless of an individual's absence history.} \]
generally been adopted in the economic literature. The associated concepts of risk and uncertainty are likely to be of considerable importance when analysing - particularly involuntary - absence decisions since whether an individual becomes sick is predominantly an uncertain or risky event.

Despite these shortcomings a number of empirical investigations have emerged, shedding some light on the analysis of observed absence behaviour. Given the limited theoretical framework, however, the results from the empirical investigations have tended to be rather inconsistent and, therefore, difficult to interpret. As well as surveying the results of the various empirical studies, Chapter 2 highlights the perplexity that stems from such a lack of theoretical rigour.

The aim of this Thesis, therefore, is to extend the theoretical foundations of the analysis of absence behaviour. In addition, some empirical analysis of observed absence behaviour is undertaken in order to interpret the observed behaviour in the context of the proposed richer and more realistic theoretical framework. In general, the objective of this Thesis is to explore the determinants of absence behaviour and identify ways in which contractual arrangements and, therefore, labour demand considerations can affect or even manipulate an individual’s incentive to absent from his/her workplace. Furthermore, the theoretical analysis is set within a multi-time period rather than a static framework in order to acknowledge the significance of the dimension of time for the absence decision-making process.

Prior to extending the model of absence behaviour, it is important to ascertain the significance of absenteeism as a labour market phenomenon. As mentioned above, the concept of absenteeism is only capable of definition if the notion of an hours constraint is incorporated into labour supply theory. The huge literature exploring the supply of labour by individuals is dominated by research into the decision problem facing an individual over the amount of hours worked. As such it is concerned with the modelling of desired rather than actual work hours, implicitly assuming the non-existence of an hours constraint [Ilmakunnas and Pudney (1990)]. This is clearly an unrealistic assumption to make and its implications are discussed in detail in Chapter 3. To summarise an employee may find that a given hours constraint falls short, exceeds or corresponds to his/her unconstrained utility maximising supply of labour, rendering the individual in a state of under-employment, over-employment or unconstrained utility maximising employment respectively. The second-best scenarios give rise to the potential for moonlighting (under-employment) or, of particular interest to this Thesis, absenteeism (over-employment) as the individual attempts to bring his/her utility maximising and contractual hours into conjunction.

The aim of Chapter 3 is to construct the profiles of an over-employed individual, an under-employed individual and an individual who is satisfied with
his/her contractual hours in order to determine the type of individual who may be regarded as a 'potential absentee'. Consequently, the analysis of Chapter 3 acknowledges that individuals may be constrained with respect to their hours of labour rather than unrealistically assuming that desired and actual work hours are in accord. In order to construct such a set of profiles, data from the British Social Attitudes Survey, a data source which is largely untapped by economists, is analysed. Indeed, the finding that over a third of the individuals surveyed indicate that their labour supply is constrained in some way provides a further mandate for any additional research into the implications of hours constraints for labour market behaviour.

Furthermore, the appendix to Chapter 3 contains the results of the estimation of a selection of labour supply schedules. By identifying those individuals in the sample who are satisfied with contractual hours, the results from labour supply schedules estimated on both desired and constrained hours can be compared. The differences between the estimates provides a useful insight into the implications of implicitly assuming that individuals are able to choose hours of work.

Given that the evidence reported in Chapter 3 suggests that hours constraints are an important feature of observed employment contracts, Chapter 4 extends the simple labour supply model of absence decision-making by setting the analysis within a multi-time period framework and focusing on the implications of a specific type of absence control scheme, an experience rated sick pay scheme, for the worker's absence decision-making process. It would seem particularly appropriate to assume, in the context of absence behaviour, that an individual's current behaviour may have important implications for future opportunities. If an individual, for example, goes absent today he/she may be eligible for a lower level of sick pay tomorrow. The essence of such a sick pay scheme is incorporated into this model for workers employed under a two period contract.

The probability of attendance derived from the theoretical model is a function of wages, sick pay and contractual hours, i.e. it is a function of the characteristics of the employment contract. Moreover, the effect of future opportunities on current decisions serves to inflate the probability of attendance in the current time period, with individuals taking account of the effect of current absence on future sick pay entitlement.

The theoretical results obtained thus predict that individuals facing experience rated sick pay schemes should be characterised by a lower probability of current period absence. The empirical analysis presented in Chapter 4 explores the determinants of the absence rates observed from a set of workers who face just such a scheme. The results confirm a priori expectations suggesting that
characteristics pertaining to the employment contract are important determinants of absence behaviour.

Appendix A4.1 expands the theoretical model of Chapter 4 by making a distinction between 'acceptable' absence (i.e. absence due to illness) and 'unacceptable' absence (i.e. shirking). The theoretical results suggest that the nature of absence decisions is a complex product of the interaction between two different types of absence control since 'unacceptable' absence, if detected, is assumed to lead to dismissal. Moreover, the theory illustrates how 'acceptably' sick workers may still choose to attend work on account of the threat of job loss resulting from the level of monitoring chosen by the firm. Such a scenario has important practical implications since if a worker's productivity is a function of sickness then situations may arise when individuals attend work when employers would prefer them to stay away.

Appendix A4.2 presents results from an alternative empirical analysis of the implications of experience rated sick pay using a discrete panel of weekly data representing the work history of each employee. The aim here is to estimate the probability of attendance for each weekly observation and then to estimate the parameters of the sickness distribution which maximise the likelihood of the observed absence history occurring. These parameters were derived for each employee and then regressed on factors such as age and sex which one would expect to influence the distribution of an individual's health. The relationship between the nature of the distribution of sickness and personal characteristics appears to be broadly in line with the findings of the medical statistics literature.

Emphasis in Chapter 5 is placed on the implications of an alternative penalty system for the absence decision making process where the provision of overtime working is conditional on past absence behaviour. A worker with an 'unacceptable' absence history is effectively banned from working any overtime for a specified time period. The penalty system is therefore similar to that analysed in Chapter 4 where remuneration levels are conditional on past absence behaviour. Thus, both absence penalty schemes emphasise the temporal link between absence decisions of the past, present and future. The experience rated sick pay scheme analysed in Chapter 4 operates by making sick pay entitlements more generous if an individual displays a satisfactory attendance record. As outlined in Chapter 4, it is difficult to justify the provision of firm-financed sick pay in excess of the statutory minimum, although such an assumption is a necessary feature of an effective experience rated sick pay scheme. In contrast, the absence control mechanism explored in Chapter 5 does not rely on such an arrangement but focuses, instead, on the income earned from attendance.
The empirical analysis of Chapter 5 explores a set of discrete panel data thereby allowing for the effects of both dynamic and cross-sectional influences. The panel of data consists of work histories derived from daily attendance records for a sample of individuals employed by a British manufacturing firm which operates an overtime ban absence control mechanism similar to that portrayed in the theoretical model described above. Given that individuals make attendance decisions on a day-by-day basis it is clear that such a micro data set is an appropriate starting point. Moreover, the analysis of such absence records explicitly introduces a time dimension, which has attracted scant attention in both the theoretical and the empirical literature, into the absence decision-making process.

It is reassuring to discover that the results of Chapter 5 are in accordance with those of other studies. In general, the analysis of this panel of daily data confirms that absence behaviour is primarily affected by contractual characteristics such as the prevailing wage rate and the penalty system operated by the firm. Moreover, the penalty system appears to be effective in exerting a moderating influence on absence behaviour whilst the theoretical and empirical findings suggest ways in which the effectiveness of the system could be further enhanced.

Chapter 6 explores a further influence on the incentive to absent from the workplace, namely dissatisfaction with the current employment contract. Such dissatisfaction may ultimately lead to the individual seeking alternative employment and so the relationship between quits, job search and absence behaviour is considered. Job search and quit behaviour have been modelled extensively as a means for workers to counteract dissatisfaction with employment contracts. Likewise absence behaviour can be recognised as a symptom of dissatisfaction with the employment contract since it implies a degree of mismatch between the employment contract and the individual's utility-maximising strategy. In this Chapter, the implications of job search for absence behaviour are explored in a theoretical model in order to highlight the interaction between these types of worker behaviour which, to date, have been analysed as distinct phenomena.

The model developed illustrates how the potential benefits of job search may affect the absence behaviour of workers employed under both single- and two-period contracts. To be specific, the potential benefits of job search serve to raise the probability of absence. Assuming that on-the-job search is ruled out and that sick pay is greater than unemployment benefit, sick pay serves to subsidise off-the-job search and, hence, inflates the incentive to absent from the workplace. A trade-off exists, however, between the benefits of search and the costs of search in terms of the amount of non-work term devoted to job search. Furthermore, the implications of the relative magnitudes of these costs and benefits for an
individual's expected utility is dependent on the state of the individual's health which in turn determines the individual's valuation of income and leisure.

As regards the relationship between quits and absence behaviour, some empirical analysis of an informative panel of firm level data is undertaken. The aim here is to ascertain the nature of the determinants of quit rates and the results obtained accord with the predictions of the theoretical analysis suggestive of a positive association between observed quit rates and absence rates.

Finally, Chapter 7 collects general concluding remarks relating to the analysis of the incentive to absent from the work place and highlights potential avenues for future research.

To summarise, this Thesis presents a selection of original theoretical and empirical results relating to the economics of absence behaviour. The theoretical modelling serves to enhance the realism of the theory of absence decision-making in ways which have, to date, been overlooked by economists. Furthermore the empirical analysis yields results which are broadly in line with those from other studies as well as being capable of interpretation within the proposed richer theoretical structure.
Chapter Two: The Economics Of Absence Behaviour

2.1 Introduction

Economists have been somewhat remiss in dealing with the issue of worker absence. This is surprising given the figures mentioned in Chapter One. Absenteeism is clearly important for what it says about the determinants of worker behaviour occurring for either valid (i.e. "sickness") or invalid (i.e. "shirking") reasons. An understanding of the factors motivating the latter can yield valuable insights into how workers value their employment contracts.

Despite all this, relatively little attention has been paid in the economic literature to either the causes and/or the effects of absenteeism. This is in marked contrast to other disciplines in the social sciences such as the field of applied psychology. The situation is, however, changing and recent years have witnessed a mild flurry of activity on the part of economists in attempting to understand this most pervasive worker behaviour. The aim of this Chapter is twofold: first, to give some perspective to these studies in relation to the economics literature and, where appropriate, the literature of other disciplines; and second, to highlight the contribution to the analysis of absence behaviour made by this Thesis.

The Chapter is set out as follows: Section 2.2 outlines some of the central theoretical issues underpinning the economics of absence. Section 2.3 reviews the existing economics literature, highlighting the links with the theoretical foundations discussed in Section 2.2. Issues for future research and final remarks are collected in Section 2.4.

2.2 Absenteeism as a Labour Supply Response

Economists have tended to analyse absence within the framework of the static neo-classical labour supply model. The potential for absenteeism, it is argued, emerges when individuals are obliged to supply a certain amount of labour within a given time period. Such constraints are common because employers are unlikely to be indifferent as to how much labour individuals supply. For example, where production takes place on an assembly line workers may be technically constrained to supply the same amount of labour at specified times [Deardorff and Stafford (1976)]. Balchin and Wooden (1992) remark that cost minimisation generally dictates that workers perform tasks at specified times in order to prevent

---

1 Some of the analysis presented in this Chapter is published in Brown and Sessions (1995).
bottlenecks, meet co-ordination requirements or, perhaps, to promote the effective utilisation of capital.

Absenteeism arises in this context when the level of contractual hours specified by the employer exceeds that which maximises the individual's utility. It is implicitly assumed in this Chapter that the utility obtained from accepting the employment contract is greater than that derived from not accepting, such that the individual’s second best (i.e. constrained) utility maximising option is to supply labour under the specified contractual obligations. An individual may accept such a contract, as opposed to seeking a first best (i.e. unconstrained) contract which specifies a supply of labour which equates the individual’s marginal and economic rates of substitution between income and leisure, because job search is costly in terms of both income and leisure time.

The formal analysis of the incentive to be absent is set out below. An individual has a utility function of the form:

\[ u = u(x, l) \]  \hspace{1cm} (2.1)

and is endowed with a stock of time:

\[ T = h + l \]  \hspace{1cm} (2.2)

where \( x \) represents a vector of consumption goods, \( h \), labour supply and \( l \), leisure. The individual’s budget constraint is represented by:

\[ x \leq m = m_0 + wh \]  \hspace{1cm} (2.3)

where \( m_0 \) is unearned income and \( w \) is the exogenous real wage.\(^2\)

In the absence of any further contractual obligations, the individual’s problem is to maximise Equation (2.1) subject to constraints (2.2) and (2.3). Assuming positive but declining marginal utilities, an interior solution to this problem implies:

\[ \frac{\partial u(x^*, l^*)}{\partial l} = \frac{u_i(x^*, l^*)}{u_x(x^*, l^*)} = w \]  \hspace{1cm} (2.4)

\[ x^* = m_0 + wh^* = m^* \]  \hspace{1cm} (2.5)

such that the marginal rate of substitution between consumption and leisure equals the economic rate of substitution. In terms of Figure 2.1 the individual faces the budget constraint \([T, E_0, E^c, l^c]\) and maximises utility by moving to the point on the

\(^2\) For simplicity, the price level is normalised to unity throughout this Chapter.
budget constraint which is tangential to his/her indifference curve. Thus, if the individual were not supply-constrained then his/her equilibrium would appear at $E^* = (x^*, l^*)$, where $l^* = T - h^*$ and $h^*$ represents the individual's optimal labour supply decision.

![Figure 2.1: Over-Employment and the Labour Supply Decision](image)

If the employment contract specifies contractual hours $h^c$, where $h^c > h^*$, then the individual would still accept the contract, since $u(x^c, T - h^c) = u(x^c, l^c) > u(m_0, T)$ (i.e. compare $I_1$ to $I_0$). Acceptance of the contract moves the individual to $E^c = (x^c, l^c)$, where $l^c = T - h^c$. However, since at $E^c$ his/her marginal rate of substitution between income and leisure exceeds the economic rate of substitution, $\left[\frac{u_x(x^c, l^c)}{u_z(x^c, l^c)}\right] > w$, the individual would have an incentive to go absent in an attempt to move towards $E^*$, where his/her marginal rate of substitution between income and leisure (i.e. the slope of his/her indifference curves) equals the economic rate of substitution (i.e. the slope of his/her budget constraint).

Hence, it is apparent that in this framework absenteeism arises due to the discontinuity in the budget constraint, which causes the individual to be rationed as to the amount of labour he/she supplies. Furthermore, the discontinuity leads to a disequilibrium position. Discontinuous budget constraints are clearly a realistic
phenomenon since the majority of employment contracts specify a wage rate and work schedule which defines contractual hours.\(^3\)

The comparative statics of absence behaviour in this simple model are relatively straightforward. An increase (decrease) in the wage rate produces an income effect which increases (decreases) the tendency to absent if leisure is a normal good, and a substitution effect which serves to decrease (increase) the tendency unequivocally. An increase (decrease) in unearned income acts as a pure income effect and so increases (decreases) the tendency to absent if leisure is normal. Finally, an increase in contractual hours will increase the tendency to absent on account of the diminishing marginal utility of leisure. This can be seen formally by defining the temptation to absent as:

\[
\Theta(x^c, l^c; w) = \frac{u(x^c, l^c)}{u_s(x^c, l^c)} - w \tag{2.6}
\]

Partially differentiating Equation (2.6) with respect to contractual hours yields the following:

\[
\frac{\partial \Theta(x^c, l^c)}{\partial h^c} = \frac{u'_s(x^c, l^c)u_l(x^c, l^c) - u_s(x^c, l^c)u'_l(x^c, l^c)}{[u_s(x^c, l^c)]^2} > 0 \tag{2.7}
\]

The above differential is positive since \(u'_s(x, l) > 0\) if leisure is assumed to be a normal good. An increase in contractual hours increases the temptation to absent because as contractual hours lengthen, the utility derived from additional leisure (income) increases (decreases).

This analysis may be supplemented with a more detailed appraisal of the costs incurred by the worker as a result of absence behaviour. The model depicted in Figure 2.1 assumes that the penalty to absence is simply lost earnings. It is likely, however, that any earnings lost as a result of absence are, at least partially, offset by sick pay, the provision of which will increase the temptation on the part of the worker to absent. The effect of a simple sick pay scheme on the individual’s absence decision is illustrated in Figures 2.2 and 2.3 below.

Assuming, for simplicity, that all individuals receive sick pay at the rate \(s < w\) for each hour of absence then two budget constraints are in operation; the conventional wage line increasing from right to left and the new sick pay line increasing from left to right. If the individual supplies no work to the firm then

\(^3\) The analysis above explores the situation in which the worker is over-employed. Alternatively, individuals may be under-employed, i.e. they may be constrained to work less hours than those which equate marginal and economic rates of substitution. In such a situation the individual may have an incentive to engage in moonlighting [see Shishko and Rostker (1976) and Killingsworth (1983)].
he/she moves to point $E_1$ with $x' - m_0$ being the sick payment to the individual (i.e. the point $E_1$ represents the position of a 100% absence record whereas the point $E^c$ is associated with 100% attendance record). If the individual takes only a portion of his/her total time allocation as absence, then he/she is effectively moving along the budget constraint $[E_1, E^c]$ characterised by the slope $w - s$.

It is apparent that the provision of $s$ will raise the incentive of the worker to be absent since its provision partially offsets the costs of absence borne by the individual i.e. in the previous analysis where sick pay is not included in the employment contract, the opportunity cost of leisure is equal to the wage rate. Once sick pay is available, the opportunity cost of leisure is modified to $(w - s) < w$. Intuitively, as the price of leisure falls, the demand for non work time rises. This is shown in Figure 2.3 where the introduction of such a sick pay scheme is examined. In Figure 2.3 contractual hours $h^c$ are, as in Figure 2.1, in excess of utility maximising hours $h^*$. The introduction of a sick pay scheme, in which absence is compensated at a rate $s < w$ for each hour of absence, enables a partial offset in the loss of earnings resulting from absence. The budget constraint facing the individual will pivot at $E^c$ to become $[T, E_1, E^c, l^c]$. The introduction of such a scheme creates an income and a substitution effect; the movement from $E^*$ to $E^{**}$ represents the substitution effect, which serves to increase absenteeism, whilst the movement from $E^{**}$ to $E^{***}$ represents the income effect, which gives a further impetus to absence on account of the assumed normality of leisure. Thus, the provision of sick pay serves to increase the incentive to be absent since it reduces the loss of income sustained when absent.

An interesting scenario would arise if sick pay were available to individuals at the same rate as wages. In terms of Figure 2.2, assuming $w = s$ would have the effect of pivoting the sick pay line upwards such that it bisects the wage line perpendicularly from below, shifting point $E_1$ vertically upwards towards some point, say $E'_1$, horizontally level with point $E^c$. The individual’s budget set in such a situation would be given by a rectangle $[T, E'_1, E^c, l^c]$, and given standard convex preferences, the worker would have an incentive to absent himself/herself fully. The assumption that $w = s$ is not unreasonable and leads to an interesting paradox: many workers suffer no immediate monetary penalty for absence, yet still choose not to use up all their sick leave, even when they cannot roll sick leave over from year to year [see Brown (1994)].

4 A possible explanation for this conundrum may be rooted in the gift-exchange model of efficiency wages developed by Akerlof (1982). Workers may be offering the firm a 'gift' of not taking all their sick leave in exchange for the firm's reciprocal 'gift' of, for example, leniency and compassion should the worker require excessive sick leave for any reason.
Figure 2.2: The Budget Constraint with Sick Pay

Figure 2.3: Over-Employment and the Provision of Sick Pay
In this model absence arises out of a discrepancy between the individual's marginal rate of substitution and the economic rate of substitution at the specified level of contractual hours. Any change in the former, therefore, will affect the incentive to be absent. We would expect, for example, an individual's marginal rate of substitution to be particularly high when leisure is relatively highly valued as, for example, at important family events such as weddings, births and funerals. This would lead to a steepening of the individual's indifference curves in Figures 2.1 to 2.3 - recall Equation (2.4) - and an increased temptation to be absent as the individual attempts to equalise his/her marginal and economic rates of substitution. Similarly, it may be the case that an individual's marginal rate of substitution will be particularly high when the individual is sick. As sickness increases, leisure time may become more valuable because of the need for recuperation and/or the fact that work may become increasingly onerous.

The key point underpinning any influence on an individual's marginal rate of substitution concerns the predictability of that influence. For example, family events are reasonably predictable *ex ante* and individuals affected by such events can tailor their behaviour accordingly. Other influences, such as health, are more random and so expose individuals to far greater risk and uncertainty.

It is apparent from the above analysis that absence can only be defined if contractual hours are specified in the employment contract. If the individual is free to supply his/her desired hours then the phenomenon of absence would not exist. Such contracts are, however, rare. Although in principle the array of contracts on offer to a particular worker of given skills could be very large, in practice they tend to be quite small - normally a full-time contract of 35-40 hours per week or a part-time contract of 15-20 hours per week. The question as to why this is the case involves issues regarding the nature of the firm's production process.

Some jobs require very precisely defined hours constraints on account of the co-ordination between factor inputs. Such contracts typically specify very clearly where and when workers are expected to be present. The type of contract offered to workers assembled on a production line, for example, will be characterised by the fact that the production line has an optimum staffing level. As a consequence, start and finish times will be carefully co-ordinated with the operating times of the line. Indeed, they are frequently staggered in order to ensure that the flow of the product

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5 Johns and Nicholson (1982) argue that absence is conditioned not only by the employment contract, but by the existence of an implicit social contract which exists between the individual, the firm and the family.

6 Such an assumption, however, is not obvious. In a world where individuals can take 'illegitimate' absence, they may prefer to recuperate on the firm's time and 'go sick' when healthy so as to enjoy unauthorised leisure. To deal with such issues would require a re-working of the simple bi-variate decomposition of time in the standard labour supply model.
through the line is matched by the staffing level. In such cases absenteeism is clearly defined [Barmby and Treble (1991a)]. Moreover, having specified contractual hours so clearly, one would expect such firms to be far more rigorous in enforcing the terms of the contract than firms for whom co-ordination is not so valuable.

Other jobs do not rely on such co-ordination and work hours are more flexible, with other aspects of employee performance being relevant. For example, the process of academic research and teaching is extremely flexible. Time spent on research and teaching can be moved from one part of the day to another with little or no output loss. It can be concentrated in certain parts of the week or spread out over several days. For this reason the typical university academic’s contract fails to specify contractual hours. Absenteeism in this case is impossible to define since attendance is not always required [Johns and Nicholson (1982) and Barmby and Treble (1991a)].

A multitude of contractual arrangements lie between these two extreme situations, the nature of each arrangement being determined by the task to be performed. Flexi-time schemes, for instance, specify a fixed period of attendance over some period of time (usually a week or month) leaving the individual to decide, within some broadly defined parameters, when hours are to be supplied. Under such a regime, although absence on a particular day is not clearly defined, it is well defined for the period over which required attendance is specified [Barmby and Treble (1991b)].

Such considerations imply that it is inappropriate to interpret observed absence behaviour solely in terms of labour supply considerations. It is apparent that what constitutes absence is determined by labour demand aspects which, in turn, determine the nature of the employment contract with observed absence behaviour conditioned accordingly by such contractual arrangements. Thus, simply concentrating on the psychology of workers is only half the problem. A prime consideration must be to place the concept of absenteeism within the much broader context of contract design. As Johns and Nicholson emphasise:

... particular attention must be paid to the probability that the very construct of absence differs across occupational groups. [Johns and Nicholson (1982), p. 153].

This line of thought raises several interesting questions: first, if absence-control mechanisms are costly then we would expect employment contracts to specify non-work time when leisure (income) is particularly highly (lowly) valued by large numbers of workers. Indeed, there are many instances when leisure time requires some degree of social co-ordination, for example, at weekends and Christmas - and
if a firm has to produce within these periods then, because workers’ marginal rates of substitution between leisure and work are particularly high, the firm may be obliged to pay a wage premium in order to induce them into the market.  

Second, it is not obvious that absenteeism is in any way inefficient. If the worker is induced to take an employment contract at which the marginal and economic rates of substitution are in discord, then he/she will have an incentive to break that contract. If the worker realises this incentive then he/she is simply signalling the discord between his/her private valuation and the market’s valuation of the allocation of time implied by the contract. Such behaviour is not inefficient for the worker because he/she is behaving rationally given the constraints he/she faces.

The firm, for its part, when faced with such a worker, will have to choose between attempting to enforce the contract - through monitoring, fines, inducements, threats of dismissal and perhaps increased contractual flexibility - or simply permitting the non-compliant behaviour. This choice will depend on a number of complex issues related to the nature of the production process, the psychology of the available work force, and the relationship of the worker to other inputs (including other workers). If the firm chooses the latter option then it must be because it perceives the marginal cost of enforcing the contract to be in excess of the marginal benefit of so doing. The CBI (1994) found that many organisations do not operate schemes to reduce absence; 38% of firms surveyed do not have an occupational health program and 49% do not use absence as a basis to determine redundancy. In such cases observed absence is simply the manifestation of a solution to a market problem. If, on the other hand, the firm chooses the former option, and thereby devotes valuable resources to ensuring contract compliance, then it is reasonable to infer that the employment contract was initially generating an inefficient solution to the contracting problem.

More generally, given the dynamic aspect of the absence decision - and the related predictability of future marginal rates of substitution between income and leisure - permitting, and even planning on some absence, may provide an optimal response by both workers and firms to the problems of risk and uncertainty. Employers, for example, may experience higher costs for unpredictable absence.

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7 Another aspect here concerns the presence of government mandated absence policies, such as statutory maternity leave. These may be rationalised in terms of an externality argument - the privately efficient level of absence might fall short of what is deemed to be socially desirable.

8 The CBI survey of absenteeism indicated that employers felt that work related stress was one of the major contributory factors of sickness absence amongst non-manual workers. Hence, employers may feel that it is more efficient for such employees to absent themselves rather than attend.
relative to predictable absence, whilst employees may experience some stochastic costs to attendance.\(^9\)

Third, in light of the above discussion it becomes meaningless to talk in terms of observed absence being in any way either supply or demand constrained. As with all economic behaviour it is the interaction of the two forces which is relevant. In terms of the above analysis, the market mechanism will determine not only observed absence behaviour, but also the system of absence control employed by the firm. This leads to an important identification problem. Observed variations in absence may be due to the behaviour of both the firm’s management as well as its employees. An increase in absenteeism, for example, might induce a firm to amend its absence control mechanism by more stringently monitoring absentees.

We turn now to the economic literature on absence and attempt to evaluate the extent to which economists have been successful in addressing these issues.

### 2.3 The Literature

In this Section I first survey the early economic literature on absence. I then discuss the revival in interest amongst economists into absence following the contributions of applied psychologists, particularly Steers and Rhodes (1978), before turning finally to the contemporary economic literature. The aim of this Section is to identify the extent to which the predictions of the labour supply model of absence behaviour have been empirically verified, and the ways in which economists have attempted to surmount its theoretical and empirical shortcomings.

#### 2.3.1 Early Contributions

Treble (1990) argues that the first serious attempts to analyse absence were the two reports issued by the Medical Research Council in London [Vernon and Bedford (1928) and Vernon et al (1931)] which were based on micro-data on British coal miners from ten collieries in the Nottingham coal field over the periods 1920-26 and 1926-28. The authors investigated the relationship between variables proxying working conditions (e.g. the depth and thickness of seam, temperature, humidity and airflow) with three different classes of absence; absence due to sickness, absence due to accidents, and a residual class, interpreted as voluntary absence.

Total absence was found to increase with the depth of the workings for all classes of worker, whilst absence due to sickness was found to be positively related to underground temperature. Absence due to minor accidents was found to increase with underground temperature, although no such relationship was found to hold for

\(^9\) A worker’s marginal rate of substitution may rise during the Wimbledon fortnight - unless it rains!
major accidents. The frequency of accidents was also found to increase with seam thickness, average output of coal per man, labour turnover, the average age of the work force and the timing of the shift. Finally, the residual category of ‘voluntary’ absence was found to increase with the distance walked underground to the workplace, labour turnover, with the distance of men’s homes from the colliery, and with the proximity of a large town.

While both reports are characterised by various deficiencies and shortcomings [see Treble (1990)], they highlighted for the first time the significance of the various characteristics of the employment contract, such as the remuneration scheme and the availability of sick pay, for observed absence - both studies found absence to be significantly affected by the presence of a sick pay scheme and to be highly sensitive to pay rates. The reports also highlighted the influence of the working environment (temperature and humidity) on absenteeism - a theme which has been stressed since in the applied psychology literature.

Other notable contributions to the early [i.e. the pre-Steers and Rhodes (1978) literature] include Ehrenberg (1970), Flanagan et al (1974), Reza (1975) and Deardorff and Stafford (1976). The main results from these papers are summarised below.

Ehrenberg (1970) challenged the conventional view amongst managers that absenteeism was the primary cause of overtime with attenders being asked to fill in the gaps created by the absentees in return for compensation at premium rates [see Hart (1987)]. The basic argument put forward by managers was that large firms attempted to allow for absenteeism by hiring stand-by workers; however, because of the stochastic nature of absence, it was impossible for them to have replacements always available, and so overtime must be worked by existing employees in order to meet production schedules.

Ehrenberg argued against this conventional wisdom, showing that a rational economic response to an increasingly certain absence rate involves increasing the amount of overtime worked per employee, whilst the effect on the level of employment is ambiguous. An increasingly uncertain absence rate raises the stock of employment and reduces the average level of overtime. The intuition for his results lies in the ‘fixity’ of labour costs; many labour costs must be paid even when an employee is absent, being independent of the exact number of hours each employee works (e.g. paid vacations, paid public holidays, private welfare and insurance schemes and statutory insurance payments). Overtime hourly wage payments, however, need not be made to absentees such that an increasingly certain absence rate modifies the labour cost function asymmetrically, increasing the marginal cost of labour purchased through additional workers relative to the marginal cost of labour purchased through increased hours.
Flanagan et al (1974) explore the economic implications of job satisfaction. Their theoretical framework suggests that as the economy grows there will be an increase in workers’ demands for both pecuniary and non-pecuniary rewards. Since an individual is assumed to be concerned with the mix between these rewards, any combination which does not satisfy such preferences will lead to a situation of disequilibrium, which in turn will lead to lower productivity and higher levels of strikes, quits and absenteeism. Once allowances are made for differences in factors such as weekly hours and personal characteristics, however, Flanagan et al are unable to find any supporting empirical evidence for their theoretical priors. This is hardly surprising given that the empirical analysis is somewhat *ad hoc*, with data deficiencies leading to inconsistent estimations of essentially related expressions of job dissatisfaction. Time-series analysis is used to examine quit rates, whilst absence is explored using cross-sectional techniques, such that any interdependencies between these expressions of job dissatisfaction are ignored [Kenyon and Dawkins (1989)]. The study nevertheless remains of interest since it places absenteeism into the realm of job satisfaction, a concept developed more fully in the applied psychology literature.

Reza (1975) explores within a specific theoretical framework a firm’s employment decision where the firm is assumed to take account of an exogenously given rate of absence. The predictions of the model suggest that as absenteeism rises, the optimal level of labour and capital falls whilst the optimal number of hours worked per worker in attendance rises. Reza analyses a fall in the real wage and shows that a worker will wish to supply fewer hours. Hence in order to supply fewer hours the individual can increase the amount of absence and, therefore, raise the absence rate. As outlined above, however, this would increase the number of hours worked by the worker’s colleagues who are in attendance. Since individuals are assumed to be homogeneous, all members of the work force would have an incentive to reduce attendance. Thus, employees may find a more beneficial method of reducing the number of hours worked by acting collectively through a union and resorting to actions such as strikes. Strikes and absenteeism have been analysed as symptoms of contractual dissatisfaction with absence being regarded as individual level action and strikes as collective action. An individual may resort to absenteeism as a short-term measure, but resort to union activity as a longer term solution [see, for example, Kenyon and Dawkins (1989)].

Deardorff and Stafford (1976) examine labour demand and supply behaviour in a situation where the firm’s production technology depends upon the simultaneous presence, during the workday, of two factors of production. Under such circumstances the firm would not be indifferent to the number of hours worked by an employee and traditional labour supply modelling, which assumes
that the length of the working day is supply determined with the worker choosing the utility maximising amount of labour supply, becomes inappropriate. In the presence of multiple factors of production, the firm’s productivity hinges on its ability to collectively organise inputs, a point which leads the authors to suggest that, ‘... the firm will itself decide the length of the working day.’ (p.671). The relevance of the paper to the economics of absence is that it provides a rationale for demand determined contractual hours, a necessary condition for any definition of absenteeism.

To summarise, it is clear that over the 1970’s a small number of economists pinpointed a variety of important and interesting implications of absence behaviour. The studies were, however, largely unco-ordinated, emphasising the lack of coherence underpinning contemporary economic interest in this area. This pragmatism stands in marked contrast to other disciplines, notably the applied psychology literature, where the research agenda appears to be far more sharply focused.

2.3.2 The Revival

Despite the somewhat promising start, the economic literature on absence was rather neglected for the best part of fifty years. It is only in the past two decades that some form of revival can be observed, with the emphasis being placed largely on empirical analysis.

The desultory performance of economists stands in marked contrast to that of applied psychologists, who have maintained a long tradition of investigation into the motivations underpinning the decision of a worker to absent. The general theme followed by these researchers has been that absence can be regarded as a withdrawal response to a negative work environment.

One of the major contributions to this field is the paper by Steers and Rhodes (1978) in which the authors attempt to construct a theory of absence based on the results of the empirical investigations to date. Although the authors do not set out a formal specification for their model, certain interesting features can be discerned. Following Chadwick-Jones et al (1973), a distinction is made between ‘unavoidable’ (‘Type A’) absence, whereby the individual is unable to attend on account of sickness; and ‘avoidable’ (‘Type B’) absence, whereby the individual lacks the motivation to attend. Job satisfaction, the outcome of an interaction between job and personal characteristics, determines the former, whilst sickness is seen as crucial to the latter. Observed absence is then interpreted as the result of a complex interaction between both ability and motivation.
Barmby et al (1991a) conduct an economic critique of the Steers-Rhodes model. Essentially, the model is lacking in the sense that it is incapable of falsification. Many of the variables used are poorly defined and incapable of measurement (e.g. 'role stress', 'work group norms' and 'personal work ethic'), plus the direction of many influences is not specified. For example, does the pressure to attend lead to an increase or decrease in observed absence? Similarly, do family responsibilities increase or decrease attendance? Moreover, for a model so grounded in empirical observation, the integrity of the empirical work on which their results are based is somewhat doubtful:

... Steers and Rhodes themselves have some harsh things to say about the quality of the empirical work on which their results were based ... At the time of writing, studies had been largely based on the examination of simple bi-variate correlations. There are problems of comparability (partly caused by poor reporting practices), and a failure in experimental work to design experiments carefully. [Barmby et al (1991a), p216].

Despite its limitations, however, the Steers-Rhodes study remains an important contribution to the economic theory of absence. In particular it highlights the implications of efficiency for absenteeism, a significant consideration because, even today, many commentators, particularly in the field of management, regard absence as unequivocally bad. Steers and Rhodes, however, noted that:

... some absenteeism may in fact be healthy for organisations in that such behaviour can allow for temporary escape from stressful situations ... (R)igid efforts to ensure perfect attendance may lead to unintended and detrimental consequences on the job ... [Steers and Rhodes (1978), p403].

The Steers-Rhodes study has also attracted criticism from within the applied psychology literature. Fichman (1984), for example, criticises both the theoretical and empirical content of the Steers-Rhodes model, outlining a theoretical framework of absence based on a dynamic model of the allocation of time which is intended to overcome some of the more problematic areas of the Steers-Rhodes contribution. Indeed, Steers and Rhodes do themselves accept many of the weaknesses of their 1978 work and in a latter study [Steers and Rhodes (1984)] outline a number of extensions to their model in the light of contemporary criticisms.

First, they respond to Chadwick-Jones et al's (1982) criticism that models such as Steers and Rhodes' are overtly focused on the role of the individual decision maker and that they pay insufficient attention to social considerations. Steers and Rhodes concede that, whilst their original model did recognise the existence of work norms as a pressure to attend, they could have made the influence of this concept somewhat more apparent. Second, they concur with the findings of
Cheloha and Farr (1980) that, amongst job attitudinal factors, job involvement may be a better predictor of absence than job satisfaction. Third, they concede Smith’s (1977) argument that it is an individual’s perception of his/her ability to attend, rather than the individual’s actual ability to attend, which is relevant in determining absence behaviour. The same event may impact differently upon different individuals - what is important is how the individual treats the event and how he/she interprets its impact on his/her ability to attend. Finally, they acknowledge that absenteeism is merely one aspect of a more general withdrawal process that includes, for example, lateness and turnover.

Steers and Rhodes also make the more general point that scientific modelling is an evolutionary process. This is certainly true of the applied psychology literature in which there has been a virulent, yet healthy debate between various researchers. The same, unfortunately, cannot be said of the economic literature, and it is this to which I now turn.

2.3.3 Contemporary Economic Literature

The 1980’s witnessed a revival of interest amongst economists into the causes and consequences of worker absence, at last taking the lead from the advancements that had been made in other disciplines. These economists applied their traditional labour market modelling techniques to worker absence with mixed results.

The Steers-Rhodes model is typical of the applied psychology literature in that it lacks a rigorous theoretical basis. Moreover, job satisfaction is highlighted as the key to an individual’s voluntary absence decision. There is, however, a strong positive correlation between job satisfaction and wages [see, for example, Freeman (1978) and Borjas (1979)], hence the effect of job satisfaction on absence behaviour may have been exaggerated. But it was not until the 1980’s, when economists at last re-entered the fray, that the role of the wage was illustrated formally.

2.3.3.1 Absenteeism and Labour Supply

The majority of economic studies have modelled absence in terms of the basic labour supply model set out in Section 2.2 with emphasis being placed on factors representing the employment contract. From that analysis it is clear that the effect of the wage rate on absence is ambiguous with conflicting income and substitution effects. Hence empirical evidence plays a key role in adjudicating.

Dunn and Youngblood (1986), for example, analyse whether an individual faced with a situation where contractual hours are greater than desired hours will absent himself/herself in order to test the following hypothesis:
\[ \text{Absence} = f(MRS - \text{wage}) \] (2.8)

An empirical measure of an individual's marginal rate of substitution (MRS) between income and leisure is derived using survey techniques which require individuals to evaluate non-pecuniary job benefits in terms of time and money. The equivalence between the time and money evaluations yields the estimate of the MRS. The results show a significant positive relationship between absence and the difference between a worker's marginal rate of substitution and the wage rate. Supportive evidence for the result of a negative relationship between wage rates and absence is found in Drago and Wooden (1992), Chaudhury and Ng (1992) and Allen (1981b). This contrasts, however, with the results of Leigh (1991) which indicate that wages and paid sick leave are not statistically significant predictors of absence.

Allen (1981a) analyses a sample of workers with self-reported measures of days absent in terms of an extended income-leisure model. It is extended by the incorporation of the assumption that the absentee suffers a lump sum penalty to cover the firm's losses from his/her absence. Such losses may arise since the firm may have to take costly measures to fill the gap created by the absentee i.e. the output of the firm may be reduced if a replacement worker cannot be found or, if a replacement is found, he/she will in general be less efficient at performing the task. In addition, the fixed costs of employment will raise the costs to the firm of employing substitute workers. Furthermore, the penalty imposed to cover losses such as these is in addition to any lost earnings which are not offset by sick pay. The penalty is assumed to be reflected in a decreased chance of promotion and/or an increased probability of being fired, with the opportunity cost of dismissal being proxied with industry dummy variables and personal characteristics. It should be pointed out, however, that the incorporation of dummy variables into the analysis does not prove to be particular informative.

Allen's paper is largely bereft of any formal theoretical modelling and so, perhaps not surprisingly, his empirical results are somewhat difficult to interpret. He finds that wages are inversely related to absenteeism, but the significance of this result is questionable. For example, evidence of a significant wage effect is found only in an equation that excludes personal characteristics. When the data is divided into occupational subgroups (blue collar and white collar) a wage effect is only present for the blue collar workers, and only then when a dummy variable describing whether or not sick pay is payable is included.

Scott and Markham (1983) re-test Allen's basic hypothesis using aggregate firm data from a survey undertaken by the American Society of Personal
Administration which contains employer-reported absence rates for each firm as a whole. They do not, however, find a statistically significant relationship between the average hourly pay rates at the firms in the sample and their average absence rates. However, these results should be interpreted somewhat cautiously because the individual behaviour in question is being inferred from highly aggregated data.

Other studies which attempt to assess the impact of wages and/or fringe benefits as explanatory variables include Chelius (1981), Dalton and Perry (1981), Deitsch and Ditts (1981) and Youngblood (1978, 1984) and Winkler (1980), the last of whom analyses absenteeism amongst school teachers and discovers a significant inverse relationship between absence and wages.

It should be borne in mind that the majority of empirical investigations are not conducted solely within the theoretical framework outlined in Section 2.2. The final equation estimated by Dunn and Youngblood (1986), for example, takes the following form:

\[
\text{Absence} = \alpha + \beta (mrs - w) + \sum \delta_i Z_i \tag{2.9}
\]

where \(\alpha, \beta, \delta_i\), are the parameters to be estimated and \(Z_i\) is a vector of socio-economic variables such as sex, age and race and marital status.

A common finding in many studies has been that females exhibit higher absence rates than males [Allen (1981a, 1984), Leigh (1981a, 1991), Drago and Wooden (1992) and Paringer (1983)]. Such a finding is somewhat difficult to interpret in terms of the standard income-leisure model of labour supply. It may be that women play a larger role in domestic duties and hence may absent themselves from work in order to gain a greater degree of flexibility. Indeed, it has typically been argued that women tend to assume responsibility for the children within a household, and so will tend to stay at home if such dependants become ill. Leigh (1986, 1991), for example, finds a positive and significant effect between absence and a 'sex - young dependants' interactive variable. This result accords with the empirical findings of the medical literature on absenteeism.

\[\text{Morbidity indices indicate that women report more illness than men despite having a higher life expectancy. Nathenson (1975, 1977) surveys sociological, psychological and biological explanations for this trend. McKeown (1989) and McKeown and Furness (1987) discover that males take fewer episodes of absence than females who in turn exhibit shorter but more frequent absence.} \]

\[\text{Emphasis in medical statistics is placed on the empirical analysis of health statistics as opposed to theoretical analysis. Relationships are examined between health status, sickness absence, personal and occupational characteristics [such studies include Pines et al (1985), Ryan (1981), Jenkins (1985), Broadhead et al (1990) and Parker et al (1987)]. Results are broadly in line with those found in the economics literature i.e. married females with young children exhibit a relatively high degree of sickness absence. It should be noted, however, that some of the statistical techniques applied in this area have been heavily criticised [Reidy (1990)].}\]
Figure 2.4: Absence Rates in the United Kingdom by Sex

Figure 2.5: Absence Rates in Great Britain by Sex
Figures 2.4 and 2.5 above illustrate the trends in the absence rates of males and females over the period 1984 to 1993.\textsuperscript{12} The graphs indicate how the absence rate for women has tended to exceed that for men in both the United Kingdom and Great Britain. A related explanatory variable is marital status. Evidence suggests that married people absent themselves less frequently. This may be due to, for example, financial pressures [Allen (1984), Keller (1983) and Leigh (1984, 1986)].

The significance of such demographic factors is not, however, universally accepted. The results cited above concerning the significance of personal characteristics contrast with those of Barmby and Treble (1991a), for example, which stress the importance of contractual characteristics. Estimating the probability of an individual going absent through a probit model, Barmby and Treble find that personal characteristics such as age, sex and marital status do not exert a significant influence on the probability of absence. Significant factors include the wage rate, working conditions and contract type. Kenyon and Dawkins (1989) also find that variables pertaining to the composition of the labour force do not exert much influence on absence. Their results indicate that variables which affect the budget constraint faced by workers in turn affect labour absence.

To summarise, it is apparent that some degree of confusion exists within the empirical literature. The puzzling results which have emerged are arguably due to weak theoretical priors.\textsuperscript{13} Recently, there has been a slow yet emerging increase in the theoretical contributions to this area and it is to these which I now turn.

2.3.3.2 Absenteeism and Labour Demand

Barmby and Treble (1991a, 1991b) argue that the weakness and conflicting nature of the evidence obtained by many studies is due to a problem of identification which stems from the fact that absence behaviour has been examined with limited reference to labour demand. The basic premise is that labour demand considerations play a more active role in determining absence than those cast by the economic studies of absence behaviour. Kenyon and Dawkins (1987), for example, remark that:

\begin{quote}
... labour absence originates on the supply-side of the market ...

However, management practices can respond to labour absence by altering the environment within which the labour supply decision takes
\end{quote}

\textsuperscript{12} The data is taken from \textit{Regional Trends} (1994) and represents the proportion of male and female employees reporting at least one day's absence from work during the week prior to the interview.  
\textsuperscript{13} The shortage of theoretical foundations may have led to the myriad of empirical specifications employed in the empirical studies of absence. The majority of the studies reviewed in this section have used cross-section data [one exception is Kenyon and Dawkins (1989) who adopt a time series approach] and adapt logit models in order to analyse rates of absence. The various adaptations introduced may have had some bearing on any divergence in the results found across different studies.
Although Kenyon and Dawkins recognise the influence of labour demand on absence behaviour, labour demand is regarded as a response to absence as opposed to a determinant. It is inevitable, therefore, that the interpretation of empirical results becomes problematic given that labour demand and labour supply are clearly interrelated. Indeed, the exclusion of labour demand considerations may lead to a mis-specified model. In order to present a more balanced approach one should consider why certain employment contracts prevail in particular sectors of the economy. The labour demand question, therefore, should be explicitly addressed.

It soon becomes apparent, however, when surveying the literature on absenteeism that there is a shortage of theoretical analyses which incorporate demand side aspects despite the fact that empirical evidence has indicated the importance of contract type on absence behaviour. The empirical conclusions reached by Allen (1981a), for example, suggest that work schedules and financial incentive schemes bear a significant influence on individuals' decisions to absent themselves from work. Similarly, Kenyon and Dawkins (1987) discover that it is variables which shift or change the slope of the budget constraint, rather than compositional variables such as sex and marital status, that predominantly influence absence behaviour. Thus, the nature of the employment contract appears to be of extreme importance when analysing the ways in which labour supply is affected by such considerations. Thus, empirical evidence implies that absenteeism should not be solely regarded as a supply side phenomenon and that the employer's demand for labour should be explicitly incorporated into the analysis.

Some researchers have endeavoured to incorporate labour demand considerations into their analysis. Allen (1981b), for example, treats absenteeism as a non-pecuniary characteristic of the compensation package by developing the hedonic framework initiated by Rosen (1974). Allen derives an offer function for an employer which indicates the combinations of wages and absence rates that he/she is willing to provide at a given level of profit. Given that each employer is characterised by such an offer curve, the envelope of all such curves yields the trade-off between wages and absence which exists in the market. Similarly a family of indifference curves representing preferences between wages and absence are derived for each individual, each of whom will choose an employer such that his/her indifference curve is tangential to the envelope of the employer's offer curves. Given that absence is an 'agreeable' job attribute, the model predicts an inverse relationship between wage rates and absence.14 Furthermore, implicit in the

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14 A more rigorous analysis of this relationship is presented in Allen (1983).
hedonic approach is the notion that some degree of absence is efficient. Although the hedonic approach incorporates both labour demand and labour supply considerations, it is somewhat disappointing that subsequent authors have failed to follow Allen’s lead.

From the discussion so far it is apparent that the extent to which the individual is able to engage in absenteeism depends on the nature of the employment contract and the measures taken by the employer to enforce it. Absenteeism in the context of the simple labour supply analysis depicted in Figures 2.1 to 2.3 arises due to the imposition of an hours constraint. If contractual hours were not defined then the concept of absenteeism would not exist. But the hours constraint represents only one characteristic of the employment contract. This relationship is subject to further complications since the setting of contractual hours is not generally independent of the determination of the offered wage rate. In order to present a more integrated theory of absenteeism some explanation for the determination of any constraint on hours is required.

In addition, to attract individuals to a firm which constrains hours, wages may have to be set to compensate for the constraint. Again this assumes that wages adjust to accommodate hours constraints which may be of a technological nature - the production technology, for example, may be such that wages are easier to alter than hours. Compensating wage differentials represent one mechanism whereby wages alter to accommodate an hours constraint imposed in certain sectors of the economy.

Abowd and Ashenfelter (1981) present a theoretical model of compensating wage differentials which serve to compensate for hours constraints. In contrast to the conventional model of absence behaviour, the constraints in this model serve to under-employ rather than over-employ the individual. The analysis below reinterprets that of Abowd and Ashenfelter to introduce the relationship between absenteeism arising from over-employment constraints and the wage differentials serving to compensate for these constraints.

Identical individuals may accept a job in either one of two sectors. In sector one there are no hours constraints; given the wage rate, \( w \), the individual in this sector can choose his/her optimal amount of labour supply. Hence, the concept of absenteeism does not exist in sector one. In sector two, on the other hand, the employment contract specifies a fixed wage and a constraint on the amount of labour to be supplied.

In sector one the individual chooses his/her optimal labour supply given wages and non labour income. \( m_0 \), where the optimal labour supply decision is defined as follows:
\[ h^* = h^*(w, m_0) \]  
\hspace{2cm} (2.10)

The individual’s indirect utility function can then be derived which is denoted by the following:

\[ V^* = V(h^*, wh^* + m_0) \]  
\hspace{2cm} (2.11)

Since the analysis is concerned with the case where the individual is over-employed, the hours constraint in sector two, \( h^c \), is assumed to be as follows:

\[ h^c > h^*(w, m_0) \]  
\hspace{2cm} (2.12)

where \( h^c \) denotes the number of hours specified in sector two as in the labour supply model depicted in Figure 2.1. The corresponding indirect utility function associated with employment in sector two is denoted by:

\[ V^c = V(h^c, wh^c + m_0) \]  
\hspace{2cm} (2.13)

Assuming the same levels of \( w \) and \( m_0 \) prevail in the two sectors, then the following inequality must hold:

\[ V(h^c, wh^c + m_0) < V(h^*, wh^* + m_0) \]  
\hspace{2cm} (2.14)

In this situation the individual will always choose a job in sector one since the utility derived in the absence of the hours constraint exceeds that from employment in the constrained sector. For labour market equilibrium to prevail the following must hold:

\[ V(h^c, w^c h^c + m_0) = V(h^*, wh^* + m_0) \]  
\hspace{2cm} (2.15)

where \( w^c \) represents the compensating variation solution which satisfies the above condition. When the employment contract stipulates contractual hours at \( h^c \), the equilibrium wage prevailing in sector two is \( w^c \) where \( w^c > w \). The compensating wage differential, \( (w^c - w) \), is such that it eliminates the difference between \( V(h^*, wh^* + m_0) \) and \( V(h^c, wh^c + m_0) \) and \( V(h^c, w^c h^c + m_0) \). Hence, in order to attract workers to sector two, the firms in this sector must offer a higher wage rate to compensate for the imposition of the hours constraint.
In the situation described so far \( h^c \) is known with certainty and the utility derived from employment in each sector is weighed up on the assumption that the individual will supply this amount of labour, i.e. the individual does not expect to absent himself/herself from work if employed in sectors one or two. It may be more realistic to assume that \( h^c \) is a random variable such that the individual is unsure of the degree to which the hours constraint will be effective.\(^{15}\) The extent to which he/she may be able to engage in absenteeism to reach his/her optimal labour supply is, therefore, subject to risk. Hence, \( h^c \) is assumed to be a random variable with a probability density function, \( g(h^c) \). The individual is assumed to have full information regarding the probability density function of \( h^c \) and is, therefore, able to determine the expected value of \( h^c \), which is denoted by \( \bar{h} \).

The individual has to decide between employment in sector one with \( w \) and \( h^* \) and employment in sector two with \( w^{cr} \), the wage which compensates for the riskiness of changes in hours worked in sector two, and \( h^c \). Thus, the wage rate, \( w^{cr} \), satisfies the following condition:

\[
E[V(h^c, w^{cr}, h^c + m_o)] = V(h^*, wh^* + m_o) \tag{2.16}
\]

That is, \( w^{cr} \) equates the level of the indirect utility functions across the two sectors of the economy.

Figure 2.6 below illustrates how \( w^{cr} \) compensates the individual for the risk faced in sector two. In this diagram the indirect utility function maximised with respect to \( h^c \), the hours constraint, is graphed where the highest point on the curve, \( o \), corresponds to the individual’s utility maximising labour supply decision. The maximised indirect utility function, \( V = V(h^c; .) \), is assumed, for simplicity, to be concave.

For simplicity, \( h^c \) is assumed to be a discrete random variable, hence \( g(h^c) \) is assumed to take the following form:

\[
pr(h^c = h^*) = \eta \\
pr(h^c = h^{\text{max}}) = 1 - \eta \tag{2.17}
\]

where \( 0 < \eta < 1 \)

Thus, \( h^{\text{max}} \) is assumed to be the upper bound on \( h^c \), the hours constraint such that \( h^c \) equals \( h^{\text{max}} \) with probability \( (1 - \eta) \) and \( h^c \) equals \( h^* \) with probability \( \eta \).

\(^{15}\) In a similar vein, Georgellis (1994) presents a matching framework in which workers acquire information regarding actual hours of work with experience on the job.
Hence, due to the assumed specification of the probability density function of $h^*$, the expected value of $h^*$ can be expressed as:

$$E[h^*] = \bar{h} = \eta h^* + (1 - \eta)h^{max} \quad (2.18)$$

whilst expected indirect utility can be expressed as follows:

$$E[V(h^*;.)] = \eta V(h^*;.) + (1 - \eta)V(h^{max};.) \quad (2.19)$$

i.e. the expected indirect utility function is defined as a weighted average of maximised indirect utility when $h^*$ equals $h^*$ and maximised indirect utility when $h^*$ equals $h^{max}$. The positive compensating variation in wages, $(w^{cr} - w)$, serves to eliminate the difference between $V(h^*;.) = V(h^*, wh^* + m_0)$ and $E[V(h^*;.)] = E[V(h^*, wh^* + m_0)]$. The compensating differential is positive due to the assumed concavity of the indirect utility function which represents risk aversion.

This reinterpretation of the model of Abowd and Ashenfelter illustrates the degree of symmetry between the literature which treats under-employment as a constraint on individual behaviour and absence behaviour as interpreted in the
context of the labour supply model. The characteristics of the employment contracts offered in the two sectors have implications for the extent to which absenteeism emerges in the economy, hence the mechanism behind this result is of importance in the analysis of absenteeism. In the situation where $h^c$ is a random variable, for example, the compensating wage differential is determined with respect to the expected value of the hours constraint. Once an individual has decided to accept the contract offered in period two, he/she may discover that $h^c$ is greater or less than $\bar{h}$. In the case where it materialises that $h^c > \bar{h}$ the individual may have an incentive to engage in absenteeism.

The discussion above highlights the parallels which exist between under-employment and over-employment. It is clear that whilst much attention has been paid to the implications of the former for worker behaviour, the implications of the latter have attracted considerably less attention. It is apparent that not only does the presence of an hours constraint define absenteeism, but the effectiveness of the imposed hours constraint is itself a major determinant of absence.

Such considerations suggest that the introduction of a degree of flexibility into employment contracts may enable the firm to exercise some control over the level of absence. Enhanced flexibility may serve to reduce an employee's demand for absence since workers may engage in absenteeism as a means of counteracting inflexible work schedules. It is in this vein that overtime systems have been proposed as a way of counteracting absenteeism. Leslie (1982), for example, argues that high overtime working should imply low rates of absenteeism. An employer may offer overtime premia for hours worked in excess of contractual hours in order to induce individuals to supply more labour. Such measures lead to non-convexity in the budget constraint which may cause workers to obtain increased utility by working overtime. In order to incorporate overtime into their labour supply-based model, Kenyon and Dawkins (1987) specify leisure as:

\[ l = T - (h' - h^a) - h^{ot} \tag{2.20} \]

where $h'$ represents standard hours, $h^a$ represents absence hours and $h^{ot}$ represents overtime hours. The implications of the amended labour supply analysis are depicted in Figure 2.7 below.

16 The idea that workers may engage in absenteeism as a means of counteracting inflexible work schedules has been suggested by Allen (1981a) who points out that the opportunity cost of working varies over time as alternatives present themselves, thereby highlighting the individual's need for flexibility.
If there are no contractual constraints and the budget line is given by the line AC, then the worker will choose to be at $E^*$ where the indifference curve $I_2$ is tangential to the budget constraint. If the employer imposes standard hours of $h^s$, then the individual has an incentive to be absent due to the divergence between $E^*$ and $E^s$. Suppose the firm ideally wants the worker to supply $h^e$ hours of labour. The firm could offer a two part wage structure to induce the worker to supply $h^e$ hours of labour where the wage for standard hours is given by the slope of the line $DA$ and the wage for ‘overtime’ hours is given by the slope of $E^oD$. In the diagram $I_1$ clearly lies above $I_2$ and is tangential to $E^oD$ at point $E^o$. Thus, with the two-part wage structure initiated by the payment of overtime premia for hours supplied in excess of standard hours, the individual has no incentive to be absent. If contractual hours were raised in the absence of an overtime premia, this would clearly increase the incentive to be absent [recall Equation (2.7)].

On the other hand, Chaudhury and Ng (1992) argue that overtime may be associated with increased absence since it may lead to less flexible working arrangements and longer working days. In addition, the income effect associated with overtime may increase absence. It is apparent, therefore, that there are two potential conflicting effects on absence resulting from any changes in overtime [Kenyon and Dawkins (1989)]. The income effect coupled with the assumption of diminishing marginal utility implies a positive relationship between overtime hours and absence. If, however, overtime hours earn a premium, as depicted in Figure 2.7, then this creates an incentive to reduce absence.
One rationale for overtime working may, therefore, be framed in terms of absence. The basic argument is that the stochastic nature of absence means that ‘stand-by’ workers are not always readily available to firms. If production schedules are dependent upon fixed team sizes then it may pay the firm to introduce some form of overtime working to enhance the flexibility of the employment input. It would follow then that it is the randomness of absence which rationalises the presence of overtime working - if absence rates were known with certainty \textit{ex ante}, management would be able to take appropriate remedial action without call to additional overtime.\footnote{Ehrenberg (1970), however, challenges this conventional view, demonstrating that an optimal response by a firm to a certain absence rate is to increase the amount of overtime worked per worker (see Section 2.3.1).}

Clearly there is some confusion in the economics literature regarding the influence of overtime on absence behaviour. To resolve the theoretical debate one must resort to empirical explorations. The paucity of data, however, has limited the ability of researchers to analyse the role of overtime. One exception is the study by Kenyon and Dawkins (1989) who argue that the availability of overtime should have implications for absence rates. As a proxy for the availability of overtime the percentage of workers working overtime is included in their time series analysis. Since the availability of overtime may be related to the average hours of overtime worked by each employee this variable is also included. Thus, a variable representing the average number of overtime hours per employee working overtime is included. Their results, however, suggest that only the latter variable is significant, indicating that an increase in overtime per employee reduces absence. Due to data scarcity, Drago and Wooden (1992) include a variable which represents hours actually worked each week since they do not have access to data on overtime working. This variable is assumed to capture the difference between hours across individuals who do work overtime and those who do not. The sign of the estimated coefficient suggests a negative association between actual work hours and absence behaviour. Chaudhury and Ng (1992) using firm level data include a dummy variable which equals one if overtime is common in the workplace. The estimated coefficient on this variable turns out, however, to be insignificant.

It is apparent from the above that overtime affects absence partly through the alterations to the length of the working day. A related point, therefore, concerns the distinction between part-time and full-time workers. One may argue that individuals whose specific preferences demand a high proportion of non-work time will opt for such a contract since it may minimise the mismatch between contractual hours and desired hours. Thus, one would conjecture that part-time workers would absent themselves less frequently since they experience enhanced flexibility with respect to
their work schedule, and, in addition, since they have fewer scheduled hours, they are likely to derive less utility from an additional unit of leisure. In addition, Chaudhury and Ng (1992) argue that part-time workers may have less job security than their full-time counterparts and, thus, may face greater penalties for absence. This has been borne out to some degree by empirical work. Chaudhury and Ng (1992), for example, in a study using firm level data, find evidence which suggests that firms with more part-time workers experience a lower level of absence. This is consistent with the results of Drago and Wooden (1992) which indicate that part-time employees exhibit low absence and accords with the empirical analysis of Barmby and Treble (1991a) which, using micro data, indicates that contract type has an important effect on absence. Early evidence from Flanagan et al (1974) suggests that absence rates are higher in industries where the weekly hours of work are relatively high.

All this stresses the crucial role played by flexibility in the determination of absence decisions. This area is problematic, however, in the respect that flexibility is a difficult concept to define and measure. Allen (1981a) incorporates dummy variables into his regression equation to represent flexibility. There is a dummy variable, for example, which equals one if the same hours are worked each day. The estimated coefficient is significant and indicates that the group of workers which works the same hours each day are characterised by a higher level of absence. Balchin and Wooden (1992) attempt to deal with the problem by including a dummy variable in their empirical analysis which indicates whether or not the largest occupational group within the work place was able to exercise some discretion over start and finish times. The results indicate that flexibility exerts an insignificant effect on absence behaviour. Further problems may arise as firm level, as opposed to micro-data, is used. Since absenteeism is essentially the outcome of an individual’s decision-making process, it may be argued that micro-data is more appropriate.

Leigh (1991) includes an ‘inflexible hours’ dummy variable in his model equalling one if the individual works the same hours each week. The results suggest that individuals with inflexible working hours are more prone to absence than those with flexible hours. Chaudhury and Ng (1992) include a dummy variable which represents whether shift work is common. They argue that the availability of shift work can be regarded as a proxy for work schedule flexibility since it may allow workers to change between shifts in order to correspond with non-work activities. Hence, if shift work is common the authors conjecture that absence rates should be lower. The estimated coefficient on the dummy variable turns out to be insignificant, yet an additional potential proxy for flexibility has been identified.
A related point explored in the literature concerns the difference between the absence behaviour of white and blue collar workers. Kenyon and Dawkins (1989) found that white collar workers are less prone to absence. This theme is also taken up by Leigh (1984, 1986). White collar workers may encounter a more flexible work schedule since they will not, for example, be tied to an assembly line. Evidence supporting this hypothesis is documented by the CBI (1994) which found that full-time manual workers in the manufacturing sector lost over twice as much working time than their non-manual counterparts. The average number of days of sickness absence per full-time manual worker in 1993 (1992) was estimated at 9.8 (10.0) days whilst the average number of days absent per full-time non-manual worker in 1993 (1992) was estimated at 4.8 (4.6) days.

The significance of flexible work schedules for absenteeism has been recognised in the management science literature. Dalton and Mesch (1990), for example, analyse absenteeism in a large US company which decided to introduce flexible scheduling in one of its divisions. The flexible scheduling system did not affect the number of hours worked per day, but allowed workers more discretion regarding when hours were worked. The results indicated that the introduction of flexible scheduling led to reductions in absenteeism. Moreover, when flexible scheduling was abandoned after the experiment, absenteeism returned to its former level.18 The applied psychology literature has also recognised the significance of flexibility for absenteeism [see, for example, Hall (1987) who argues that the importance attached to flexibility may rise in the future with the increase in single parent and dual-career families].

These results highlight the significance of contract type for absence decisions. As mentioned above, only a few theoretical models of absence behaviour have explicitly incorporated demand side analysis. In the light of the empirical considerations discussed above, Barmby and Treble (1991b) argue that measures taken to control absence should be considered in the context of labour demand theory in addition to the response of workers to absence controls. A theoretical framework is constructed in which the concept of a worker's marginal contribution to profit is used to specify how the employer determines the level of contractual hours, which given an exogenous wage rate, maximises profits. The firm, therefore, faced with heterogeneous workers has to balance the contributions made by over-employed and under-employed workers to set contractual hours.

Typically in the conventional labour supply model, the individual faces a fixed wage and then makes his/her optimal labour supply decision. Some empirical evidence, however, suggests that the wage rate offered is related to hours worked

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18 The popularity of flexible scheduling, however, is not widespread throughout the management science literature. Pierce et al (1989), for example, regard its support as 'unsubstantiated folklore'.

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[Lundberg (1984)]. In the model of Barmby and Treble (1991b), the firm faces a continuum of optimal labour supply decisions for a given wage rate. From the opposite point of view a continuum of hours may be offered by the firms in the economy and the individual may then choose the job which specifies desired hours. The existence of tied wage-hours packages may lead to a situation where the individual faces a trade-off between hours and wages with the individual choosing a job which specifies undesirable hours if the offered wage rate is sufficiently attractive [see, for example, Altonji and Paxson (1988) and Lundberg (1984)]. The prospect of such endogenous wages adds a further dimension to the implications of contract design for absenteeism.

Indeed, to address the question of contract design the determination of all the characteristics of the employment contract such as wages, sick pay and hours has to be considered. In such a setting, the possibility of one firm offering employees different contracts may arise. Barmby and Treble (1991b) consider the hours setting problem faced by the employer in the context of a heterogeneous work force and a fixed wage rate. This contrasts with the theoretical analysis of Coles and Treble (1993) who, in a model of homogenous risk averse workers, examine the relationship between wage/sick pay policy, production technology and the resulting equilibria. Their findings suggest that the existence of different wage/sick pay rates among firms should be attributed to technological factors. Similarly, Weiss (1985) remarks that, ‘... in evaluating the cost of absenteeism to firms, the nature of the production process is critical’.

Coles and Treble (1993) analyse the moral hazard problem which is related to imperfectly monitored absence behaviour, i.e. the problem is concerned with determining whether a worker chooses not to work or is actually unable to work. They are concerned with the notion of contract design, i.e. the question as to what type of contract might alleviate this moral hazard problem. They analyse the extreme case of an assembly line where a fixed number of workers must attend in order to produce a positive level of output. The firm faces three possible alternatives; (i) to employ too many workers and hold ‘reserves’; (ii) to manipulate contract structure in order to induce workers to attend; and (iii) to implement an alternative production process. Coles and Treble analyse the first two options. Their theoretical analysis suggests that firms characterised by constant returns to scale are more likely to pay relatively generous levels of sick pay, leading to relatively high levels of absence, whilst firms characterised by assembly lines might find it beneficial to pay a relatively high average wage but low sick pay provisions which, therefore, makes it more risky to work for such a firm. The paper emphasises how both the costs of absence to the firm and the type of absence control are fundamentally related to the nature of the firm’s production process.
2.3.3.3 Absenteeism and Shirking

If absence behaviour is costly for the firm, one would expect it to penalise any voluntary absence on the part of its work force, thereby limiting any costs over and above those implied by legitimate and, therefore, unavoidable absence. Interpreting voluntary absence as a form of shirking on the part of the worker implies that the firm may have an incentive to monitor absentees and punish any it detects as shirking. Typically, imperfect monitoring of employees is assumed - this seems to be particularly applicable to absenteeism since employers face a hard task of distinguishing between involuntary and voluntary absence without appropriate medical certification. Punishment, if detected shirking, might take the form of fines or dismissals. Any penalties of this nature will serve to increase the expected costs of absence faced by the employee. As such, the effect of absence behaviour on the probability of being dismissed may act as a discipline device, an approach which is consistent with the efficiency wage hypothesis whereby the prospect of unemployment serves to curb shirking on the part of workers [see for example Akerlof and Yellen (1984) and Shapiro and Stiglitz (1984)].

Krueger and Summers (1988) assess the empirical support of efficiency wage theories and discover that lower absenteeism is one of the benefits of paying higher wages. Similarly, Doherty (1979) remarks that one would expect job security to vary over time with an inverse relationship between sickness absence and unemployment. The results of this time series analysis confirms these a priori expectations.

Weiss (1985) postulates an efficiency wage type relationship for workers employed along a production line and demonstrates that the optimal wage for firms operating an assembly-line production process is a sharply decreasing function of the probability of worker absence. Weiss argues that any evaluation of the cost of absenteeism to the firm depends crucially on the nature of the production process, as stressed in the recent contribution of Coles and Treble (1993). Standard production theory would assume that the marginal product of a worker is well defined and, as under perfect competition, is equal to his/her wage. In such models the cost to the firm of absenteeism is simply the wage (sick pay) if the worker is fully (partially) compensated when absent, or alternatively zero should the

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19 There is some evidence which suggests that in some sectors of the economy rigorous measures are taken to monitor absence, '... it is not unusual for someone who has been off for two weeks to have an interview with the occupational health nurse. Even if the absence is certified by a doctor, they send someone out for a second opinion.' [Public Service, May (1993)].

20 The implications of an efficiency wage type relationship for absenteeism was pre-figured by Allen (1983) who discusses the relationship between wages and employee behaviour.

21 Applied psychologists such as Steers and Rhodes (1984) acknowledge the importance of the state of the economy for absence decisions, '... in times of high unemployment, there may be increased pressure to maintain a good attendance record for fear of losing one's job.' [Steers and Rhodes (1984), p. 240].
employment contract prohibit compensation for non-attendance. A worker’s absence history, therefore, should not affect his/her value to the firm except in so far as they were remunerated whilst absent ‘... but this observation seems at odds with the conventional wisdom that one of the most highly valued attributes of a work force is a low rate of absenteeism.’ [Weiss (1985), p. 277].

Weiss rationalises the conventional wisdom by modelling an assembly line production process which requires a critical number of workers to operate—workers in excess of this critical number are redundant whilst output falls to zero if less than the critical number of workers attend. In such a situation a worker’s propensity to be absent will have a significant effect on his/her value to the firm, even if workers are not paid when they are absent.

Barmby et al (1994) explore the relationship between absenteeism and efficiency wages explicitly. Their model incorporates a health based utility function in which increased levels of sickness alter the marginal rate of substitution in favour of leisure. A reservation sickness level is calculated which offers a temptation for individuals to ‘shirk’ and take illegitimate absence. The theoretical results suggest a negative relationship between the wage and the probability of absence.

Although the empirical work in this area is still somewhat underdeveloped, some limited progress has been made. As discussed in Section 2.3.3.1, Allen (1981a) extends the basic labour supply model of Section 2.2 by assuming that the absentee suffers a lump sum penalty reflected in a decreased chance of promotion or an increased probability of being fired. Similarly Leigh (1985) includes a variable which captures the expected duration of a spell of unemployment if dismissed and finds a negative effect on absence rates.22 Balchin and Wooden (1992) extend this line of analysis and define a penalty function which is a function of the opportunity cost of being dismissed and the level of the dismissal threat chosen by the firm. The empirical evidence suggests that absence is affected by both of these factors.23

It should be noted that some studies have yielded conflicting results. Chaudhury and Ng (1992) include a lay-off variable representing the proportion of employees laid off as a proxy for the penalty associated with absence. The argument behind the inclusion of this proxy is that lay-offs imply less job security which in turn leads to less absence. The insignificant estimated coefficient on the lay-off variable is, however, inconsistent with the evidence cited above. The proportion of lay-offs may, however, be regarded as a rather crude proxy for the

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22 Kenyon and Dawkins (1989) and Drago and Wooden (1992) find similar evidence.
23 These results should be treated with some caution, however, since problems were encountered finding suitable proxies for some of the variables specified in the theoretical model. The threat of dismissal variable, for example, is proxied by the actual total dismissal rate. If the dismissal threat is credible, then one would surely expect a negative correlation between the threat and actual dismissals.
penalty associated with absence and if employees fear that redundancies are imminent then they may absent themselves in order to seek alternative employment.\textsuperscript{24} Leigh (1991) assesses the effect of the individual's perception of the prospect of unemployment on absence decisions using survey techniques which yield information on the worker's subjective evaluation of the rate of unemployment in his/her region of residence. Leigh also finds that the unemployment rate is an insignificant predictor of absence.\textsuperscript{25}

Furthermore, the effectiveness of a penalty system based on efficiency wages may be influenced by additional factors such as unionisation. A union member, for example, may feel that he/she faces more protection against dismissal. Employers may find it relatively expensive to fire a worker if a set of formal procedures must be adhered to. Drago (1993) uses Australian data in order to determine whether efficiency wages explain dismissals. Their results indicate that unions reduce the probability that the firm will dismiss any employees. One reason for this may be that union members are less inclined to engage in 'unacceptable behaviour' such as voluntary absenteeism on account of the threat of losing the benefits of unionisation, for example, higher wages and more attractive work schedules [Freeman (1981)].\textsuperscript{26} Metcalf (1993), for example, states that semi-skilled employees in workplaces where a union is recognised for collective bargaining received earnings, on average, in 1984 which were approximately 8\% more than their non union counterparts. Metcalf points out, however, that the union/non-union differential is the outcome of factors such as union density, closed shop practices and the nature of the product market. Furthermore, contradictory evidence has been discovered by studies incorporating such additional factors which indicate that less importance should be attached to the existence and the extent of the union/non-

\textsuperscript{24} Similarly, Steers and Rhodes (1984) remark that once an employee is aware of the fact that he/she will be laid off, then absenteeism may rise as the individual tries to locate alternative employment. Evidence from Owens (1966) indicates that employees who had been given notice of layoff were characterised by significantly higher rates of absence than a group of comparable employees who were not going to be laid-off. The relationship between absence, job search and quits is explored at length in Chapter 6.

\textsuperscript{25} It should be pointed out, however, that the relationship between absence behaviour and unemployment is not as clear-cut as the efficiency wage hypothesis might indicate: Northern Ireland, for example, is the region in Great Britain characterised by both the highest absence rate in 1991 and 1993, 6\% and 5.7\%, respectively, and the highest unemployment rate in 1991 and 1993, 13.7\% and 14.0\%, respectively [\textit{Employment Gazette, April, (1994)}]. One should recognise, therefore, that the influence of additional socio-political factors may complicate the association between unemployment and absence rates.

\textsuperscript{26} On the other hand, however, non-unionised firms may be more likely to offer fringe benefits such as extra statutory sick pay in order to lower the likelihood of unionisation [Beaumont (1987)].
union differential. Hence, the alleged benefits of unionisation have been questioned.\textsuperscript{27}

Leigh (1981b, 1985) and Allen (1984) find evidence which indicates that union members are more likely to be absent than non-union members. Similarly, Chaudhury and Ng (1992) find that unionisation increases total days lost due to absenteeism. The positive correlation between absenteeism and unionisation may be the result of higher sick pay allowances negotiated by trade unions as mentioned above. Allen (1984), Freeman (1978) and Borjas (1979) find that job dissatisfaction is higher among union members. Such evidence suggests that the union is not altogether effective in improving working arrangements. Absenteeism, therefore, may be considered a temporary escape from the working environment, i.e. it may be regarded as a short-term method of dealing with job dissatisfaction. Action through unions, on the other hand, may be regarded as a long-term and more permanent process [Reza (1975) and Kenyon and Dawkins (1989)]. It is interesting to note that several empirical studies have found that unions do appear to exert some influence on hours of work. Perloff and Sickles (1987), Earle and Pencavel (1990) and DiNardo (1991), for example, find evidence which suggests that unionisation in the US exerts a moderating influence on the length of the working week. Thus, despite the fact that union members may enjoy shorter working hours, and whilst shorter working hours are generally associated with lower absence, unionisation appears to increase absence behaviour, \textit{ceteris paribus}.

\textbf{2.3.3.4 Absenteeism and Health}

The discussion so far has assumed that absenteeism on behalf of the individual is to some extent voluntary in that he/she knows the level of utility obtained from the employment contract and can compare it to that derived from the utility maximising labour supply decision. Absenteeism arises as the individual attempts to move towards this utility maximising level of labour supply. Absenteeism, therefore, arises not because the individual is unable to work but because he/she chooses not to. Empirical studies of absence behaviour have been hindered, however, by the problem of distinguishing between voluntary and involuntary absence.

Workers typically cite illness as an explanation for absence, even if this is not the case, since illness is considered to be an acceptable excuse for not working. Evidence from Dunn and Youngblood (1986) supports the view that illness is used as an excuse by workers to move to their optimum. Similarly, Nicholson (1976)

\textsuperscript{27} Casey (1994), however, finds evidence which supports the hypothesis that the presence of recognised blue collar unions increases the probability of the provision of extra-statutory sick pay for all employees.
discovers that when control is exerted over non-sickness absence the level of reported sickness absence tends to rise. There is, however, an additional dimension to the problem which is concerned with the fact that the degree to which individuals believe themselves to be incapacitated due to a given level of sickness varies across individuals. In the case of a heterogeneous work force the level of sickness at which one worker believes himself/herself to be unable to attend work may differ from that of another. Johns and Nicholson (1982) emphasise the fact that individual differences in the interpretation of causes of absence are of extreme importance when analysing absence behaviour:

... how is it that one worker with a mild head cold manages to come to work whereas another finds this an adequate reason to remain at home. [Johns and Nicholson (1982), p. 142].

Furthermore, the criteria used to judge whether one is fit enough to attend work may change over time. In addition, different firms may harbour different opinions regarding what constitutes an ‘acceptable’ level of sickness. This leads to the question as to what is the level of sickness beyond which the firm believes that it is reasonable to be absent [see Barmby et al (1994)].

In the context of the labour supply model, absence is voluntary in the respect that it arises due to over-employment. A weakness of the economic literature on absenteeism, and in sharp contrast to the medical statistics literature - see Footnote 11 - has been the tendency of theoretical models to ignore the state of an individual’s health. It seems unrealistic, however, to ignore such influences when modelling absence decisions and indeed labour supply decisions. Empirical studies, on the other hand, have attempted to analyse the influence of health on absence behaviour. Allen (1981a), for example, includes a health evaluation variable which proved to be significant, reports of ill health being correlated with higher absenteeism. Leigh (1991) also includes variables reflecting health status and hazardous working conditions and, indeed, was surprised at the strength of these variables as predictors of absence. Health variables which proved to be significant predictors included being overweight and suffering from insomnia. The results of Paringer (1983) are a further endorsement of the importance of health status for observed absence behaviour. The empirical importance of the health variables

---

28 In the medical statistics literature emphasis has been placed on measurements of morbidity, such as how much sickness exists in the population and grouping sickness in terms of severity. One of the major problems of these statistics is that sickness is hard to define due to the substantial differences in severity. Additional problems arise with analysing such data as one is observing absence as opposed to sickness behaviour.


30 Similarly, Allen (1981b) discovers that absence rates are higher in plants where there appears to be high rates of occupational illness and injury.
reinforces the argument that health status should be explicitly incorporated into the theory.

To make the labour supply model more realistic one can explicitly incorporate sickness into the decision-making framework and, thereby, allow the possibility of distinguishing between voluntary and involuntary absence. The importance of recognising the distinction between voluntary and involuntary absence has been discussed in other disciplines. In the applied psychology literature, for instance, a distinction is made between ‘unavoidable’ (‘Type A’) absence due to illness where the individual is unable to attend and avoidable (‘Type B’) absenteeism where the individual lacks the motivation to attend [Chadwick-Jones et al (1973)]. Dalton and Mesch (1991) emphasise that organisational control can only be effectively exerted over the latter.

It is apparent that the severity of any spell of illness has implications not only for workers’ absence decisions but also for the actions taken by employers. If an individual becomes seriously ill then the firm can take measures to allow for such anticipated absences. In the long term the firm can replace a seriously injured or sick worker by making temporary recruitments or rescheduling existing employees. Obviously the firm may still incur some expenses by adjusting the work force, the extent of which will depend on the nature of the job. If an individual is seriously ill, changing the penalties to absenteeism will not encourage the individual to return to work and absence control in such cases becomes ineffective.

Bartel and Taubman (1979) examine the effects of particular diseases on labour supply and earnings, concentrating on major diseases such as arthritis and bronchitis which may lead to long-term absence and may be of concern to employers as employees age. Dunn and Youngblood’s results also show that absence declines with age except in the case of the oldest workers. Similar evidence is presented by Allen (1984,1981a). Table 2.1 below presents the absence rates across regions of Great Britain for two age categories - 44 years of age and under and over 45 years of age [Regional Trends (1987, 1989)]. It is apparent from the figures set out in Table 2.1 that the national statistics reported suggest that absence rates appear to rise with age which implies that age is an important indicator of absence behaviour. Indeed, Allen (1981a) concludes that age is the only personal characteristic found to influence absence.
In order to analyse the unexpected absence behaviour of workers, however, attention should be drawn away from events which cause severe adverse health effects which may lead to long term or even permanent absence from work and towards the effects of day-to-day sickness. The results of Chaudhury and Ng (1992) indicate that total days lost and long term absences, defined as those exceeding five days, are influenced by different factors with long term absences primarily determined by personal characteristics.

The health of individuals has been explicitly included in individuals’ utility functions in some areas of economic literature. Viscusi and Evans (1990), for example, analyse the empirical and economic implications of utility functions which depend on health status. Their empirical analysis indicates that job injuries reduce both the total and the marginal utility of income. The state dependent utility approach has been used to deal with situations characterised by variations in health status [Zeckhauser (1970,1973) and Arrow (1974)]. This approach specifies discrete states of the world, each of which is associated with a specific health level and income level. Expected utility is expressed as the sum of utilities in each state weighted by the probability of each state occurring [Arrow (1974) and Phelps (1973)].

Following Barmby et al (1994) an index of sickness, $\sigma$, may be incorporated into the utility function. This index is assumed to be a random variable with a probability density function $f(\sigma)$ with higher values of $\sigma$ representing

---

**Table 2.1: Absence Rates in Great Britain by Age\(^{31}\)**

<table>
<thead>
<tr>
<th>Regions</th>
<th>1985</th>
<th>1987</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16-44 years</td>
<td>45 and over</td>
</tr>
<tr>
<td>UK</td>
<td>4.2</td>
<td>4.9</td>
</tr>
<tr>
<td>England</td>
<td>4.2</td>
<td>4.9</td>
</tr>
<tr>
<td>Scotland</td>
<td>3.5</td>
<td>4.8</td>
</tr>
<tr>
<td>Wales</td>
<td>4.2</td>
<td>6.3</td>
</tr>
</tbody>
</table>

---

\(^{31}\) The data is taken from *Regional Trends* (1994) and represents the proportion of employees reporting at least one day absent from work during the week prior to the interview.

\(^{32}\) Leigh (1989) analyses the contribution of 36 specific illnesses to absenteeism. Those which appear to have the most influence are day-to-day illnesses such as colds and flus.
higher levels of sickness. Utility is expressed as a function of consumption, leisure and the individual's level of sickness or health:

\[ U = U(x, l, \sigma) \quad (2.21) \]

where \( U \) represents the individual's utility, \( x \) represents the individual's consumption of goods and services and \( l \) represents the individual's leisure time. It is assumed that utility is increasing in consumption and leisure and decreasing in sickness. Moreover, the marginal utility of leisure (consumption) is assumed to increase (decrease) at higher levels of sickness, the rationale for this being that as individuals become sicker more leisure time is required for the purpose of recuperation and/or because the supply of labour becomes more onerous. Thus, the following assumptions are adopted: \( \partial U / \partial x > 0, \partial U / \partial l > 0, \partial U / \partial \sigma < 0, \partial U^2 / \partial l \partial \sigma > 0 \) and \( \partial U^2 / \partial \sigma \partial x < 0 \).

A convenient expositional device is obtained by defining the index of sickness over the range \([0, 1]\) and specifying Cobb-Douglas preferences:

\[ U = x^{(1-\sigma)/\sigma} \quad (2.22) \]

As \( \sigma \) tends to one the individual places relatively more value on leisure time or recuperation time as opposed to consumption. As \( \sigma \) approaches one, the individual would invest his/her entire endowment of time in consuming leisure. The opposite applies when \( \sigma \) approaches zero. As the individual experiences a lower level of sickness he/she attaches a relatively higher weight to consumption as opposed to leisure.34

Different methodological approaches to research into health and illness have discussed the question of treating health as a continuum.35 An early advocate in favour of treating health as a continuum is Cochrane (1972) whose arguments stressed the need to get away from the simple medical model which dichotomised health as either 'good' or 'bad'. Similarly, the model of absence specified by Kahana and Weiss (1992), specifies discrete outcomes in the respect that an individual is either healthy or sick. If the individual is sick then he/she is unable to work. Hence only a healthy individual faces the decision between absence and

33 In the context of the discussion above, one would expect the nature of the distribution of sickness to change over time, becoming increasingly skewed toward higher levels as age rises.
34 Leisure is essentially being interpreted as recuperation time. One may argue, however, that as an individual becomes sicker, he/she may prefer to go to work since leisure cannot be enjoyed when ill (recall Footnote 6).
35 See Long (1984) for a survey of methodological issues concerning research into health and illness.
work. This approach is clearly unrealistic in the sense that an entire spectrum of states of health exist which leads to a complex interaction between the absence decision and health status. The inclusion of a continuous index of sickness directly into the utility function seems to conform to the idea of treating health as a continuous as opposed to a discrete phenomenon.

As illustrated in Figure 2.1, absenteeism becomes possible when there are discontinuities in the budget line. As a consequence of such discontinuities utility maximisation may not occur at a tangency point. Consider an extremely rigid budget line which consists of two points $E^c$ and $E^s$.

\[ \text{Figure 2.8: Health Status and Absenteeism} \]

If the individual attends work then he/she is at point $E^c = \{x^c, l^c\}$, with $l^c = T - h^c$, where $h^c$ represents the hours of work specified in the employment contract. Absence is described by point $E^s = \{x^s, T\}$. The individual’s utility maximising problem is as follows:

\[
\begin{align*}
\max_U &= x^{(1-\sigma)} l^\sigma \\
\text{s.t.} \\
x &= x^c = w \iff l = T - h^c \\
or \\
x &= x^s = s \iff l = T 
\end{align*}
\]  

(2.23)
The realisation of $\sigma$ determines whether the individual’s utility is maximised at point $E^*$ or $E'$. It is apparent that different realisations of $\sigma$ serve to pivot the indifference curve - higher values of $\sigma$ lead to a relatively steeper indifference curve and vice versa. Intuitively, an increase in $\sigma$ increases the marginal rate of substitution between consumption and leisure such that the individual places a greater value on leisure.

The assumption of Cobb-Douglas preferences implies well-behaved, convex indifference curves, the properties of which can be shown formally by the following differentials:

$$\frac{\partial x}{\partial l} = -\frac{\sigma x}{(1-\sigma)t} < 0, \quad \frac{\partial^2 x}{\partial l^2} = \frac{\sigma x}{(1-\sigma)t^2} > 0$$

(2.24)

The attendance decision will depend upon the ‘reservation’ level of sickness, $\sigma^*$, which is defined implicitly by the realisation of sickness at which the individual is indifferent between attendance and absence. Formally, this is defined as follows:

$$w^{(1-\sigma^*)}(T - h') = s^{(1-\sigma^*)}(T)$$

(2.25)

such that:

$$\sigma^* = \frac{\ln \left( \frac{w}{s} \right)}{\ln \left( \frac{w}{s} \right) + \ln \left( \frac{T}{T - h'} \right)}$$

(2.26)

In the context of Figure 2.8, the indifference curve $IC(\sigma^*)$ represents the case where the level of sickness is such that the individual is indifferent between absence and attendance. The slope of the indifference curve is determined by the value of $\sigma$ which determines whether an individual attends or not. If $\sigma \geq \sigma^*$, then the individual maximises utility by absenting himself/herself from work. In this case the slope of the indifference curve is steeper than that of $IC(\sigma^*)$, for example $IC(\sigma_2)$. Conversely, if $\sigma < \sigma^*$, then the individual maximises utility by attending work. In this case the slope of the indifference curve is flatter than that of $IC(\sigma^*)$, such as $IC(\sigma_1)$.

If the individual faces some risk regarding the level of sickness then his/her objective is to maximise expected utility. Expected utility can be expressed as a weighted average of the expected utility of an attender and the expected utility of an absentee where the weights are the probability that $\sigma < \sigma^*$ and the probability that
\( \sigma \geq \sigma^* \) respectively. The probability that \( \sigma < \sigma^* \) is expressed as the integral of the probability density function between 0 and \( \sigma^* \) and the probability that \( \sigma \geq \sigma^* \) is expressed as the integral of the probability density function between \( \sigma^* \) and one. The individual is assumed to evaluate the expected value of consumption and leisure in the case of attendance and absence using the conditional probability distributions to determine the expected value of \( \sigma \). In the case of an absentee the expected value of \( \sigma \), conditional on \( \sigma \) being between \( \sigma^* \) and one, is substituted into the utility function. Conversely, to determine the expected utility of attending work the expected value of \( \sigma \), conditional on \( \sigma \) being between 0 and \( \sigma^* \), is used. For simplicity, consider a logarithmic transformation of Expression (2.22), i.e. \( U = (1 - \sigma) \ln(x) + \sigma \ln(l) \). Hence, the expected utility function can be expressed as:

\[
E[U] = \int_{0}^{\sigma^*} f(\sigma) d\sigma \left[ 1 - E[\sigma | \sigma < \sigma^*] \right] \ln(w) + E[\sigma | \sigma < \sigma^*] \ln(T - h') + \\
\int_{\sigma^*}^{1} f(\sigma) d\sigma \left[ 1 - E[\sigma | \sigma \geq \sigma^*] \right] \ln(s) + E[\sigma | \sigma \geq \sigma^*] \ln(T) \]

(2.27)

where:

\[
E[\sigma | \sigma < \sigma^*] = \int_{0}^{\sigma^*} \left( \frac{f(\sigma)}{\int_{0}^{\sigma} f(\sigma) d\sigma} \right) \sigma^* d\sigma
\]

(2.28)

\[
E[\sigma | \sigma \geq \sigma^*] = \int_{\sigma^*}^{1} \left( \frac{f(\sigma)}{1 - \int_{0}^{\sigma} f(\sigma) d\sigma} \right) \sigma^* d\sigma
\]

(2.29)

The value of \( \sigma^* \) which maximises the above expected utility function is equal to Condition (2.26) regardless of the distribution of the probability density function of \( \sigma \). The first order condition for maximisation is derived by differentiating under the integral sign which yields the following expression [see Henderson and Quandt (1971)]:

48
\[
\frac{\partial E[U]}{\partial \sigma^*} = f(\sigma^*)[(1 - \sigma^*)\ln(w) + \sigma^* \ln(T - h')] +
\]
\[
f(\sigma^*)[(\sigma^* - 1)\ln(s) - \sigma^* \ln(T)] = 0
\]

which can be rearranged to yield: 36

\[
\sigma^* = \frac{\ln\left(\frac{w}{s}\right)}{\ln\left(\frac{w}{s}\right) + \ln\left(\frac{T}{T - h'}\right)}
\]

Maximising the expected utility function with respect to \( \sigma^* \) may be regarded as a mechanism whereby the individual determines the best absence decision rule to be employed. The decision rule which maximises Equation (2.27) is invariant to the distribution. Changes in the probability function change the expected utility function, but not the utility maximising decision rule. This is surprising as one would expect behaviour to change if the distribution of sickness changes. Rothschild and Stiglitz (1970, 1971) model increases in risk as a change in the distribution of the random variable which shifts weight from the centre to the tails of the distribution with the mean kept constant. In the context of the model of absence behaviour described above, changes in the amount of risk affect the probability of \( \sigma \) being greater or less than \( \sigma^* \) and consequently the expected values of the payoffs from being absent or not. The decision rule employed, however, when making absence decisions will not change as the amount of risk represented by the distribution function changes.

It is apparent that the introduction of risk and uncertainty into a one period model is somewhat arbitrary. Hence it is important to consider the dynamic implications of the theoretical and empirical analysis of absence behaviour.

A key point here concerns the relationship between health and past absence records. Prior to recruitment, screening of potential employees can be undertaken in

36 Simplifying the first order condition yields:

\[
\frac{\partial E[U]}{\partial \sigma^*} = (1 - \sigma^*)\ln(w) + \sigma^* \ln(T - h') + (\sigma^* - 1)\ln(s) - \sigma^* \ln(T) = 0
\]

In order to check for a maximum, the first order condition is partially differentiated with respect to \( \sigma^* \):

\[
\frac{\partial^2 E[U]}{\partial \sigma^* \partial \omega} = \ln\left(\frac{s}{w}\right) + \sigma^* \ln\left(\frac{T - h'}{T}\right) < 0
\]

The second order condition is negative since \( w > s \) and \( T > h' > 0 \), hence the condition for a maximum is satisfied.
order to predict future sickness from past records of illness or absence, i.e. to determine the characteristics of \( f(\sigma) \). Keller (1983) and Breaugh (1981), for example, argue that an individual’s past absence record is a good predictor of future absenteeism. This argument is supported by the findings of the CBI (1994) which suggest that some eighty-nine per cent of firms take some measures to avoid the recruitment of potential absentees. Moreover, employers may be able to exert some control over the future health of employees - Steers and Rhodes (1984), for example, remark that firms can promote sound physical health. Bertera (1990) analyses the effects of a workplace health promotion program on absenteeism which involves the dissemination of information on nutrition, smoking cessation, fitness etc. The results indicate that the associated benefits, such as reduced absenteeism, outweighed the costs of implementing the scheme. This is related to the empirical evidence which suggests that education is inversely related to absence since education is considered to be positively related to good health [Drago and Wooden (1992)].

Borofsky and Smith (1993) analyse the rates of turnover, work accidents and unauthorised absence among two groups of employees. One group was hired prior to the inclusion of a pre-employment screening inventory in the selection process whilst the other group was hired subsequently. The pre-employment screening inventory comprised of a set of self-administered questions designed to gather information on individuals' behaviour. The questions ranged from subjects as diverse as one’s life-style and job commitment. The results showed that the rates of turnover, accidents and absence were lower in the group hired after the inclusion of the pre-employment inventory. Despite the fact that self-administration procedures may induce applicants to be less critical of themselves, the results suggest that potential benefits of comprehensive screening procedures may well exist.

The importance of screening is emphasised by the adverse selection process which operates in the labour market, i.e. a firm which finds absenteeism relatively expensive tends to offer high wages with a relatively inflexible work schedule and vice versa for a firm which finds absenteeism relatively inexpensive. Allen (1981b, 1983) has expressed this selection mechanism using hedonic wage equations which capture the idea that there is a trade-off between wages and expected absence faced by potential employees creating ‘compensating differentials’ for absenteeism. According to this approach absence is viewed as a job characteristic. Allen (1984) remarks that:

The ability to miss work repeatedly while keeping one’s job is a job characteristic desirable to many workers, regardless of whether that time
is spent recovering from short-term illnesses or enjoying three-day weekends. [Allen (1984), p.332].

Allen’s model, however, operates on the principle that only the wage adjusts as absence changes, the implicit assumption being that the other arguments in the individual’s utility function are fixed. Consequently, many aspects of the labour supply decision are ignored.

Turnbull and Sapsford (1992) cite evidence which supports the claim that historically some groups of workers view absenteeism as a job characteristic:

... for the docker absenteeism was regarded as an entitlement, and as such it was not considered to be a legitimate disciplinary offence. [Turnbull and Sapsford (1992), p.298].

Another aspect of this selection mechanism is examined by Waldron et al (1991). One of the questions addressed in this analysis is whether health affects labour force participation. If empirical evidence suggests that people who expect bad health in the future (i.e. who expect high values of \( \sigma \)) do not join the labour force, then this suggests that emphasis should be placed on episodes of unexpected and relatively minor illness. Indeed, Taylor-Gooby and Dean (1990) argue that, during periods of economic recession, the unhealthy or disabled workers are usually amongst the first groups to leave the labour market. Their analysis of the General Household Survey indicates that in 1984 less workers than in 1981 reported chronic ill health. Nevertheless, as unemployment was rising over this period, workers who were prone to ill health may have left the labour market, which could create the impression that the health of the work force was rising.

2.3.3.5 Absenteeism and Dynamics

The possibility of screening through the analysis of past absence records introduces a dynamic aspect to the analysis of absence. A major criticism of virtually all theoretical models of absence to date concerns their ignorance of such considerations. Kenyon and Dawkins (1987) recognise this:

The existence ... of paid sick leave entitlements could introduce a dynamic structure to the model in that a heavy usage of sick leave entitlements through labour absence in one period could lead to a more parsimonious use of entitlements in the subsequent period (or periods), and conversely. Secondly, expectations about the future path of real wages or over time or the state of industrial relations could also affect dynamic adjustment. Thirdly, habit persistence may play a part in determining labour absence. Thus the accurate specification of a model of labour absence may well require the inclusion of lagged dependent and/or independent variables. However, it is difficult a priori, to be precise about dynamic structure in that theory, in this case, appears to provide no obvious guide to dynamic relationships. Our modelling strategy, then, will be to search empirically for appropriate structure
estimation and appropriate econometric specification diagnostics. [Kenyon and Dawkins (1987), p4].

It would seem more appropriate, however, to develop a dynamic theoretical framework in order to channel empirical work through a more structured environment. Some theoretical analyses have considered shirking in a dynamic context. Carlin (1989), for example, emphasises that the detection of shirking does not always lead to immediate dismissal and that the interaction between workers and employers should ideally be modelled as a repeated game.

The first claim that an adequate model of absence behaviour should address dynamic considerations was put forward by Johns and Nicholson (1982). In this paper the authors proposed six ‘counter propositions’ to challenge the then existing theories of absence. ‘Counter Proposition Four’ (CP-4) stated that:

*Absence is temporal behaviour and continually subject to dynamic change.* By definition, absence relocates the distribution of time from work to non-work. Thus, the meaning of absence events to both absentees and others in their social framework, may be distinguished by duration as well as by perceived causes ... This compels us to view absence causation as a recursive learning process, and ... to expect ‘lawful changes’ in absence behaviour over time and from episode to episode. [Johns and Nicholson (1982), p. 136].

Once the need for dynamics is accepted, the next issue regards the particular dynamic estimation approach to be adopted. This has proved somewhat problematic with the paucity of theoretical foundations resulting in rather ad hoc empirical specifications. Moreover, the empirical results that have been obtained are rather difficult to interpret given the lack of theoretical underpinnings. But despite the slow pace of theoretical contributions in this area, empirical advances have been made.

The empirical literature since the mid-1980s has taken on board many of the suggestions regarding dynamics outlined in the papers collected by Goodman and Atkin (1984). Fichman (1988, 1989), for example, constructs a dynamic model which places emphasis on the motivational aspects of absence decisions. Barnby et al (1991a, 1991b), on the other hand, allow for demand side considerations by incorporating the attempts of the employer to control for worker absence through the use of an experience rated sick pay scheme, which incorporates bonuses for

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37 This dichotomy between incidence and duration was picked up by Drago and Wooden (1992). Acknowledging Johns and Nicholson (1982), Drago and Wooden argue that the appropriate empirical specification may require separating predictions of ‘absence events’ (i.e. incidence) and ‘absence rates’ (i.e. duration). The authors point out that ‘... although absence events and absence rates may have different determinants, they are related by the fact that an event is required for any positive rate.’ [Drago and Wooden (1992), p. 774].

38 Some theoretical progress has been made in this respect by Brown (1993, 1994) who explores the implications of absence decisions within a two period context and Kahana and Weiss (1992), who analyse absence behaviour as a repeated game.
‘good’ attendance and alterations in the level of sick pay according to absence histories. If the level of sick pay is dependent on past absence behaviour then a temporal aspect to absence decisions emerges - today’s attendance decision will affect tomorrow’s sick pay entitlement.

These papers, along with Harrison and Hulin (1989), have a common theme in terms of the statistical methods employed to model absence and attendance as dynamic phenomena. Over time, an individual switches from one state to another and the analyst’s task is to model the determinants of these switches by analysing the time spent in each state. Models representing the duration of events i.e. time spent in the state of absence are generally specified in terms of a hazard function which represents the rate of transition and which is modelled as a transformation of the probability density function of the random variable, duration [see Lancaster (1990) for an exposition of these statistical techniques]. The methods used by the various researchers are similar. Fichman uses a Weibull hazard function to model the probability of transition from attendance to absence and finds significant differences in the hazard function associated with the start of an absence spell depending upon whether the spell is paid or unpaid.39 Harrison and Hulin (1989) apply a similar hazard rate model to the daily attendance records of 2,130 white-collar employees. Their analysis, which includes no quantitative measure of financial variables, demonstrated that temporal variables such as the month in which the attendance spell took place and historical variables such as the number of spells of absence in the previous year have a significant effect on the hazard rate of voluntary absence.40 Demographic variables that were significantly correlated with aggregated absences were not, however, found to improve the prediction of the hazard rate.

Barmby et al (1991a) incorporate both financial considerations representing sick pay eligibility and personal characteristics into a Weibull hazard model of absence duration in order to model the transition from non-absence to absence. Sex and marital status appear to be important determinants of duration, with female workers and married workers tending to take more prolonged absence spells than their male and single counterparts. Furthermore, ‘acceptable’ absence spells (i.e.

39 This approach entails assuming that the nature of the hazard function is determined by the Weibull probability density function which takes the following form:

\[ f(x; a, b) = abx^{b-1}e^{-ax} \]

where parameters \( a \) and \( b \) are assumed to be positive. Although, to a certain extent the choice of density function is somewhat arbitrary, Cox and Oakes (1984) attempt to weigh up the relative merits of the numerous distributions on offer. One main advantage of the Weibull distribution concerns the ease of computation.

40 In January, for example, the hazard rate for absence was found to be particularly low.
medically certified spells attracting minimal, if any, penalties) were found to be of longer duration than 'unacceptable' spells.

Despite their achievement in introducing dynamics into the empirical analysis of absence modelling, all these models are nevertheless lacking in several respects [see Treble (1990)]. First, both Fichman and Harrison and Hulin classify absence spells, somewhat synthetically, as either voluntary or involuntary. Harrison and Hulin, for example, define three categories of absence; short-term voluntary absence, short-term semi-voluntary absence and long-term involuntary absence. The distinction between the three rests on rather subjective criteria. Barmby et al (1991a) avoid this and classify absence as either acceptable absence, if medically certified, or unacceptable, if not medically certified, and find significant effects of sick pay variables on the duration of both types of absence.

Second, implicit in each of the above models is an inefficiency resulting from the separate modelling of the two transitions involved. Harrison and Hulin include in their specification a large number of variables intended to capture the absence and holiday history of individual workers, both before and during the absence spell under examination. Barmby et al include in their specification measures of absence histories using a sequential logit model for the commencement of a spell. Many of these variables are found to have a relatively large, significant effect on the probability of starting an absence spell, suggesting that a fruitful way forward may be to attempt the simultaneous modelling of both transitions i.e. the transition from absence to attendance and the transition from attendance to absence. The relevant statistical methods for this type of modelling are outlined by Lancaster (1990) and Lancaster and Imbens (1990).

Finally, and most importantly, none of these papers offers a clearly specified, fully integrated model of the absence decision. Barmby et al (1991a) develop a model in the tradition of the economics of labour supply which is applicable only to their data, which is itself derived from a firm operating a somewhat especial sick pay scheme.

In conclusion, the statistical methods based on models of this kind are developing rapidly and there is little doubt that their use in future studies will yield dividends [see Rust (1987) and Hotz and Miller (1989)]. The main advantage of the approach is that it permits the incorporation into the model of highly complex constraints, thereby permitting the explicit modelling of wage, tax, overtime and other absence control influences.
2.4 Concluding Remarks

Clearly some progress has been made in both the theoretical and empirical analysis of worker absenteeism. The area is still, however, somewhat underdeveloped relative to other areas of labour economics. This is unfortunate given that absenteeism constitutes a significant loss of work-time and, therefore, has important implications for both household income and firm productivity. Clearly the existence of such ‘costs’ warrants further research into the determinants of absence behaviour.

In general, economists have modelled absenteeism in terms of an optimal labour supply response on the part of workers to the contractual obligations dictated by the employer. Consequently, demand side aspects have attracted limited attention. Such an approach is clearly at odds with general economic behaviour in which the interaction of demand and supply plays a central role in determining market allocations. This exclusion is all the more surprising given the emphasis that has recently been placed on contract design in other areas of labour economics such as implicit contract theory. Hopefully the present survey, by encouraging economists to address demand side (and dynamic) considerations, will help to promote the development of a more general theory of absence and, thereby, provide a more solid foundation on which to base empirical research.
Chapter 3: A Profile of the Over-Employed

3.1 Introduction

The huge literature exploring the supply of labour by individuals is dominated by research into the decision problem facing an individual over the amount of hours worked and is, therefore, concerned primarily with the modelling of desired rather than actual work hours [Ilmakunnas and Pudney (1990)]. Due to the paucity of data, however, the majority of empirical studies seeking to estimate labour supply equations have been based on data pertaining to actual rather than desired hours of work [see comprehensive surveys by Ashenfelter and Layard (1986) and Heckman et al (1981)]. Such an assumption is clearly unrealistic:

For both institutional and technical reasons, many jobs are associated with a fixed length for the working week and there is little scope for individuals to control their hours of work, except by changing job. But changing job is a costly operation, and there are also very few job opportunities available in large sectors of the spectrum of weekly hours. Consequently many individuals are likely to be observed out of equilibrium with respect to their labour supply at any given time. [Ilmakunnas and Pudney (1990), p183].

Altonji and Paxson (1992) find evidence which is consistent with the hypothesis that constraints on the choice of hours within individual firms limit the extent to which workers experiencing a change in their marginal rate of substitution between income and leisure are able to change hours of work within a job. Similarly, Kahn and Lang (1991) obtain results which suggest that using actual hours of work causes bias in labour supply estimates. Further evidence supporting the existence of hours constraints and the resulting bias in estimates is documented by Dickens and Lundberg (1993).1

As highlighted in the previous Chapter, emphasis throughout this Thesis is placed on the extent to which the constraints imposed on an individual’s choice of work hours by the employer affect worker behaviour. It is apparent that a given constraint may lead to either over-employment or under-employment depending on whether the constraint implies an upper or lower bound on hours worked. If the upper limit lies below the utility maximising level of labour supply, the constraint leads to a position of under-employment - the individual would ideally like to supply more hours of labour. Conversely, if the utility maximising level of labour supply lies below the hours constraint, then this lower limit serves to over-employ the individual. Consequently, the relationship between contractual hours and

---

1 The implications of assuming a coincidence of actual and desired hours of work for labour supply estimates are explored in Appendix A3.
utility maximising hours, and the extent to which any constraints that do exist are binding, has important implications for worker behaviour [see Brown et al (1986)].

Consider the simple budget constraint depicted in Figure 3.1 below.

![Figure 3.1: Over-Employment, Under-Employment and (Un)Constrained Employment](image)

If we assume the employer specifies that $H_c$ hours of labour must be supplied, then, ignoring corner solutions, we can identify three possible situations which may arise. First, the individual’s indifference curve (such as $Ic_3$) may be tangential to the line segment AB. Hence, such ‘over-employment’ describes a situation where the individual’s marginal rate of substitution between consumption and leisure at contractual hours exceeds the individual’s economic rate of substitution between income and leisure at contractual hours. Recalling the analysis of Section 2.2, Chapter 2, with $u = u(x, l)$ defining the individual’s utility in terms of consumption ($x$) and leisure ($l$), then over-employment may be defined formally by the following condition:

$$\frac{\partial u(x, l)}{\partial l} > w \frac{\partial u(x, l)}{\partial x}$$

(3.1)
Furthermore, the extent to which the constraint is binding depends on whether the individual can absent himself/herself in order to supply less labour. As long as contractual hours exceed the individual’s preferred or utility maximising hours, a potential utility gain from absence behaviour may exist.

Alternatively, the individual’s indifference curve may be tangential to the line segment CB (such as Ic1), implying that the individual is under-employed. In this case, the individual’s marginal rate of substitution between consumption and leisure at contractual hours is less than the individual’s economic rate of substitution between income and leisure at contractual hours:

\[
\frac{\partial u(x, l)}{\partial l} < w
\]

i.e. the amount of leisure that an individual is willing to sacrifice for additional income exceeds the amount he/she is obliged to sacrifice through the labour market. The extent to which this type of constraint is binding depends upon whether the individual can increase his/her labour supply through overtime working and/or ‘moonlighting’.

The final, and theoretically least likely, situation is where the individual is neither over-employed nor under-employed and which occurs when the worker’s indifference curve (such as Ic2) is tangential to AC at point B. Hence, under such circumstances the individual’s marginal rate of substitution at contractual hours and the slope of the budget constraint at contractual hours are in accord:

\[
\frac{\partial u(x, l)}{\partial l} = w
\]

In such a situation, the worker is simultaneously constrained and supplying his/her utility maximising amount of labour.

It is apparent that any given employment contract can lead to either over-employment (OE), under-employment (UE) or ‘utility-maximising’ employment (UME). Despite the possibility of three outcomes, labour economists have tended to focus on one outcome in isolation. Tegle (1985), for example, derives hours of labour supply equations for a household model consisting of two household members where one of the household members is over-employed. Despite the analysis of the interesting interaction between the two household members, Hart (1987) criticises Tegle’s assumption of over-employment since no justification for this assumption is given. As emphasised above, an employment contract can lead
to three possible outcomes and, as such, a more general specification may be preferable.

Given the focus of this Thesis, the aim of this Chapter is primarily to ascertain the characteristics of an over-employed individual in order to determine the characteristics of 'potential absentees'. For completeness, however, the profiles of an under-employed individual and an individual whose contractual hours are in accord with utility maximising hours are also explored, since such individuals can be regarded as 'potential non-absentees'.

The Chapter is set out as follows: Section 3.2 outlines the data and methodology; Section 3.3 presents the results of the empirical analysis and final comments are collected in Section 3.4.

3.2 Data and Methodology

The data set analysed in this Chapter is derived from the British Social Attitudes (BSA) Survey. The BSA Survey is a series of surveys started by the Social and Community Planning Research in 1983 and core funded by the Monument Trust. Surveys were conducted annually over the period 1983-1991, excluding 1988. Additional contributions are also made by the Department of the Environment, the Countryside Commission, the Nuffield Foundation, the ESRC, Marks and Spencer Plc and Shell UK Ltd. The data are derived from a cross-sectional sample of adults aged 18 and over living in private households whose addresses were included in the electoral registrar. The sampling was facilitated by selecting 114 Parliamentary constituencies from among all those in Great Britain on the basis of the Registrar General's Standard Regions.

From each parliamentary constituency a polling district was randomly identified and selected. Addresses were chosen from these polling districts by treating the listed electors as circular with a fixed interval and marking the name of the individual on which the sampling interval landed. This method ensured a probability proportionate to the number of listed electors. Where possible these electors were chosen for the survey. Where there was a difference between the register entry and the current members of the household, the interviewer selected one respondent by means of a random selection grid.

The data from the BSA Survey was used to construct the set of profiles described above. The BSA survey is ideally suited to address such issues, since, although largely unexplored by economists, this data set contains a wealth of information on individual characteristics which yields an informative list of potential explanatory variables.
The BSA surveys for 1985, 1989 and 1990 contain a question which asks individual employees if (a) they would like to work fewer hours than they are currently working, (b) if they would like to work more hours than they are currently working and (c) if they are happy with their current hours of work and, hence, would not like to change these contractual hours. An individual who agrees with (a) can be regarded as a 'potential absentee', since his/her contractual hours and utility maximising hours are clearly in discord. By the same criterion, individuals who agree with part (b) can be regarded as potential 'moon-lighters' and individuals who agree with part (c) can be regarded as being neither over- nor under-employed.

A sub-sample of 3614 employees who were asked the above question was isolated from the BSA survey, 2494 (69%) of whom reported that they were satisfied with contractual hours, 964 (27%) of whom reported that they would like to work fewer hours and the remaining 156 (4%) employees reported that they would like to work more hours. Hence, almost one-third of the sub-sample reported that they faced hours of work constraints of some kind, implying that the assumption that individuals are able to choose work hours within a job (or are able to costly switch to another employer offering contractual hours equal to preferred hours) is clearly inappropriate.

In order to determine the effect of various personal, demographic and job characteristics on the probability of being in one of the three states, the logit model is specified. The logit model is based on the cumulative logistic probability density function and is specified for observation $i$ as:

$$p(d_i = 1) = \frac{1}{1 + e^{-\alpha - \beta x_i}}$$  \hspace{1cm} (3.4)

where $p(d_i = 1)$ represents the probability that the individual $i$ is situated in the specified state of interest given knowledge of $x_i$, a set of explanatory variables, where $e$ denotes the base of natural logarithms. Three logit regressions were estimated separately for each possible state, i.e. over-employment, under-employment and satisfaction with contractual hours.\(^2\)

Thus, the general methodology is to estimate the three logit regressions in order to determine the relationship between the probability of being OE, UE or UME and a specified set of regressors. The BSA survey is a rich source of

\(^2\) A similar bivariate analysis was undertaken by Ham (1982) in order to explore the determinants of the probability of under-employment using US data. The results suggest that years in education reduce the probability of under-employment whilst union membership and increases in the rate of unemployment raise the probability of under-employment. In addition, the probability of under-employment appears to differ across geographic regions.
information on an individual's personal and job characteristics and, as such, permits an interesting insight into the extent to which specific types of workers are satisfied or dissatisfied with their contractual hours. The regression results obtained offer a compact method of cross-tabulating OE, UE and UME incidence against a set of specified regressors. Given that the objective of this Chapter is to identify the three types of employees, such an approach is appropriate.  

3.3 Results

The effects of a number of characteristics are explored which can be broadly split into three groups: personal characteristics, job characteristics and residential influences. Tables 3.3 to 3.5 present the sub-sample rates and the results of the three logit regressions for OE, UE and UME respectively whilst some variable definitions pertaining to the expectations and job satisfaction explanatory variables are set out in Table 3.6. 

Prior to discussing the specific implications of each variable, it is interesting to consider some general diagnostics pertaining to the empirical specification in its entirety. The likelihood ratio test statistics reported in Tables 3.3 to 3.5, test the hypothesis that the explanatory variables (excluding the constant) have no influence on the choice probabilities in the logit analysis, i.e. that $\beta_2 = \beta_3 = \ldots = \beta_k = 0$ where $k$ equals the number of explanatory variables and $\beta_1$ represents the constant. The likelihood ratio test statistic is defined as:

$$-2 \ln \lambda = 2 \left[ \ln \hat{l}(\Omega) - \ln \hat{l}(\omega) \right]$$

(3.5)

where $\hat{l}(\Omega)$ is the value of the likelihood function evaluated at the maximum likelihood estimates and $\hat{l}(\omega)$ is the maximum value of the likelihood function under the hypothesis that $\beta_2 = \beta_3 = \ldots = \beta_k = 0$. It is reassuring to note that the magnitude of the estimated test statistics for each of the three regressions is such that the hypothesis that $\beta_2 = \beta_3 = \ldots = \beta_k = 0$ is not accepted.

3 In order to explore implications of desired vis a vis actual work hours, a selection of labour supply schedules were estimated, the results of which are presented in Appendix A3. Since the BSA Surveys enable identification of those employees who express satisfaction with their current work hours, we can derive a sample of desired work hours for this sub-group of individuals. Labour supply equations are also estimated for the entire sample of employees in order to provide a benchmark for comparison. In addition, the sub-sample of over-employed individuals is isolated in order to explore the nature of the labour supply schedule for an individual who faces constraints regarding labour supply. The results suggest that the nature of labour supply schedules are highly sensitive to the definition of work hours.

4 The sub-sample rates are defined as the percentage of survey respondents with a given characteristic reporting themselves as either OE, UE or UME.
In addition, Table 3.1 below presents a selection of measures of goodness of fit in order to assess the predictive capacity of the three regressions equations. There have been numerous measures proposed in the literature - the three measures presented below are amongst the most frequently used in the analysis of limited dependent variables [see Maddala (1983) for a survey of the measures of goodness of fit].

Table 3.1: Measures of Goodness of Fit

<table>
<thead>
<tr>
<th>Potential Measures:</th>
<th>OE</th>
<th>UE</th>
<th>UME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maddala $R^2 = 1 - \left( \frac{\hat{\omega}}{\hat{\Omega}} \right)^{2/n}$</td>
<td>0.1835</td>
<td>0.0778</td>
<td>0.1260</td>
</tr>
<tr>
<td>Cragg-Uhler $R^2 = \left{ \left[ \frac{\hat{\omega}}{\hat{\Omega}} \right]^{2/n} - \left[ \frac{\hat{\omega}}{\hat{\Omega}} \right]^{2/n} \right} / \left( 1 - \left[ \frac{\hat{\omega}}{\hat{\Omega}} \right]^{2/n} \right)$</td>
<td>0.2674</td>
<td>0.2300</td>
<td>0.1774</td>
</tr>
<tr>
<td>Chow $R^2 = 1 - \left{ \frac{\sum_{i=1}^{n} (d_i - \hat{d}<em>i)^2}{\sum</em>{i=1}^{n} (d_i - \bar{d}_i)^2} \right}$</td>
<td>0.1946</td>
<td>0.1462</td>
<td>0.1363</td>
</tr>
</tbody>
</table>

The goodness of fit measures not only appear to be relatively small, but there appears to be some inconsistencies regarding the ranking of the models. At first sight, the levels of the Cragg-Uhler $R^2$ and Chow $R^2$ suggest that the UE model is characterised by better predictive capability than the UME specification whilst the Maddala $R^2$ measure appears to suggest the opposite. Maddala (1983), however, proves that the upper bound on the Maddala $R^2$ measure is less than one. More specifically, he derives the following bounds for this measure of goodness of fit:

$$0 \leq Maddala \ R^2 \leq 1 - \left[ \frac{\hat{\omega}}{\hat{\Omega}} \right]^{2/n} \quad (3.6)$$

where $n$ represents the number of observations (i.e. 3614). Table 3.2 below presents the upper bounds of the Maddala $R^2$ measure and the goodness of fit measure as a percentage of its range. Thus, although the relative ranking of the models appears to be restored once allowance is made for the upper bounds of the Maddala $R^2$ measure, the analysis suggests that, even after one accounts for the upper bound of this goodness of fit measure, these models are characterised by

---

5 N.B. $d_i$, $\hat{d}_i$, and $\bar{d}_i$ represent the dependent variable, the predicted value of the dependent variable and the mean value of the dependent variable respectively.
rather poor predictive capacity. One problem with this specific measure of goodness of fit, however, lies in the fact that even if the fit of the model is perfect, the Maddala $R^2$ will be significantly less than one which suggests that this statistic does not provide a good measure of fit.

<table>
<thead>
<tr>
<th>Table 3.2: Upper Bounds of the Maddala R² Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \ln \hat{\ell}(\omega) )</td>
</tr>
<tr>
<td>OE</td>
</tr>
<tr>
<td>UE</td>
</tr>
<tr>
<td>UME</td>
</tr>
</tbody>
</table>

Cragg and Uhler (1973) propose an alternative measure which does lie on the unit interval. The values of the Cragg-Uhler $R^2$ presented in Table 3.1, at first glance appear to be relatively low, but Cragg and Uhler (1973) remark that if such a measure of goodness fit is estimated at around 0.3, then this should be regarded as '... quite a good fit' [Cragg and Uhler (1973), p.402]. Thus, the goodness of fit measure reported for the OE regression may be regarded as an indicator of reasonable predictive power. Attention will now be paid to the specific implications of each regressor for the probability of being in the state of OE, UE or UME.

3.3.1 Personal Characteristics

Age, Sex and Marital Status

As illustrated by Equation 2.9 in Chapter 2, personal characteristics such as age, sex and marital status have been specified as explanatory variables in studies seeking to ascertain the determinants of the amount of absence observed across individuals.

Subsequently, age in years and age in years squared were entered into the three regressions. Age appears to exert a significant positive influence on both the probability of being over-employed and the probability of being under-employed and a significant negative influence on the probability of being satisfied with contractual hours. The situation is reversed in the case of the age squared variable. The results accord with those of Kahn and Lang (1991) which also

---

6 The mean (standard deviation) value of age is 39.12 (11.48), 34.18 (11.34) and 38.68 (12.8) for respondents reporting themselves as OE, UE and UME respectively.
suggest that OE rises with age. The results, however, are not entirely in accordance with those seeking to explore the determinants of observed absence behaviour which, in general, suggest that absenteeism is concentrated amongst the oldest and the youngest employees [see, for example, Allen (1981a, 1981b)].

The results surveyed in Chapter 2 also suggest that females exhibit more absence behaviour than males. It is apparent from Tables 3.3 to 3.5, that the sub-sample rate of OE (UE) amongst female respondents is significantly higher (lower) than that of their male counterparts, which suggests that female employees may desire to work less hours which is consistent with the hypothesis that females are more prone to absence behaviour. Moreover, once other individual characteristics are controlled for, the dummy variable representing a male employee impacts negatively on the probability of being over-employed and positively on the probability of being under-employed, which confirms that the potential to absent is greater among female employees.

The sub-sample rate of OE amongst married respondents exceeds that of single respondents, whilst the sub-sample rate of UE appears to be somewhat lower. The logit analysis suggests, however, that marital status does not exert a significant influence, ceteris paribus, in any of the three regressions, which suggests that the differential sub-sample rates of OE, UE and UME between married and single individuals is largely attributable to other factors. Similarly, although differentials are apparent in the sub-sample rates of OE, UE and UME between respondents with and without a pre-school child, the logit analysis suggests that the existence of such a child does not exert a significant effect on the differentials ceteris paribus.7

A dummy variable relating to an often ignored dimension of domestic arrangements was included in the analysis, taking the value of one if the respondent co-habits with his/her parents. It is apparent that two conflicting effects may be identified with such an arrangement. On the one hand, the respondent’s parents may assist in domestic duties, such as child care, which may relieve the respondent of the need to absent from the work place in order to attend to such domestic matters. On the other hand, the respondent’s parents may be dependent on the respondent which may lead to more absence from the work place in order to care for elderly or sick dependent relatives. Unfortunately, the data do not permit discrimination between the two situations.

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7 It is well documented in the literature on absence behaviour that the significance of personal characteristics as predictors of absence behaviour has not been universally accepted [see, for example, Barmby and Treble (1991a), Allen (1981a) and Kenyon and Dawkins (1989)].
<table>
<thead>
<tr>
<th>Variable</th>
<th>Sub-Sample Rates</th>
<th>Estimated Coefficient</th>
<th>T-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal Characteristics:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>32.08</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Male</td>
<td>20.59</td>
<td>-0.3800</td>
<td>-3.0749***</td>
</tr>
<tr>
<td>Age</td>
<td>22.54</td>
<td>0.1175</td>
<td>4.0111***</td>
</tr>
<tr>
<td>Age Squared</td>
<td>-</td>
<td>-0.0015</td>
<td>-3.9065***</td>
</tr>
<tr>
<td>Single</td>
<td>28.36</td>
<td>-0.0490</td>
<td>-0.3708</td>
</tr>
<tr>
<td>Pre-School Child</td>
<td>27.25</td>
<td>-0.2300</td>
<td>-1.5884</td>
</tr>
<tr>
<td>No Pre-School Child</td>
<td>26.60</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No Parents in home</td>
<td>28.47</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Parents in home</td>
<td>17.19</td>
<td>-0.5012</td>
<td>-2.7261***</td>
</tr>
<tr>
<td>White</td>
<td>26.73</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Asian</td>
<td>16.67</td>
<td>-0.9128</td>
<td>-2.0455**</td>
</tr>
<tr>
<td>African</td>
<td>33.33</td>
<td>0.1886</td>
<td>0.5575</td>
</tr>
<tr>
<td>CSE</td>
<td>24.39</td>
<td>-0.0280</td>
<td>-0.2086</td>
</tr>
<tr>
<td>Apprenticeship</td>
<td>36.43</td>
<td>0.0544</td>
<td>0.3556</td>
</tr>
<tr>
<td>RSA</td>
<td>18.66</td>
<td>-0.3832</td>
<td>-2.3989**</td>
</tr>
<tr>
<td>'O' level</td>
<td>28.62</td>
<td>0.2358</td>
<td>2.2162**</td>
</tr>
<tr>
<td>'A' level</td>
<td>31.19</td>
<td>-0.0388</td>
<td>-0.3417</td>
</tr>
<tr>
<td>Technical Qualifications</td>
<td>31.27</td>
<td>-0.1195</td>
<td>-0.7833</td>
</tr>
<tr>
<td>Vocational Qualifications</td>
<td>21.69</td>
<td>-0.6200</td>
<td>-2.0182**</td>
</tr>
<tr>
<td>BTech</td>
<td>34.93</td>
<td>0.1099</td>
<td>0.5291</td>
</tr>
<tr>
<td>Degree</td>
<td>30.11</td>
<td>-0.1701</td>
<td>-1.0411</td>
</tr>
<tr>
<td>Teacher training qualification</td>
<td>32.97</td>
<td>0.2055</td>
<td>0.9784</td>
</tr>
<tr>
<td>Nursing Qualification</td>
<td>23.93</td>
<td>-0.2052</td>
<td>-0.7990</td>
</tr>
<tr>
<td>Expect1a</td>
<td>31.93</td>
<td>0.2719</td>
<td>2.6890***</td>
</tr>
<tr>
<td>Expect1b</td>
<td>25.05</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Expect2a</td>
<td>27.97</td>
<td>0.1046</td>
<td>1.1092</td>
</tr>
<tr>
<td>Expect2b</td>
<td>25.00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Expect3a</td>
<td>31.21</td>
<td>0.1819</td>
<td>0.8375</td>
</tr>
<tr>
<td>Expect3b</td>
<td>26.49</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Expect4a</td>
<td>24.44</td>
<td>-0.1230</td>
<td>-1.1849</td>
</tr>
<tr>
<td>Expect4b</td>
<td>29.38</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Expect5a</td>
<td>24.33</td>
<td>-0.2939</td>
<td>-2.8286***</td>
</tr>
<tr>
<td>Expect5b</td>
<td>29.67</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Expect6a</td>
<td>29.19</td>
<td>-0.1254</td>
<td>-0.5966</td>
</tr>
<tr>
<td>Expect6b</td>
<td>26.54</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Job Characteristics:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue Collar</td>
<td>25.99</td>
<td>-0.1455</td>
<td>-1.2971</td>
</tr>
<tr>
<td>Non Blue Collar</td>
<td>27.16</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Trade Union Member</td>
<td>29.57</td>
<td>0.1979</td>
<td>1.6458*</td>
</tr>
<tr>
<td>Non Trade Union Member</td>
<td>24.45</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nominal Earnings</td>
<td>-</td>
<td>0.0005</td>
<td>2.2006**</td>
</tr>
<tr>
<td>Nominal earnings Squared</td>
<td>-</td>
<td>-0.2000E-7</td>
<td>-2.4686**</td>
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Likelihood Ratio Test (69 df) 292.876***
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<th>T-Ratio</th>
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Likelihood Ratio Test (df 69) 486.526***
### Table 3.6: Variable Definitions: Expectations and Job Satisfaction

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<tr>
<th>Variable</th>
<th>Definition</th>
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<td>Expect1a</td>
<td>Equals one if the individual does not think that there will be less employees at his/her workplace next year</td>
</tr>
<tr>
<td>Expect1b</td>
<td>Equals one if the individual thinks that there will be less employees at his/her workplace next year</td>
</tr>
<tr>
<td>Expect2a</td>
<td>Equals one if the individual thinks that the rate of unemployment will fall next year</td>
</tr>
<tr>
<td>Expect2b</td>
<td>Equals one if the individual thinks that the rate of unemployment will rise next year</td>
</tr>
<tr>
<td>Expect3a</td>
<td>Equals one if the individual thinks that the rate of inflation will fall next year</td>
</tr>
<tr>
<td>Expect3b</td>
<td>Equals one if the individual thinks that the rate of inflation will rise next year</td>
</tr>
<tr>
<td>Expect4a</td>
<td>Equals one if the individual thinks that his/her income has kept up with inflation over the past year</td>
</tr>
<tr>
<td>Expect4b</td>
<td>Equals one if the individual thinks that his/her income has fallen with inflation over the past year</td>
</tr>
<tr>
<td>Expect5a</td>
<td>Equals one if the individual thinks his/her real income will increase next year</td>
</tr>
<tr>
<td>Expect5b</td>
<td>Equals one if the individual thinks his/her real income will decrease next year</td>
</tr>
<tr>
<td>Expect6a</td>
<td>Equals one if the individual feels that he/she will have to leave the firm involuntarily</td>
</tr>
<tr>
<td>Expect6b</td>
<td>Equals one if the individual feels that he/she will not have to leave the firm involuntarily</td>
</tr>
<tr>
<td>Satis1a</td>
<td>Equals one if the individual finds life comfortable at his/her present level of income</td>
</tr>
<tr>
<td>Satis1b</td>
<td>Equals one if the individual finds life uncomfortable at his/her present level of income</td>
</tr>
<tr>
<td>Satis2a</td>
<td>Equals one if the employee thinks that the management-employee relations are good at the work place</td>
</tr>
<tr>
<td>Satis2b</td>
<td>Equals one if the employee thinks that the management-employee relations are poor at the work place</td>
</tr>
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<td>Satis3a</td>
<td>Equals one if the individual thinks that it is unlikely that he/she will leave the current job this year</td>
</tr>
<tr>
<td>Satis3b</td>
<td>Equals one if the individual thinks that it is likely that he/she will leave the current job this year</td>
</tr>
<tr>
<td>Satis4a</td>
<td>Equals one if the individual is satisfied with his/her current level of wages</td>
</tr>
<tr>
<td>Satis4b</td>
<td>Equals one if the individual is unsatisfied with his/her current level of wages</td>
</tr>
<tr>
<td>Satis5a</td>
<td>Equals one if the individual believes that the pay gap at the work place is too small</td>
</tr>
<tr>
<td>Satis5b</td>
<td>Equals one if the individual does not believe that the pay gap at the work place is too small</td>
</tr>
<tr>
<td>Satis6a</td>
<td>Equals one if the individual believes that the pay gap at the work place is too large</td>
</tr>
<tr>
<td>Satis6b</td>
<td>Equals one if the individual does not believe that the pay gap at the work place is too large</td>
</tr>
<tr>
<td>Satis7a</td>
<td>Equals one if the individual thinks that the firm is well managed</td>
</tr>
<tr>
<td>Satis7b</td>
<td>Equals one if the individual does not think that the firm is well managed</td>
</tr>
</tbody>
</table>
It is apparent that the sub-sample rate of OE is significantly lower, and the sub-sample rates of UE and UME are significantly higher, amongst individuals who co-habit with their parents. The logit results suggest that the former effect dominates with respondents living in the same residence as their parents experiencing significantly more (less) UE (OE).

A further three dummy variables (Asian, African and White) were incorporated into the analysis to represent ethnic origin. Once again there have been mixed results reported in the existing literature on absence behaviour concerning the implications of ethnic origin. Allen (1981a) and Leigh (1991), for example, both include a non-white dummy in their empirical specifications which proves to be an insignificant explanatory variable for absence behaviour. In a later analysis, Allen (1984), however, obtains results which suggest that absence rates are higher among non-whites, contradicting his earlier results. It would appear from the current analysis that ideally one should make a distinction between Asian and African individuals rather than simply classifying such culturally diverse groups as ‘non-white’.

It is clear from the sub-sample rates that the incidence of OE (UE) amongst respondents of an African origin is higher (lower) than that of respondents of both other ethnic backgrounds. Relative to Whites, however, it is only respondents of an Asian origin who are characterised by a significantly higher (lower) probability of being UE (OE) ceteris paribus. Thus, being of African origin does not appear to influence the differential probability of being in any of the three states relative to Whites implying that the differential across the sub-sample rates for Africans and Whites can be accounted for by other factors.

**Education**

The implications of education for absence behaviour have attracted some attention in the literature with the empirical evidence suggesting an inverse relationship between absence and education due to the perceived positive association between absence and good health and good health and education [see Section 2.3.3.4, Chapter 2].\(^8\) A further dimension to the relationship between absence behaviour and education exists, however, if one acknowledges the high degree of correlation which exists between educational attainment and occupational status. University graduates, for example, are mostly professionals, whilst unskilled manual workers usually have few, if any, qualifications. Furthermore, white collar employment is associated with a relatively higher degree of flexibility than blue collar employment. Section 2.3.3.2, Chapter 2, has discussed the inverse relationship which exists between job flexibility and absenteeism in some detail.

\(^8\) Allen (1981a, 1981b) and Leigh (1986, 1991), for example, obtain results which suggest that education is inversely related to absenteeism.
In Tables 3.3 to 3.5, eleven categories of educational attainment are specified ranging from CSE to degree level. Although, some of the variables fail to reach significance in the logit analysis, there are several results which warrant further discussion. The sub-sample rates for both OE and UE are highest amongst individuals with an apprenticeship as compared to other educational achievements, whilst the sub-sample rate for UME is the lowest amongst this group of employees. One might conjecture that the relatively high incidence of OE (and UE) may be prevalent amongst such individuals given that this qualification is usually associated with inflexible blue collar employment contracts. Moreover, the high incidence of UE amongst respondents with an apprenticeship may reflect the fall in manual employment following the decline of the British manufacturing sector over the 1970s and 1980s where the apprenticeship system tends to predominate.

The logit regressions suggest that, once other factors are taken into consideration, apprenticeships appear to exert a large positive effect only on the probability of being under-employed. Thus, the implications of the hours inflexibility for over-employment, and thus absence behaviour, often associated with blue collar employment appear to be out-weighed once one takes account of other characteristics.

The RSA secretarial qualification may be regarded as the clerical equivalent to an apprenticeship. It is apparent from Tables 3.3 to 3.5 that the sub-sample rate of OE (UME) is lowest (highest) amongst respondents with an RSA qualification as compared to other educational qualifications. The RSA dummy variable is characterised by a significant negative coefficient in the OE regression and a significant positive coefficient in the UME regression, implying that the presence of an RSA qualification, ceteris paribus, will lower the potential to absent. Such a result is not particularly surprising since secretarial skills are generally associated with flexible white collar employment.

In a similar vein, the sub-sample rate of UE is lowest amongst respondents with a degree as compared to other educational qualifications. The dummy variable which indicates whether or not the individual has a degree, however, only attains significance in the UE regression with the estimated coefficient suggesting that the possession of a degree exerts a very large negative impact on the probability of being under-employed. This result ties in with the findings of Coleman and Pencavel (1993a, 1993b) for the US which suggest that work hours have risen over the past two decades in the US for both male and female college graduates.

Similarly, the possession of accountancy and other related vocational qualifications appears to lower the probability of UE and to raise the probability
of being satisfied with contractual hours, *ceteris paribus*, in both cases by a relatively large amount. Since such qualifications are naturally associated with professional and managerial occupations, where contractual hours are relatively flexible, the results are in accordance with *a priori* expectations.

**Expectations**

Following the discussion of Section 2.3.3.5, Chapter 2, which highlights the importance of dynamics and, therefore, expectations in analysing absence behaviour, a number of variables representing the individual’s expectations over factors pertaining to future employment opportunities were incorporated into the analysis.

From Tables 3.3 to 3.5, it is apparent that the sub-sample rate of OE (UE) is higher (lower) amongst individuals who believe that the number of individuals employed at his/her work place will not fall over the coming year than that of individuals who are pessimistic about future changes in the number of employees employed at the work place. The logit results confirm that the potential to absent from the work place is inflated if the individual believes that the number of individuals employed at his/her work place will not decline over the coming year. Such beliefs may enhance the perceived job security of the individual which may in turn encourage absence behaviour. Such behaviour clearly fits in with the efficiency wage hypothesis discussed in Section 2.3.3.3, Chapter 2. In addition, if the conditions of the economy lead to increases in labour demand, employers have tended to rely on the provision of overtime working rather than the employment of additional workers [see, for example, Hart and Ruffell (1993)]. Such actions would raise the average hours of the existing work force which could further intensify the tendency towards OE.

It is interesting to note that despite the differentials in the sub-sample rates of OE, UE and UME between individuals who are optimistic about future rates of unemployment and inflation and individuals who are pessimistic about such macroeconomic indicators, these expectations variables are not characterised by a significant coefficient in any of the logit regressions. Hence, employment prospects in an individual’s work place appear to influence the potential to absent whilst conditions in the general economy appear to be unimportant predictors of the potential to absent once one controls for other factors.

A further set of variables, Expect6a and Expect6b, were incorporated into the empirical analysis; Expect6a equals one if the individual believes that he/she will have to leave the firm involuntarily in the near future due to, for example, lay-offs and redundancies whilst Expect6b equals one if the individual believes the opposite. The sub-sample rate of OE is higher amongst those individuals who believe that they will be made redundant in the near future, whilst the sub-sample
rates of UE and UME are lower amongst this group of individuals. It is apparent from the logit results that the prospect of involuntary redundancy appears to exert a very large negative effect on the probability of UE and a significant positive impact on the probability of being satisfied with contractual hours. It may be the case that an individual who perceives that he/she is likely to be involuntarily unemployed in the near future will express satisfaction with current employment.

Differentials in the sub-sample rates of OE, UE and UME exist across individuals who believe that their real income has increased over the past year (Expect4a) and those who believe that their real income has fallen (Expect4b). The sub-sample rates of OE and UE are higher, and that of UME lower, amongst those who believe that their real income has fallen. Turning to the logit analysis, if an individual believes that his/her real income has increased over the past year then such beliefs inflate the probability that an individual is satisfied with his/her hours of work. Such results reinforce the proposition that a strong positive correlation between job satisfaction and wages exists [see Section 2.3.3, Chapter 2].

Furthermore, the sub-sample rates of OE and UE are more pronounced amongst individuals who believe that their real income will decline next year (Expect5b) as opposed to those who believe that their real income will increase over the coming year (Expect5a). It is not surprising that the sub-sample rate of UME is lowest amongst those who believe that their real income will fall. Moreover, once other influences are taken into account, the logit analysis suggests that if an individual believes that his/her real income will rise over the next year then the probability of OE is reduced whilst the probability of UME is increased. Such results further reinforce the hypothesis that a strong positive correlation between the wage rate and job satisfaction exists.

3.3.2 Job Characteristics

Occupation, Income and Contractual Hours
It is apparent from Chapter 2 that contractual arrangements play an important role in the theory of absence behaviour. Accordingly, a dummy variable representing blue collar employment was included in the empirical analysis. Differentials in the sub-sample rates of OE, UE and UME are apparent across blue collar and non-blue collar employees, with the sub-sample rate of OE, somewhat surprisingly, being higher amongst non-blue as opposed to blue collar employees, and the sub-sample rate of UE (UME) being higher (lower) amongst blue collar
employees. Controlling for other factors via the logit analysis, the blue collar dummy variable reaches significance in one regression only. The results suggest that blue collar employment raises the probability of being under-employed.

The implications of trade union membership were explored given the potential effects of such membership on the level of satisfaction with contractual arrangements. From Tables 3.3 to 3.5 it is apparent that differentials in the sub-sample rates of OE, UE and UME exist across trade union and non-trade union members. The sub-sample rate of OE is greater amongst union members whilst the sub-sample rates of UE and UME appear to be lower across union as opposed to non-union members. From Tables 3.3 to 3.5, it is apparent that trade union membership exerts a significant positive impact on the probability of OE and a significant negative impact on the probability of UE, suggesting that the potential to absent from the work place may be inflated amongst trade union members. The studies surveyed in Section 2.3.3.3, Chapter 2, confirm that absence behaviour appears to be more pronounced among union as opposed to non-union members.

Clearly, the income of an individual plays a prominent role in any theory of labour market behaviour and to ascertain the implications of income for the potential to absent, the individual’s yearly earnings were included in the analysis. Some summary statistics relating to the continuous variables are presented in Table 3.7 below. Earnings appear to be positively associated with the probability of OE whilst earnings squared impact negatively on OE. It is interesting to note the relatively small magnitude of the estimated coefficient of the earnings variables. One explanation for this may lie in the extensive set of job satisfaction variables which has been included in the analysis. Since job satisfaction and earnings are likely to be positively correlated, the inclusion of the job satisfaction variables discussed below may have dampened the earnings effect.

In addition, a proxy for unearned income was constructed since changes in the level of unearned income will act as a pure income effect thereby, assuming the normality of leisure, stimulating absence behaviour. In contrast to Allen (1981a), who also includes such a variable, the unearned income variable is significant and takes the expected positive sign in the over-employed regression. The size of the coefficient is, however, somewhat small. Unearned income,

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9 As reported in the previous Chapter, empirical evidence suggests that blue collar employees are more prone to absence behaviour than white collar employees [see, for example, Kenyon and Dawkins (1989)].
10 Unfortunately, the BSA survey does not contain questions relating to the sick pay arrangements prevailing at the work place.
11 The unearned income proxy was constructed by subtracting the individual’s earnings from household income which is defined in the BSA survey as the summation of income across all household members.
however, is a difficult concept to measure and the definition incorporated is clearly deficient in some areas. Ideally, for example, one would like to have information on transfer payments and income from asset holdings. Thus, although the variable is characterised by the expected sign the results should be treated with some caution.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Over-Employed</th>
<th>Under-Employed</th>
<th>Utility Maximising Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>standard deviation</td>
<td>mean</td>
</tr>
<tr>
<td>Nominal Earnings</td>
<td>11421</td>
<td>6585.7</td>
<td>5762.8</td>
</tr>
<tr>
<td>Unearned Income</td>
<td>5486.5</td>
<td>6429</td>
<td>5346.2</td>
</tr>
<tr>
<td>Hours of Work</td>
<td>44.283</td>
<td>10.481</td>
<td>28.391</td>
</tr>
</tbody>
</table>

In order to allow for the length of the working week, contractual hours were included in the regression analysis. In accordance with *a priori* expectations, contractual hours exert a positive influence on the probability of OE and a negative influence on both the probability of UE and the probability of UME.  

*Job Satisfaction*

A set of variables pertaining to the satisfaction of the individual towards his/her job and workplace was incorporated into the regression analysis in order to account for the types of influences on absence behaviour discussed within the applied psychology literature (see Section 2.3.2, Chapter 2).  

The sub-sample rates of OE and UE are significantly higher amongst individuals who believe that management-employee relations at the workplace are poor (see Satis2b) whilst the sub-sample rate of UME is highest amongst those who believe that management-employee relations at the workplace are good (see Satis2a). These findings are confirmed by the logit analysis with the estimated coefficient on Satis2a signifying a significant negative effect on the probability of being both over-employed and under-employed and a significant positive effect on the probability of being content with contractual hours of work. The results, therefore, suggest that the impetus to absent (moon-light) from the workplace is

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12 Kahn and Lang (1991) find evidence which suggests that workers who desire to work longer hours tend to work longer hours.
somewhat curbed if the worker perceives that management-employee relations are good at the workplace. 13

Similarly, the sub-sample rate of OE is much higher and the sub-sample rate of UME is much lower amongst individuals who believe that their workplace is poorly as opposed to well-managed. Confirmation is obtained from the logit analysis since the variable Satis7a, which indicates whether the individual perceives his/her firm as well managed, is characterised by a negative coefficient in the OE regression which suggests that the potential to absent is reduced if an individual has confidence in the ability of the management at his/her workplace.

Differentials in the sub-sample rates of OE, UE and UME are also apparent across individuals who are satisfied with the perceived pay gap across employees in the firm and those who are dissatisfied with the perceived pay gap. The sub-sample rate of OE (UME) amongst individuals who feel the pay gap to be too large (small) are higher (lower) than the sub-sample rate for individuals who express satisfaction with the pay gap. The sub-sample rate of UE amongst individuals who believe that the pay gap is too small is lower than that of individuals who are satisfied with the prevailing pay gap whilst the sub-sample rate of UE amongst individuals who believe that the pay gap is too large is higher than that of individuals who are satisfied with the prevailing pay gap. One explanation for this may lie in the fact that individuals who perceive the pay gap as too small are likely to be in managerial positions with relatively high levels of educational attainment whilst those who perceive it as too large are likely to be relatively less-skilled employees in non-managerial positions who face the most insecurity in time of economic decline.

The logit results suggest that, ceteris paribus, dissatisfaction with the pay gap exerts a (relatively large) positive effect on the probability of being over-employed and a (moderate) negative effect on the probability of being satisfied with contractual hours. It would thus appear that an employee’s satisfaction or otherwise with his/her employment conditions may impact significantly on the potential to absent. Indeed, in a recent contribution, Rees (1993) emphasises the important role played by the perceived ‘fairness’ in wage comparisons across, for example, individuals or unions in observed labour market behaviour which is lacking in the standard neo-classical theory of labour contract determination.

It is apparent from Tables 3.3 to 3.5 that the sub-sample rates of OE and UE are lower amongst individuals who are satisfied with their current level of wages (Satis4a) whilst that of UME is higher amongst individuals who are

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13 It might be the case that Satis2a (or any variable representing job satisfaction) is correlated with the existence of managerial innovations such as flexi-time arrangements which enhance flexibility in the work place thereby dampening the effect from hours constraints.
satisfied with current wages as compared to the group of individuals who express dissatisfaction with the current level of wages (Satis4b). Moreover, once other factors are controlled for in the logit analysis, the estimated coefficients for the variable Satis4a suggest a significant negative (positive) association between OE (UME) and wage satisfaction.

Differentials in the sub-sample rates of OE, UE and UME are also prevalent across individuals who find life comfortable at their present level of income (Satis1a) and those who find life uncomfortable at their present income level (Satis1b). The sub-sample rates of OE and UE are higher amongst individuals who find life uncomfortable at their present income level whilst the rate of UME is lower amongst such respondents. Moreover, the sub-sample rate of UE amongst individuals reporting such uncomfortable arrangements is more than double that of individuals who do not report any such problems. The logit analysis confirms that individuals who face an uncomfortable life at present income levels are likely to be under-employed since the variable Satis1a appears to exert a highly significant and relatively large negative impact on the probability of being under-employed, suggesting that individuals who find life uncomfortable at their current income level are highly likely to perceive themselves as under-employed.

The sub-sample rates of OE and UE are significantly lower, and the sub-sample rate of UME significantly higher, amongst individuals who feel that it is unlikely that they will voluntarily leave their employer in the near future (see Satis3a) as compared to those individuals who feel that it is likely that they will quit their current employer (see Satis3b). Once again, confirmation is obtained from the logit analysis, since the variable Satis3a is characterised by a highly significant negative coefficient in the OE regression which suggests that the potential to absent is somewhat reduced if the individual feels that it is unlikely that he/she will voluntarily leave the firm. Such predictions tie in with results of the Georgellis (1994) who argues that job satisfaction is positively associated with job tenure.

The Work Place
Leigh (1991) explores the role of employee and job attributes as predictors of absenteeism in a national sample of 1308 workers. The category of variables reflecting aspects of an individual’s job includes a variable which represents the size of the organisation i.e. the number of employees at the respondent’s workplace. Leigh argues that there are conflicting hypotheses concerning the effect of firm size on absenteeism.

Employees in a large firm may, on the one hand, believe that they can be easily replaced if they go absent, which would be difficult in a small firm. This is consistent with the results of the survey undertaken by Ashworth et al (1993)
which suggest that small firms experience very low rates of absence since employees are aware of the difficulties generated by spells of absence for the both the firm and their attending colleagues. Evidence which supports the hypothesis that large work places are characterised by higher rates of absence has been found by Winkler (1980), Allen (1981b), Leigh (1984) and Peel and Wilson (1991). On the other hand, there is some evidence which suggests that more committed employees are attracted to large firms and, as a result, large firms experience relatively less absenteeism.\(^1\) Leigh’s results indicate, however, that the firm size variable is on the borderline of significance and as such does not settle the ambiguity surrounding the sign of this variable.

Balchin and Wooden (1992), who analyse a data set containing 1391 work place level observations, also include a work place size variable. Their analysis is concerned with exploring the implications of the threat of dismissal for poor performance on absence behaviour and the authors conjecture that larger work places tend to be more X-inefficient and, as such, characterised by lower levels of dismissal threat. In addition, as emphasised by applied psychologists such as Steers and Rhodes (1978, 1984), employees in large work places may feel more alienated which in turn leads to lower levels of job satisfaction and ultimately to absenteeism or even quit behaviour. The results of Balchin and Wooden (1992) suggest that firm size is positively related to absenteeism which is consistent with the hypothesis cited above.

It is clear from Tables 3.3 to 3.5 that the sub-sample rate of OE is significantly higher amongst employees of large firms as opposed to those of small firms. Conversely, the sub-sample rates of UE and UME appear to be significantly higher amongst individuals employed by small rather than large firms. One explanation for the UME finding may lie in the fact that contact between employers and employees may be more direct in a small firm which may allow some discussion regarding contractual arrangements. The logit results presented in Tables 3.3 to 3.5 are generally in accordance with those of Balchin and Wooden (1992), since the estimated coefficient of the large firm variable exerts a significant positive effect on the probability of OE and a significant negative influence on the probability that contractual hours and utility maximising hours are in accord.

In addition, the sub-sample rate of OE appears to be more prevalent at unionised as opposed to non-unionised work places whilst the sub-sample rate of UE appears to be only marginally higher at unionised work places. It is surprising

\(^{14}\) Garen (1985) who adapts a job screening model finds a positive correlation between firm size and earnings. The findings also indicate that individuals who choose to acquire more schooling are more likely to enter a large firm.
that the logit results suggest that the presence of a union at the work place only exerts a relatively large positive influence on the probability of being underemployed. Furthermore, the sub-sample rate of OE is higher amongst individuals who believe that the trade union at his/her work place is poorly managed, whilst the sub-sample rates of UE and UME are higher amongst individuals who believe that the union is well-run. The logit results suggest that the presence of a 'well-run' trade union appears to lower the probability of OE and inflate the probability of UE.

**Industry**

Allen (1981a) discusses the role industry dummies play in the determination of absenteeism but finds that only one of the sixteen industrial classifications - durable manufacturing - appeared to exert a positive and significant effect on the rate of absence. In Tables 3.3 to 3.5, it is apparent that OE appears to be greatest in the engineering sector with a sub-sample rate of 37.78 percent, more than double that prevailing in the agricultural sector - the sector characterised by the lowest sub-sample rate. It is not surprising, therefore, that the engineering sector is characterised by the lowest sub-sample rate of UE. The logit analysis confirms the industrial specificity of OE incidence with the coefficient on the dummy variable representing the engineering sector indicating a higher probability of OE in the engineering sector relative to that in the service sector.

One possible explanation for these results could lie in the recent moves towards shorter working hours. Over the 1980s, the engineering industry in the UK was involved in a dispute between the employers and the engineering unions, following the unions' claim for a reduction in the length of the working week [see Labour Research (1989, 1990) and McKinlay and McNulty (1992)]. One impetus behind this movement was the high amount of overtime working prevalent in the industry; cuts in the length of the working week were proposed as a stimulus to the employment of additional workers rather than utilising the existing work force more intensively.

The metal extraction industry dummy variable is also characterised by a positive coefficient in the OE regression and a negative coefficient in the UME regression. These results are indicative of dissatisfaction with the level of

15 One might predict a strong positive correlation between trade union membership and the variable indicating that the employee believes the union at his/her work place is well-run i.e. individuals who believe that the union is poorly managed are unlikely to subscribe to that association. The Spearman's Rank correlation coefficient between these two variables was calculated at 0.47 suggestive of a positive but not particularly high degree of correlation. Consequently both of these variables were incorporated in the empirical analysis.

16 One explanation for this might lie in the fact that the durable manufacturing sector in the US is characterised by a traditionally unionised work force [Tigges and Tootle (1990)].
contractual hours, and thus potential absence behaviour, in this particular sector. The recent survey undertaken by the CBI (1994) confirms the prediction that this particular sector of the economy does indeed experience a relatively high degree of absenteeism, the findings for 1993 indicating the highest sectoral rate of sickness absence (5.1%) - more than twice that of media and broadcasting sector, the sector with the lowest recorded rate(2.0%). Furthermore, in 1992 the metal extraction sector recorded the second highest rate of sickness absence.

The results also suggest that such dissatisfaction may prevail in the distribution sector since the logit results suggest that the incidence of UME is particularly low in this sector. The results from the CBI (1994) are supportive of the results from the logit analysis since they indicate that this sector of the economy experienced the fourth highest rate of sickness absence (4.3%) in 1993.

In contrast, the sub-sample rates of Tables 3.3 to 3.5 suggest the incidence of OE in the energy industry is relatively low whilst the incidence of UME is relatively high. The logit results confirm this with the estimated coefficient on the dummy variable representing the energy sector being characterised by a relatively large negative (positive) coefficient in the OE (UME) regression, indicating that employment in this sector lowers the potential to absence. One explanation for the particularly low incidence of OE in the energy sector may lie in the implications of the erosion of employment in this sector for labour market behaviour. Individuals who feel threatened by future job loss may, therefore, be less likely to voice job dissatisfaction.

3.3.3 Residential Influences

Region
The majority of studies of absenteeism in Great Britain have used firm specific data sets which rules out any role for regional effects. In contrast, some of the studies which have utilised US data have used non-firm specific data in which regional effects may be prevalent. It is apparent that disparities in absence behaviour across regions may exist due to, for example, differences in unemployment rates or differences in the industrial mix which may prevail across regions. Allen (1984), who includes regional dummy variables in his analysis of the American Current Population Survey, finds that individuals located in the

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17 Absence rates are defined here as sickness absence time as a percentage of total working time.
18 Unfortunately, there are a distinct shortage of data pertaining to absence rates across industries (this issue is discussed in more detail in Chapter 7).
19 The number of individuals employed in the Electricity, Gas and Other Energy and Water Supply sector, for example, has fallen from 356,000 in 1981 to 265,000 in 1992 [Employment Gazette (1995)].
The southern regions of the United States are more prone to absence behaviour than those in the north-eastern, north-central and western regions. Leigh (1983, 1984), who also analyses American data, includes regional dummies but does not devote much discussion to these variables.

It is apparent from the sub-sample rate analysis that the incidence of OE is highest in the South East. A set of regional dummy variables was included in the logit analysis with the South East dummy variable being omitted from the regression. All of the estimated coefficients in the OE regression are negative in sign which indicates that non South Eastern residence exerts a negative impact on the potential to absent. Since the rate of unemployment in the South East has been traditionally the lowest in Great Britain, one would expect, in accordance with efficiency wage considerations, residents here to exhibit more absence behaviour.

**Housing Tenure**

The BSA survey contains a set of questions relating to the residential tenure of the respondents. A dummy variable representing owner occupancy is incorporated into the analysis given the bias in British society towards owner occupancy. It is apparent from Tables 3.3 to 3.5 that the sub-sample rate of OE amongst owner occupiers exceeds that of non owner occupiers - the opposite holding for the sub-sample rates of UE and UME. Furthermore, the results from the logit analysis presented in Table 3.3 suggest that owner occupation raises the probability of OE, ceteris paribus.

In addition, a set of dummy variables representing the number of years spent in the respondent's current residence was incorporated into the empirical specification. The sub-sample rates suggest that the incidence of OE and UE is greatest amongst those individuals who have occupied their present home for less than one year, whilst that of UME is greatest amongst those who have resided at their present home for more than twenty years. From the regression results, it is apparent that individuals with the shortest possible tenure at their current residence appear to be the most dissatisfied with current contractual hours. The magnitudes of the coefficients signalling such dissatisfaction appear to diminish as years in the residence lengthen.20

### 3.4 Concluding Remarks

The aim of this Chapter was to explore how the potential to absent from the work place differs across specific demographic, occupational and regional sectors of the economy. The approach taken was to compare the characteristics of individuals

20 These results could reflect an age/job tenure effect whereby older, more tenured workers have established themselves in more favourable and flexible employment positions.
who ideally would prefer to supply fewer hours of labour with those of individuals who, according to various empirical studies, are more prone to absence behaviour. In general, the results suggest that the potential to absent is curbed amongst male employees of a non-African background who co-habit with their parents, have relatively pessimistic expectations regarding future changes in the work force and their real income and who express satisfaction with their working arrangements and environment. To summarise, the results suggest that a significant section of the work force face constraints regarding their supply of labour and, furthermore, that the type of individuals facing such constraints can, in some instances, be determined. The empirical analysis, therefore, suggests that labour market constraints are an important labour market concept and provides a mandate for further research into observed labour market behaviour, such as absenteeism, which can be regarded as a direct consequence of over-employment - itself a consequence of imposed hours constraints.
A3 The Determinants of Desired Hours of Labour Supply

A.3.1 Introduction

The aim of this Appendix is to investigate the extent to which assuming a coincidence of actual and desired hours of labour supply is likely to affect labour supply estimates. The general methodology of Kahn and Lang (1991) is adopted since this study represents one of the few which explores self-reports of preferred hours of work. As emphasised in Section 3.1, data limitations have forced the majority of labour supply studies to focus upon actual rather than desired hours of work. Since the BSA Surveys enable identification of employees who express satisfaction with their current work hours, a sample of desired work hours for this sub-group of individuals can be derived. The analysis of Kahn and Lang (1991) is replicated in order to determine the nature of the labour supply schedule using British data on desired hours of work. Labour supply equations are also estimated for the entire sample of employees to provide a benchmark for comparison. In addition, the sub-sample of over-employed individuals is isolated in order to explore the nature of the labour supply schedule for potential absentees.¹

A3.2 Empirical Analysis

Following Kahn and Lang (1991) a standard cross-section labour supply equation may be defined as follows:²

\[ \ln(h^*_i) = \beta X_i + b \ln(w_i) + \epsilon_i \]  

(A3.1)

where \( h^*_i \) represents desired hours of work, \( X_i \) represents a vector of explanatory variables, \( w_i \) denotes the wage rate and \( \epsilon_i \) represents a random error term. In general, \( h^*_i \) is not observed and so researchers are consigned to estimating a regression equation of the form:

\[ \ln(h_i) = \beta X_i + b \ln(w_i) + \epsilon_i + \mu_i \]  

(A3.2)

¹ A parallel study for the sub-sample of under-employed individuals was not undertaken since the sample of such individuals is somewhat small.

² Since the objective of this Appendix is to emphasise the importance of distinguishing between actual and desired hours of work rather than explaining the determinants of labour supply per se, a simplified labour supply equation is specified which ignores complications such as non-linearities due to the taxation system or inter-temporal influences.
where $h_i$ represents observed hours of work and $\mu_i$ represents the deviation, $(h_i - h_i^*)$. The estimation of Equation (A3.2) is problematic, since unless $\mu_i$ is orthogonal to the explanatory variables, then ordinary least squares estimates of $\beta$ and $b$ will be biased.

Three sets of results are presented in this Appendix, the first of which relates to the sub-sample of employees who express satisfaction with current hours of work. For this set of individuals, actual hours of work coincide with desired hours of work, such that a labour supply schedule equivalent to equation (A3.1) can be estimated. The second sub-sample of employees comprises the entire sample to ascertain the implications of assuming a coincidence between desired and actual hours of work for the estimated labour supply schedule. Finally, a labour supply schedule was estimated for the 'over-employed' sub-sample of employees to highlight the implications of assuming a coincidence between desired and actual work hours for potential absentees.

Despite the benefit of obtaining data pertaining to desired hours, there are some serious shortcomings of the data set relating to the gathering of information on wages and income.\(^3\) The BSA surveys do not ask for specific figures for wages or income - instead respondents are asked to indicate into which category their income falls. The categorical data, thus, had to be translated into a continuous variable.\(^4\)

Furthermore, to construct the wage variable, the income variable had to be divided by hours worked. If the hours variable is subject to any measurement error, then dividing income by hours will induce a spurious negative correlation between the wage term and the error term. To counter this problem instrumental variable techniques were employed. Kahn and Lang (1991) use an extensive set of occupational dummy variables as instruments for the wage variable.\(^5\) Since the BSA surveys do not contain such an extensive set of occupational dummies, educational dummy variables were used as an alternative.\(^6\) If educational attainment affects labour supply via wages only, then the inconsistency is

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\(^3\) The problems encountered are similar to those reported by Kahn and Lang (1991).

\(^4\) A similar recoding exercise is undertaken by Blanchflower (1991) who explores income determination using data from the BSA Survey.

\(^5\) In most labour supply studies the wage rate is regarded as an endogenous variable and as such instrumental variables techniques are often specified. The choice of instruments for the wage is problematic since wage endogeneity may be the consequence of two causes. Firstly, as mentioned above dividing income by hours worked may induce spurious correlation between hours and wages in the presence of measurement error in wages. Secondly, unmeasured characteristics may exist which affect both the wages and hours [see Ham (1982) for a concise survey of these issues].

\(^6\) A high degree of correlation exists between educational attainment and occupation - university graduates, for example, are mostly professionals whilst unskilled manual workers usually have few, if any, qualifications [see, for example, Brown and Sessions (1994) and Pissarides and Wadsworth (1990)].
eliminated. Some correlation, however, may exist between educational attainment and hours which does not operate through wage differences. For example, more highly educated individuals may prefer to work longer (or shorter) hours irrespective of wages. Consequently, the bias resulting from the division of income by hours will be reduced rather than eliminated entirely.

One major advantage with the BSA survey over the Survey of Work Reduction (SWR) analysed by Kahn and Lang (1991) is that, as mentioned in Section 3.3.2, an estimate of unearned income can be obtained by calculating the discrepancy between household and individual income. In contrast, the SWR combines both labour and non-labour income in a single question. A further bias, not present in the BSA data, may therefore arise as one cannot distinguish between the potentially conflicting effects of these two sources of income.

Figure A3.1 illustrates the distribution of contractual (desired) hours for the employees expressing satisfaction with hours of work. The frequency distribution is similar to that reported by Kahn and Lang (1991), with a spike at around 40/41 weekly hours of work.

![Figure A3.1: The Distribution of Contractual Hours for Employees who are Satisfied with Current Contractual Hours](image)

In Table A3.1 below the instrumental variables estimates of the determinants of $\ln(h^*_i)$ are presented. The estimated coefficient on $\ln(w_i)$ is characterised by a
relatively small, yet highly significant, positive sign indicative of a dominant substitution effect.

<table>
<thead>
<tr>
<th>Table A3.1: Dependent Variable = (\ln(h^*_t))</th>
<th>Sub-Sample = Employees satisfied with Contractual Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Estimated Coefficient</td>
</tr>
<tr>
<td>(\ln(w_t))</td>
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</tr>
<tr>
<td>Unearned Income</td>
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</tr>
<tr>
<td>Male</td>
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</tr>
<tr>
<td>Age</td>
<td>-0.6054E-02</td>
</tr>
<tr>
<td>Married</td>
<td>-0.0719</td>
</tr>
<tr>
<td>Pre-School Child</td>
<td>-0.1291</td>
</tr>
<tr>
<td>Owner Occupier</td>
<td>-0.0290</td>
</tr>
<tr>
<td>Trade Union Member</td>
<td>0.0274</td>
</tr>
<tr>
<td>Asian</td>
<td>0.0647</td>
</tr>
<tr>
<td>African</td>
<td>0.1015</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.1758</td>
</tr>
<tr>
<td>Energy</td>
<td>0.1206</td>
</tr>
<tr>
<td>Metal Extraction</td>
<td>0.0435</td>
</tr>
<tr>
<td>Engineering</td>
<td>0.0606</td>
</tr>
<tr>
<td>Construction</td>
<td>0.0749</td>
</tr>
<tr>
<td>Distribution</td>
<td>-0.0310</td>
</tr>
<tr>
<td>Transport &amp; Communications</td>
<td>0.0858</td>
</tr>
<tr>
<td>Other Manufacturing</td>
<td>0.0737</td>
</tr>
<tr>
<td>Public Sector</td>
<td>-0.0332</td>
</tr>
<tr>
<td>Large Firm</td>
<td>-0.8190E-03</td>
</tr>
<tr>
<td>Constant</td>
<td>3.4825</td>
</tr>
<tr>
<td>(R^2)_IV (^8)</td>
<td></td>
</tr>
<tr>
<td>Sargan Test (10 df.) (^9)</td>
<td></td>
</tr>
<tr>
<td>Number of Observations</td>
<td></td>
</tr>
</tbody>
</table>

The estimated negative coefficient on the unearned income proxy suggests that the amount of non-labour income serves to lower desired hours of work which qualifications, vocational qualifications, a BTech, a Degree, teacher training qualifications or nursing qualifications.

\(^8\) Since the \(R^2\) measure of goodness of fit under instrumental variables estimation, with a lower bound of minus infinity, is not well defined, an alternative measure, denoted \(R^2_{IV}\), is presented. This measure represents the squared correlation coefficient between the observed and predicted dependent variable.

\(^9\) The Sargan Test [Sargan (1984)] tests whether the educational attainment dummy variables and remaining explanatory variables are invalid first stage regressors. The test indicates whether the first stage regressors are orthogonal to the residual from the structural equation and is calculated by regressing the residual from the structural equation on the set of instruments. Sargan (1984) proves that the Sargan Test statistic is distributed as a \(\chi^2\) with degrees of freedom equal to the number of additional instruments for the wage minus one.

88
accords with \textit{a priori} expectations. Ham (1982) reports similar evidence suggestive of a small yet significant negative unearned income coefficient.

In addition to the wage variable, a selection of demographic and additional job characteristics was incorporated into the analysis. Given that the number of degrees of freedom is lower than in the logit analysis of Section 3.3 and that emphasis in this Appendix is primarily concerned with the coefficient of $\ln(w_i)$, a somewhat smaller set of explanatory variables was constructed than in the empirical analysis presented earlier in this Chapter.

The highly significant estimated coefficient on the male dummy variable suggests that males desire longer hours of work than females. Desired hours appear to decline with age, which is consistent with the hypothesis that over-employment rises with age [Kahn and Lang (1991)]. Being married and having a pre-school child appear to exert negative influences on desired hours, suggesting that family members may have preferences which are biased in favour of leisure time. The desired hours amongst respondents of an African origin tend to be higher than those of other ethnic backgrounds.

The results also suggest that membership of a trade union acts to raise desired hours of work. One explanation for this may be that trade union members receive more favourable working arrangements than their non-union counterparts. Industrial affiliation also exerts a significant effect on the desired level of work hours, with individuals employed in the manufacturing sector appearing to desire more hours of work than those employed in the service sector.

It should also be noted that the goodness of fit statistic, $R^2_{iv}$, is relatively high for cross-section data indicating that the model is characterised by reasonable predictive power. In addition, the Sargan test statistic rejects the hypothesis that the educational dummy and remaining exogenous variables are invalid first stage regressors, i.e. instruments for the wage.

To provide a benchmark for comparison, a second empirical analysis was undertaken maintaining the unrealistic assumption that contractual hours coincide with desired hours for all employees. Figure A3.2 below presents a histogram of contractual hours for this sample of employees.

---

10 Ideally one would like to estimate separate regression for males and females to investigate the reasonable prior that it is (married) females who prefer shorter hours whilst (married) males prefer longer hours. Given the limited number of observations available, however, this option was not viable.
Since the proportion of individuals expressing satisfaction with current work hours dominates the sample, it is not surprising that the nature of the histogram is similar to that presented in Figure A3.1 with the exception that relatively more weight is present at the lower end of the distribution in Figure A3.2.

The results presented in Table A3.2 below relate to the labour supply schedule estimated for the entire sample. In general, the signs of the estimated coefficients appear to be relatively robust to the inclusion of 'constrained' individuals.

The estimated coefficient on $\ln(w_i)$ is reduced in size, although the substitution effect remains dominant. One would expect the influence of the wage variable on work hours to be curbed given that once actual work hours are included into the analysis, the observed relationship between hours and wages will reflect both labour demand and labour supply considerations, whereas regressing optimal (constrained) hours only would reflect primarily labour supply (demand) considerations. Similarly, the estimated coefficient on the unearned income variable is negative, indicative of a moderating influence on desired work hours.

The results set out in Table A3.2 suggest that the nature of the labour supply schedule is sensitive to the definition of work hours, with the estimated coefficients of the explanatory variables being slightly reduced in magnitude. It
should be noted that the predominance of ‘utility maximising’ individuals in the sample may be acting to curb excessive changes in the labour supply estimates.

Table A3.2: Dependent Variable = $\ln(h_i)$

<table>
<thead>
<tr>
<th>Sub-Sample = All Employees</th>
<th>Estimated Coefficient</th>
<th>T-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\ln(w_i)$</td>
<td>0.15016</td>
<td>6.1064***</td>
</tr>
<tr>
<td>Unearned Income</td>
<td>-0.4900E-05</td>
<td>-5.4040***</td>
</tr>
<tr>
<td>Male</td>
<td>0.2952</td>
<td>18.6120***</td>
</tr>
<tr>
<td>Age</td>
<td>-0.4924E-02</td>
<td>-9.7382***</td>
</tr>
<tr>
<td>Married</td>
<td>-0.0434</td>
<td>-3.1039***</td>
</tr>
<tr>
<td>Pre-School Child</td>
<td>-0.1085</td>
<td>-5.9768***</td>
</tr>
<tr>
<td>Owner Occupier</td>
<td>-0.0164</td>
<td>-1.0738</td>
</tr>
<tr>
<td>Trade Union Member</td>
<td>0.0255</td>
<td>2.0518**</td>
</tr>
<tr>
<td>Asian</td>
<td>0.0594</td>
<td>1.3211</td>
</tr>
<tr>
<td>African</td>
<td>0.0818</td>
<td>1.7778*</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.1468</td>
<td>2.1396**</td>
</tr>
<tr>
<td>Energy</td>
<td>0.0671</td>
<td>2.0321</td>
</tr>
<tr>
<td>Metal Extraction</td>
<td>0.0264</td>
<td>0.8438</td>
</tr>
<tr>
<td>Engineering</td>
<td>0.0653</td>
<td>3.1894***</td>
</tr>
<tr>
<td>Construction</td>
<td>0.0718</td>
<td>2.5996***</td>
</tr>
<tr>
<td>Distribution</td>
<td>-0.0287</td>
<td>-1.5638</td>
</tr>
<tr>
<td>Transport &amp; Communications</td>
<td>0.0769</td>
<td>3.1594***</td>
</tr>
<tr>
<td>Other Manufacturing</td>
<td>0.0700</td>
<td>3.2665***</td>
</tr>
<tr>
<td>Public Sector</td>
<td>-0.0371</td>
<td>-2.6127***</td>
</tr>
<tr>
<td>Large Firm</td>
<td>0.0155</td>
<td>1.0198</td>
</tr>
<tr>
<td>Constant</td>
<td>3.4523</td>
<td>107.6900***</td>
</tr>
</tbody>
</table>

$R^2_{IV}$ 0.2911
Sargan Test 44.4522***
Number of Observations 3614

Finally, to highlight the possible implications for potential absentees, a labour supply schedule was estimated for individuals who report themselves to be over-employed. The histogram for actual hours of work for this sub-sample of 964 constrained individuals is represented in Figure A3.3 below.
Figure A3.3: The Distribution of Contractual Hours for Over-Employed Employees

The estimated labour supply equation estimated for the sub-sample of over-employed individuals is presented in Table A3.3. The aim is to demonstrate that the general methodology of estimating a labour supply equation is inappropriate for analysing actual work hours where a sample is dominated by constrained individuals.\textsuperscript{11} It is apparent from Table A3.3 that the significance of the demographic variables is, in general, much reduced. This is not particularly surprising since for this sub-sample of individuals actual work hours would be dominated by labour demand considerations since these individuals have expressed dissatisfaction with the current arrangements.

The estimated coefficient on $\ln(\omega_i)$ differs greatly from that reported in the first two sets of results, being characterised by a much smaller and highly insignificant coefficient. Indeed, most of the explanatory variables in this specification are insignificant. This is not particularly surprising. Since the dependent variable represents actual hours worked and the set of regressors, in general, relates to the personal characteristics of individuals, one would not expect

\textsuperscript{11} It could be argued that the ‘constrained’ sample should include both over-employed and under-employed individuals, since neither group are supplying their preferred level of hours. Interpreting such an equation would, however, be somewhat problematic on account of the heterogeneous nature of the sample. It would, thus, appear preferable to concentrate on each constrained group separately. Given the limited size of the under-employed sample, however, it was decided to concentrate exclusively upon the over-employed group.
a particularly good fit between the data given that the level of actual hours may predominantly reflect labour demand rather than labour supply considerations.

Furthermore, the goodness of fit measure is significantly reduced indicative of a lower degree of predictive power. In addition, the Sargan test statistic is insignificant which suggests that the use of educational attainment dummy variables as instruments for the wage is inappropriate and that the educational dummies and other explanatory variables are not legitimate first stage regressors. One explanation for this may lie in the fact that, as mentioned above, instrumenting the wage with educational attainment will not eliminate the bias arising from dividing income by hours of work since some correlation between hours and educational attainment may exist which is not due to wage differentials. One might argue that the degree of correlation between hours and educational attainment in the case of actual hours worked may be higher than in the case of

![Table A3.3: Dependent Variable = ln(hi) Sub-Sample = Over-Employed Employees](attachment:image.png)

\[
\begin{array}{|c|c|c|}
\hline
\text{Variable} & \text{Estimated Coefficient} & \text{T-Ratio} \\
\hline
\ln(w_i) & 0.9824E-02 & 0.2883 \\
\text{Unearned Income} & -0.7344E-06 & -0.6127 \\
\text{Male} & 0.2061 & 10.8320*** \\
\text{Age} & -0.9418E-03 & -1.3985 \\
\text{Married} & 0.2723E-02 & 0.1525 \\
\text{Pre-School Child} & 0.4820E-02 & 0.2115 \\
\text{Owner Occupier} & -0.0175 & -0.8388 \\
\text{Trade Union Member} & -0.0139 & -0.8327 \\
\text{Asian} & 0.2069 & 2.8513*** \\
\text{African} & 0.7350E-02 & 0.1419 \\
\text{Agriculture} & 0.0435 & 0.3965 \\
\text{Energy} & -0.0625 & -1.4022 \\
\text{Metal Extraction} & -0.0489 & -1.3614 \\
\text{Engineering} & -0.0160 & -0.6458 \\
\text{Construction} & 0.0178 & 0.5194 \\
\text{Distribution} & 0.0112 & 0.4222 \\
\text{Transport & Communications} & 0.0367 & 1.2435 \\
\text{Other Manufacturing} & -0.2419E-02 & -0.8284E-01 \\
\text{Public Sector} & -0.0354 & -1.8805* \\
\text{Large Firm} & -0.8315E-02 & -0.4825 \\
\text{Constant} & 3.6931 & 72.3840*** \\
\hline
\end{array}
\]

\[
R^2_{IV} = 0.2148
\]

\[
\text{Sargan Test} = 12.9176
\]

\[
\text{Number of Observations} = 964
\]
desired hours. Part-time employees, for example, are likely to be less educated than full-time employees irrespective of wage differentials. Thus, the assumption that the educational dummy variables do not belong in the labour supply function explicitly (i.e. they only enter through their influence on the wage variable) may be particularly inappropriate once actual hours of work are analysed. 12

To conclude, it would appear that the results presented in Table A3.3 are not particularly informative implying that the general methodology adopted to estimate the determinants of desired hours is inappropriate in the case of actual hours. Although, Kahn and Lang (1991) obtain evidence which suggests that individuals who desire to work longer hours do in fact tend work longer actual hours, i.e. there appears to be some degree of correlation between actual and desired hours, it would seem that a different approach should be adopted in order to ascertain the determinant of actual work hours. In sum, the differences in the results presented in Tables A3.1 to A3.3 highlight the differences between actual and desired hours of labour supply once one acknowledges the existence of constraints on labour supply.

A3.3 Summary

The aim of this Appendix was to explore the extent to which the distinction between actual and desired hours of work affects the estimates of labour supply schedules. The empirical estimation reported in Table A3.1 is concerned with the sample of employees who expressed satisfaction with their work hours in the BSA survey and, as such, represents the closest approximation to the labour supply schedule represented by Equation (A3.1). The other estimations maintained the inappropriate assumption that actual hours and desired hours coincide - an assumption that has been frequently made in the literature given the distinct lack of data pertaining to desired hours of labour supply. In general, the results presented in this Appendix are in accordance with those presented by Ham (1982) and Kahn and Lang (1991), both of whom report significant differences between labour supply functions estimated for individuals reporting that their work hours have been constrained and those individuals reporting satisfaction with actual hours.

12 A further regression was undertaken with the educational dummy variables entered as explanatory variables in the hours of labour supply equation rather than as instruments in the wage equation. In general, the results suggested that vocational qualifications may raise hours of work. The magnitude of the Breusch-Pagan statistic, however, was suggestive of the presence of heteroskedasticity and one cannot rule out the possibility that measurement error may be adversely affecting these estimates.
Chapter 4: The Implications of Experience Rated Sick Pay for Absence Decisions

4.1 Introduction

It is apparent from the discussion presented in Section 2.2, Chapter 2, that sick pay plays a prominent role in the formation of absence decisions. As Figure 2.3 demonstrates, the provision of sick pay engenders a further impetus to absence. Consequently, Allen (1981a) remarks that in the context of the simple labour supply model of absenteeism, ceteris paribus:

.... an individual will be absent more frequently in plants where sick leave is paid to absent workers. [Allen (1981a), p.79].

This is in accordance with the predictions of the extended absence model of Section 2.3.3.4, Chapter 2, since the reservation sickness level [recall Equation (2.26)] is decreasing with respect to sick pay (i.e. $\frac{\partial \sigma^*}{\partial s} < 0$); an increase in sick pay, therefore, raises the probability of absence. Intuitively, a rise in the level of sick pay diminishes the gap between remuneration from attendance and remuneration from absence and, hence, makes absence more likely.

Moreover, as highlighted by Coles and Treble (1993), since sick pay represents one aspect of the employment contract, it should also feature prominently in labour demand analysis. Firms whose production processes make absence particularly costly, for instance, may specify relatively low levels of sick pay and compensate low sick pay with relatively high wages in order to induce attendance. Thus, it is apparent that sick pay not only influences absence decisions on the part of the worker but may also be regarded as a potential mechanism for absence control to be exercised the firm.

Doherty (1979) emphasises the parallels that exist between sick pay and unemployment benefit. In stark contrast to the plethora of studies investigating the implications of the latter for unemployment and job search [see Layard et al (1991) for a comprehensive review of this area], research into the implications of the former for absence behaviour has, however, been sadly lacking. This is despite the fact that:

... there is an equally strong prima facie case for examining the relationship between sickness absence and the level and structure of national insurance benefits. [Doherty (1979), p50].

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1 Sections 4.2 and 4.3 of this Chapter are published in Brown (1994).
Doherty highlights evidence which suggests that variations in sickness absence can be explained by economic variables relating to the provision of benefits. Similarly, Fenn (1981) finds evidence suggesting that the duration of sickness absence in the United Kingdom is influenced by economic factors such as the loss of income whilst ill. Despite this, however, the effects of sick pay on the incidence and duration of absence spells have attracted relatively little attention in the economics literature.

One exception is the study undertaken by Allen (1981a) who controls for the implications of both the availability and variability of sick pay for observed absence rates. In accordance with *a priori* expectations, the results indicate that blue collar workers who are not eligible for paid sick leave are characterised by the largest negative coefficient on wages - the substitution effect of an increase in wages for such workers proving dominant. Balchin and Wooden (1992) and Ng (1989) further endorse the significance of sick pay, finding a positive association between the provision of sick pay and observed absence behaviour.

The results of other studies, however, have not supported the proposition that paid sick leave encourages absence. Chaudhury and Ng (1992), for example, include a variable which indicates whether a loss of income is incurred if absent. The inclusion of this variable does not support the prediction that paid sick leave dampens the substitution effect of a wage change. The results of Leigh (1991) are also inconsistent with the hypothesis that sick leave raises absence.²

Some studies, although acknowledging the importance of sick pay for absence, have suffered from a lack of data on sick leave provisions. The quarterly data covering the period from 1966 to 1984 used by Kenyon and Dawkins (1989), for example, does not allow the authors to distinguish between paid and unpaid sick leave. A time trend is, however, included in the regressions in order to account for the extension of paid sick leave entitlements over the time period in question. Provisions for paid sick leave rose from approximately five to approximately eight days per annum over the sample period. Their results indicate an upward trend in absence and the authors attribute this trend to the extension of paid sick leave. Allen (1981b) also acknowledges the importance of sick leave provisions for the attendance decision, but was only able to include a variable which represents short-term accident and sickness benefit which turned out to be insignificant.

Furthermore, it is highly likely that employers are aware of the influence of sick pay provisions on absence behaviour. From the viewpoint of the simple analysis presented in Chapter 2 it would appear that employers are somewhat

² It should be noted that shortcomings of both these both studies can be cited. Chaudhury and Ng (1992) attempt to extract information concerning individual decision-making from firm level data whilst the analysis of Leigh (1991) suffers from a lack of any firm theoretical basis.
irrational in providing sick pay since it raises the likelihood of absence behaviour. One explanation for its provision may be concerned with its use as a means of absence control. Indeed, this issue is attracting increasing attention given the current British Conservative Government's policy to transfer sick responsibilities from the state to employers [Taylor-Gooby and Lakeman (1988) and Casey (1994)].³ Taylor-Gooby and Dean (1990) survey employers' attitudes towards the provision of employer administered yet Government funded statutory sick pay. It is apparent from the survey that many employers regard such a scheme as an additional way to enhance absence control. Indeed, Taylor-Gooby and Dean (1990) conclude:

... by providing justification for the rigorous absence reporting and monitoring procedures adopted by certain larger employers, SSP has enhanced their powers to manage. [Taylor-Gooby and Dean (1990), p.66].

Hence, it appears that employers are aware of the influence of sick pay policies on absence and appear to be placing such policies within the ambit of absence control. This observation is supported by the CBI's 1994 survey of employers which found that seventy seven percent of employers stated that they would consider intensifying their sickness absence controls with the removal of the statutory sick pay rebate.

This finding is re-enforced by evidence from Taylor-Gooby and Lakeman (1988) who survey employees' perceptions regarding sick pay. It is interesting to note that when asked how employers would determine the level of sick pay, the largest group of respondents (45%) believed that the setting of sick pay was most strongly influenced by the firm's profitability.

Despite the potential use of sick leave as a means of absence control, economists have tended to focus their empirical and theoretical analyses on alternative types of absence control, such as the threat of dismissal, thereby emphasising the role played by efficiency wage considerations in the formation of absence decisions (see Section 2.3.3.3, Chapter 2). Clearly the dismissal threat may exert an important influence on curbing excessive absence behaviour, but one would not, however, expect the majority of employees to engage in excessive absenteeism. One could, therefore, anticipate that the majority of employees would be more concerned with the short-term penalties to absence such as loss of income, and given that sick pay provisions dictate the extent of this income loss, then one would expect sick pay to be a key determinant of absence behaviour.⁴

³ Disney (1987), however, has pointed out that if the Government's aim was to raise the number of occupational sick pay schemes, then such an aim has been relatively unsuccessful since statutory sick pay arrangements have appeared to exert little impact on existing or, indeed, inducing new sick pay schemes.

⁴ The interaction between two types of absence control schemes - one related to the provision of sick pay scheme and one concerned with the imposition of an dismissal threat is explored from a theoretical viewpoint in an Appendix to this Chapter, Section A4.1.
In contrast, Balchin and Wooden (1992), who explore the implications of the threat of dismissal for absenteeism, argue that sick leave entitlements in Australia do not vary to a great extent across work places except in the public sector where sick pay schemes are considered to be more generous since entitlements rise with tenure. Dummy variables reflecting the private sector and casual employment are included in order to capture the effects of differential sick pay arrangements. The results turn-out, however, to be rather inconclusive with the estimated coefficient on the private sector dummy variable proving to be insignificant whilst the estimated negative coefficient on the casual employment dummy variable is significant. It could be argued, however, that such dummy variables may not capture effects which can be solely attributed to sick pay. Furthermore, even if sick leave entitlements are uniform across establishments, the extent to which they are exhausted across employees is clearly not uniform. Such problems, however, are related to the lack of data at a suitable level of dis-aggregation.

Clearly, there is some debate within the economics literature regarding the incentives of employers to make sick pay provisions. Turnbull and Sapsford (1992) who explore absenteeism among dock workers from a historical perspective, propose an alternative reason for paying sick pay. It is apparent that absence, which was regarded as a job characteristic, arose for numerous reasons, for example, the avoidance of particular cargoes. Furthermore, Turnbull and Sapsford (1992) remark that:

.... as the dockers were not paid for such absence they regarded 'their time' as their own, to be allocated and utilised as they saw fit. [Turnbull and Sapsford (1992), p301].

Hence, the provision of sick pay could be regarded as an extension of managerial control beyond the territory of the workplace to curb the perception that absence time belongs solely to the individual.

The aim of this Chapter is to place sick pay entitlement into the forefront of the absence decision-making process. In Section 4.2, a dynamic model of absenteeism is presented in which the absence behaviour of an individual is analysed from a partial equilibrium view point which explores the implications of a particular type of absence control scheme for absence behaviour. The type of absence control analysed is based upon the level of sick pay entitlements. More specifically, absence behaviour is analysed in the context of an employment contract which embodies the essence of an experience rated sick pay scheme. The results of this model highlight the potential benefits of analysing absenteeism in the context of

---

5 Casual workers are not eligible for sick pay entitlement.
a dynamic as opposed to a static framework as has generally been the case in the theoretical models of absence behaviour to date.

It seems particularly appropriate to model absence behaviour within a dynamic context since it is the consequence of a time allocation problem. Furthermore, individuals usually work for more than one time period and, consequently, absence decisions made today are likely to have implications for the future nature and duration of the employment contract. Some empirical models of absenteeism have recognised the temporal nature of absence decisions but theoretical contributions to the literature have been slow to recognise this aspect of the decision-making process. 6

As mentioned in Section 2.3.3.4, Chapter 2, an additional weakness of the existing literature concerns the fact that theoretical models of absenteeism have, in general, tended to overlook the state of an individual’s health. It seems unrealistic, however, to ignore such influences in the context of absenteeism and, indeed, labour supply decisions. 7 In an attempt to rectify this shortcoming Barmby et al. (1994) have analysed the importance of health status for absence decisions in a static framework. The general approach adopted by Barmby et al. (1994) which was outlined in Section 2.3.3.4, Chapter 2, is extended in Section 4.2 into a multi-period framework which encompasses the influence of both present and future sickness states on absence decisions.

Moreover, as mentioned in Chapter 1, once absenteeism is set in a dynamic context, risk and uncertainty are likely to be of considerable importance when analysing absence decisions since whether or not an individual becomes sick is predominantly a stochastic event. This oversight is rectified in the two period framework developed in this Chapter with the individual facing risk in period one regarding health status in period two. In the context of the model of Section 4.2 risk regarding sickness leads to stochastic changes in the slope of the individual’s indifference curve - hence the analysis incorporates the concept of state-dependent preferences. Section 4.3 presents some empirical results which examine the determinants of the observed absence rates of a sample of workers who are employed under a contract which embodies an experience rated sick pay scheme. Section 4.4 concludes Chapter Four by highlighting some possible avenues for further research.

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7 Especially since empirical studies such as Allen (1981a), Leigh (1991) and Paringer (1983) indicate a significant relationship between absenteeism and health variables as surveyed in Section 2.3.3.5, Chapter 2.
4.2 A Two-Period Model Of Absence Behaviour

In the context of absenteeism it seems particularly appropriate to assume that an individual's current behaviour has implications for future opportunities. In the case of an experience rated sick pay scheme, for instance, if an individual goes absent in the current time period then this may make him/her eligible for a lower level of sick pay in the future. The essence of such a sick pay scheme is incorporated into the model presented in this Section for workers employed under a two period employment contract.

A convenient expositional device is to assume that individuals have a log-linear utility function of the following form:

\[ U_i = (1 - \sigma_i) \ln(c_i) + \sigma_i \ln(l_i) \quad \text{where } i = 1, 2 \]  

(4.1)

where \( i \) represents the time subscript, \( c_i \) represents consumption in period \( i \), \( l_i \) represents leisure in period \( i \) and \( \sigma_i \) represents an index of sickness in period \( i \). Utility is assumed to be increasing with respect to consumption and leisure and decreasing with respect to sickness.

It is assumed that the individual has committed himself/herself to a two period contract to be enforced in periods one and two. This contract is a conditional contract which specifies the same wage, \( w \), and level of contractual hours, \( h \), in both periods and two levels of sick pay. Sick pay entitlement in the first period is set at a relatively high rate and sick pay in the second period is conditional on absence behaviour in the first period. If an individual goes absent in period one, sick pay is \( s^H \). If the individual also goes absent in period two then sick pay in period two is \( s^L \) where \( s^H > s^L \). Rationality ensures that when the individual determines the period one work attendance decision rule he/she takes account of the fact that his/her decision to attend in period one has consequences for sick pay entitlement in period two.

The analysis of this Section focuses on the derivation of the individual's period one absence decision-making rule. Once period one starts the individual knows the value of \( \sigma_1 \), the realisation of sickness in period one, and the nature of the probability density function of \( \sigma_2 \), the realisation of sickness in the second

---

8 Barmby and Treble (1993) present the results of a preliminary multi-period theoretical analysis of an experience rated sick pay scheme in a discrete time period model where time is divided into years and days. The theoretical results obtained indicate the potential effects of expanding the time horizon.
period, \( f(\sigma_i) \). For simplicity, it is assumed that the realisation of sickness in both periods is determined by \( f(\sigma_i) \) which represents the uniform distribution:\(^9\)

\[
    f(\sigma_i) = \begin{cases} 
        1 & 0 < \sigma_i < 1 \\
        0 & \text{otherwise}
    \end{cases} \quad \text{where } i = 1, 2
\] (4.2)

As soon as period two begins, the individual knows the value of \( \sigma_2 \). Hence as soon as period two starts, the individual faces the same decision-making process as in the static model of Section 2.3.3.4, Chapter 2.

If the individual goes absent in period one, the reservation sickness level in period two, \( \sigma_2^*|_{\lambda_1} \), will be greater than the reservation sickness level in period two if the individual attends in period one, \( \sigma_2^*|_{w_1} \). If the individual goes absent in period one, sick pay in period two is set at the relatively low level, \( s^L \) whilst if the individual attends in period one, sick pay in period two will be set at the relatively high level, \( s^H \). Recalling the analysis of Section 2.3.3.4, Chapter 2, it follows that \( \sigma_2^*|_{\lambda_1} \) and \( \sigma_2^*|_{w_1} \) are defined as:

\[
    \sigma_2^*|_{\lambda_1} = \frac{\ln \left( \frac{w}{s^L} \right)}{\ln \left( \frac{w}{s^L} \right) + \ln \left( \frac{T}{T-h} \right)}
\] (4.3)

\[
    \sigma_2^*|_{w_1} = \frac{\ln \left( \frac{w}{s^H} \right)}{\ln \left( \frac{w}{s^H} \right) + \ln \left( \frac{T}{T-h} \right)}
\] (4.4)

---

\(^9\) The sickness indices, \( \sigma_i \) and \( \sigma_j \), are modelled as random variables with separate probability distributions. It may be more realistic however to assume that \( \sigma_i \) and \( \sigma_j \) are jointly distributed, with the realisation of sickness in period one implying a particular form for the probability distribution in period two. If \( \sigma_i \) takes a high value, then one may expect \( \sigma_j \) to be skewed towards higher realisations of sickness, given that recovering from a state of ill health may take some time. Let \( f(\sigma_i, \sigma_j) \) be the joint probability density function of \( \sigma_i \) and \( \sigma_j \). Hence the conditional probability density function of \( \sigma_j \) given a particular value of \( \sigma_i \), \( \hat{\sigma}_i \), is as follows:

\[
    f(\sigma_j|\hat{\sigma}_i) = \frac{f(\sigma_i, \sigma_j)}{f_i(\hat{\sigma}_i)}
\]

where \( f_i(\hat{\sigma}_i) \) is the marginal probability density function. The conditional density function above can then be incorporated into the expected utility function.
Since the reservation sickness level is decreasing with respect to sick pay, \( \sigma_i^* \big|_{s_i} \) is greater than \( \sigma_i^* \big|_{w_i} \). This can be confirmed by examining the sign of the partial derivative of Expression (2.26) with respect to \( s \):\(^{10}\)

\[
\frac{\partial \sigma^*}{\partial s} = \left( \ln \left( \frac{T}{T-h} \right) \right) \times \left( \ln \left( \frac{T}{T-h} \right) + \ln \left( \frac{w}{s} \right) \right)^{-1} < 0
\]

(4.5)

Therefore, we can conclude that \( \sigma_i^* \big|_{s_i} > \sigma_i^* \big|_{w_i} \), since \( s^H > s^L \). This is clearly in accordance with a priori expectations, i.e. the higher the level of sick pay the greater the probability of absence since the disparity between income from attendance and income from absence is diminished. The following analysis explores how the reservation sickness level in period one is affected once the individual allows for the effect of his/her decision to attend or absent in period one on future sick pay entitlement.

The reservation level of sickness in period one, \( \sigma_i^* \), is defined as the value of \( \sigma_i \) which equates the lifetime utility conditional on attendance in period one with the lifetime utility conditional on absence in period one. Hence, \( \sigma_i^* \) is defined implicitly by the following condition:

\[
(1 - \sigma_i^*) \ln(w) + \sigma_i^* \ln(T-h) + \left( \frac{1}{1+\rho} \right) E[U_{2|w_i}] = (1 - \sigma_i^*) \ln(s^H) + \sigma_i^* \ln(T) + \left( \frac{1}{1+\rho} \right) E[U_{2|s_i}]
\]

(4.6)

In Equation (4.6), \( E[U_{2|w_i}] \) represents expected utility in period two conditional on attendance in period one, which implies that sick pay in period two will be at the relatively high level, \( s^H \), and \( E[U_{2|s_i}] \) represents expected utility in period two conditional on absence in period one, which implies that sick pay in period two will be set at the relatively low level, \( s^L \). Expected utility in period two is assumed to be discounted at the individual’s subjective rate of time preference, \( \rho \).

\(^{10}\) The second derivative, \( \frac{\partial^2 \sigma^*}{\partial s^2} \), was examined in order to ascertain whether the relationship between \( \sigma^* \) and \( s \) is concave or convex. The sign of the second derivative, however, turned out to be ambiguous in the absence of further assumptions relating to the relative magnitude of the parameters of the model. For instance, if \( \ln\left( \frac{T-h}{T} \right) > 2 \ln\left( \frac{T-h}{T} \right) \), then \( \frac{\partial^2 \sigma^*}{\partial s^2} > 0 \).
Expected utility in period two is expressed as a weighted average of the expected utility of an attender and the expected utility of an absentee where the weights are the probability that the realisation of sickness is less than the reservation sickness level and the probability that the realisation of sickness is greater than the reservation sickness level respectively. The individual is assumed to evaluate the expected value of consumption and leisure in the case of attendance and absence using the conditional probability distributions to determine the expected value of \( \sigma_2 \). In the case of an absentee the expected value of \( \sigma_2 \), conditional on \( \sigma_2 \) being between the reservation sickness level and one, is substituted into the utility function. Conversely to determine the expected utility of attending work the expected value of \( \sigma_2 \), conditional on \( \sigma_2 \) being between zero and the reservation sickness level, is used. Hence, \( E[U_2|\lambda_i] \) and \( E[U_2|w_i] \) are expressed as follows:

\[
E[U_2|\lambda_i] = \sigma_2^*\lambda_i \left\{ 1 - \left( \frac{\sigma_2^*\lambda_i}{2} \right) \ln(w) + \left( \frac{\sigma_2^*\lambda_i}{2} \right) \ln(T - h) \right\} + \\
\left( 1 - \sigma_2^*\lambda_i \right) \left\{ 1 - \left( \frac{1 + \sigma_2^*\lambda_i}{2} \right) \ln(s^L) + \left( \frac{1 + \sigma_2^*\lambda_i}{2} \right) \ln(T) \right\}
\]

\[
E[U_2|w_i] = \sigma_2^*w_i \left\{ 1 - \left( \frac{\sigma_2^*w_i}{2} \right) \ln(w) + \left( \frac{\sigma_2^*w_i}{2} \right) \ln(T - h) \right\} + \\
\left( 1 - \sigma_2^*w_i \right) \left\{ 1 - \left( \frac{1 + \sigma_2^*w_i}{2} \right) \ln(s^U) + \left( \frac{1 + \sigma_2^*w_i}{2} \right) \ln(T) \right\}
\]

Substituting Equations (4.7) and (4.8) into Condition (4.6) and rearranging yields the following value of the reservation sickness level in period one:

\[
\sigma_1^* = \sigma_2^*w_i \left\{ \frac{\delta}{(1 + \rho) \left[ \ln\left( \frac{W}{s^U} \right) + \ln\left( \frac{T}{T - h} \right) \right]} \right\}
\]

where the second term of Equation (4.9) reflects the effect on the period one reservation sickness level of recognising the future implications of current absence decisions and is defined by:
\[
\delta = E[U_{2|w}] - E[U_{2|a}] = \frac{\ln \left( \frac{S^L}{S^U} \right) \ln \left( \frac{T-h}{T} \right)^2}{2 \left( \ln \left( \frac{S^L}{W} \right) + \ln \left( \frac{T-h}{T} \right) \right) \ln \left( \frac{W}{S^U} \right) + \ln \left( \frac{T}{T-h} \right)} > 0
\]

(4.10)

Since \( \delta \) is positive, the effect of future opportunities on current decisions in the context of this model serves to raise the reservation sickness level in period one, \( \sigma^*_1 \), and, hence, decreases the probability of absence in the first period. This is in accordance with what one would expect since \( E[U_{2|a}] \) is increasing with respect to \( s^L \):

\[
\frac{\partial E[U_{2|a}]}{\partial s^L} = \frac{\ln \left( \frac{T}{T-h} \right)^2}{s^L \ln \left( \frac{W}{S^U} \right) + \ln \left( \frac{T}{T-h} \right)} > 0
\]

(4.11)

i.e. raising the level of sick unambiguously raises the level of expected utility.\(^{11}\)

To summarise, if the analysis were set in a static context representing period one only, the reservation sickness level would equal \( \sigma^*_1 \). Extending the analysis into a two period context serves to increase the reservation sickness level, due to the fact that the individual takes account of the influence of current decisions on future sick pay entitlement, absence becomes less likely. Since an experience rated sick pay scheme represents one form of absence control, intuitively one would expect such a scheme to raise the reservation sickness level as demonstrated above. It is interesting to note that the numerator of \( \delta \) represents an interaction between a term which reflects the difference between the two levels of sick pay and a term which reflects the difference between non-work time when attending work and non-work time when absent.

An important point emerges when considering the comparative statics of the reservation sickness level specified by Equation (4.9) which is concerned with the question as to why firms have an incentive to pay sick pay above the statutory minimum. In the context of the conventional labour supply model, an increase in

---

\(^{11}\) The second derivative was also examined in order to ascertain whether the relationship between \( E[U_{2|a}] \) and sick pay is concave or convex. The sign of the second derivative, however, turned out to be ambiguous in the absence of further assumptions relating to the relative magnitude of the parameters of the model. For instance, if \( \left[ \ln \left( \frac{T}{T-h} \right) + \ln \left( \frac{W}{s} \right) \right] > 2 \), then the second derivative is negative.
sick pay is associated with a higher level of absence. Sick pay serves to decrease the loss in earnings incurred when absent from work and, hence, reduces the costs of absence incurred by the employee. Despite the fact that the theory predicts that higher sick pay leads to a higher degree of absenteeism, empirical evidence indicates that many firms instigate sick pay schemes which specify company sick pay in excess of the statutory minimum.

The Department of Social Security (1988) reported, for example, the results of a survey of 1125 private and public sector employers, 803 of which offered company sick pay schemes as opposed to relying on the statutory sick pay scheme. The CBI (1994) found supporting evidence in its survey of 500 employers which indicated that 92% of respondents operated an occupational sick pay scheme. Similar evidence is cited by Casey (1994) who explores the 1990 Workplace Industrial Relations Survey and finds that 79% of establishments surveyed provided extra statutory sick pay for all employees.

In the context of the model presented in this Chapter some justification can be found for specifying sick pay in excess of the statutory minimum. Equation (4.12) below represents the partial derivative of the period one reservation sickness level of this two period model with respect to the level of period one sick pay:

$$
\frac{\partial \sigma^*_1}{\partial s^H} = \frac{\partial \sigma^*_1}{\partial s^H} + \left(1 + \rho\right) \left[\ln \left(\frac{w}{s^H}\right) + \ln \left(\frac{T}{T-h}\right)\right] + \left(1 + \rho\right) s^H \left[\ln \left(\frac{w}{s^H}\right) + \ln \left(\frac{T}{T-h}\right)\right]^2
\right)
$$

(4.12)

The first term of Expression (4.12) represents the effect of increasing sick pay in the context of a single period model which is reflected in the partial differential specified in Equation (4.5). This captures the extent to which an increase in $s^H$ reduces the difference between income received from absence and income received from attendance in period one. Clearly as this gap is diminished this influence serves to reduce the reservation sickness level and increases the probability of absence. The following term, however, implies that as $s^H$ is increased the future penalty to absence in the current period is increased. This is reflected in the fact that an increase in $s^H$, ceteris paribus, widens the gap between the two levels of sick pay. This effect is illustrated by the partial differential below which is unambiguously positive:
It becomes apparent that in order to sign the differential specified in Equation (4.12) further assumptions must be adopted, since \textit{a priori} one cannot determine which of the two effects outlined above dominates. The differential represented by Equation (4.12) can be re-arranged as follows:

\[
\frac{\partial \delta}{\partial s^H} = \frac{\left[ \ln \left( \frac{T-h}{T} \right) \right]^2} {2s^H \left[ \ln \left( \frac{w}{s^H} \right) + \ln \left( \frac{T}{T-h} \right) \right]^2} > 0
\]  

(4.13)

Clearly the sign of \( \frac{\partial \delta}{\partial s^H} \) depends on the sign of \( \mu \). In order to sign \( \mu \), some conditions need to be imposed. If, for example, \( \rho \geq 0 \) and \( (1 + \rho) \geq s^H \), then \( \frac{\partial \sigma^*_i}{\partial s^H} \) is negative. The former condition is reasonable to assume. It is difficult, however, to give any intuition for the latter condition. If these two conditions are satisfied, then an increase in period one sick pay is associated with an increase in the probability of absence in period one. In general, however, the sign of \( \frac{\partial \sigma^*_i}{\partial s^H} \) is ambiguous which does not rule out the possibility that an increase in sick pay may reduce absence. Hence, this may give some justification for the existence of many firms in Great Britain endorsing company sick pay schemes which stipulate levels of sick pay in excess of statutory sick pay.

The theoretical results from this Section indicate that if an individual faces a sick pay scheme whereby a particular level of absence in the current period implies a lower level of sick pay in the future, this will lower the probability of absence in the current period. The empirical analysis presented in Section 4.3 below explores
the determinants of the absence rates observed from a set of workers who face a type of absence control in accordance with that described in this Section.

4.3 Empirical Analysis

The data for this study has been collected from four factories belonging to a manufacturing firm which operates on the basis of a production line. These factories are situated in different parts of Great Britain with work forces consisting mainly of production workers. The data set consists of the firm's payroll for the period September 1987 to 1989, daily absence records and personnel records. The payroll provides weekly information on basic, overtime and premium pay. The absence records contain information concerning reasons for absence on a daily basis whilst the personnel records contain data pertaining to the personal characteristics of employees such as sex and marital status.

In 1983 the firm introduced an experienced rated sick pay scheme in these four factories which was actually put into action in 1985 once the necessary information had been gathered. This scheme was introduced as the firm felt that the costs of the former sick pay scheme were high with respect to actual levels of sickness absence. Under the new scheme, sick pay is available at three different rates, $s^A$, $s^B$ and $s^C$ where $s^A > s^B > s^C$. The rate of sick pay of grade A workers is equal to average earnings up to a maximum of basic pay plus one third. The sick pay of grade B workers is equal to basic pay. Finally, grade C workers are not eligible for company sick pay, hence their sick pay entitlement is equal to statutory sick pay, $s^C$. Workers are graded according to their absence record over the previous two years.

Each day of absence is awarded a certain number of points which are accumulated over the specified time period. The number of points accumulated over the given period of time determines the sick pay grade of the worker. Grades are assigned as follows:

---

12 Earnings include overtime and bonus payments.
13 A similar points-system absence control mechanism is analysed by Kuzmits (1981). Under this system each occurrence of absence attracts one point regardless of duration. Further points are given for tardiness and partial absence. In addition, employees who fail to report their absence by a specified time receive a further two points. Perfect attendance over a month leads to the removal of one point. Disciplinary action is taken according to the number of points accumulated over one year. Data was collected before and after the instigation of the system and the results indicate that there was a significant reduction in the mean level of absence occurrence. Absence duration, however, did not change significantly.
The daily accumulation of points is registered in each employee’s absence record. A day’s absence is automatically awarded one point if it is self or medically certified. If taken on a ‘non-benefit day’, the absence spell attracts two points where ‘non-benefit days’ are defined as days when statutory sick pay is not due. In general, ‘non-benefit days’ are the first three days of an absence spell except in the case where there has been a separate spell of absence within the previous eight weeks.

For grade A and B workers, sick pay exceeds the statutory level. Hence, if statutory sick pay is not due, the cost to the firm is $s^A$ and $s^B$ respectively. If, however, statutory sick pay is due, then the firm essentially ‘tops-up’ the statutory payments, which are financed by national insurance contributions, and the cost to the firm of a day’s absence effectively becomes $(s^A - s^C)$ and $(s^B - s^C)$. Thus, the cost to the firm is clearly increased on non-benefit days since the firm does not gain from the provision of statutory sick pay. If an individual does not accumulate any points during the period, then he/she will be awarded a bonus of minus ten points which will be added to the points total of the following period.

The sick pay scheme allows the personnel managers to exercise some degree of discretion over the awarding of points in specific circumstances. Certain absences attract zero points. These are termed ‘acceptable’ absences where acceptability usually implies hospitalisation or serious medically certified sickness. Self-certification is not usually deemed acceptable. The inclusion of such a clause in the sick pay scheme allows the firm to exercise some discretion in cases where a worker is, for example, hospitalised or suffering from serious illness. Furthermore, it is apparent that serious illness is capable of verification, hence the monitoring role of the firm can be concentrated on such cases, whilst ‘unacceptable’ absences attract the automatic punishment determined by the accumulation of points.

Consider, for simplicity, the extreme case faced by a grade A worker where absence in the current period leads to being re-graded as B in the following time period. In the context of the theoretical model presented in Section 4.2, this implies that the reservation sickness level of the grade A worker in the current time period, $\sigma^A_1$, can be derived as follows:

\[
\text{sick pay grade} = \begin{cases} 
A & \text{if points} \leq 21 \\
B & \text{if } 21 < \text{points} \leq 41 \\
C & \text{if points} > 41 
\end{cases} \quad (4.16)
\]

14 The cost to the firm is only increased in the case of grade A and B workers since grade C workers do not receive company sick pay.
where:

\[ \delta^A = \frac{\left[ \ln \left( \frac{s^B}{s^A} \right) \right]^2 \ln \left( \frac{T-h}{T} \right)}{2 \left\{ \ln \left( \frac{w}{s^A} \right) + \ln \left( \frac{T-h}{T} \right) \right\} \ln \left( \frac{w}{s^A} \right) + \ln \left( \frac{T-h}{T} \right) \} > 0 \]  \hspace{1cm} (4.18)

where \( s^B = s^L \), i.e. sick pay if down-graded equals the level of sick pay paid to a grade B worker and \( s^A = s^H \), i.e. current sick pay is determined by the A grading.

The situation faced by a worker graded B is slightly more complicated since a poor attendance record could lead to a lower sick pay grade whilst a good attendance record, on the other hand, could lead to a higher sick pay grade in the following time period.

Once again consider, for simplicity, the extreme case faced by a grade B worker where absence in the current period leads to being re-graded C in the following time period whereas attendance in the current time period leads to being re-graded A in the next time period. In the context of the theoretical model presented in Section 4.2, this implies that the reservation sickness level of the grade B worker in the current time period, \( \sigma_{1B*} \), can be derived as follows:

\[ \sigma_{1B*} = \frac{\ln \left( \frac{w}{s^B} \right)}{\ln \left( \frac{w}{s^B} \right) + \ln \left( \frac{T-h}{T} \right) + \left\{ \frac{\delta^B}{(1+\rho) \ln \left( \frac{w}{s^A} \right) + \ln \left( \frac{T-h}{T} \right) } \right\} \]  \hspace{1cm} (4.19)

\[ \delta^B = \frac{\left[ \ln \left( \frac{s^C}{s^A} \right) \right]^2 \ln \left( \frac{T-h}{T} \right)}{2 \left\{ \ln \left( \frac{w}{s^A} \right) + \ln \left( \frac{T-h}{T} \right) \right\} \ln \left( \frac{w}{s^A} \right) + \ln \left( \frac{T-h}{T} \right) \} > 0 \]  \hspace{1cm} (4.20)

It is apparent that \( \delta^B > \delta^A \) since by definition \( s^A > s^B > s^C \). Although the model embodies a simplified version of the experience rated sick pay scheme introduced by the firm it is clear that, once the individual takes account of the implications of current absence decisions for future levels of sick pay, both current and future
levels of sick pay play a prominent role in the formation of current absence decisions.

The aim of the experience rated sick pay scheme is to reward employees whose absence history exhibit relatively little absence behaviour and to provide an incentive for employees who have a history of high absenteeism to absent themselves less frequently. Under this scheme the individual’s absence decision affects eligibility for sick pay in the future. Since an individual’s behaviour determines the rate of sick pay, the price of a day’s absence differs across employees.

Barmby et al (1991a) undertake an empirical analysis of the implications of such a sick pay scheme for absence behaviour, exploring both the incidence and duration of absence. The incidence of absence is investigated using a discrete panel data model similar to Heckman (1981) and estimates are presented of the parameters of a Weibull hazard model of duration. The incentive properties of the threat of a lower grade of sick pay are analysed by including a parameter representing the closeness to the points boundaries, i.e. the boundaries between re-grading. The results of the study indicate that sex and marital status are important determinants of absence duration. In general, married and female employees appear to take longer absences, whilst acceptable absences (i.e. those which do not attract any points and, therefore, do not contribute to re-grading at a lower sick pay grade) tend to be longer than unacceptable absences. The accumulation of points is also found to be a significant determinant of absence. In general, the boundary between the B and C grades exerts a stronger effect on absence behaviour than the boundary between grades A and B. In addition, sick pay provisions are not found to explain incidence. As the authors point out some of their results are somewhat difficult to interpret. One weakness of this study concerns the fact that payroll data was not available hence factors such as wages and actual levels of sick pay, which play a prominent part in absenteeism, were not incorporated into the analysis.

Parallels exist between the provision of experience rated sick pay within this firm and the theoretical model of Section 4.2. The individuals who are graded B face the situation described in the theoretical model of Section 4.2, i.e. absence in the current period can lead to a lower level of sick pay in the future. Grade B workers in the current period are eligible for a level of sick pay which is equal to the individual’s basic pay. A high level of absence in the present period, however, may lead to the individual being re-graded as C in the future period which would imply the lowest level of sick pay equal to statutory sick pay. Grade A workers whose

15 More detailed information regarding the nature of such a model is specified in Footnote 39, Chapter 2.
weekly earnings exceed the basic rate of pay which include, for example, workers who work overtime or workers who receive shift premia, also face the problem analysed in Section 4.2. Grade A workers in the current period are eligible for a level of sick pay which is equal to the individual's earnings. A high level of absence in the present period, however, may lead to the individual being re-graded as B in the future period which would imply the lower level of sick pay which equals the individual's basic pay. Grade A workers whose weekly basic earnings are not supplemented in any way would not be affected by being re-graded from A to B. Grade C workers are already in the lowest category, hence unacceptable absence may attract different sanctions such as the threat of dismissal as the level of sick pay cannot be lowered any further.

Tables 4.1, 4.2, 4.3 and 4.4 below present results of some empirical investigations into the factors which influence the absence rates of grade A workers whose earnings exceed basic pay, grade B workers and grade C workers.\footnote{Absence rates are defined as the percentage of days absent in 1988 excluding holidays.}

The total sample consists of 2157 workers who were continuously employed by the firm throughout 1988 and whose working week starts on Monday and ends on Friday. From this sample 1137 workers were graded A with earnings exceeding basic pay, 126 workers were graded A with earnings equal to basic pay, 645 workers were graded B and 249 workers were graded C.\footnote{As mentioned at the start of this Section, the data set analysed is obtained by merging the data from four factories operated by the firm. The first factory, which is referred to as site one, has a work force of 539 employees, 60\% of which is graded A, 37\% of which is graded B and 3\% of which is graded C. The second factory, which will be referred to as site two, has the smallest work}
illustrates the nature of the distribution of absence rates across the workers employed by the firm. It is apparent that, as one would expect, the absence rates of individual workers are skewed towards relatively low levels, the mean rate being 0.037 with a standard deviation of 0.067.

Following Balchin and Wooden (1992), Allen (1981a, 1981b) and Kenyon and Dawkins (1989), the relationship between an employee’s absent rate and the chosen regressors is specified in log-odds form since the absence rate lies on the unit interval. Perfect attenders, i.e. individuals with an absence rate of zero over the period were included in the sample, the absence rate in such cases was set to a arbitrarily chosen small number.18 The log-odds form is a transformation of the logit model which is based on the cumulative logistic probability density function. The logistic model is specified as:

\[ p(d_i = 1) = \frac{1}{1 + e^{-\alpha - \beta_i x_i}} \]  
(4.21)

where \( p(d_i = 1) \) represents the probability that a certain choice will be made (i.e. \( d_i = 1 \) corresponds to the event of absence and \( d_i = 0 \) corresponds to the event of attendance) given knowledge of \( x_i \), a set of explanatory variables where \( e \) represents the base of natural logarithms.

Re-arranging Equation (4.21) yields the following:

\[ e^{-\alpha - \beta_i x_i} = \frac{1}{p(d_i = 1)} - 1 = \frac{1 - p(d_i = 1)}{p(d_i = 1)} \]  
(4.22)

Since \( e^{-\alpha - \beta_i x_i} = \frac{1}{1/e^{\alpha + \beta_i x_i}} \), Equation (4.22) can be re-written as follows:

\[ \frac{p(d_i = 1)}{1 - p(d_i = 1)} = e^{\alpha + \beta_i x_i} \]  
(4.23)

Taking the natural logarithm of both sides:

---

force consisting of 323 employees, 60% of which is graded A, 31% of which is graded B and 9% of which is graded C. At site three there is a work force of 647 employees - 62% of which is graded A, 28% of which is graded B and 10% of which is graded C. The fourth site has the largest work force of 648 workers - 68% of which is graded A, 25% of which is graded B and 7% of which graded C.

\[
\ln \left( \frac{p(d_i = 1)}{1 - p(d_i = 1)} \right) = \alpha + \beta x_i \tag{4.24}
\]

where \( p(d_i = 1)(1 - p(d_i = 1))^{-1} \) is the ratio of the odds of \( d_i = 1 \) against \( d_i = 0 \). The proportion of successes in the sample, \( P_i \), i.e. in this case the proportion of days absent, is used as an estimate for \( p(d_i = 1) \). In addition, the following definition is made, \( \epsilon_i = p_i - p(d_i = 1) \).

Hence, the following 'observed' logit can be expressed as:

\[
\ln \left( \frac{p_i}{1 - p_i} \right) = \ln \left( \frac{p(d_i = 1) + \epsilon_i}{1 - p(d_i = 1) - \epsilon_i} \right) \tag{4.25}
\]

which can be expanded as follows:

\[
\ln \left( \frac{p_i}{1 - p_i} \right) = \ln \left( \frac{p(d_i = 1)}{1 - p(d_i = 1)} \right) + \ln \left[ 1 + \left( \frac{\epsilon_i}{p(d_i = 1)} \right) \right] - \ln \left[ 1 - \left( \frac{\epsilon_i}{1 - p(d_i = 1)} \right) \right] \tag{4.26}
\]

Zellner and Lee (1965) use a Taylor expansion in order to re-write Equation (4.26) as follows:

\[
\ln \left( \frac{p_i}{1 - p_i} \right) = \ln \left( \frac{p(d_i = 1)}{1 - p(d_i = 1)} \right) + \frac{\epsilon_i}{p(d_i = 1)} + \frac{\epsilon_i}{1 - p(d_i = 1)} \tag{4.27}
\]

Recalling Equation (4.24):

\[
\ln \left( \frac{p_i}{1 - p_i} \right) = \alpha + \beta x_i + \left( \frac{\epsilon_i}{p(d_i = 1)(1 - p(d_i = 1))} \right) \tag{4.28}
\]

which forms the basis of the specified regression equation. It is apparent from the final term in equation (4.28) that the nature of the transformation required to specify the log-odds form leads to estimates which are subject to heteroskedasticity. Thus, the approach introduced by White (1980) is adopted below in order to produce t-ratios which are heteroskedastic consistent.

The regressors include daily average earnings over the period, a term which reflects the difference between average daily sick pay during the present period and expected average daily sick pay in the future period if the individual faces a lower
grade in the next time period, contractual hours and personal characteristics such as sex, marital status and age. Variable definitions and some summary statistics are presented in Table 4.1 below.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ar</td>
<td>an individual's absence rate in 1988</td>
</tr>
<tr>
<td>wage</td>
<td>average daily basic wage in 1988</td>
</tr>
<tr>
<td>chrs</td>
<td>daily contractual hours</td>
</tr>
<tr>
<td>ssp</td>
<td>average daily statutory sick pay</td>
</tr>
<tr>
<td>$s^B - s^C$</td>
<td>average daily basic wage - statutory sick pay (i.e. difference between sick pay at a B grade and at a C grade)</td>
</tr>
<tr>
<td>$s^A - s^B$</td>
<td>average daily earnings - average daily basic wage (i.e. difference between sick pay at an A grade and at an B grade)</td>
</tr>
<tr>
<td>fd</td>
<td>dummy variable which equals 1 if the individual is female</td>
</tr>
<tr>
<td>msd</td>
<td>dummy variable which reflects marital status which equals 1 if the individual is single</td>
</tr>
<tr>
<td>age</td>
<td>average age of the worker in years over 1988</td>
</tr>
<tr>
<td>avd</td>
<td>average duration of spells of sickness in days in 1988</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4.1(b): Summary Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (Standard Deviation)</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>ar</td>
</tr>
<tr>
<td>chrs</td>
</tr>
<tr>
<td>ssp</td>
</tr>
<tr>
<td>$s^B - s^C$</td>
</tr>
<tr>
<td>$s^A - s^B$</td>
</tr>
<tr>
<td>fd</td>
</tr>
<tr>
<td>msd</td>
</tr>
<tr>
<td>age</td>
</tr>
<tr>
<td>avd</td>
</tr>
</tbody>
</table>
Figure 4.2a: Histogram of \( (s^A - s^B) \) for the Grade A Workers

Figure 4.2b: Histogram of \( (s^B - s^C) \) for the Grade B Workers

Figure 4.2a (4.2b) above illustrates the distribution of the difference between current sick pay and sick pay in 1989 for grade A (grade B) individuals facing down-grading, i.e. \( s^A - s^B \) \( (s^B - s^C) \). It is apparent from Figure 4.2a that this difference is skewed towards relatively low levels whilst Figure 4.2b illustrates that there is relatively little variation in the difference between current and future sick pay of a grade B worker. The difference between sick pay if graded B and sick pay if graded C is, however, concentrated around relatively higher levels than the...
difference between current sick pay and sick pay in the next period, if the individual faces a lower grade, for grade A workers.

In Table 4.1(b) above it is apparent that the mean difference between the sick pay of a grade B worker and sick pay if graded C is higher than the mean difference between sick pay if graded A and sick pay if graded B. This fits in with the evidence of Barmby et al (1991a) which suggests that the boundary between the B and C grades exerts a stronger effect on absence behaviour than the boundary between grades A and B.\textsuperscript{19}

Table 4.2 below presents the results of the empirical analysis of the determinants of the observed absence rates of the grade A workers. The estimated coefficient on the wage variable is significant at the 5\% level and is characterised by the expected sign which suggests a negative relationship between the basic daily wage and absence rates reflecting a dominant substitution effect associated with an increase in wages. The estimated coefficient indicates that a one percent rise in wages causes on average a fall in the incidence of absence of 0.02 percentage points.\textsuperscript{20}

The estimated sign of the coefficient of the wage variable is consistent with that from other empirical studies: Allen (1981a), Balchin and Wooden (1992) and Chaudhury and Ng (1992), for example, find evidence which supports a negative relationship between wages rates and absence. The magnitude of the estimated coefficient on wages is, however, relatively high in comparison with that found in other studies. The wage effect presented by Balchin and Wooden (1992), for example, is particularly small and is argued to be a result of characteristics which are specific to the Australian labour market. Differences in the estimated coefficient on the wage variable across studies may arise from differences in data sources. Balchin and Wooden (1992) and Chaudhury and Ng (1992), for example, use firm level data as opposed to micro data. In contrast, Allen (1981a) who uses self-reported measures of absence is unable to calculate the wage rate and hence is forced to use a proxy. The present study benefits from a micro data set which incorporates detailed payroll information and, therefore, may allow a more appropriate analysis of the observed behaviour of the individual.

The term which reflects the difference between $s^A$, current sick pay, and $s^B$, sick pay if re-graded at a lower level in the following year, is significant at the 1\% level. The results indicate a negative relationship between absence rates and

\textsuperscript{19} Further empirical analysis pertaining to the behaviour of individuals conditioned by the boundary between the B and C grades is presented in an Appendix to this Chapter, Section A4.2.

\textsuperscript{20} The marginal affect on $ar$ of a regressor, $x$, equals $ar(1-ar)\hat{\beta}$ where $\hat{\beta}$ represents the estimated coefficient. The elasticity of $ar$ with respect to $x$ is defined as $ar(1-ar)\hat{\beta}(x)/ar$ where $ar$ and $x$ represent their mean values.
which is in accordance with the theoretical results of Section 4.2, i.e. as the future penalty of absence increases absence behaviour becomes less likely. The effect of this regressor, however, is smaller than the wage effect. A one percent rise in the difference between the two levels of sick pay leads to, on average, a fall in absence of 0.0026 percentage points. Since the wage effect represents the current penalty to absence and \((s^a - s^b)\) represents the future penalty, one might expect the current penalty to exert the greatest effect on current absence behaviour.

### Table 4.2: Dependent Variable = \(\ln[ar / (1-ar)]\)
Sample = Grade A Employees

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Estimated Coefficient</th>
<th>T-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>wage</td>
<td>-0.4805</td>
<td>-2.4163**</td>
</tr>
<tr>
<td>(s^a - s^b)</td>
<td>-0.1476</td>
<td>-2.5944***</td>
</tr>
<tr>
<td>chrs</td>
<td>0.3641</td>
<td>2.7944***</td>
</tr>
<tr>
<td>fd</td>
<td>-0.2073</td>
<td>-0.1945</td>
</tr>
<tr>
<td>msd</td>
<td>-0.7096</td>
<td>-0.7046</td>
</tr>
<tr>
<td>fd*msd</td>
<td>1.6457</td>
<td>1.2698</td>
</tr>
<tr>
<td>site one</td>
<td>1.2111</td>
<td>1.4260</td>
</tr>
<tr>
<td>site two</td>
<td>5.2144</td>
<td>7.1452***</td>
</tr>
<tr>
<td>site three</td>
<td>-0.1790</td>
<td>-0.2017</td>
</tr>
<tr>
<td>avd</td>
<td>1.4632</td>
<td>7.4823***</td>
</tr>
<tr>
<td>age</td>
<td>-0.5060</td>
<td>-2.4522**</td>
</tr>
<tr>
<td>age(^2)</td>
<td>0.0045</td>
<td>1.7901*</td>
</tr>
<tr>
<td>constant</td>
<td>-3.3590</td>
<td>-0.7658</td>
</tr>
<tr>
<td>Breusch-Pagan Test (12 df.)</td>
<td>134.2360***</td>
<td></td>
</tr>
<tr>
<td>Adjusted R(^2)</td>
<td>0.1995</td>
<td></td>
</tr>
</tbody>
</table>

21 *** , ** and * denote significance at the 1%, 5% and 10% level respectively for a two tailed test.
The estimated coefficient on contractual hours is also significant at the 1% level and is characterised by the expected sign suggesting a positive relationship between absence rates and contractual hours with an increase in contractual hours of one percent leading to an average increase in the incidence of absence of 0.024 percentage points. Empirical analysis by Barmby and Treble (1991a) and Chaudhury and Ng (1992) also suggests that contract type, as represented by the level of contractual hours, has important implications for absence behaviour. Chaudhury and Ng (1992), for example, discover that firms with more part-time workers experience a lower level of absence. One would conjecture that part-time workers would absent themselves less frequently since such employment contracts allow enhanced work schedule flexibility. In addition, since part-time workers have fewer scheduled hours, economic theory suggests that they would derive less utility from an additional unit of leisure. 22

It is also apparent from Table 4.2, that different sites exert different influences on absence rates. The dummy variable representing site two exerts a strong positive effect on absence rates which is significant at the 1% level whilst the other site dummies appear to be less powerful. Drago and Wooden (1992) argue that the significance of plant dummies may reflect plant specific illnesses. Alternatively, plant level absence norms may develop which are unique to each factory and, hence, differ across the firm as a whole. In the case of grade A workers, for example, average absence rates differ significantly across plants ranging from 0.025 to 0.037. A further explanation is related to the conditions in the local labour markets since each factory is located in a different region of Great Britain. Differences in local rates of unemployment may, for example, lead to differences in absence rates across plants.

Moreover, earnings for grade A workers at site two are significantly lower than that at the other plants: average daily earnings for grade A workers in the other plants are approximately £35.63 whilst average daily earnings for grade A workers at site two are £29.70. This lowers the current penalty of a day’s absence as derived from the loss in earnings and, in addition, if earnings are low this implies that $s^A$ tends to $s^B$ which indirectly lowers the future penalty of absence. Both of these effects may reduce the pressure on an individual to attend and may account for the positive relationship between the dummy variable representing site two and observed absence rates. The role of site dummies will be discussed further in relation to the results of the grade B workers.

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22 Rather than a discrete classification into part time and full time contracts, the data set analysed in this Chapter provides information on contractual hours which encompasses the entire range of contracts offered by the firm.
Somewhat surprisingly, the dummy variables representing female workers and marital status turn out to be insignificant. This is consistent, however, with the evidence of Barmby and Treble (1991a) which suggests that contractual arrangements are more important determinants of absence behaviour than personal characteristics.

The composition of the work force may also have important implications for absenteeism with younger workers turning over jobs more frequently and undertaking off-the-job search through labour absence. This may be the result of, for example, lower commitment to either the firm or the work group. Alternatively, younger workers may simply experience a greater opportunity cost for any foregone leisure. Thus, average age in years over 1988 was included as a regressor and the results appear to be more promising than those pertaining to other personal characteristics. Furthermore, the results are consistent with those of Allen (1981a) who finds that age is the only personal characteristic to exert a significant influence on absence rates. The results in Table 4.2 indicate that younger workers are associated with a higher probability of absence. These results are consistent with those of Dunn and Youngblood (1986) and Allen (1981a).

In addition, Dunn and Youngblood (1986) find that absence declines with age except in the case of the oldest workers. This result is consistent with the sign of the estimated coefficient on age squared. In the context of the index of sickness discussed in Section 4.2, one would expect the nature of the distribution of sickness to change over time, becoming increasingly skewed towards higher levels as age rises. According to Cascio (1986) and Cascio and McEvoy (1989), this is consistent with the belief of managers that older workers are likely to absent themselves more often due to poor health. Overall, the evidence fits in with that of Allen (1981a) which suggests that the relationship between absenteeism and age is quadratic rather than linear.

Finally, the relationship between observed absence rates and the average duration of absence spells over 1988 was found to be positive and highly significant. It is interesting to note that the size of the estimated coefficient is relatively large - this will be discussed in further detail below in relation to the results from the analysis of the absence rates of the grade B workers.

In Table 4.3 the results of the empirical analysis of determinants of absence behaviour of the grade B workers are presented. Two specifications of the model are included - the only difference between the two models being the inclusion and exclusion of the regressors representing age. In the first specification where age and age squared are included, the overall results are relatively weak. The estimated coefficient on the wage is negative and just significant at the 10% level. The only other variables to achieve significance are contractual hours, the dummy variable
representing site one and the average duration of absence. Figures 4.3a and 4.3b illustrate the distribution of age across grade B and grade A workers respectively. From Figure 4.3b, it is apparent that there is a more distinctive skew towards high age levels which may account for the interpretable relationship between age and absence for this group of workers. There appears to be more variation in the distribution of age across grade B workers with a much less distinctive skew towards high age groups which may, therefore, render the interpretation of the relationship between age and absence somewhat difficult. Due to the weak results from the first specification, emphasis will be placed on the second specification which excludes age and age squared.

![Table 4.3: Dependent Variable =ln[ar/(1-ar)]](image)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Estimated Coefficient</th>
<th>T-Ratio</th>
<th>Estimated Coefficient</th>
<th>T-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>wage</td>
<td>-1.2238</td>
<td>-1.7597*</td>
<td>-1.4489</td>
<td>-2.0562**</td>
</tr>
<tr>
<td>SC - SB</td>
<td>-0.0841</td>
<td>-1.2098</td>
<td>-0.1036</td>
<td>-1.4853</td>
</tr>
<tr>
<td>SC - SB</td>
<td>-1.0610</td>
<td>-1.5674</td>
<td>-1.2315</td>
<td>-1.7958*</td>
</tr>
<tr>
<td>chrs</td>
<td>0.2888</td>
<td>1.7150*</td>
<td>0.3684</td>
<td>2.1273**</td>
</tr>
<tr>
<td>fd</td>
<td>0.1659</td>
<td>0.1301</td>
<td>-0.1614</td>
<td>-0.1257</td>
</tr>
<tr>
<td>msd</td>
<td>0.1113</td>
<td>0.0876</td>
<td>0.7275</td>
<td>0.5760</td>
</tr>
<tr>
<td>fd*msd</td>
<td>-0.9813</td>
<td>-0.6597</td>
<td>-1.2044</td>
<td>-0.7986</td>
</tr>
<tr>
<td>site one</td>
<td>-2.1067</td>
<td>-2.9162***</td>
<td>-1.9568</td>
<td>-2.7285***</td>
</tr>
<tr>
<td>site two</td>
<td>-0.2189</td>
<td>-0.2630</td>
<td>-0.4250</td>
<td>-0.5040</td>
</tr>
<tr>
<td>site three</td>
<td>0.6969</td>
<td>0.9731</td>
<td>0.2087</td>
<td>0.2950</td>
</tr>
<tr>
<td>avd</td>
<td>0.6655</td>
<td>-4.4006***</td>
<td>0.6342</td>
<td>4.2713***</td>
</tr>
<tr>
<td>age</td>
<td>-0.1437</td>
<td>-0.7727</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>age^2</td>
<td>0.0006</td>
<td>0.2405</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>constant</td>
<td>1.3172</td>
<td>0.2828</td>
<td>-3.2605</td>
<td>-1.0513</td>
</tr>
<tr>
<td>Breusch-Pagan Test</td>
<td>40.792*** (13 df.)</td>
<td>32.681*** (11 df.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R^2</td>
<td>0.1049</td>
<td>0.0894</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Number of Observations = 645
Figure 4.3a: Histogram of Age for the Grade B Workers

Figure 4.3b: Histogram of Age for the Grade A Workers
The situation faced by a grade B worker differs from that faced by a grade A worker since a grade B worker can be re-graded at both a lower level (i.e. grade C) in 1989 as a penalty for a bad attendance record in 1988 and a higher level (i.e. grade A) in 1989 as a reward for a good attendance record in 1988. In order to allow for this effect, an additional regressor is included which represents the expected difference between $s^A$ and $s^B$. Despite the fact that the estimated coefficient on this regressor is insignificant, the coefficient does take the expected sign which indicates that a greater expected difference between $s^A$ and $s^B$ is associated with lower absence rates. The term which reflects $(s^B - s^C)$ is characterised by a statistically significant negative coefficient. This is in accordance with the theoretical results of Section 4.3, i.e. absence behaviour becomes less likely as the future penalty to absence increases. Moreover, it is apparent from a comparison between the magnitude of the estimated coefficients of $(s^B - s^C)$ and $(s^A - s^B)$ that these results appear to be consistent with those of Barmby et al (1991a) suggesting that the boundary between the B and C grades exerts a stronger effect on absence behaviour than the boundary between grades A and B.

The estimated coefficient for the grade B workers on the wage variable is significant at the 5% level and is characterised by the expected sign, as in the case of the grade A workers. It is interesting to note that the size of the estimated coefficient is greater than that estimated for the grade A workers with a one percent increase in wages on average causing a fall in the incidence of absence of 1.49 percentage points. One reason for this may be that average earnings for the B grade workers are much lower than those for the A grade workers. Grade A workers appear to supplement their basic pay to a much greater extent with overtime and shift work. Consequently, grade B workers may be influenced more significantly by changes in the basic wage than their grade A counterparts.

The estimated coefficient on contractual hours, which is statistically significant at the 5% level, is slightly larger in magnitude for the grade B workers than for the grade A workers. As in the previous case the estimated coefficient is positive indicating, in accordance with a priori expectations, a positive relationship between absence and contractual hours.

It is clear from Table 4.3 that, as in the case of the grade A workers, different sites exert different effects on absence rates. In the case of the grade B workers, the dummy variable representing site one exerts a strong negative effect on absence rates. In the discussion above some general reasons were cited for the observed different influences of the various plants, such as differences in local unemployment rates. It is not apparent, however, why a specific dummy should be powerful for only one set of workers in a given location. In order to determine why
the dummy variable representing site two has a significant negative effect on the absence rates of grade B workers, it is necessary to establish whether significant differences for these workers exist across sites. For the grade B workers, the average earnings at site one were significantly higher than at the other three plants, thereby augmenting the loss in earnings associated with a day's absence in this specific plant which in turn would have a moderating influence on the absence rates.

In the case of both grade A and grade B workers, the results indicate a significant positive association between absence rates and average duration of absence spells. The relationship for the grade A workers appears to be much more pronounced than that for the grade B workers. The mean duration of absence spells across grade A workers is significantly lower than that of grade B workers whilst the average incidence of absence spells across each grade appears to be relatively consistent (2.7 for grade A workers and 2.6 for grade B workers). Absence rates are clearly determined by both incidence and duration of absence. Average duration for the grade A workers is characterised by a lower standard deviation and a definite skew exists towards absence spells of short duration i.e. spells of one to two days. This implies that a more direct association between the proportion of days absent and average duration of absence spells exists. In the case of grade B workers, there appears to be more variation in the average length of spells across individuals. This implies a less direct association between average duration and absence rates and could account for the lower estimated coefficient on this variable.

As a benchmark for comparison, Table 4.4 presents the results of the empirical analysis of the sample of grade C workers. Despite the fact that this group of workers does not face the threat of a lower level of sick pay in the future, empirical analysis was nevertheless conducted in order to compare the behaviour of grade A and B workers with grade C workers. Since grade C workers who exhibit very low levels of absence can be re-graded as B in 1989, \( (s^B - s^C) \) is included as a regressor.

From Table 4.4, however, it is apparent that the daily wage, \( (s^B - s^C) \) and contractual hours do not exert a significant effect on the absence rates of grade C workers. Similarly personal characteristics such as marital status and sex do not significantly affect absence rates. Average duration of absence spells does exert a significant positive effect on absence rates as in the case of grade A and grade B workers. Age also turns out to be a significant determinant of absence - exhibiting a negative effect in accordance with expectations.
It is apparent from Table 4.4 that the dummy variables representing sites one and two exert a large negative influence on observed absence rates. One explanation for the magnitude of this effect may be that once an employee is graded C any further excessive absence is penalised through a warnings system administered by the personnel office. Once a grade C employee has accumulated three warnings any further unacceptable behaviour is punished by dismissal. The personnel officers administer warnings by following subjective rather than objective criteria, i.e. they appear to exercise a significant degree of discretion. It is not surprising, therefore, that some site dummies, i.e. those representing sites one and two, exhibit a significant negative impact on absence rates whilst other site dummies fail to reach significance. The site dummies, therefore, could be interpreted as proxies which
capture the effects of different personnel management and the leniency or stringency of the managers involved.23

To summarise, the empirical results presented in this Section provide some support for the predictions which arise from the theoretical analysis of Section 4.2. It is apparent from the empirical analysis that the determinants of the reservation sickness level, e.g. wages, sick pay and contractual hours, appear to have a significant and interpretable influence on absence rates. Moreover, those variables which characterise the employment contract seem to exert a greater influence on absence rates than personal characteristics such as sex and marital status. This is in accordance with the results of Allen (1981a) which suggest that:

... the most easily observable personal characteristics are unrelated to work attendance. [Allen (1981a), p78].

In addition, the implications of the results presented in this Section are in accordance with those of Barmby and Treble (1991a) and Chaudhury and Ng (1992) which highlight the importance of contract type for absence behaviour. These results are also consistent with those of Dalton and Mesch (1991) who conclude that an organisation’s absence policy is a much stronger predictor of avoidable absenteeism than the demographic characteristics of the labour force.

4.4 Concluding Remarks

The aim of this Chapter was primarily to extend the current theory of absence behaviour by addressing two major weaknesses which characterise the modelling of absence, namely the ignorance of labour demand and dynamic considerations. Analysing absenteeism from a static perspective is clearly an unrealistic approach and this Chapter, building upon the static model of Barmby et al (1994) in which contractual considerations play a prominent role, analyses absence within a multi-period framework. The theoretical results which emerge indicate that once the individual recognises the future implications of his/her current absence decisions then his/her current absence behaviour is modified accordingly. In particular, the

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23 Given the relatively weak results presented in Table 2.4, it seemed appropriate to test for model mispecification. Ramsey Reset tests were carried out by running three additional regressions of the dependent variable on the independent variables and on the powers two, three and four of the predicted dependent variable. The estimated test statistics were 19.546 (1, 229 df.), 16.844 (2, 228 df.) and 11.360 (3, 227 df.) respectively indicating that the equation is mis-specified. This result is not surprising given that the grade C employers represent the minority group of employees which contains those individuals whose absence behaviour does not appear to be influenced by the absence control scheme. Hence, the absence behaviour of this set of employees may be determined by factors which are not captured by the available data.
results suggest that the provision of experience rated sick pay lowers the probability of absence.

The empirical results of Section 4.3 present some support in favour of the predictions which arise from the theoretical results. Moreover, it is apparent from the results of Section 4.3 that contractual arrangements play a key role in the absence decision making process, a finding which is consistent with the results of other empirical studies. Furthermore, differences in the observed absence behaviour of the three categories of employees can, in the main, be related to factors which determine current and future penalties to absence.

Finally, it is interesting to note that the firm under investigation has chosen to establish the same sick pay scheme across sites. It is clear from the empirical results, however, that despite this uniformity the implications of the scheme are widely differentiated across sites. One explanation for this may lie in the differential availability of overtime, potential earnings, and therefore in the levels of $s^A$ and $s^B$ across sites. Although the nature of the firm's production process may dictate differences in the provision of overtime and shift working across plants, the results suggest that it may, therefore, be appropriate to operate site-specific methods of absence control.

To summarise, the implications of the analysis suggest that the firm is able to exert some degree of control over absenteeism by altering characteristics of the employment contract. It appears that the sick pay scheme does exert a significant degree of control over absenteeism, but it should be noted that the loss of current earnings associated with absence has a greater influence on the absence decision than the loss of any future sick pay entitlement.
A4.1 Appendix One: The Threat of Dismissal

A4.1.1 Introduction

The analysis presented in Section 4.2 assumes that absence does not attract any punishment over and above that embodied in the experience rated sick pay scheme. Consequently, the absentee only suffers a loss of income since sick pay is assumed to be less than the wage. As mentioned in Section 2.3.3.3, Chapter 2, some studies have analysed the implications of additional penalties for absence behaviour. Allen (1981a), for example, assumes that an absentee, in addition to lost income, faces a lump sum penalty reflected in a decreased chance of promotion or an increased probability of dismissal to cover the firm’s losses. Balchin and Wooden (1992) define a similar penalty function which is a function of the opportunity cost of being dismissed and the level of dismissal threat chosen by the firm.1 Their empirical results suggest that absence is affected by both the expected cost of dismissal and the level of the dismissal threat.

Penalties of this nature essentially raise the expected cost of absence faced by the employee with the probability of being dismissed acting as a discipline device. Such an approach is consistent with the efficiency wage hypothesis whereby the prospect of unemployment serves to curb shirking on the part of workers [Shapiro and Stiglitz (1984)]. Barmby et al (1994), who explore the relationship between absenteeism and efficiency wages explicitly, obtain theoretical results suggesting a negative relationship between the wage and the probability of absence. Weiss (1985) postulates a similar relationship for workers employed by a firm operating production line technology. Both of these models, however, suffer from a major shortcoming in that they are static.

In many instances the detection of shirking does not lead to immediate dismissal [Carlin (1989)]. Hence, the interaction between workers and employers should ideally be modelled as a repeated game, i.e. the time horizon should be expanded. In this Appendix, the analysis presented in Section 4.2 is extended to introduce the notion of ‘unacceptable’ absence, which attracts a possible threat of dismissal, into the two period framework of Section 4.2. Thus, the interaction

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1 The authors assume that the dismissal threat level is positively correlated with the actual dismissal rate. Such an approach is open to criticism, since if the dismissal threat is credible, one might expect an increase in the threat to reduce the level of actual dismissals. The authors justify their assumed positive correlation by invoking Drago’s (1993) assumption that if the elasticity of absence with respect to the dismissal threat is less than one, then an increase in the threat level will reduce absence but by a relatively small amount, such that the level of actual dismissals will rise. This relationship is, however, somewhat tenuous with a lack of any rigorous theoretical structure.
between two types of absence control, an experience rated sick pay scheme and the threat of dismissal, is analysed.

Focus is placed on an additional complication which arises when interpreting ‘unacceptable’ absence as shirking, namely the possibility that individuals who wish to absent themselves due to poor health may come to work under certain circumstances due to the fear of losing their job. An employee who turns up to work regardless of poor health may inadvertently impose costs on the firm; the productivity of the individual may decline or the condition of the individual may be contagious - leading to, for example, a costly epidemic of flu throughout the work force.

A4.1.2 The Imposition of a Dismissal Threat

The absence decision analysed in Section 4.2 is expressed as a choice between two distinct options; attendance and absence. This analysis is unrealistic in the sense that the firm’s only response to the worker’s absence behaviour is to set a lower level of sick pay in period two if the worker absents in period one. Absenteeism may, however, lead to further measures of absence control. The firm may, for example, have some notion of what it deems to be ‘acceptable’ absence and may be willing to dismiss any worker taking ‘unacceptable’ absence. This leads to the issue of what actually constitutes ‘(un)acceptable’ absence. Incorporating sickness into a model of absenteeism, therefore, suggests that a distinction could be made between ‘acceptable’ absence, whereby an individual is physically and/or psychologically unable to work, and ‘unacceptable’ absence whereby the individual’s health is deemed adequate for the execution for his/her duties. Such a dichotomy implies the existence of some ‘critical’ level of sickness which marks the threshold of ‘acceptable’ absence. Furthermore, one might expect ‘unacceptable’ absence to attract further punishment from the employer.

Clearly disparities may arise between the level of sickness above which the individual prefers absence (the reservation sickness level) and the level of sickness beyond which the employer feels that it is acceptable for the employee to absent himself/herself from work (the acceptable sickness level). This disparity essentially forms the basis of the efficiency wage model of Barmby et al (1994). If the acceptable sickness level exceeds the reservation sickness level, then informational asymmetries play an important role if the firm is unable to determine the individual’s level of sickness. To be sure, a range of sickness values exist over
which individuals may be tempted into taking ‘unacceptable’ (i.e. shirking) absence.\(^2\)

Following the approach adopted by Barmby et al (1994), a minimum level of sickness, \(\sigma^a\), is defined such that for levels of sickness over the closed interval \([\sigma^a,1]\), the individual is deemed to be ‘acceptably’ sick and thereby entitled to company sick pay without threat of dismissal. Values of sickness which lie within this range may be, for example, viewed as medically certifiable. For simplicity, the Barmby et al (1994) assumption that \(\sigma^a\) is exogenously determined and equal to the value of \(\sigma\) such that the individual is indifferent between attending work and being unemployed, \(\sigma^a\) is adopted. Maintaining the model specifications developed in Section 4.2, this implies:

\[
\sigma^a = \sigma^a \equiv \frac{\ln \left( \frac{w}{b} \right)}{\ln \left( \frac{w}{b} \right) + \ln \left( \frac{T}{T-h} \right)} \tag{A4.1.1}
\]

where \(b\) denotes unemployment benefit. In the static model of Barmby et al (1994), given the assumption that sick pay is always greater than unemployment benefit, the reservation sickness level will always lie below \(\sigma^a\). Once the time horizon is increased, however, this may not be the case and situations may arise when the reservation sickness level in period one exceeds \(\sigma^a\), such that workers prefer work to ‘legitimate’ absence.

It would seem appropriate to assume that the individual faces some punishment if caught misrepresenting his/her level of sickness. This punishment is modelled as dismissal, where \(q \in [0,1]\) represents the probability that the firm is able to ascertain an absentee’s true state of health. It is assumed that any worker dismissed by the firm is able to claim unemployment benefit. The reservation level of sickness in a static one period framework, \(\sigma^{**}\), is defined as the level of sickness such that the expected utility from attendance is equal to the expected utility from absence. Maintaining the assumption that sick pay is set at the relatively high rate, \(s^H\), implies that \(\sigma^{**}\) satisfies the following condition:

\[
(1 - \sigma^{**}) \ln(w) + \sigma^{**} \ln(T-h) = (1-q)\left[(1 - \sigma^{**}) \ln(s^H) + \sigma^{**} \ln(T)\right] + q\left[(1 - \sigma^{**}) \ln(b) + \sigma^{**} \ln(T)\right] \tag{A4.1.2}
\]

\(^2\) Firms may encounter problems distinguishing between different types of absence. Absence from work is usually justified by sickness, i.e. the individual reports that he/she is too ill to work even if this is not the case. Evidence from Dunn and Youngblood (1986) supports the view that illness is used as an excuse by workers to move towards their optimum labour supply position (see Section 2.3.3.4, Chapter 2).
Equation (A4.1.2) can be re-arranged as follows:

\[
\sigma^* = \frac{\ln \left( \frac{w}{s^H} \right) + q \ln \left( \frac{s^H}{b} \right)}{\ln \left( \frac{w}{s^H} \right) + q \ln \left( \frac{s^H}{b} \right) + \ln \left( \frac{T}{T-h} \right)}
\]

(A4.1.3)

If the realisation of sickness lies between the reservation sickness level and the ‘acceptable’ level of sickness, then the individual has an incentive to illegitimately absent himself/herself from work since the expected utility from absence exceeds that from attending work.

It is apparent from Equation (A4.1.4) below that any increase in the probability of dismissal would raise the reservation sickness level:

\[
\frac{\partial \sigma^*}{\partial q} = \frac{\ln \left( \frac{s^H}{b} \right) \ln \left( \frac{T}{T-h} \right)}{\ln \left( \frac{w}{s^H} \right) + q \ln \left( \frac{s^H}{b} \right) + \ln \left( \frac{T}{T-h} \right)} > 0
\]

(A4.1.4)

The sign of the second derivative indicates that the effect of an increase in the probability of detection diminishes as \( q \) increases:

\[
\frac{\partial^2 \sigma^*}{\partial q^2} = \frac{-2 \left[ \ln \left( \frac{s^H}{b} \right) \right]^2 \ln \left( \frac{T}{T-h} \right)}{\ln \left( \frac{w}{s^H} \right) + q \ln \left( \frac{s^H}{b} \right) + \ln \left( \frac{T}{T-h} \right)^3} < 0
\]

(A4.1.5)

Barmby et al (1994) explore the relationship between ‘unacceptable’ (i.e. shirking) absence and wages in this single period framework. The aim of this Appendix is to extend the time horizon of the theoretical framework and, in addition, to analyse the effects of both experience rated sick pay and the imposition of a dismissal threat.

Consider how the reservation sickness level is determined in the context of the two period model of Section 4.2 once a distinction is made between ‘acceptable’ and ‘unacceptable’ (i.e. shirking) absence. The reservation sickness level, \( \sigma^*_1 \), will be defined as the value of sickness such that the utility from attendance in period one, plus the discounted expected utility in period two conditional on attendance in period one, equals the expected utility from absence in period one plus the discounted expected utility in period two conditional on absence in period one:
Equation (A4.1.6) implicitly defines the individual’s period one decision rule for determining the value of the reservation sickness level, \( \sigma_i^{**} \). It is apparent that a priori he/she does not know whether the his/her reservation sickness level will be greater or less than the minimum ‘acceptable’ sickness level. Thus, there are three potential events which may occur - ‘acceptable’ absence, ‘unacceptable’ absence which is not detected and ‘unacceptable’ absence which is detected. The individual knows, however, that since sickness is defined over the unit interval and since \( \sigma^a \) represents the minimum ‘acceptable’ sickness level, that there is a \( (1 - \frac{1}{1+\rho}) \) probability that the reservation sickness level will be greater than or equal to \( \sigma^a \) and, therefore, will enable absence on the part of the individual without fear of dismissal, whilst there is a \( \sigma^a \) probability that the reservation sickness level will be less than \( \sigma^a \) and, therefore, that absence will attract a probability of dismissal.

Thus, in the two period framework the reservation sickness level in period one may lie above or below the minimum acceptable level. Under the former situation, workers will attend work despite the fact that their realisation of sickness in period one is such that absence does not attract any threat of dismissal. ‘Acceptable’ sickness in period one still implies that sick pay entitlement in period two is equal to the relatively low level and this wedge between \( s^H \) and \( s^L \) may raise the reservation sickness level in period one beyond \( \sigma^a \).

Situations may arise when individuals attend work when employers would prefer them to stay away. In the theoretical model of Kahana and Weiss (1992), for example, daily paid workers employed by a profit maximising firm will, under some circumstances, work when it is in the firm’s interests that the workers absent. In the context of the proposed two worker-model, workers under conditions of profit maximisation are only paid on days when they attend work. Thus, the wage is only equal to the marginal productivity displayed when in attendance. In addition, the marginal productivity of an individual depends on how often his/her colleague attends on the same days. Marginal productivity is enhanced when the overlap between workers attending is minimised. Since, individuals are only paid for attendance and since prior to the formulation of their work attendance decision, they
are not aware as to whether their colleague is sick or not, the attendance rates in this model are shown to be sub-optimal and exceed the pareto optimal level.

Similarly, Kenyon and Dawkins (1987) argue that individuals may reduce recovery time from illness below socially optimal levels as a response to economic incentives. This may result in a reduction of the productivity at the work place by, for example, spreading illnesses such as flu throughout the work force. Doherty (1979) quotes from Morgan and Martin (1975):

The most important reason determining how soon a person who has been sick returned to work was thought by all samples to be the drop in income during illness, followed by the fear of losing one’s job and boredom at home. [Morgan and Martin (1975), p7].

Fenn (1981) finds similar evidence which supports the claim that the duration of sickness in the UK is influenced by economic factors.

Rearranging Condition (A4.1.6), which allows for the fact that situations may arise where an individual may attend the work place despite the fact that his/her state of health is such that he/she is entitled to ‘acceptable’ absence, yields the following:

\[
\sigma_i^* = \frac{\ln \left( \frac{w}{s^H} \right) + q\sigma^a \ln \left( \frac{s^H}{b} \right) + \left( \frac{1}{1 + \rho} \right) \left[ E[U_1|w_i] - E[U_2|\lambda_i] \right]}{\ln \left( \frac{w}{s^H} \right) + q\sigma^a \ln \left( \frac{s^H}{b} \right) + \ln \left( \frac{T}{T-h} \right)}
\]

(A4.1.7)

where \( E[U_1|w_i] \) represents expected utility in period two conditional on attendance in period one and \( E[U_2|\lambda_i] \) represents expected utility in period two conditional on absence in period one.

From Equation (A4.1.8) below, it is apparent that \( E[U_2|w_i] \) is a weighted average of the expected utility of an attender, the expected utility of an individual who is ‘acceptably’ absent, the expected utility of an individual who is ‘unacceptably’ absent weighted by the probability of not being detected and the expected utility of an individual who is ‘unacceptably’ absent weighted by the probability of being detected:
\[
E[U_{2|_{w_i}}] = \sigma_{2|_{w_i}}^{*} \left\{ \left[ 1 - \left( \frac{\sigma_{2|_{w_i}}^{*}}{2} \right) \right] \ln(w) + \left( \frac{\sigma_{2|_{w_i}}^{*}}{2} \right) \ln(T - h) \right\} +
(1 - \sigma^*) \left\{ \left[ 1 - \left( \frac{1 + \sigma^*}{2} \right) \right] \ln(s^H) + \left( \frac{1 + \sigma^*}{2} \right) \ln(T) \right\} +
(1 - q) \left( \sigma^* - \sigma_{2|_{w_i}}^{*} \right) \left\{ \left[ 1 - \left( \frac{\sigma^* + \sigma_{2|_{w_i}}^{*}}{2} \right) \right] \ln(s^H) + \left( \frac{\sigma^* + \sigma_{2|_{w_i}}^{*}}{2} \right) \ln(T) \right\} +
q \left( \sigma^* - \sigma_{2|_{w_i}}^{*} \right) \left\{ \left[ 1 - \left( \frac{\sigma^* + \sigma_{2|_{w_i}}^{*}}{2} \right) \right] \ln(b) + \left( \frac{\sigma^* + \sigma_{2|_{w_i}}^{*}}{2} \right) \ln(T) \right\} 
\]

(A4.1.8)

where:

\[
\sigma_{2|_{w_i}}^{*} = \frac{\ln\left( \frac{w}{s^H} \right) + q \ln\left( \frac{s^H}{b} \right)}{\ln\left( \frac{w}{s^H} \right) + q \ln\left( \frac{s^H}{b} \right) + \ln\left( \frac{T}{T - h} \right) } 
\]

(A4.1.9)

i.e. the period two reservation sickness level conditional on attendance in period one is a function of the relatively high level of sick pay, \(s^H\).

Equations (A4.1.10) and (A4.1.11) below define \(E[U_{2|_{A_i}}]\) which is essentially a weighted average of expected utility in period two conditional on ‘unacceptable’ absence in period one and not being detected, \(E[U_{2|_{NF_i}}]\), expected utility in period two conditional on ‘unacceptable’ absence in period one and being detected, \(E[U_{2|_{F_i}}]\), and expected utility in period two conditional on ‘acceptable’ absence in period one, \(E[U_{2|_{NF_i}}]\), where the weights are \((1 - q)\sigma^*,\ q\sigma^*\) and \((1 - \sigma^*)\) respectively:

\[
E[U_{2|_{A_i}}] = (1 - q)\sigma^* E[U_{2|_{NF_i}}] + q\sigma^* E[U_{2|_{F_i}}] + (1 - \sigma^*) E[U_{2|_{NF_i}}] 
\]

(A4.1.10)

where:
\[ E[U_2|_{\text{NR}1}] = \sigma^*_2|_{\lambda_1} \left\{ 1 - \left( \frac{\sigma^*_2|_{\lambda_1}}{2} \right) \ln(w) + \left( \frac{\sigma^*_2|_{\lambda_1}}{2} \right) \ln(T-h) \right\} + \]

\[ (1 - \sigma^a) \left\{ 1 - \left( \frac{1 + \sigma^a}{2} \right) \ln(s^+T) + \left( \frac{1 + \sigma^a}{2} \right) \ln(T) \right\} + \]

\[ (1 - q) \left( \sigma^a - \sigma^*_2|_{\lambda_1} \right) \left\{ 1 - \left( \frac{\sigma^a + \sigma^*_2|_{\lambda_1}}{2} \right) \ln(s^+) + \left( \frac{\sigma^a + \sigma^*_2|_{\lambda_1}}{2} \right) \ln(T) \right\} + \]

\[ q \left( \sigma^a - \sigma^*_2|_{\lambda_1} \right) \left\{ 1 - \left( \frac{\sigma^a + \sigma^*_2|_{\lambda_1}}{2} \right) \ln(b) + \left( \frac{\sigma^a + \sigma^*_2|_{\lambda_1}}{2} \right) \ln(T) \right\} \]

(A4.1.11)

and:

\[ \sigma^*_2|_{\lambda_1} = \frac{\ln\left( \frac{w}{s^L} \right) + q \ln\left( \frac{s^L}{b} \right)}{\ln\left( \frac{w}{s^L} \right) + q \ln\left( \frac{s^L}{b} \right) + \ln\left( \frac{T}{T-h} \right)} \]  

(A4.1.12)

i.e. the period two reservation sickness level conditional on absence in period one is a function of the relatively low level of sick pay, \( s^L \). Thus, expected utility in period two if the individual is not dismissed in period one, \( E[U_2|_{\text{NR}1}] \), is a weighted average of the expected utility of attendance in period two, ‘acceptable’ absence in period two, undetected ‘unacceptable’ absence in period two and detected ‘unacceptable’ absence in period two.

The expected utility in period two conditional on detected ‘unacceptable’ absence in period one is defined as follows:

\[ E[U_2|_{F_1}] = \left( \frac{1}{2} \right) \left[ \ln(b) + \ln(T) \right] \]  

(A4.1.13)

Equation (A4.1.13) implicitly assumes that if the individual is dismissed in period one, he/she does not secure employment in period two.

As in Section 4.2, the reservation sickness level in period two is decreasing with respect to sick pay:
Thus, once period two starts the analysis is the same as in the single period model which means that the reservation sickness level in period two will always lie below the acceptable level of sickness, i.e. \( \sigma^*_2 |_{w_1} < \sigma^*_2 |_{a_i} < \sigma^* \) if \( 0 \leq q < 1 \) since \( s^H > s^L > b \).

In order to ascertain the future consequences of current work attendance decisions, the sign of the additional term of the numerator of Equation (A4.1.7),

\[
E[U_{2|w_1}] - E[U_{2|a_i}],
\]

needs to be determined. The difference between expected utility in period two conditional on attendance in period one, \( E[U_{2|w_1}] \), and expected utility in period two conditional on absence in period one, \( E[U_{2|a_i}] \), can be expressed as follows:

\[
E[U_{2|w_1}] - E[U_{2|a_i}] = E[U_{2|w_1}] - (1 - q \sigma^*) E[U_{2|a_i}] - q \sigma^* E[U_{2|a_i}] \quad (A4.1.15)
\]

The magnitude of Expression (A4.1.15) is obviously influenced by \( q \), the probability of detection, which is the outcome of the firm’s choice of monitoring intensity. For ease of analytical exposition, it is useful to examine the extreme cases of zero monitoring and perfect monitoring.

When \( q \) is equal to zero no distinction is made between ‘acceptable’ and ‘unacceptable’ sickness and Equation (A4.1.15) reduces to \( \delta \), the difference between expected utility in period two conditional on attendance in period one and expected utility in period two conditional on absence in period one [recall Equation (4.10), Section 4.2]:

\[
\delta = \frac{\left[ \ln \left( \frac{s^L}{s^H} \right) \right] + \ln \left( \frac{T - h}{T} \right)^2}{\left\{ 2 \left[ \ln \left( \frac{s^L}{w} \right) + \ln \left( \frac{T - h}{T} \right) \right] \right\} > 0 \quad (A4.1.16)
\]

Thus, when \( q \) equals zero, \( E[U_{2|w_1}] > E[U_{2|a_i}] \) which implies that the future implications of current actions curb the tendency to absent from the work place.
At the opposite extreme of perfect detection, it can also be shown that \( E[U_2|w_1] > E[U_2|a_1] \). As \( q \) approaches unity, Equation (A4.1.10) reduces as follows:

\[
E[U_2|a_1] = \sigma^2 E[U_2|F_1] + (1 - \sigma^2) E[U_2|F_1] \tag{A4.1.17}
\]

i.e. expected utility conditional on absence in period one is a weighted average of the expected utility in period two if dismissed in period one and the expected utility in period two if the individual is not dismissed in period one where the weights are determined by the probability of 'unacceptable' absence and 'acceptable' absence respectively. Thus, the difference between expected utility in period two conditional on attendance in period one and expected utility in period two conditional on absence in period one is as follows:

\[
\{E[U_2|w_1] - E[U_2|a_1]\}_{q=1} = \{E[U_2|w_1] - E[U_2|F_1]\}_{q=1} + \sigma^2 \{E[U_2|F_1] - E[U_2|F_1]\}_{q=1} \\
= \phi_{q=1} + \sigma^2 \{E[U_2|F_1] - E[U_2|F_1]\}_{q=1} \tag{A4.1.18}
\]

where:

\[
\phi_{q=1} = \{E[U_2|w_1] - E[U_2|F_1]\}_{q=1} \tag{A4.1.19}
\]

Taking the two bracketed terms on the right hand side of Equation (A4.1.18) in turn, the first term is positive when the probability of detection is equal to one:

\[
\phi_{q=1} = \frac{\ln\left(\frac{T}{T-h}\right)^2}{2 \ln\left(\frac{w}{b}\right)} > 0 \tag{A4.1.20}
\]

Thus, as long as \( E[U_2|F_1] \) is not less than \( E[U_2|F_1] \), the effect of the future implications of current absence decisions raises the probability of attendance.\(^3\)Furthermore, since expected utility conditional on absence in period one is a weighted average of the expected utility in period two if dismissed in period one

\(^3\)This is clearly a plausible assumption to make since if were not the case then the individual would derive more utility from unemployment than employment.
and the expected utility in period two if the individual is not dismissed in period one (recall Equation A4.1.17), then it must be the case that $E[U_2|\lambda_i] < E[U_2|\lambda_f]$. 

One should note that situations where the probability of detection equals one or zero are somewhat extreme. Clearly the case when $0 \leq q \leq 1$ is more realistic, i.e. it seems appropriate to assume imperfect monitoring of absence behaviour since employers encounter obvious problems in distinguishing between voluntary and involuntary absence. It is interesting, therefore, to determine the sign of $E[U_2|w_i] - E[U_2|\lambda_i]$ when $q$ lies between zero and one, $\delta_{0<q<1}$, in order to determine the implications of an imperfect monitoring technology on the probability of absence.

In order to determine such implications, it is necessary to ascertain the sign of $\delta_{0<q<1}$. Since $E[U_2|\lambda_i] > E[U_2|\lambda_f]$, it follows from Expression (A4.1.10) that $E[U_2|w_i] > E[U_2|\lambda_f] > E[U_2|\lambda_i]$. Equations (A4.1.21) to (A4.1.24) below demonstrate that $E[U_2|w_i] - E[U_2|\lambda_f]$ is positive when $0 \leq q \leq 1$. Since $E[U_2|\lambda_f]$ is greater than $E[U_2|\lambda_i]$, then the analysis implies that $\delta_{0<q<1}$ is positive:

$$E[U_2|w_i] - E[U_2|\lambda_f] = \phi = \frac{(q-1)^2 \ln \left( \frac{s^H}{s^L} \right) \ln \left( \frac{T}{T-h} \right)^2}{2 \left[ \ln \left( \frac{w}{b} \right) + \ln \left( \frac{T}{T-h} \right) \right]^2} + \phi'_{q=1} > 0$$

(A4.1.21)

$$\tau_1 = \ln \left( \frac{w}{s^H} \right) + q \ln \left( \frac{s^H}{b} \right) + \ln \left( \frac{T}{T-h} \right) > 0$$

(A4.1.22)

$$\tau_2 = \ln \left( \frac{s^L}{w} \right) + q \ln \left( \frac{b}{s^L} \right) + \ln \left( \frac{T-h}{T} \right) < 0$$

(A4.1.23)

$$\tau_3 = \ln \left( \frac{b}{s^L} \right) \left[ q \ln \left( \frac{s^H}{b} \right) + \ln \left( \frac{w}{b} \right) + \ln \left( \frac{s^H}{b} \right) \ln \left( \frac{s^L}{w} \right) \right] + \ln \left( \frac{T}{T-h} \right) \left[ \ln \left( \frac{b}{s^H} \right) + \ln \left( \frac{b}{s^L} \right) \right]$$

(A4.1.24)

Since $\tau_3 < 0$, then $\phi$ is unambiguously positive. This algebraic result is confirmed by Figure A4.1.1 below which depicts the log-linear expected utility functions represented by Equations (4.7), (4.8), (A4.1.8) and (A1.1.11).
When \( q \) equals zero, \( \ln(w)A\ln(T) \) represents the utility function specified by Equation (4.8) and \( \ln(w)B\ln(T) \) represents the utility function specified by Equation (4.7). The expected utility function denoted by Equation (4.8) is represented by the expected value of the line segment \( \ln(w)A \) evaluated using the expected value of \( \sigma_2 \) conditional on \( \sigma_2 \) being less than \( \sigma_2^{*}_{w_1} \) plus the expected value of the line segment \( A\ln(T) \) evaluated using the expected value of \( \sigma_2 \) conditional on \( \sigma_2 \) being greater than \( \sigma_2^{*}_{w_1} \). The expected utility function denoted by Equation (4.7) is represented by the expected value of the line segment \( \ln(w)B \) evaluated using the expected value of \( \sigma_2 \) conditional on \( \sigma_2 \) being less than \( \sigma_2^{*}_{A_1} \) plus the expected value of the line segment \( B\ln(T) \) evaluated using the expected value of \( \sigma_2 \) conditional on \( \sigma_2 \) being greater than \( \sigma_2^{*}_{A_1} \). Clearly \( \ln(w)A\ln(T) \) lies above \( \ln(w)B\ln(T) \) which implies that there is a higher level of expected utility associated with the higher level of sick pay.
Once $0 \leq q \leq 1$, then the individual has to take into the account the fact that there is a probability of being dismissed attached to ‘unacceptable’ absence. In order to demonstrate the implications of an imperfect monitoring technology, the following definitions are adopted:

$$E[y_1] = (1 - \sigma_2)[(1 - q)\ln(s^u) + q\ln(b)]$$ \hspace{1cm} (A4.1.25a)

$$E[y_2] = (1 - \sigma_2)[(1 - q)\ln(s^u) + q\ln(b)]$$ \hspace{1cm} (A4.1.25b)

In the diagram, the value of the reservation sickness represented by Equation (A4.1.9), $\sigma_2^\ast|_{w_1}$, is derived at point $A^\ast$ and the value of the reservation sickness represented by Equation (A4.1.12), $\sigma_2^\ast|_{w_1}$, is derived at point $B^\ast$. It is apparent that $\ln(w)A^\ast C_1 C_2 \ln(T)$ reflects $E[U_2|_{w_1}]$ and $\ln(w)B^\ast C_3 C_4 \ln(T)$ reflects $E[U_2|_{w_2}]$. There is a discontinuity in the line segments at point $\sigma^\ast$ since if $\sigma_2$ is greater than or equal to $\sigma^\ast$ then absence is ‘acceptable’ and, hence, does not attract any threat of dismissal. Clearly, $\ln(w)A^\ast C_1 C_2 \ln(T)$ lies above $\ln(w)B^\ast C_3 C_4 \ln(T)$. Thus, we can conclude that $E[U_2|_{w_1}] > E[U_2|_{w_2}] > E[U_2|_{w_3}]$. This means that the threat of dismissal which is attached to ‘unacceptable’ absence serves to raise the reservation sickness level. Hence, in the context of this model the existence of the threat of dismissal reduces the probability of absence. Furthermore, it is apparent from Figure A4.1.1, that as $q$ increases, Expressions (A4.1.21a) and (A4.1.21b) both tend to $\ln(b)$.

Equation (A4.1.4) illustrates that the reservation sickness level in the static single period model is increasing with respect to $q$. It is interesting to consider how $\delta_{0 < q < 1}$, which determines the magnitude of the period one reservation sickness level, responds to changes in the probability of detection. Due to the intractability of the algebra, attention will be paid to simulation experiments. The results of three different cases are presented in Tables A4.1.1 to A4.1.3 below:
### Table A4.1.1: Simulation Results: Case One

**Case One:** \( w = 9, s^H = 6, s^L = 5, b = 4, T = 24, h = 9 \)

| \( q \) | \( \phi \) | \( \delta_{10 \leq q \leq 1} \) | \( \sigma^* \) | \( \sigma_{1}^{\ast} \) \( |_{p=0} \) | \( \sigma_{1}^{\ast} \) \( |_{p=5} \) | \( \sigma_{1}^{\ast} \) \( |_{p=10} \) |
|---|---|---|---|---|---|---|
| 0.0 | 0.02175 | 0.02175 | 0.63308 | 0.62616 | 0.61105 | 0.60967 |
| 0.1 | 0.01955 | 0.03693 | 0.63308 | 0.63882 | 0.61316 | 0.61082 |
| 0.2 | 0.01773 | 0.05247 | 0.63308 | 0.65178 | 0.61532 | 0.61200 |
| 0.3 | 0.01625 | 0.06830 | 0.63308 | 0.66499 | 0.61752 | 0.61320 |
| 0.4 | 0.01506 | 0.08439 | 0.63308 | 0.67840 | 0.61975 | 0.61442 |
| 0.5 | 0.01412 | 0.10067 | 0.63308 | 0.69200 | 0.62202 | 0.61566 |
| 0.6 | 0.01341 | 0.11712 | 0.63308 | 0.70576 | 0.62431 | 0.61691 |
| 0.7 | 0.01288 | 0.13386 | 0.63308 | 0.71966 | 0.62663 | 0.61817 |
| 0.8 | 0.01253 | 0.15069 | 0.63308 | 0.73370 | 0.62897 | 0.61945 |
| 0.9 | 0.01234 | 0.16767 | 0.63308 | 0.74785 | 0.63133 | 0.62073 |
| 1.0 | 0.01227 | 0.18478 | 0.63308 | 0.76213 | 0.63371 | 0.62203 |

### Table A4.1.2: Simulation Results: Case Two

**Case Two:** \( w = 14, s^H = 11, s^L = 8, b = 6, T = 24, h = 8 \)

| \( q \) | \( \phi \) | \( \delta_{10 \leq q \leq 1} \) | \( \sigma^* \) | \( \sigma_{1}^{\ast} \) \( |_{p=0} \) | \( \sigma_{1}^{\ast} \) \( |_{p=5} \) | \( \sigma_{1}^{\ast} \) \( |_{p=10} \) |
|---|---|---|---|---|---|---|
| 0.0 | 0.04195 | 0.04195 | 0.67634 | 0.68653 | 0.65639 | 0.65365 |
| 0.1 | 0.03519 | 0.05590 | 0.67634 | 0.69856 | 0.65839 | 0.65474 |
| 0.2 | 0.03001 | 0.07141 | 0.67634 | 0.71193 | 0.66062 | 0.65595 |
| 0.3 | 0.02604 | 0.08808 | 0.67634 | 0.72631 | 0.66302 | 0.65726 |
| 0.4 | 0.02303 | 0.10563 | 0.67634 | 0.74144 | 0.66554 | 0.65864 |
| 0.5 | 0.02077 | 0.12386 | 0.67634 | 0.75717 | 0.66816 | 0.66007 |
| 0.6 | 0.01912 | 0.14264 | 0.67634 | 0.77336 | 0.67086 | 0.66154 |
| 0.7 | 0.01796 | 0.16187 | 0.67634 | 0.78994 | 0.67362 | 0.66305 |
| 0.8 | 0.01721 | 0.18146 | 0.67634 | 0.80683 | 0.67644 | 0.66458 |
| 0.9 | 0.01681 | 0.20136 | 0.67634 | 0.82399 | 0.67930 | 0.66614 |
| 1.0 | 0.01668 | 0.22154 | 0.67634 | 0.84139 | 0.68220 | 0.66772 |
The simulation results serve to demonstrate that both \( \phi \) and \( \delta_{\text{lsq}_{qs}} \) are positive and that \( \phi \) is decreasing with respect to \( q \) whilst \( \delta_{\text{lsq}_{qs}} \) is increasing with respect to \( q \). Figure A4.1.2 below which graphs \( \phi \) and \( \delta_{\text{lsq}_{qs}} \) against \( q \) illustrates the nature of these relationships.

The numerical analysis presented in Tables A4.1.1 to A4.1.3 also suggests that in all three cases the reservation sickness level in period one is increasing with respect to the probability of detection and, in some cases, actually exceeds \( \sigma^* \). Figure A4.1.3 below graphs \( \sigma_{1}^* \) against \( q \) in each of the three cases. The horizontal red line included in each figure represents the value of \( \sigma^* \). It is apparent from the set of illustrations that the magnitude of the discount factor, \( \rho \), plays a prominent role in determining whether or not \( \sigma_{1}^* \) exceeds \( \sigma^* \).
Figure A4.1.2: Differences in Expected Utility
Figure A4.1.3: The Implications of \( q \) for the Reservation Sickness Level in Period One
In the context of the single period model, it is apparent that the reservation sickness level is increasing with respect to the probability of detection. Once the time horizon is extended, the results of the simulation experiments demonstrate that as \( q \) increases, the influence of the future implications of current absence decisions rises which, therefore, lowers the probability of current absence behaviour. Moreover, under certain circumstances, the individual’s reservation sickness level in period one lies above \( \sigma^* \), hence there is a range of values of sickness, \([\sigma^*, \sigma^*_1]\), over which the individual is entitled to go absent without fear of dismissal but the level of the threat is such that the individual attends work.

Hence, it becomes apparent that once the time horizon is extended changes in the probability of dismissal have two effects on the reservation sickness level. These effects are illustrated by Equation (A4.1.26) below:

\[
\frac{\partial \sigma^*_1}{\partial q} = \frac{\partial \sigma^*}{\partial q} + \frac{\partial}{\partial q} \left[ \frac{\delta_{u \text{sgs}1}}{(1 + \rho) \tau} \right] > 0 \tag{A4.1.26}
\]

Thus, increases in \( q \) serve to increase \( \sigma^*_1 \) and, hence, make absence less likely. This effect is reinforced since the results from the simulations suggest that \( E[U_2|w_1] - E[U_2|a_1] \) is also increasing with respect to \( q \). Thus, both the level of the dismissal threat and the provision of experience rated sick pay appear to reduce the tendency to absent from the work place. The results accord with \textit{a priori} predictions since both of these influences represent a means of absence control.

### A4.1.3 Concluding Remarks

In this Appendix the effects of two types of absence control techniques on absence decisions have been explored; an experience rated sick pay scheme and the imposition of a dismissal threat. The results obtained are in line with empirical results such as those from Balchin and Wooden (1992) which indicate that a dismissal threat and, indeed, the level of this threat have a significant effect on absenteeism. Clearly the theoretical results obtained from the two period model presented in this Appendix suggest that the nature of absence decisions is a complex result of the interaction between different types of absence control and the individual’s expectations regarding the future implications of current decisions.
A4.2 Appendix Two: The Sickness Distribution: An Empirical Analysis

A4.2.1 The Sickness Distribution

It is apparent from the empirical results presented in Section 4.3 that, in the case of the grade B employees, the estimated coefficients on wages and the difference between sick pay if graded B and sick pay if graded C are relatively large in comparison with those estimated for the grade A workers. This accords with the results of Barmby et al (1991a) who discover that the points boundary between grades B and C exerts a stronger influence on absence behaviour than the points boundary between the A and B grades. In order to investigate the absence behaviour of the individuals who are affected by the B/C boundary more fully, maximum likelihood techniques were used to present an alternative empirical analysis of the theoretical structure of Section 4.2. This analysis aims to utilise the payroll data and the absence histories in order to gather information pertaining to the nature of the sickness distribution across individuals, the objective being to examine the relationship between the parameters of an individual’s sickness distribution and his/her personal characteristics.¹

The absence histories of the workers continuously employed over 1988 form a discrete balanced panel of weekly data where at each point in time an observation reveals whether an individual was absent or not in a particular week. Each observation can be expressed as follows:

\[
d_i = \begin{cases} 
1 & \text{absent} \\
0 & \text{work} 
\end{cases}
\]

where:

\(i = 1, \ldots, N \text{ and } t = 1, \ldots, T\)

where \(i\) represents the individual subscript and \(t\) denotes the time subscript. In terms of the model described in Section 4.2, the probability that \(d_i = 0\) is equal to the probability that \(\sigma_{it} > \sigma_{it}\), i.e. the probability that the reservation sickness level of individual \(i\) in time period \(t\) exceeds the realisation of sickness of individual \(i\) in time period \(t\). This can be expressed formally as:

¹ A similar analysis for A grade workers proved problematic. This is not altogether surprising given that the ratio of earnings to sick pay of such workers may, under certain circumstances, tend to unity.
\[ p(d_{it} = 0) = p(\sigma^*_i > \sigma_{it}) = \int_0^{\sigma^*_i} f(\sigma_{it}) d\sigma_{it} \]  
(A4.2.2)

Likewise, the probability that the realisation of sickness of individual \( i \) in time period \( t \) exceeds the reservation sickness level of individual \( i \) in time period \( t \), i.e. the probability that \( \sigma^*_i < \sigma_{it} \) can be expressed as:

\[ p(d_{it} = 1) = p(\sigma_{it} > \sigma^*_i) = \int_{\sigma^*_i}^{\sigma_{it}} f(\sigma_{it}) d\sigma_{it} \]  
(A4.2.3)

Therefore, the likelihood function for this panel of data takes the following form:

\[ L = \prod_{i=1}^{N} \prod_{t=1}^{T} p(\sigma_{it} > \sigma^*_i)^{d_{it}} \left[ 1 - p(\sigma_{it} > \sigma^*_i) \right]^{1-d_{it}} \]  
(A4.2.4)

In order to evaluate such a likelihood function the value of the reservation sickness level for each individual at each point in time is required. From Equations (4.9) and (4.10) it is apparent that \( \sigma^*_i \) is a function of \( w, h, s^H \) and \( s^L \). Therefore the reservation sickness level, \( \sigma^*_i \), can be calculated for each grade B and grade C worker at each point in time using the data contained in the payroll.

In addition, a functional form for \( f(\sigma_{it}) \) must be specified in order to calculate the probability of attendance or absence associated with a given level of \( \sigma^*_i \). The index of sickness, \( \sigma^* \), is assumed to be a random variable characterised by the beta distribution, \( B(a,b) \). The beta distribution describes a family of probability density functions of continuous random variables defined over the range 0 to 1 with a density function given by:

\[ f(\sigma_{it}) = \frac{1}{B(a,b)} \sigma_{it}^{a-1} (1 - \sigma_{it})^{b-1} \]

where:

\[ B(a,b) = \int_0^1 \sigma_{it}^{a-1} (1 - \sigma_{it})^{b-1} d\sigma \]  
(A4.2.5)

and:

\[ a > 0, b > 0 \]

The following graphs illustrate how the values of the parameters \( a \) and \( b \) determine the nature of the probability density function.2

2 If \( a \) and \( b \) equal to one, the beta distribution reduces to the uniform distribution.
Figure A4.2.1(a): Probability Density Functions of the Beta Distribution

Figure A4.2.1(b): Cumulative Distribution Functions of the Beta Distribution

Figure A4.2.1(a) illustrates examples of beta density functions for specific values of the shape parameters $a$ and $b$ and Figure A4.2.1(b) shows the respective cumulative distribution functions. It is apparent from the above diagram that use of the beta distribution implies a rich range of probability distributions with the direction and degree of skewness of the density function determined by the relative values of $a$ and $b$.

The objective of this Appendix is to maximise the likelihood function with respect to $a$ and $b$ for each individual in order to estimate the values of the parameters of $a$ and $b$ which maximise each individual’s likelihood function which is in turn derived from the individual’s absence history for 1988 whilst the

---

3 The beta density functions and the cumulative distribution functions were plotted using Mathematica Version 2.04.
reservation sickness level at each point in time is calculated from payroll data. In order to maximise the likelihood function it is necessary to evaluate \( p(\sigma_i > \sigma_i^*) \) or \( p(\sigma_i < \sigma_i^*) \) depending on whether the individual absents or attends at each point in time. The likelihood function for each individual’s event history can be reduced to:

\[
L_i = \prod_{t=1}^{T} p(\sigma_i > \sigma_i^*)^d_i [1 - p(\sigma_i > \sigma_i^*)]^{1-d_i}
\]

where \( T \) is equal to 52, i.e. representing the 52 weeks in 1988.

A FORTRAN program was constructed and then compiled which evaluates the integrals represented by Equations A4.2.2 and A4.2.3 and maximises Equation (A4.2.6) with respect to \( a \) and \( b \) using NAG library subroutines. A full listing of the program is presented in Section A4.2.2 below. The program invokes a Quasi-Newton algorithm in order to maximise the likelihood function described by Equation (A4.2.6). This algorithm approximates the Hessian matrix of second order partial derivatives by a matrix which is updated at each iteration with information found with respect to the curvature of the objective function [see the NAG FORTRAN Manual (1990) for further details].

Quasi-Newton methods of optimisation can be based on the analysis of either first order or second order derivatives. Methods based on first derivatives only may be particularly useful in situations where it is difficult or even impossible to calculate the second derivatives of a given function. Given the complex nature of the likelihood function specified in Equation (A4.2.6), a Quasi-Newton method based on first derivatives only was used to maximise the likelihood function. The Quasi-Newton methods based on first derivatives basically entail approximating the Hessian matrix by analysing finite differences of the gradient function. All curvature information is computed at a single point - so the selection of the finite difference interval is a much debated area. Quasi-Newton methods which are based on first derivatives only basically build up information regarding the curvature of the function with iterations of a ‘descent’

---

4 The parameters \( a \) and \( b \) are assumed to lie in the range \([0.5E-8, 50]\). The chosen upper limit is in accordance with that set by Pearson and Johnson (1968), who calculate tables of probability integrals for the incomplete and complete beta function for values of \( a \) and \( b \) between 1 and 50. Pearson and Johnson (1968) remark that, ‘... as \( a \) and \( b \) approach 50, the standard deviation of the curve of the incomplete beta is about 1/20th of the range and 99.9% of the curve’s area falls on less than 1/3 of the range.’

5 Since the probability of a particular individual’s event history occurring is maximised, the individual subscript can be omitted.

6 Specifically, routines E04HBF, E04JBF, E04JBO and G01BDF.
method in order to accumulate observed information on the function and its gradient. Quasi-Newton methods, therefore, approximate the curvature of non-linear functions without explicitly constructing the Hessian matrix.

The gradient function derived from the first derivative is given by $g(.)$, the gradient function at point $x_k$ is, therefore, given by:

$$ g(x_k) $$ (A4.2.7)

Assume that $s_k$ represents a small step away from point $x_k$, the gradient function, therefore, becomes:

$$ g(x_k + s_k) $$ (A4.2.8)

Thus, the difference between the gradient at the two points weighted by the movement away from $x_k$ yields information on the curvature of the function between the specified interval:

$$ [g(x_k + s_k) - g(x_k)]s_k $$ (A4.2.9)

Moreover, the above information can be derived using information on first derivatives only. Each iteration of the optimisation program yields such information.

At the start of the $k^{th}$ iteration, a matrix $B_k$ which approximates the Hessian matrix is constructed which contains the curvature information which has been already accumulated from iterations 1 to $k - 1$. After point $x_{k+1}$ is determined, $B_k$ is updated in order to produce $B_{k+1}$ where:

$$ B_{k+1} = B_k + U_k $$ (A4.2.10)

where $U_k$ represents the update matrix. Let $s_k$ denote a small change in $x$ during the $k^{th}$ iteration:

$$ s_k = x_{k+1} - x_k $$ (A4.2.11)

and let $y_k$ denote the change in the gradient function:

$$ y_k = g(x_{k+1}) - g(x_k) $$ (A4.2.12)
The updated Hessian approximation matrix should satisfy the condition that:

\[ B_{k+1}s_k = y_k \quad \text{(A4.2.13)} \]

i.e. the approximation to the Hessian matrix weighted by the movement away from \( x_k \) must equal the change in the gradient, this is known as the Quasi-Newton condition. The iterations continue until there is global convergence at a stationary point [see Gill et al. (1981) for further details of Newton methods of optimisation].

The Quasi-Newton algorithm which is operationalised by the NAG subroutine E04JBF was devised by Gill and Murray (1972). This particular routine is also used by Davies (1993) in an analysis of the residential mobility of owner occupiers who remarks that:

... (he) has found it to be robust, and, with no derivatives required, easy to operationalise for maximum likelihood calibration of non standard models. [Davies (1993), p. 149].

which clearly endorses the practical applications of this particular NAG subroutine.

The resulting values of the parameters \( a \) and \( b \), therefore, indicate the nature of the probability function of the index of sickness, \( \sigma_i \), which maximises the likelihood of the occurrence of the observed absence history of each employee. Thus, the implementation of the maximisation program enabled the construction of a data set containing the values of \( a \) and \( b \) which maximise the likelihood of each observed absence history occurring.

It is apparent that the nature of the distribution of sickness is likely to be influenced by personal characteristics such as age and sex. As \( a \) increases relative to the value of \( b \), for example, the distribution of sickness is skewed towards higher levels of sickness. One may expect that as age increases the distribution of sickness would be skewed towards higher levels. This relation can be expressed formally as writing parameters \( a \) and \( b \) as functions of personal characteristics such as age, i.e. \( a = h[\alpha + \beta(\text{age})] \) and \( b = h[\alpha + \beta(\text{age})] \). Figure A4.2.2 below plots the probability density function for a distribution with parameter \( a \) equal to 2.9 (the average value of \( a \) for employees above the age of 55 years) and parameter \( b \) equal to 5 (the average value of \( b \) for employees above the age of 55 years). As a benchmark for comparison, the probability density function for a distribution with parameter \( a \) equal to 2.23 (the average value of \( a \) for employees below the age of 21 years) and parameter \( b \) equal to 8 (the average value of \( b \) for employees below the age of 21 years) is also plotted.
It is apparent from the above plots, that the nature of the density function appears to be skewed towards higher levels of the sickness parameters as the age of employees rises. Similarly, one can compare the nature of the probability density function between male and female employees. Figure A4.2.3 below plots the probability density function for a distribution with parameter $a$ equal to 2.1 (the average value of $a$ for female employees) and parameter $b$ equal to 7.6 (the average value of $b$ for female employees). The probability density function for a distribution with parameter $a$ equal to 2.4 (the average value of $a$ for male employees) and parameter $b$ equal to 7 (the average value of $b$ for male employees) is also plotted.
Although, the difference between the density function is not as pronounced as the differences in the density function across age, the plots suggest that the sickness index of females is skewed towards lower levels than that of their male counterparts.

Clearly, considering the nature of average values of $a$ and $b$ suppresses a great deal of information pertaining to the values of the parameters across individuals. In order to examine such considerations more fully, the values of $a$ and $b$ which maximise the likelihood function for each individual were regressed on a set of observed personal characteristics of the employees using standard OLS techniques since the magnitude of the estimated Breusch-Pagan statistic did not suggest the presence of heteroskedasticity. In addition, since a relatively small amount of information relating to the personal characteristics is available, Ramsey Reset tests to check for model mis-specification were carried out by running three additional regressions of the dependent variable on the independent variables and on the powers two, three and four of the predicted dependent variable, the estimated test statistics were $0.09569$ (1, 888 df.), $0.70024$ (2, 887 df.) and $1.7824$ (3, 886 df.) respectively for the case where the dependent variable is $a$. The estimated test statistics when the dependent variable is $b$ were $0.14189$, $0.15186$ and $0.12368$. Thus, the magnitudes of the test statistics point towards no model mis-specification in both of the regression equations presented.

The results presented in Table A4.2.1(a) indicate that there is a positive relationship between the parameter $a$ and age, i.e. the higher is an employee’s age, the more skewed is the distribution of sickness towards higher levels which conforms with a priori expectations. This evidence is re-enforced by the results presented in Table A4.2.1(b) which imply a negative association between age and the parameter $b$. The lower is the magnitude of $b$ relative to that of $a$, the greater is the extent to which the distribution is skewed towards higher levels of $\sigma$.

In Table A4.2.1(b), the coefficient on the female dummy variable is positive suggesting that female employees are characterised by a distribution of sickness which is skewed towards relatively low levels. The results from the medical statistics literature [Studies include Pines et al (1985), Ryan (1981), Jenkins (1985), Broadhead et al (1990) and Parker et al (1987)], which is mainly concerned with the empirical analysis of health statistics as opposed to theoretical analysis, are broadly in line with the evidence from the economic literature, i.e. that married females with young children exhibit a high degree of sickness absence. Such evidence seems to conflict with that presented in Table A4.2.1(b) and Figure A4.2.3.
### Table A4.2.1(a): Dependent Variable = a

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Estimated Coefficient</th>
<th>T-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.119199</td>
<td>3.166***</td>
</tr>
<tr>
<td>Female</td>
<td>-0.552158</td>
<td>-0.769</td>
</tr>
<tr>
<td>Married</td>
<td>0.574032</td>
<td>0.594</td>
</tr>
<tr>
<td>Female*married</td>
<td>-2.564850</td>
<td>-0.813</td>
</tr>
<tr>
<td>Constant</td>
<td>8.222168</td>
<td>4.611***</td>
</tr>
<tr>
<td>F-Statistic</td>
<td></td>
<td>3.500260***</td>
</tr>
<tr>
<td>(4, 889 df.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breusch-Pagan Test</td>
<td></td>
<td>8.145</td>
</tr>
<tr>
<td>(4 df.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R²</td>
<td></td>
<td>0.0184</td>
</tr>
</tbody>
</table>

Number of Observations = 894

### Table A4.2.1(b): Dependent Variable = b

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Estimated Coefficient</th>
<th>T-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.027087</td>
<td>-2.502**</td>
</tr>
<tr>
<td>Female</td>
<td>0.536086</td>
<td>2.597***</td>
</tr>
<tr>
<td>Married</td>
<td>0.504926</td>
<td>1.818*</td>
</tr>
<tr>
<td>Female*married</td>
<td>-0.126880</td>
<td>-1.398</td>
</tr>
<tr>
<td>Constant</td>
<td>4.061856</td>
<td>7.922***</td>
</tr>
<tr>
<td>F-Statistic</td>
<td></td>
<td>5.77160***</td>
</tr>
<tr>
<td>(4, 889 df.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breusch-Pagan Test</td>
<td></td>
<td>9.612</td>
</tr>
<tr>
<td>(4 df.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R²</td>
<td></td>
<td>0.0181</td>
</tr>
</tbody>
</table>

Number of Observations = 894

---

7 Average age of employee in 1988.
The traditional indices of sickness used in the medical statistics literature, however, are the percentage of time lost and average episodes of absence per person. Such data is, therefore, analysed at an aggregate level and, as a result, a significant amount of information is left unexplored. McKeown (1989) and McKeown and Furness (1987) argue that such indices do not provide information on the type of absence, i.e. long or short-term absence, and how such absence is distributed across employees. McKeown and Furness discover that males take fewer episodes of absence than females who in turn exhibit shorter but more frequent absence, which is in accordance with the results of Table A4.2.1(b). Barmby et al (1991a), on the other hand, discover that married and female employees take longer absences. It is apparent, however, that one is observing absence behaviour as opposed to sickness behaviour, i.e. observed absence does not necessarily imply sickness.

In Table A4.2.1(b), the coefficient on the married dummy variable is positive suggesting a negative association between marriage and the level of sickness. Nathenson (1975, 1977) who surveys the relationship between illness and personal characteristics discovers that, in general, empirical evidence from household surveys has shown that married individuals are less prone to illness than single individuals. Hence, the results of Table A4.2.1(b) are consistent with Nathenson’s findings.

To summarise, maximum likelihood techniques were used to determine the characteristics of the distribution of sickness for a sub-sample of the individuals whose absence rates were analysed in Section 4.3 using information held in the company’s payroll and absence records. Moreover, the relationship between the nature of the distribution of sickness and personal characteristics were broadly in line with the findings of the medical statistics literature.

A4.2.2 The Maximisation Program

```
PROGRAM MAIN
  c Maximum Likelihood program which uses E04JBF in order to determine the
c values of the parameters of the beta distribution which maximise the
c likelihood function formed by the weekly absence histories of the employees.
  Integer N, LH, LIW, LW	parameter (N=2, LH=N*(N-1)/2, LIW=2, LW=9*N)
  Integer NOUT
  Parameter (NOUT=6)
  Real*8 BIG, ETA, F, FEST, SMALL, STEPMX, XTOL, PROB
  Integer IBOUND, IFAIL, INTYPE, IPRINT, J, MAXCAL
  Logical LOCSCH
  Real*8 BL(N), BU(N), DELTA(N), G(N), HESD(N), HESL(LH)
  Real*8 W(LW), X(N)
  Integer ISTATE(N), IW(LIW)
```
Call E04HBF at the starting point to find suitable differencing intervals.

\[ \begin{align*}
X(1) &= 6.50d0 \\
X(2) &= 6.50d0 \\
IFAIL &= 0 \\
HESD(1) &= 0d0 \\
HESD(2) &= 0d0 \\
HESL(1) &= 0d0
\end{align*} \]

call E04HBF(N, FUNCT, X, J, DELTA, HESL, LH, HESD, F, G, IW

\* , LIW, W, LW, IFAIL)

**write(NOUT, *), ‘E04JBF PROGRAM RESULTS’**

**write(NOUT, *) ‘function evaluations were needed by E04HBF’**

**write(NOUT, 99999) J, ‘function evaluations were needed by E04HBF’**

**write(NOUT, *) ‘function evaluations were needed by E04HBF’**

**write(NOUT, 99998) (HESD(J), J=1, N)**

**write(NOUT, 99997) ‘error exit type’, IFAIL. ‘-see routine document’**

**write(NOUT, 99996) ‘function value on exit is’, F**

**write(NOUT, 99996) ‘at the point’, (X(J), J=1, N)**

**write(NOUT, 99996) ‘at the point’, (X(J), J=1, N)**

**write(NOUT, 99996) ‘at the point’, (X(J), J=1, N)**

**write(NOUT, 99996) ‘at the point’, (X(J), J=1, N)**
write(NOUT, 99995) 'where ISTATE contains', ', '
write(NOUT, *) TESL contains'
write(NOUT, 99994) (HESL(J), J=I, LH)
write(NOUT, 99993) 'and HESD contains', (HESD(J), J= 1, N)
end if
end if
end if
stop
99999 format(x, i3, x, a)
99998 format(x, p, 4e15.4)
99997 format(x, a, i3, a)
99996 format(x, a, 4f12.4)
99995 format(x, a, a)
99994 format(x, p, 6e20.40)
99993 format(x, a, p, 6e20.4)
end subroutine

subroutine FUNCT(IFLAG, N, XC, FC, GC, IW, LIW, W, LW)
c Subroutine to evaluate the objective (likelihood) function
Real*8 FC
Integer IFLAG, LIW, LW, N
Real*8 GCN(N), W(LW), XC(N)
Real*8 prod1, prod2, bprod, PROB, EUA, EUW, EXA, EXW
Real*8 PROBA, PROBW, w(49), s(49), h(49), da(49), dw(49)
Integer IW(LIW)
Real*8 A, B, d(49), work, absent
Integer iabs(49), empno(49), weekno(49)
c PROB(A, B) corresponds to the evaluation of the following;
\[
\frac{1}{B(a, b)} \int_0^1 (1 - \sigma_i)^{b-1} (\sigma_i)^{a-1} d\sigma_i
\]
c where PROB(A, B)=work(A,B). Likewise absent(A, B) corresponds to,
\[
\frac{1}{B(a, b)} \int_0^1 (1 - \sigma_i)^{b-1} (\sigma_i)^{a-1} d\sigma_i
\]
c work(A, B)=PROB
absent(A, B)=1-PROB
if (IFLAG.ne.3) then
open (2, file='name of data file', status='old')
do 25 k=1, 49
read(2, *, end= 100) empno(k), weekno(k), da(k),
* dw(k), w(k), s(k), h(k), iabs(k)
c N.B. dw equals $\sigma^{w_1}$ and da equals $\sigma^{d_1}$.
A=XC(1)
B=XC(2)
call INTEGRATEA(A, B, PROB, da, k, G01BDF)
PROBA=PROB
call INTEGRATEW(A, B, PROB, dw, k, G01BDF)
PROBW=PROB
A=A+1
call INTEGRATEAA(A, B, PROB, da, k, G01BDF)
EXA=PROB
call INTEGRATEWW(A, B, PROB, dw, k, G01BDF)
EXB=PROB
A=XC(1)
c EUW equals the expected utility function in period two if the employee
c attends in period one and EUA equals the expected utility function if the
c employee is absent in period one.
EUW = PROBW*((I-EXW)*w(k)+EXW*(24-h(k)))+
* (1-PROBW)*((I-EXW))*s(k)+(I-EXW)*24)
EU = EUW - EUA
\[\frac{d}{w(k)-s(k)+EU/(w(k)-s(k)+h(k))}
\]
call INTEGRATE(A, B, PROB, d, k, G01BDF)
if ((iabs(k).eq.0).and.(k.eq.1)) then
  prodl=work(A, B)
else if ((iabs(k).eq.1).and.(k.eq.1)) then
  prodl=absent(A, B)
else if ((iabs(k).eq.2).and.(k.eq.1)) then
  prodl=1
end if
if ((iabs(k).eq.0).and.(k.gt.1)) then
  prod2=work(A, B)
bprod=prod1*prod2
  prod1=bprod
else if ((iabs(k).eq.1).and.(k.gt.1)) then
  prod2=absent(A, B)
bprod=prod1*prod2
  prod1=bprod
end if
25 continue
FC = (-I)*bprod
end if
rewind(2)
100 print*, 'end of file'
return
end subroutine MONIT(N, XC, FC, GC, ISTATE, GPJNRM, COND,
* POSDEF, NITER, NF, LIW, W, LW)
c monitoring routine
Parameter (NOUT=6)
Real*8 COND, FC, GPJNRM
Integer LIW, LW, N, NF, NITER
LOGICAL POSDEF
Real*8 GC(N), W(LW), XC(N)
Integer ISTATE(N), IW(LIW)
Integer ISJ, J

write (NOUT, *'Itn fn evals fn value norm of proj gradient'
write (NOUT, 99999) NITER, NF, FC, GPJNRM
write (NOUT, *'J X(J) G(J) status'
do 20 J=1, N
  ISJ=ISTATE(J)
if (ISJ.gt.0) then
  write (NOUT, 99998) J, XC(J), GC(J), 'Free'
else if (ISJ.eq.-1) then
  write (NOUT, 99998) J, XC(J), GC(J), 'Upper bound'
else if (ISJ.eq.-2) then
  write(NOUT, 99998) J, XC(J), GC(J), 'Constant'
end if
20 continue
if(COND.ne.0.0e0) then
if(COND.gt.1.0e6) then
write (NOUT,*)
* 'estimated condition number of projected hessian is more than 1.0E+6'
else
write (NOUT, 99997)
* 'estimated condition number of projected hessian=', COND
157
end if
if (.NOT. POSDEF) then
  c The following statement is included so that this MONIT can be used
  c in conjunction with any of the routines E04JBF, E04KDF, E04LBF
  write (NOUT, *)
  ' projected hessian matrix is not positive definite'
end if
return
end if

99999 format(x, i3, 6x, i5, 2(6x, p, e20.4))
99998 format(x, i2, x, p, 2e20.4, a)
99997 format(x, a, p, e10.2)
end

subroutine INTEGRATE(A, B, PROB, d, k)
  c This subroutine evaluates the probability $p\left(\sigma_i > \sigma_i\right)$ using the beta
distribution.
  Real*8  A, B, PROB, X, d(49)
  Integer  IFAIL
  Real*8  G01BDF
  external  G01BDF
  IFAIL=0
  X=d(k)
  PROB=G01BDF(X, A, B, IFAIL)
  return
end

subroutine INTEGRATEA(A, B, PROB, da, k)
  c This subroutine evaluates the probability $p\left(\sigma_i > \sigma_i\right)$ using the beta
distribution in order to evaluate the expected utility function if the
c individual goes absent in period one.
  Real*8  A, B, PROB, X, da(49)
  Integer  IFAIL
  Real*8  G01BDF
  external  G01BDF
  IFAIL=0
  X=da(k)
  PROB=G01BDF(X, A, B, IFAIL)
  return
end

subroutine INTEGRATEW(A, B, PROB, dw, k)
  c This subroutine evaluates the probability $p\left(\sigma_i > \sigma_i\right)$ using the beta
distribution in order to evaluate the expected utility function if the
c individual attends in period one.
  Real*8  A, B, PROB, X, dw(49)
  Integer  IFAIL
  Real*8  G01BDF
  external  G01BDF
  IFAIL=0
  X=dw(k)
  PROB=G01BDF(X, A, B, IFAIL)
  return
end
Chapter 5: Overtime and Absenteeism

5.1 Introduction

In general, studies have employed cross-section data in order to analyse the empirical implications of absence decisions within the context of neo-classical labour supply theory [see, for example, Allen (1981a), Dunn and Youngblood (1986) and Drago and Wooden (1992)]. The aim of this Chapter is to explore the determinants of observed absence behaviour within an extended theoretical framework. In general, absence decisions have been modelled within a static theoretical framework which clearly suppresses any dynamic considerations. The extensions introduced in this Chapter modify the static model of absence by expanding the time horizon of the decision-making process in order to highlight the inter-temporal link which may be relevant as individuals make daily absence decisions. Furthermore, empirical analysis is conducted by exploring a panel of daily data. Clearly, the analysis of such data is advantageous given the benefits of the union of cross-section and time series considerations.

In addition, emphasis is placed on the implications of a specific absence penalty system for the absence decision making process within a multi-time period model. This absence penalty system makes the provision of overtime working conditional on past absence behaviour. A worker with an ‘unacceptable’ absence history is effectively banned from working any overtime for a specified time period. The penalty system, therefore, is similar to that analysed in Chapter 4 where the level of sick pay is conditional on past absence behaviour. Thus, both absence penalty schemes emphasise the temporal link between past, present and future absence decisions. Furthermore, the experience rated sick pay scheme analysed in Chapter 4 operates by making sick pay entitlements more generous if an individual displays a ‘satisfactory’ attendance record. As outlined in Chapter 4, it is difficult to justify the provision of sick pay which is in excess of the statutory minimum - a necessary feature of an effective experience rated sick pay scheme. In contrast, the absence control mechanism explored in this Chapter does not rely on such an arrangement but focuses, rather, on the income earned from attendance.

The empirical analysis set out in Sections 5.4 and 5.5 explores a set of discrete panel data which consists of work histories derived from daily attendance records for a sample of individuals employed by the British manufacturing firm.
which operates the overtime ban absence control mechanism. Given that individuals make attendance decisions on a day-by-day basis it is clear that such a micro data set is an appropriate starting point. Moreover, the analysis of such absence records explicitly introduces a time dimension into the absence decision-making process which has not attracted much attention in the literature.

It is reassuring to discover that the results are in accordance with those of other studies. In general, the analysis of this panel of daily data confirms that absence behaviour is primarily affected by contractual characteristics such as the prevailing wage rate and the penalty system operated by the firm. Moreover, the penalty system appears to be effective in exerting a moderating influence on absence behaviour and, furthermore, the empirical findings suggest ways in which the effectiveness of the system could be further enhanced.

The remainder of this Chapter is set out as follows: Section 5.2 motivates the study by highlighting some background issues pertaining to the economics of absence and overtime. Section 5.3 extends the conventional labour supply theory in order to place absenteeism into the realm of multi-period analysis. Section 5.4 describes the data set and methodology which is used to analyse the dynamic nature of absence decisions. Section 5.5 discusses the empirical findings and Section 5.6 concludes the Chapter and highlights avenues for further research.

5.2 Absenteeism and Overtime

The analysis of overtime working is central to both labour supply and labour demand issues. The provision of overtime leads to alterations in the length of the working day and, as such, has implications for the labour supply and, therefore, the work attendance decision of the individual. On the other hand, the provision of overtime working is clearly a consequence of the firm's demand for labour at a given point in time. Despite the central role played by overtime provisions in labour demand and labour supply analysis, such considerations do not play a prominent part in the economic literature on absence behaviour.

One issue which has attracted some attention in the economic literature centres on the belief that a high level of overtime working raises unemployment [see, for example, Leslie and Wise (1980)]. One reason why firms may be reluctant to employ additional workers may concern the implications of human capital investment for the degree of worker utilisation [Hart and Ruffell (1993)].

2 The results, therefore, unlike those of Allen (1981a), are firm and site specific but are advantageous in the respect that they are derived from daily panel data.

3 This is despite the relatively early contribution made by Johns and Nicholson (1982) who argue that an adequate model of absence should address dynamic considerations, '[... absence is temporal behaviour and continually subject to dynamic change.]' [Johns and Nicholson (1982), p. 136].
Furthermore, Hart (1987) remarks that a situation of high unemployment with some sectors of the economy being characterised by high levels of overtime may be regarded as politically and socially unacceptable. Hence, it is not surprising that attention has been paid to policies which may be introduced to alleviate such problems. Calmfors and Hoel (1988), for example, explore the proposal that a reduction in standard working time through 'work-sharing' represents one potential way of increasing employment.

Evidence from the New Earnings Surveys shows how average overtime hours across individuals have been increasing over the 1980's, this evidence is summarised in Table 5.1 below which confirms that overtime working is an important phenomenon in the British economy.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1981</td>
<td>4.0</td>
<td>0.7</td>
<td>1.1</td>
<td>0.3</td>
</tr>
<tr>
<td>1984</td>
<td>5.0</td>
<td>1.3</td>
<td>1.6</td>
<td>0.5</td>
</tr>
<tr>
<td>1988</td>
<td>6.1</td>
<td>2.0</td>
<td>1.6</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Figure 5.1 below, which depicts the amount of overtime hours worked in the British manufacturing industry over the period 1972 to 1992, confirms the significance of overtime working to the British manufacturing sector. Further evidence pertaining to the importance of overtime working is highlighted by Milner (1993) who presents evidence suggesting that trade unions have exploited the dependence of British firms on overtime working by channelling dissatisfaction through a particular form of industrial action, 'the overtime ban' defined as a restriction on working time through the collective refusal to work overtime. Milner, who analyses the CBI Data Bank for the period 1979 to 1989, demonstrates that in every year of this firm level survey, the frequency of overtime bans exceeds that of strikes.

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4 British production industries are defined as the energy, water supply, manufacturing and construction industries.
Since the influence of overtime working on absence behaviour plays a key role in the analysis presented in this Chapter, it is useful to re-iterate the hypotheses of economists concerning the relationship between overtime hours and absence which were discussed in detail in Section 2.3.3.2, Chapter 2. The implications of overtime working for absence behaviour have attracted some attention in the literature [see, for example, Chaudhury and Ng (1992), Kenyon and Dawkins (1989) and Leslie (1982)].

Absenteeism in the context of labour supply analysis arises due to the imposition of an hours constraint. Such considerations imply that enhanced flexibility may reduce an employee’s demand for absence since absenteeism constitutes a means to counteract inflexible work schedules. In this vein, overtime systems have been proposed as a way of counteracting absenteeism. Leslie (1982), for example, argues that high overtime working should imply low rates of absenteeism since an employer may offer overtime premia for hours worked in excess of contractual hours in order to induce individuals to supply more labour. Such measures lead to non-convexity in the budget constraint which may cause workers to obtain increased utility by working overtime (as depicted in Figure 2.7, Chapter 2).

Chaudhury and Ng (1992), on the other hand, argue that overtime may be associated with increased absence since it may actually lead to less flexible working arrangements and longer working days. In addition, the income effect associated
with overtime may inflate the tendency to absent from the work place. It is apparent, therefore, that there are two potentially conflicting effects on absence behaviour resulting from any changes in overtime provisions [Kenyon and Dawkins (1989)]. The income effect coupled with the assumption of diminishing marginal utility implies a positive relationship between overtime hours and absence. If overtime hours earn a premium, however, then this creates an incentive to reduce absence.

Clearly there is some debate in the economics literature regarding the effect of overtime on absence behaviour. Dalton and Mesch (1992) highlight the essence of the paradox which exists if a firm provides overtime to attenders in order to compensate for absentees:

Employees working additional overtime hours may be able to 'afford' absence. [Dalton and Mesch (1992), p. 292].

Such an effect may lead to another group of workers working overtime and so on. This tendency has been called the 'snowball effect'. Similarly, Johns and Nicholson (1982) cite evidence from Gowler (1969) and Martin (1971) which suggests that workers may substitute readily available 'lucrative' overtime work for standard work hours and, therefore, exhibit more absence during the standard contractual hours. Furthermore, Ehrenberg and Schumann (1982) and Trejo (1991, 1993) find that union workers in the US are more likely than non-union workers to receive premium pay for overtime. Trejo (1993), for example, finds that:

... after controlling for individual characteristics including industry and occupation, unionization raises the probability of receiving premium pay for overtime by 8 percentage points. [Trejo (1993), p. 276].

Such evidence suggests that the potential 'snowball' effect may be greater in unionised firms which may give unions, under some circumstances, an incentive to enforce absence control mechanisms. As pointed out in Section 2.3.3.3, Chapter 2, empirical evidence has indicated that unionisation is generally associated with increased absenteeism. In this vein, Allen (1981a) points out that some unions may implement their own disciplinary measures to curb persistent absenteeism given that the majority of workers attend on a regular basis. Similarly, the historical evidence of Turnbull and Sapsford (1992) describes how one set of workers viewed absence as a job characteristic [see Section 2.3.3.4, Chapter 2] except in the case where the gang itself refused to cover for an absentee if the individual in question had exceeded the 'absence norm' of the group. Chaudhury and Ng (1992) acknowledge that unions may implement disciplinary measures, but argue that:

... although lower absenteeism may result, such effects are not likely to dominate: if union-imposed penalties are greater, workers will have less
It is apparent, however, that since the majority of workers do not engage in excessively high levels of absenteeism, it is unlikely that the main body of the workforce will have such an incentive to leave the trade union.

The penalty system analysed in this Chapter introduces an interesting interaction between absenteeism and overtime working. The absence penalty system is based upon an actual scheme implemented by the firm which forms the basis of the empirical analysis of Sections 5.4 and 5.5. The scheme is particularly interesting in that it has emerged as the product of an implicit agreement between the personnel managers and the trade union with both parties co-operating in the enforcement of the absence control scheme.

Furthermore, the temporal nature of absence decisions becomes apparent when one considers the potential penalties which absence behaviour may attract. Allen (1981a), for example, extends the income-leisure model by incorporating the assumption that, in addition to lost earnings, the absentee suffers a lump sum penalty to cover the firm's losses from his/her absence. The penalty is assumed to be reflected in a decreased chance of promotion and/or an increased probability of being fired. Similarly, Kenyon and Dawkins (1989) include such a penalty function in their analysis and proxy the penalty function with a variable which represents the percentage change in employment, their hypothesis being that the higher are lay-offs the more 'threatened' employees will feel and the greater the perceived penalty associated with any absence behaviour.

It is apparent that these types of penalty functions may have important dynamic implications; current absence behaviour, for example, may lead to unemployment in a future time period. Researchers have, however, consistently incorporated such considerations into static theoretical models by assuming that absence exerts a negative influence on current income only. Such an approach does not allow for a penalty structure whereby current absence attracts a penalty such that costs are carried over to some future time period.

Moreover, the type of penalties hypothesised by Allen (1981a) and Kenyon and Dawkins (1989) are specified in rather vague terms. In contrast, the firm from which the data analysed in Sections 5.4 and 5.5 has been collected administers a very specific penalty system which is related to the provision of overtime working.

5 Such losses may arise because since the firm has to take costly measures to fill the gap created by the absentee, i.e. the output of the firm may be reduced if a replacement worker cannot be found or if a replacement is found he/she will in general be less efficient at performing the task. In addition, the fixed costs of employment will raise the cost to the firm of employing substitute workers.
in the firm and, hence, provides an interesting interaction between the absence penalty system and the incidence of overtime hours.

5.3 Theoretical Considerations

The theoretical framework outlined in this Section is based on Allen (1981a) and Kenyon and Dawkins (1989), both of which analyse absence within the framework of the static neo-classical labour supply model outlined in Section 2.2, Chapter 2. The potential for absenteeism within this theoretical framework emerges when individuals are obliged to supply a certain amount of labour within a given time period. Such constraints are common since employers are unlikely to be indifferent as to how much labour individuals supply.

If we accept the basic premise that observed absence rates are the outcome of the absence decision-making process which is modelled within the income-leisure framework, we are faced with the problem that individuals will, in general, make their attendance decision on a day-by-day basis. Hence, in order to analyse this daily decision, the analysis of daily absence records is preferable to the analysis of workers' absence rates over a given time period. This issue is discussed more fully in Sections 5.4 and 5.5.

Once absence is set in a daily context it would seem particularly appropriate to analyse absence as an all-or-nothing decision taken by an individual worker, i.e. on a given day the individual either attends or absents. The standard model of absence behaviour can be modified to incorporate this all-or-nothing choice by assuming that the individual’s utility function is a function of consumption, $x$, leisure, $l$ and sickness, $\sigma$:

$$U = U(x, l, \sigma)$$ (5.1)

where $\sigma$ represents a stochastic parameter which determines the value of the individual's marginal rate of substitution between income and leisure. This parameter is exogenously determined each period and its inclusion formally allows for the observation made by Allen (1981a) that an individual's opportunity cost of working may vary over time as alternatives to work arise. Assuming that absence is a discrete concept, the individual either attends on a particular day and receives the following level of utility:

$$u = u(wh^e, T - h^e, \sigma) = u^w(\sigma)$$ (5.2)

or, alternatively, absents and receives:
\[ u(S, T, \sigma) = u^A(\sigma) \]  \hspace{1cm} (5.3)

where \( w \) represents the wage rate, \( T \) represents the individual's stock of time, \( h^c \) represents contractual hours, and \( S = sT \) represents total sick-pay remuneration since \( s \) denotes the sick pay rate. A pivotal level of \( \sigma, \sigma^* \), exists such that:

\[ u^w(\sigma^*) = u(wh^c, T - h^c, \sigma^*) = u(S, T, \sigma^*) = u^A(\sigma^*) \]  \hspace{1cm} (5.4)

i.e. \( \sigma^* \), the reservation sickness level, ensures that the utility from attendance equals the utility from absence. Hence, this pivotal level of the marginal rate of substitution between consumption and leisure can be used to derive the following daily absence decision-making rule: absent from work if \( \sigma > \sigma^* \) and attend otherwise.\(^6\)

Due to the existence of readily available overtime in the firm, where the absence histories analysed in Sections 5.4 and 5.5 were collected, problems were encountered as employees were aware that overtime would be offered within the near future. Hence, they could choose to absent themselves in the knowledge that the loss of earnings from absence could be offset in the future by working fewer overtime hours at enhanced overtime rates. In order to curb such an incentive, the firm introduced an absence penalty system which took the form of a ban on overtime working. More specifically, there is an implicit agreement in the firm between the personnel managers and the trade union that if an individual takes two unauthorised absences (i.e. absences which are not medically certified) within a five week period, then the individual will not be given any opportunity to work overtime for the next four weeks. The threatened overtime ban is, therefore, assumed to curb excessive levels of absence.

For ease of analytical exposition, this penalty system is scaled down by assuming that one day of absence implies a two day overtime ban, thereby making the inter-temporal link which exists between absence decisions apparent within a simplified theoretical framework. A three period framework is adopted such that in time period 1, employees do not work any overtime. The pivotal value of the marginal rate of substitution in period 1, which is used to make the period 1 attendance decision, is defined implicitly by the condition that utility from attendance in period 1 plus expected utility in periods 2 and 3 conditional on

\( \sigma^* \) is analogous to that of Barmby et al. (1994) who formally analyse the link between absenteeism and efficiency wages in a single period model.
attendance in period 1 equals utility from absence in period 1 plus expected utility in periods 2 and 3 conditional on absence in period 1:

\[ u_i^w(\sigma_1^\ast) + E[u_{21}u_i = u_i^w(\sigma_1^\ast)] + E[u_{31}u_i = u_i^w(\sigma_1^\ast)] =
\]

\[ u_i^a(\sigma_1^\ast) + E[u_{21}u_i = u_i^a(\sigma_1^\ast)] + E[u_{31}u_i = u_i^a(\sigma_1^\ast)] \]

(5.5)

where:

\[ u_i^w(\sigma_1^\ast) = u_i(wh^c, T - h^c, \sigma_1^\ast) \]

(5.6)

\[ u_i^a(\sigma_1^\ast) = u_i(S, T, \sigma_1^\ast) \]

(5.7)

i.e. \( u_i^w(\sigma_1^\ast) \) denotes the level of utility in period 1 at the reservation sickness level if the individual attends and \( u_i^a(\sigma_1^\ast) \) denotes the level of utility in period 1 at the reservation sickness level if the individual absent. Similarly, \( E[u_{21}u_i = u_i^w(\sigma_1^\ast)] \) represents expected utility in period 2 conditional on attendance in period 1 and, therefore, given the opportunity of overtime in period 2 and \( E[u_{21}u_i = u_i^a(\sigma_1^\ast)] \) represents expected utility in period 2 conditional on absence in period 1 and, therefore, given the imposition of an overtime ban in period 2. Hence, \( E[u_{21}u_i = u_i^w(\sigma_1^\ast)] \) can be defined as follows:

\[ E[u_{21}u_i = u_i^w(\sigma_1^\ast)] = p(\sigma_2 < \sigma_2^1|w_1)E[u_{21}^w(\sigma_2)\mid \sigma_2 < \sigma_2^1|w_1] +
\]

\[ p(\sigma_2 \geq \sigma_2^1|w_1)E[u_{21}^a(\sigma_2)\mid \sigma_2 \geq \sigma_2^1|w_1] \]

(5.8)

where:

\[ E[u_{21}^w(\sigma_2)\mid \sigma_2 < \sigma_2^1|w_1] = E[u_2(wh^c + w^o h^o, T - h^c - h^o, \sigma_2)\mid \sigma_2 < \sigma_2^1|w_1] \]

(5.9)

\[ E[u_{21}^a(\sigma_2)\mid \sigma_2 \geq \sigma_2^1|w_1] = E[u_2(S, T, \sigma_2)\mid \sigma_2 \geq \sigma_2^1|w_1] \]

(5.10)

and \( w^o \) represents the wage paid for overtime hours, \( h^o \) represents the number of overtime hours and \( \sigma_2^1|w_1 \), the reservation sickness level in period two conditional on attendance in period 1, is defined implicitly by the following condition:

---

7 It is assumed that \( w^o > w \), i.e. overtime hours are assumed to attract a premium.
where:

\[ u_2^w(\sigma^*_2|w_1) = u_2(wh^c + w^h h^c, T - h^c - h^*, \sigma^*_2|w_1) \] (5.12)

\[ u_2^s(\sigma^*_2|w_1) = u_2(S, T, \sigma^*_2|w_1) \] (5.13)

Hence, expected utility in period 2 conditional on attendance in period 1 [depicted by Equation (5.8)] is a weighted average of the expected utility given attendance in period 2 and the expected utility given absence in period 2, where the weights which reflect the probability of attendance and absence respectively, are determined by \( \sigma^*_2|w_1 \), the critical level of sickness in period 2 given attendance in period 1. To be sure, \( \sigma^*_2|w_1 \) denotes the level of sickness in period 2 at which the individual is indifferent between absence and attendance given the opportunity of overtime working in period 2.

The crucial message from the analysis is that the expected utility of attendance in period 2, the expected utility of absence in period 2 and \( \sigma^*_2|w_1 \) are all determined by the non-imposition of the overtime ban in period 2 given the attendance decision of period 1. Hence, it is clear that an inter-temporal link exists across the absence decisions in periods 1 and 2.

Similarly, \( E[u_2|u_1 = u^*_1(\sigma^*_1)] \) can be defined as follows:

\[ E[u_2|u_1 = u^*_1(\sigma^*_1)] = p(\sigma_2 < \sigma^*_2|a_1)E[u^w_2(\sigma_2)|\sigma_2 < \sigma^*_2|a_1] + \]
\[ p(\sigma_2 \geq \sigma^*_2|a_1)E[u^s_2(\sigma_2)|\sigma_2 \geq \sigma^*_2|a_1] \] (5.14)

where:

\[ E[u^w_2(\sigma_2)|\sigma_2 < \sigma^*_2|a_1] = E[u_2(wh^c, T - h^c, \sigma_2)|\sigma_2 < \sigma^*_2|a_1] \] (5.15)

\[ E[u^s_2(\sigma_2)|\sigma_2 \geq \sigma^*_2|a_1] = E[u_2(S, T, \sigma_2)|\sigma_2 \geq \sigma^*_2|a_1] \] (5.16)

and \( \sigma^*_2|a_1 \), the reservation sickness level conditional on absence in period 1, is defined implicitly by the following condition:
\[ u_2^w(\sigma_2^*|_{h_i}) + E[u_3|u_2 = u_2^w(\sigma_2^*|_{h_i})] = u_2^s(\sigma_2^*|_{h_i}) + E[u_3|u_2 = u_2^s(\sigma_2^*|_{h_i})] \]  

(5.17)

where:

\[ u_2^w(\sigma_2^*|_{h_i}) = u_2(whc, T - h^c, \sigma_1^*|_{h_i}) \]  

(5.18)

\[ u_2^s(\sigma_1^*|_{h_i}) = u_2(S, T, \sigma_1^*|_{h_i}) \]  

(5.19)

Hence, expected utility in period 2 conditional on absence in period 1 is a weighted average of the expected utility given attendance in period 2 and not working any overtime and the expected utility given absence in period 2, where the weights which reflect the probability of attendance and absence are determined by \( \sigma_2^*|_{h_i} \), the critical level of sickness in period 2 conditional on absence in period 1.

Moreover, it is apparent from Conditions (5.11) and (5.17) that further dynamic implications exist between the absence decisions of periods 1 and 2 and the attendance decision of period 3. It is apparent from Condition (5.5) that attendance in period 1 implies two possible levels of expected utility in period 2 [recall Equation (5.8)] - expected utility from attending work in period 2 conditional on attendance in period 1 and expected utility from absence in period 2 conditional on attendance in period 1 - which in turn condition the possible outcomes in period 3. To summarise, attendance in period 1 implies that overtime working in period 2 is available which affects the period 2 attendance decision through the expected utility of attendance, the expected utility of absence and the value of the reservation sickness level. Clearly, despite the provision of overtime working, there is still some probability that an individual who attends in period 1 will be absent in period 2 and will, therefore, face an overtime ban in period 3. Alternatively, if the individual attends in periods 1 and 2, no overtime ban will be imposed in period 3.

Similarly, it is apparent from Condition (5.5) that absence in period 1 implies two possible levels of expected utility in period 2 [recall Equation (5.14)] - expected utility from attendance in period 2 conditional on absence in period 1 and expected utility from absence in period 2 conditional on absence in period 1 - which in turn conditions the possible outcomes in period 3. Absence in period 1 implies that the individual will face an overtime ban in periods 2 and 3. Clearly, absence in period 2 does not introduce any further sanctions since the absence decision of period 1 implies that the overtime ban holds for the subsequent periods regardless of the attendance decision of period 2.
The four potential pay-offs in period 3, which reflect the four possible absence histories which may arise in this 3 period framework, are defined below. The first potential level of expected utility in period 3 assumes attendance in periods 1 and 2:

\[ E[u_3\mid u_2 = u_2^w(\sigma_3^*)] = p(\sigma_3 < \sigma_3^*\mid w_2)E[u_3^w(\sigma_3)\mid \sigma_3 < \sigma_3^*\mid w_2] + \\
 p(\sigma_3 \geq \sigma_3^*\mid w_2)E[u_3^w(\sigma_3)\mid \sigma_3 \geq \sigma_3^*\mid w_2] \quad (5.20) \]

where:

\[ E[u_3^w(\sigma_3)\mid \sigma_3 < \sigma_3^*\mid w_2] = E[u_3(wh^c + w^o h^o, T - h^c - h^o, \sigma_3)\mid \sigma_3 < \sigma_3^*\mid w_2] \quad (5.21) \]

\[ E[u_3^w(\sigma_3)\mid \sigma_3 \geq \sigma_3^*\mid w_2] = E[u_3(S, T, \sigma_3)\mid \sigma_3 \geq \sigma_3^*\mid w_2] \quad (5.22) \]

and where \( \sigma_3^*\mid w_2 \) is defined implicitly by:

\[ u_3^w(\sigma_3^*\mid w_2) = u_3(wh^c + w^o h^o, T - h^c - h^o, \sigma_3^*\mid w_2) = u_3(S, T, \sigma_3^*\mid w_2) = u_3^w(\sigma_3^*\mid w_2) \quad (5.23) \]

Thus, Equation (5.20) represents expected utility in period 3 conditional on attendance in periods 1 and 2.

Similarly, the level of expected utility in period 3 conditional on attendance in period 1 and absence in period 2 can be defined as follows:

\[ E[u_3\mid u_2 = u_2^w(\sigma_2^*)] = p(\sigma_3 < \sigma_3^*\mid w_1, w_2)E[u_3^w(\sigma_3)\mid \sigma_3 < \sigma_3^*\mid w_1, w_2] + \\
 p(\sigma_3 \geq \sigma_3^*\mid w_1, w_2)E[u_3^w(\sigma_3)\mid \sigma_3 \geq \sigma_3^*\mid w_1, w_2] \quad (5.24) \]

where:

\[ E[u_3^w(\sigma_3)\mid \sigma_3 < \sigma_3^*\mid w_1, w_2] = E[u_3(wh^c, T - h, \sigma_3)\mid \sigma_3 < \sigma_3^*\mid w_1, w_2] \quad (5.25) \]

\[ E[u_3^w(\sigma_3)\mid \sigma_3 \geq \sigma_3^*\mid w_1, w_2] = E[u_3(S, T, \sigma_3)\mid \sigma_3 \geq \sigma_3^*\mid w_1, w_2] \quad (5.26) \]

and where \( \sigma_3^*\mid w_1, w_2 \) is defined implicitly as follows:
Thus, Equation (5.24) represents expected utility in period 3 conditional on attendance in period 1 and absence in period 2.

The third potential level of expected utility in period 3 conditional on absence in period 1 and attendance in period 2 can be defined as follows:

\[
E[u_3|u_2 = u_2^{w}(\sigma^*_3|_{A_2})] = p(\sigma_3 < \sigma^*_3|_{A_2})E[u_3^{w}(\sigma_3)|\sigma_3 < \sigma^*_3|_{A_2}] + \]
\[
p(\sigma_3 \geq \sigma^*_3|_{A_2})E[u_3^{\bar{a}}(\sigma_3)|\sigma_3 \geq \sigma^*_3|_{A_2}] \tag{5.28}
\]

where:

\[
E[u_3^{w}(\sigma_3)|\sigma_3 < \sigma^*_3|_{A_2}] = E[u_3^{w}(wh^c,T-h,\sigma_3)|\sigma_3 < \sigma^*_3|_{A_2}] \tag{5.29}
\]

\[
E[u_3^{\bar{a}}(\sigma_3)|\sigma_3 \geq \sigma^*_3|_{A_2}] = E[u_3^{\bar{a}}(S,T,\sigma_3)|\sigma_3 \geq \sigma^*_3|_{A_2}] \tag{5.30}
\]

and where \(\sigma^*_3|_{A_2}\) is defined implicitly by:

\[
u_3^{w}(\sigma^*_3|_{A_2}) = u_3^{w}(wh^c,T-h,\sigma^*_3|_{A_2}) = u_3^{w}(S,T,\sigma^*_3|_{A_2}) = u_3^{\bar{a}}(\sigma^*_3|_{A_2}) \tag{5.31}
\]

where Equation (5.28) represents expected utility in period 3 conditional on absence in period 1 and attendance in period 2.

Finally, the fourth potential level of expected utility in period 3 conditional on absence in periods 1 and 2 is set out below:

\[
E[u_3|u_2 = u_2^{\bar{a}}(\sigma^*_3|_{A_2})] = p(\sigma_3 < \sigma^*_3|_{A_2})E[u_3^{w}(\sigma_3)|\sigma_3 < \sigma^*_3|_{A_2}] + \]
\[
p(\sigma_3 \geq \sigma^*_3|_{A_2})E[u_3^{\bar{a}}(\sigma_3)|\sigma_3 \geq \sigma^*_3|_{A_2}] \tag{5.32}
\]

where:

\[
E[u_3^{w}(\sigma_3)|\sigma_3 < \sigma^*_3|_{A_2}] = E[u_3^{w}(wh^c,T-h,\sigma_3)|\sigma_3 < \sigma^*_3|_{A_2}] \tag{5.33}
\]

\[
E[u_3^{\bar{a}}(\sigma_3)|\sigma_3 \geq \sigma^*_3|_{A_2}] = E[u_3^{\bar{a}}(S,T,\sigma_3)|\sigma_3 \geq \sigma^*_3|_{A_2}] \tag{5.34}
\]
and where $\sigma_3|_{\lambda_1A_2}$ is defined implicitly by:

$$u_3^w(\sigma_3|_{\lambda_1A_2}) = u_3(wh^*, T - h^*, \sigma_3|_{\lambda_1A_2}) = u_3(S, T, \sigma_3|_{\lambda_1A_2}) = u_3^4(\sigma_3|_{\lambda_1A_2})$$ (5.35)

where Equation (5.32) reflects expected utility in period 3 conditional on absence in period 1 and absence in period 2.

For clarity, the structure of the individual’s decision-making process over the three time periods is summarised in the form of a decision tree presented in Figure 5.2 below. The associated Table 5.2 presented below sets out the definitions of the eight potential period 3 payoffs:

<table>
<thead>
<tr>
<th>Pay-Off</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$E\left[u_3^A(\sigma_3)</td>
</tr>
<tr>
<td>2</td>
<td>$E\left[u_3^W(\sigma_3)</td>
</tr>
<tr>
<td>3</td>
<td>$E\left[u_3^A(\sigma_3)</td>
</tr>
<tr>
<td>4</td>
<td>$E\left[u_3^W(\sigma_3)</td>
</tr>
<tr>
<td>5</td>
<td>$E\left[u_3^A(\sigma_3)</td>
</tr>
<tr>
<td>6</td>
<td>$E\left[u_3^W(\sigma_3)</td>
</tr>
<tr>
<td>7</td>
<td>$E\left[u_3^A(\sigma_3)</td>
</tr>
<tr>
<td>8</td>
<td>$E\left[u_3^W(\sigma_3)</td>
</tr>
</tbody>
</table>

Thus, Figure 5.2 and the associated Table 5.2 above illustrate the significance of inter-temporal influences for the absence decision-making process within this simplified three period framework.
The Individual makes the period 1 attendance decision

Absent

Work

The Individual makes the period 2 attendance decision conditional on absence in period 1

Absent

Work

The Individual makes the period 2 attendance decision conditional on attendance in period 1

Absent

Work

period 3 decision: conditional on absence in periods 1 and 2

Absent

Work

period 3 decision: conditional on absence in period 1 and attendance in period 2

Absent

Work

period 3 decision: conditional on attendance in period 1 and absence in period 2

Absent

Work

period 3 decision: conditional on attendance in periods 1 and 2

Absent

Work

Pay-Off 1

Pay-Off 2

Pay-Off 3

Pay-Off 4

Pay-Off 5

Pay-Off 6

Pay-Off 7

Pay-Off 8

Figure 5.2: The Decision-Making Process over Three Time Periods
Since, for ease of theoretical exposition, the assumption has been made that the analysis ends at the end of period 3, it is apparent that:

\[
\sigma_3^*_{w, A_2} = \sigma_3^*_{A_1, w_2} = \sigma_3^*_{A_1, A_2} \tag{5.36}
\]

We may for illustrative purposes deviate from the simplifying assumption made in this Section and consider what happens if the analysis does not end after period 3. If the time horizon is extended, then, irrespective of any attendance decision in period 4, in general, it is the case that:

\[
\sigma_3^*_{w, A_2} \neq \sigma_3^*_{A_1, w_2} \neq \sigma_3^*_{A_1, A_2} \tag{5.37}
\]

The structure of Condition (5.5) implicitly assumes that the analysis ends after period 3. If this is not the case, then it is apparent that the attendance decisions of periods 2 and 3 will have further implications for future absence behaviour. The possible absence histories which can be formed over periods 1, 2 and 3 are summarised in Table 5.3 below together with the implications of each potential absence history for the imposition or non-imposition of an overtime ban in periods 4 and 5.

<table>
<thead>
<tr>
<th>Absence Histories</th>
<th>Future Implications of the Absence History for the Overtime Ban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period 1</td>
<td>Period 2</td>
</tr>
<tr>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Absent</td>
<td>Work</td>
</tr>
<tr>
<td>Absent</td>
<td>Work</td>
</tr>
<tr>
<td>Work</td>
<td>Absent</td>
</tr>
<tr>
<td>Work</td>
<td>Absent</td>
</tr>
<tr>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>Work</td>
<td>Work</td>
</tr>
</tbody>
</table>
Hence, Table 5.3 highlights the extent to which the penalty system analysed in this Section implies the existence of an inter-temporal link between current and future absence decisions through the provision of future overtime working.

So far the mechanics of the overtime ban system have been outlined. As mentioned in the introductory Section 5.1, this system has been implemented as a means of modifying absence behaviour - more specifically, the system is aimed at reducing the probability of absence in the current period by making the provision of future overtime working conditional on current absence records. Clearly, for this system to be effective, the wage premium paid for overtime working should be sufficient to offset the decrease in utility arising from the subsequent loss in leisure time. Hence, the wage premium should be of a sufficient magnitude to ensure that the following conditions are satisfied:

\[
E[u_2|u_1 = u_1^w(\sigma_i^*] > E[u_2|u_1 = u_1^\ell(\sigma_i^*)]
\]

(5.38)

and:

\[
E[u_2|u_1 = u_1^w(\sigma_i^*)] > E[u_1|u_1 = u_1^\ell(\sigma_i^*)]
\]

(5.39)

Condition (5.5) can be re-written as follows:

\[
u_1^w(\sigma_i^*) + \delta = u_1^\ell(\sigma_i^*)
\]

(5.40)

where:

\[
\delta = E[u_2|u_1 = u_1^w(\sigma_i^*)] - E[u_2|u_1 = u_1^\ell(\sigma_i^*)]
\]

\[+ E[u_3|u_1 = u_1^w(\sigma_i^*)] - E[u_3|u_1 = u_1^\ell(\sigma_i^*)] > 0
\]

(5.41)

Thus, if Conditions (5.38) and (5.39) are satisfied, the inclusion of \(\delta\) serves to increase the level of expected utility associated with attendance in period 1, i.e. the incorporation of the dynamic implications of current absence decisions raises the likelihood of attendance in the context of this theoretical structure. This is in accordance with a priori expectations - the introduction of the inter-temporal link between absence decisions and overtime working has been explicitly devised as an absence control mechanism and as such should curb the tendency to absent from the work place.

A further point becomes apparent when considering the conduct of individual employees once their absence record dictates that an overtime ban is to be imposed.
If an individual goes absent in period 1, this ensures that an overtime ban is to be imposed in periods 2 and 3. If the individual then also goes absent in period 2, then the existing ban will be extended to cover periods 3 and 4 effectively. Thus, the marginal cost of absence in period 2 is an overtime ban in period 4 only, since the opportunity to work overtime in period 3 has already been relinquished. Hence, once an overtime ban is already in place, absence becomes relatively cheaper due to declining marginal cost of future absence.

To summarise, the aim of this Section is primarily to extend the static model of absence decisions into the realm of multi-period analysis by highlighting the potential inter-temporal link which may exist across the absence decisions of different time periods. In addition, this analysis of worker behaviour across discrete time periods incorporates the essence of a specific means of absence control and introduces an interesting interaction between absenteeism and overtime working.

5.4 Data and Estimation

The approach taken by the majority of researchers has been to explain the amount of absence observed (i.e. absence rates across individuals or work places) with a set a regressors, such as wages and contractual hours, derived from the income-leisure framework. Studies which analyse the amount of absence undertaken by individual workers over a specified time period include Allen (1981a) and Dunn and Youngblood (1986). Allen (1981a), for example, uses survey data where each individual reports the number of work days missed in the two weeks before the interview. Problems arise since the number of work days scheduled is not reported and, furthermore, if workers missed more than one day no information is given with respect to whether absence occurred on consecutive days. Alternatively, firm-level studies have been conducted which analyse the determinants of the amount of absence observed across work places [such as Allen (1981b), Chaudhury and Ng (1992) and Balchin and Wooden (1992)]. Such an approach is problematic,

Typically econometric specifications employed to analyse absence rates have been based on the log-odds transformations of the logit model [e.g. Allen (1981a), Drago and Wooden (1992) and Kenyon and Dawkins (1989)]. There are problems, however, with such a specification in the case of perfect attenders. In general, studies have set the absence rates of perfect attenders to an arbitrarily chosen small number [e.g. Drago and Wooden (1992)]. This approach was adopted in the empirical analysis of Chapter 4.

Clearly such an approach does not allow for the distinction between the duration and incidence of absence. The importance of the dichotomy between incidence and duration is emphasised by Drago and Wooden (1992). Acknowledging Johns and Nicholson (1982), Drago and Wooden argue that the appropriate empirical specification may require separating predictions of ‘absence events’ (i.e. incidence) and ‘absence rates’ (i.e. duration). The authors point out that ‘... although absence events and absence rates may have different determinants, they are related by the fact that an event is required for any positive rate.’ [Drago and Wooden (1992), p. 774].

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however, given the attempt to determine aspects of individual behaviour from firm level data.

Once the temporal nature of the individual’s absence decision-making process is acknowledged, the analysis of panel data seems to be particularly appropriate. The aim of the following Section is to analyse a firm-specific set of panel data which has been collected from a manufacturing company operating in Great Britain. The panel is formed by merging the personnel records of the company which contain personal characteristics of employees, daily absence records, which contain daily reasons for absence, and the information held in the firm’s payroll which contains information pertaining to the weekly earnings of employees.

The aim of this Chapter is to analyse absence behaviour within a more general setting where both labour supply and labour demand considerations are relevant. This data set consists of a discrete panel of daily data formed by 2092 employees over a maximum of 78 weeks from June 1988 to December 1989. Each observation of the panel indicates whether an individual was absent from work or not on a given day:

\[ d_{it} = \begin{cases} 1 & \text{if the individual is absent} \\ 0 & \text{if the individual attends} \end{cases} \quad i = 1, \ldots, N \quad t = 1, \ldots, T_i \quad (5.42) \]

where \( i \) represents the case subscript and \( t \) represents the time subscript. Thus, if \( d_{it} = 1 \), this indicates a spell of absence on a given day where absence is assumed to be either self or medically certified absence or absence without permission.

The estimations were carried out by specifying a logistic model with the contribution to the likelihood by the \( i^{th} \) case and \( t^{th} \) event as follows:

\[ L_i(\beta) = \left( \frac{\exp(\beta'X_{it})}{1 + \exp(\beta'X_{it})} \right)^{d_{it}} \quad (5.43) \]

\[ X_{it} = \text{vector of explanatory variables} \quad (5.44) \]

\[ \beta = \text{vector of parameter estimates} \]

The results presented in the following Section illustrate the influence of a set of explanatory variables on the probability of absence, i.e. on the probability of \( d_{it} \) being equal to one.\(^{10}\) The set of independent variables can be broadly split into two

\(^{10}\) In an Appendix to this Chapter, Appendix A5, the results of some additional estimations based on an extended form of the logistic model, the logistic-normal mixture model, are presented.
groups; those which represent characteristics of the employment contract and those which reflect employees' personal characteristics. Table 5.4 contains some summary statistics relating to the set of explanatory variables. The information conveyed in Table 5.4 is supplemented with the set of histograms presented in Figures 5.3 to 5.6 below.

The conventional labour supply model of absence places the emphasis on the influence of contractual arrangements on absence decisions. The wage rate, therefore, plays a central role in the theory of absence behaviour with empiricists left the task of determining whether the income effect or substitution effect dominates. Following this lead, the daily wage rate (wage), a time varying parameter, is included in the set of explanatory variables. In general, researchers have found a negative relationship between wages and absence behaviour. Dunn and Youngblood (1986), for example, analyse the conditions under which an individual faced with a situation in which contractual hours exceed desired hours, will absent himself/herself. Their results show a significant positive relationship between absence and the (positive) difference between a worker’s marginal rate of substitution and the wage rate. Supportive evidence for the result of a negative relationship between wage rates and absence is found by Drago and Wooden (1992) and Chaudhury and Ng (1992).

From the discussion of Section 5.2, it is apparent that overtime affects absence partly through the alterations to the length of the working day. A related point, therefore, concerns the distinction between part-time and full-time workers. One may argue that individuals whose specific preferences demand a high proportion of non-work time will opt for a part-time contract since such a contract may minimise the mismatch between contractual hours and desired hours. Thus, one would conjecture that part-time workers would absent themselves less frequently since they experience enhanced flexibility with respect to their work schedule and, furthermore, since they have fewer scheduled work hours, they are likely to derive less utility from additional leisure. In addition, Chaudhury and Ng (1992) argue that part-time workers may have less job security than their full-time counterparts and, thus, may face greater penalties for absence. This has been borne out to some degree by empirical work.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (Standard Deviation)</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Workers</td>
<td>Full-time Workers</td>
</tr>
<tr>
<td>wage</td>
<td>17.89 (5.26)</td>
<td>25.86 (5.11)</td>
</tr>
<tr>
<td>chrs</td>
<td>5.67 (1.21)</td>
<td>7.66 (1.96)</td>
</tr>
<tr>
<td>overtime ban</td>
<td>n.a.</td>
<td>0.08 (0.26)</td>
</tr>
<tr>
<td>permanent</td>
<td>0.80 (0.40)</td>
<td>0.91 (0.29)</td>
</tr>
<tr>
<td>full-time</td>
<td>0.26 (0.44)</td>
<td>n.a.</td>
</tr>
<tr>
<td>female</td>
<td>0.79 (0.41)</td>
<td>0.39 (0.49)</td>
</tr>
<tr>
<td>married</td>
<td>0.56 (0.50)</td>
<td>0.40 (0.49)</td>
</tr>
<tr>
<td>female*married</td>
<td>0.50 (0.50)</td>
<td>0.20 (0.40)</td>
</tr>
<tr>
<td>tenure</td>
<td>6.36 (6.37)</td>
<td>10.71 (7.71)</td>
</tr>
<tr>
<td>age</td>
<td>34.43 (11.57)</td>
<td>37.96 (12.23)</td>
</tr>
</tbody>
</table>

11 This represents the group of workers who were continuously employed over the 78 week period whilst the previous column refers to all full-time employees.
Figure 5.3: Histogram of the Number of Event Histories of All Employees

Figure 5.4: Histogram of Average Weekly Earnings of All Employees
Figure 5.5: Histogram of Average Age of All Employees over the Period of Analysis

Figure 5.6: Histogram of Average Job Tenure of All Employees over the Period of Analysis
Chaudhury and Ng (1992) find evidence which suggests that firms with more part-time workers experience a lower level of absence. This is consistent with the results of Drago and Wooden (1992) which indicate that part-time employees exhibit low absence. Early evidence from Flanagan et al (1974) suggests that absence rates are higher in industries where the weekly hours of work are relatively high. Thus, daily contractual hours (chrs) were included in the set of explanatory variables in order to determine the impact of the length of the working day on absenteeism.

A dummy variable (permanent) which takes the value of one if the employment contract is permanent and zero otherwise is included in the model. The intuition behind the inclusion of this variable is based on the a priori hypothesis that individuals under temporary contracts may exhibit different behaviour to the rest of the work force. Such individuals may, for example, be more likely to devote resources to job search in order to find more secure employment. Furthermore, if an employee knows that his/her contract will terminate in the near future, then the sanctions imposed on current absence behaviour may be less threatening.

To capture the effects of the imposition of an overtime ban on absence behaviour, a dummy variable (overtime ban) was incorporated which takes the value of one if the past absence history dictates that an overtime ban is currently in place and zero otherwise. As highlighted in Section 5.2, absence behaviour once an overtime ban is imposed may differ from absence behaviour prior to the imposition of such a ban, thus this dummy variable is included in order to capture the effects of any such change in behaviour.

In accordance with other studies [such as Allen (1981a) and Dunn and Youngblood (1986)], this empirical investigation is not conducted solely within the framework of the neo-classical labour supply model and socio-economic variables such as age, sex and marital status are incorporated into the empirical specifications accordingly. 12 Personal characteristics include a dummy variable (female) which equals one if the individual is female, a dummy variable (married) which equals one if the individual is married and a further interactive dummy which equals one if the individual is female and married.

A common finding in many of the labour supply based studies has been that females exhibit higher absence rates than males [Allen (1981a, 1984), Leigh (1981, 1991), Drago and Wooden (1992), and Paringer (1983)]. Such a finding is somewhat difficult to interpret in terms of the standard income-leisure model of labour supply. It may be that women play a larger role in domestic duties and hence

---

12 The significance of such demographic factors is not, however, universally accepted. Kenyon and Dawkins (1989) find that variables pertaining to the composition of the labour force do not exert much influence on absence. Their results indicate that variables which affect the budget constraint faced by workers affect labour absence.
may absent themselves from work in order to gain a greater degree of flexibility. Indeed, it has typically been argued that women tend to assume responsibility for the children within a household, and so will tend to stay at home if these become ill. Leigh (1986, 1991), for example, finds a positive and significant effect between absence and an interactive ‘sex - young dependant’ variable. A related explanatory variable is marital status. Evidence suggests that married people absent themselves less frequently [see, for example, Allen (1984), Keller (1983) and Leigh (1986)].

The variables age and tenure, which are time varying parameters incrementing over an individual’s record length, are also included in the set of explanatory variables. The relationship between the probability of absence and job tenure has attracted some attention in the literature. Given that job tenure and the level of investment in firm specific human capital are interrelated, with investment in firm specific human capital typically proxied by tenure [see, for example, Blau and Kahn (1981)], the relationship between absence and tenure may be framed in terms of human capital theory. In the context of efficiency wage considerations, the individual’s expected utility loss from dismissal due to excessive absence behaviour increases with investment in firm-specific human capital. Thus, individuals with low tenure may have accumulated an insignificant amount of firm specific human capital and may be more prone to absence behaviour. As tenure rises the loss associated with dismissal rises and individuals may modify their absence behaviour accordingly. Such considerations imply a negative relationship between tenure and absence behaviour. On the other hand, employees with relatively high tenure may become bored or dissatisfied with their job as time progresses but may find it difficult to leave, suggestive of a positive association between age and tenure. A further justification for the positive association between absenteeism and tenure is based on the argument that if the savings rate is positive,

13 Prior to incorporating both age and tenure into the empirical specification, the Spearman’s rank correlation coefficient between these two variables was calculated in order to assess the degree of co-linearity between these two related variables. In the case of all employees (continuously) employed over the period of analysis the correlation coefficient was (0.55) 0.61 whilst in the case of full-time employees only (continuously) employed over the period of analysis the correlation coefficient was (0.53) 0.57. Although the positive correlation between these two variables confirms a priori expectations, the degree of correlation is not particularly high so both variables are included in the analysis of Section 5.5.

14 It is recognised, however, that observed tenure is a complex result of numerous factors in addition to human capital considerations. Henley et al (1994), for example, explore the impact of housing equity and private pension schemes on job tenure. The results indicate that housing equity has a negative impact on job tenure and that the membership of an occupational pension scheme raises tenure. Shah (1985) also discovers that pension schemes have important implications for job tenure.

15 Furthermore, this effect may be accentuated since as Allen (1981b) points out wages may proxy labour market experience and, as such, may rise with experience. This will exert a further moderating force on absence behaviour, assuming that the substitution effect dominates the income effect.
then tenure should be positively associated with net assets [Drago and Wooden (1992)]. The existence of such a positive relationship is supported by the findings of Leigh (1986).

Furthermore, as the investment in firm specific human capital rises, the dismissal costs for both the employee and the employer rise [Drago and Wooden (1992)]. Thus, the employer may find it relatively less expensive to fire employees with low tenure rather than those with relatively longer tenure. Consequently, the threat of dismissal may be felt more keenly amongst new recruits.

Thus, one should recognise the effect of tenure on the behaviour of both the employee and the employer:

Since firm specific human capital increases dismissal costs for both the employer and the employee, we cannot predict what effect job tenure will have on absence. [Drago and Wooden (1992), p.766].

Hence, as tenure rises employees may be less inclined to 'shirk' whilst employers may be more tolerant of any lapses in the required standards of behaviour.

Thus, it is difficult to predict the effect of tenure on absence a priori and empirical analysis is required to resolve the debate. Evidence supporting a negative relationship between absenteeism and tenure is found by Drago and Wooden (1992), Fitzgibbons and Moch (1980), Watson (1981), Keller (1983) and Youngblood (1984).

The age composition of the work force may also have important implications for absenteeism. Younger workers may, for example, turn jobs over more frequently and undertake job search off the job through labour absence [Allen (1981a) and Kenyon and Dawkins (1989)].\textsuperscript{16} This may be the result of, for example, lower commitment to either the firm or the work group. Alternatively, younger workers with less financial and family commitments may simply experience a greater opportunity cost for any foregone leisure. Dunn and Youngblood (1986) and Allen (1981a, 1984) find that younger workers are associated with a higher level of absence behaviour. These findings fit in the predictions of human capital theory since younger workers are unlikely to have accumulated much firm specific human capital. On the other hand, younger workers may be expected to enter into job matches of a relatively low quality due to factors such as labour market inexperience. Hence, an employee involved in a bad match may absent himself/herself in order to seek alternative employment.

Dunn and Youngblood (1986) find that absence declines with age except in the case of the oldest workers. The implications of age for absence behaviour have

\textsuperscript{16} This issue is discussed in more detail in the following Chapter.
attracted a great deal of interest in the applied psychology literature [references include Steers and Rhodes (1978, 1984) and Hackett (1990)]. According to Steers and Rhodes the relationship between age and ‘unavoidable’ absence is direct, i.e. it can be explained by the positive relation between susceptibility to illness and age. In addition, older workers may feel that their level of investment in human capital is such that they are insulated against dismissal for excessive absence behaviour. Overall, as Allen (1984) remarks, the evidence suggests that the relationship between absenteeism and age is quadratic rather than linear. In order to explore such effects, a term representing age squared is included in the set of regressors.

Following Barmby et al (1991) absence lagged one period is included in order to explore the phenomenon of state-dependence. The intuition behind the inclusion of the lagged dependent variable lies in the hypothesis that the marginal rate of substitution between income and leisure may not be independently determined in each time period. In the context of job search, for example, absence in one period to complete a job application form may be followed by absence in the next period to attend a job interview.\(^{17}\)

The set of workers employed by the firm may be broadly split into those who face the overtime ban system discussed in Section 5.2 and those who do not face this absence control system. Since overtime working is only offered to full-time employees, the overtime ban system is operational for this sub-sample of workers only. Out of the total number of 2092 employees, there are 344 full-time employees.

Prior to the exploration into the determinants of absence behaviour, a logistic model is employed to analyse the determinants of overtime working. The objective of the analysis is to determine the credibility of the threatened overtime ban by examining the extent to which overtime working is inhibited by the presence of an overtime ban. Thus, logit analysis is conducted with the dependent variable indicating whether or not the individual works overtime on a given day:

\[
\begin{align*}
    w_{it} = \begin{cases} 
    1 & \text{if the individual works overtime} \\
    0 & \text{if the individual does not work overtime} 
    \end{cases} \\
    i = 1, \ldots, N \\
    t = 1, \ldots, T_i 
\end{align*} 
\]  

(5.45)

Given the aim of this analysis, the overtime ban variable is included in the set of explanatory variables in order to determine the implications of the ban for current overtime working.

\(^{17}\) It should be noted, however, that when analysing panel data the existence of time persistent unobserved effects can generate ‘spurious’ state dependence [Heckman (1981) and Hsiao (1989)].
Once the degree of effectiveness of the overtime ban is established, the determinants of the absence behaviour of the sub-sample of full-time employees who face this specific absence control mechanism are explored. In addition, some empirical analysis is conducted to compare the absence behaviour of full-time and part-time employees. Since only the latter group faces the control scheme, such an exercise may yield further insights into the effect of this scheme on the observed behaviour of employees.

5.5 Results

The results presented in Table 5.5 represent the influence of the set of explanatory variables described in Section 5.4 on the probability of a full-time worker working overtime. Two sets of estimates are presented, one set contains the sub-sample of full-time workers who were continuously employed by the firm over the 78 week period. Thus, this data set forms a discrete balanced panel of data. Such an approach may clearly be problematic since it may induce sample selection bias. Individuals who are ill-suited to the job, i.e. those characterised by a large disparity between contractual hours and utility maximising hours, are unlikely to remain with the firm throughout a given period of analysis. The inclusion of all employees in the analysis serves to ease such a selection problem. The second set of estimates was estimated from a panel of data which consists of uneven record lengths for each individual depending on whether he/she remained at the firm for the entire period, started working for the firm after the start date of the study or left before the end of the 78 week period.18

In addition to providing information pertaining to the effectiveness of the overtime ban, this empirical analysis into the determinants of the incidence of overtime working is interesting given the importance of the provision of overtime to the British economy as outlined in Section 5.2. It is somewhat alarming, however, to find that there is an acute shortage of research into overtime working in the field of labour economics especially in the context of the British economy. Some analysis has been carried out in the US.19 Trejo (1993), for example, undertakes a cross-sectional probit analysis in order to identify the determinants of the incidence

---

18 Problems may arise if the workers who leave the firm during the period of analysis do not respond to the dynamic considerations specified in the model. In general, the results, however, from the balanced and unbalanced panel presented in this Chapter do not diverge significantly which suggests that the individuals who are not continuously employed over the time period do appear to respond to the nature of the employment contract as opposed to any additional ‘unobserved’ influences which are discussed in more detail in Appendix A5.

19 One explanation for the greater interest in the effects of overtime among US researchers may be concerned with the relatively stringent control of minimum overtime premia in the US through Government regulation [see Hart (1987) for further details].
of overtime working. The results indicate that female, minority and older workers are characterised by significantly lower overtime participation rates. In an earlier study using logit analysis, Trejo (1991) finds similar evidence. Hence, the logistic analysis presented below is similar to that undertaken by Trejo (1991, 1993) and may serve to expand the research into British overtime working.

For the purposes of the present study, we are primarily concerned with the estimated coefficient on the overtime ban variable. It is clear from Table 5.5 that the estimated coefficient is significant at both the 1% and the 5% level and is characterised by a relatively large negative coefficient.

Table 5.5: Standard Logistic Model:  
Dependent Variable = Overtime Working  
Sample = Full-Time Workers

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Unbalanced Panel of Data</th>
<th>Balanced Panel of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated Coefficient</td>
<td>T-Ratio</td>
</tr>
<tr>
<td>wage</td>
<td>-0.0403</td>
<td>-2.8747***</td>
</tr>
<tr>
<td>chrs</td>
<td>0.0619</td>
<td>13.8750***</td>
</tr>
<tr>
<td>overtime ban</td>
<td>-0.7571</td>
<td>-2.9832***</td>
</tr>
<tr>
<td>permanent</td>
<td>0.5358</td>
<td>2.1422**</td>
</tr>
<tr>
<td>married</td>
<td>0.0323</td>
<td>18.1331***</td>
</tr>
<tr>
<td>female</td>
<td>-1.1948</td>
<td>-5.8263***</td>
</tr>
<tr>
<td>female*married</td>
<td>-0.2875</td>
<td>-10.2803***</td>
</tr>
<tr>
<td>lag-absence</td>
<td>-0.9535</td>
<td>-15.7456***</td>
</tr>
<tr>
<td>tenure</td>
<td>0.0724</td>
<td>2.5151**</td>
</tr>
<tr>
<td>tenure2</td>
<td>-0.1722E-02</td>
<td>-2.1132**</td>
</tr>
<tr>
<td>age</td>
<td>0.1230</td>
<td>3.1023***</td>
</tr>
<tr>
<td>age2</td>
<td>-0.1503E-02</td>
<td>-3.1286***</td>
</tr>
<tr>
<td>constant</td>
<td>-5.0485</td>
<td>-26.4860***</td>
</tr>
</tbody>
</table>

Likelihood Ratio Test  
Maddala R2 0.1636 0.1707  
Maddala R2 / Range 0.2181 0.2279  
Cragg-Uhler R2 0.0652 0.0689  
Number Of Observations 120106 107952
Thus, it appears that the probability of working overtime is significantly reduced by the imposition of a ban. Moreover, the size of the estimated coefficient, which is relatively consistent across both sets of estimates, suggests that once an individual’s absence history dictates the imposition of a ban, then the ban will indeed be effective.\(^\text{20}\)

In addition, there are other interesting results to note. The estimated coefficient on the daily wage variable is negative which suggests that higher levels of basic pay will be associated with a lower probability of overtime working. Intuitively, this implies that an income effect may be operating which lowers an individual’s incentive to work additional overtime hours as the income from the standard working day rises. The results also suggest that the inverse relationship between the wage and the incidence of overtime working is more pronounced for the unbalanced panel of data. The estimated coefficient on contractual hours, which is relatively consistent across both sets of estimates, suggests a positive relationship between the length of the working day and the probability of working overtime. This may be the result of the system introduced by the firm whereby priority for any available overtime is given to those workers whose contracts are characterised by relatively longer hours. The estimated coefficient on the dummy variable representing a permanent contract suggests that priority for overtime working may be given to permanent employees. This may be the result of, for example, established work groups operating in the firm [see Drago and Wooden (1992) for a detailed discussion of the implications of work groups for employee behaviour]. Furthermore, this positive relationship appears to be stronger in the case of the balanced panel of data.

Turning to the personal characteristics; being married appears to increase the probability of overtime working - one reason for this may be the existence of financial pressures. Being female appears to exert a very large negative influence on the probability of overtime working. Women may be reluctant to work overtime given that women generally play a greater role in domestic duties than their male counterparts. Consequently, being married and female reduces the likelihood of any overtime.\(^\text{21}\) The estimated coefficient on the lagged absence variable suggests that

\(^{20}\)Since the coefficient on the overtime ban variable is not equal to one, then this implies that the absence control rule is not perfectly observed i.e. some banned workers may indeed be undertaking overtime work. The proportion of days when a banned individual works overtime as a proportion of days when overtime is worked is, however, relatively low, 5.1\%. Thus, in 94.9% of cases, overtime is carried out by non-banned individuals which implies that the rule is observed in the majority of cases.

\(^{21}\)Brown et al (1986), who analyse the nature of budget constraints faced by UK workers, find supporting evidence which suggests that women in general, and particularly married women, appear to have simpler payment systems. One reason for this may be that women seem to work shorter hours than their male counterparts and, as such, overtime working becomes irrelevant and is not regarded as part of the payment schedule.
absence on the previous day is negatively associated with overtime working. One explanation for this may be concerned with the active management policy pursued by the company which serves to give employees the shortest possible notice of future overtime working in order to prevent workers from ‘planning’ their absence accordingly. Alternatively, if a positive correlation exists between absence behaviour over time, then an individual who absented in the previous period may be likely to absent in the current time period. In addition, some correlation clearly exists between the imposition of an overtime ban and absence history in the previous time period.

Tenure is positively related to the probability of working overtime. The firm may, for example, offer overtime to individuals as they acquire firm specific human capital or, on the other hand, such individuals may be choosing to work overtime. The coefficient on tenure squared, in contrast, suggests that individuals with a high tenure may refrain from overtime working. Such a tendency may be related to the amount of savings accumulated by such employees [Drago and Wooden (1992) and Leigh (1986)]. In addition, the relationship between absence and tenure appears to be less pronounced in the case of the balanced panel. The relationship between age and overtime working appears to follow a similar pattern.

In addition to discussing the specific implications of each variable, it is interesting to consider some general diagnostics pertaining to the empirical specification in its entirety. The likelihood ratio test statistic reported in Table 5.5 is significant thereby rejecting the hypothesis that the explanatory variables (excluding the constant) have no influence on the choice probabilities in the logit analysis. The goodness of fit measures presented in Table 5.5, however, suggest that the model is characterised by relatively poor predictive power. One explanation for this may lie in the fact that overtime incidence is determined by both labour supply and labour demand influences. Since only information related to labour supply aspects is available in the data set, then influential labour demand considerations may not be captured by the empirical specification and this may account for the low predictive capacity of the model. Thus, although the empirical analysis has provided some insight into the types of individuals working overtime, the results should be treated with some caution given the limited information available on labour demand considerations.

Turning to the analysis of absence behaviour, the results of Table 5.6 represent the influence of the set of explanatory variables on the probability of a full-time worker being absent. The estimated coefficient on the wage variable is statistically significant at both the 5% and the 1% level. The daily wage rate is negatively associated with the probability of absence in both empirical specifications. This result is consistent with the findings from other empirical
studies such as Allen (1981a), Balchin and Wooden (1992) and Chaudhury and Ng (1992) which produce evidence supporting a negative relationship between wages and absence. A negative relationship between wages and absence implies that the substitution effect generated by a wage increase dominates the income effect. The magnitude of the estimated coefficient on wages indicates that on average a one percent rise in average daily earnings would lead to a fall in the incidence of absence of 0.0113 (0.0152) percentage points for the continuously employed full-time workers (all full-time workers).

| Table 5.6: Standard Logistic Model: |
| Dependent Variable = Daily Absence |
| Sample = Full-Time Workers |

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Unbalanced Panel of Data</th>
<th>Balanced Panel of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated Coefficient T-Ratio</td>
<td>Estimated Coefficient T-Ratio</td>
</tr>
<tr>
<td>wage</td>
<td>-0.0218 -3.6625***</td>
<td>-0.0227 -3.6275***</td>
</tr>
<tr>
<td>chrs</td>
<td>0.0389 1.8190*</td>
<td>0.0221 1.9432*</td>
</tr>
<tr>
<td>overtime ban</td>
<td>0.3967 5.3075***</td>
<td>0.3220 4.0465***</td>
</tr>
<tr>
<td>permanent</td>
<td>0.0844 0.7526</td>
<td>0.1981 1.4161</td>
</tr>
<tr>
<td>married</td>
<td>0.0265 0.3285</td>
<td>0.0536 0.6290</td>
</tr>
<tr>
<td>female</td>
<td>0.2452 2.7502***</td>
<td>0.1887 1.9414**</td>
</tr>
<tr>
<td>female*married</td>
<td>-0.0699 -0.5699</td>
<td>-0.1415 1.0960</td>
</tr>
<tr>
<td>lag-absence</td>
<td>4.7581 6.6734***</td>
<td>4.8687 6.5263***</td>
</tr>
<tr>
<td>tenure</td>
<td>0.2210E-02 0.1768</td>
<td>-0.2877E-02 -0.2168</td>
</tr>
<tr>
<td>tenure2</td>
<td>-0.1099E-03 -0.3262</td>
<td>0.2047E-04 0.0577</td>
</tr>
<tr>
<td>age</td>
<td>-0.0425 -2.4560**</td>
<td>-0.0457 -2.4031**</td>
</tr>
<tr>
<td>age2</td>
<td>0.5157E-03 2.4815**</td>
<td>0.5533E-03 2.4362**</td>
</tr>
<tr>
<td>constant</td>
<td>-6.3681 -6.8607***</td>
<td>-5.7663 -5.5902***</td>
</tr>
<tr>
<td>Likelihood Ratio Test</td>
<td>5950.2*** 23746.5***</td>
<td></td>
</tr>
<tr>
<td>Maddala R2</td>
<td>0.0483 0.1975</td>
<td></td>
</tr>
<tr>
<td>Maddala R2 / Range</td>
<td>0.3377 0.7131</td>
<td></td>
</tr>
<tr>
<td>Cragg-Uhler R2</td>
<td>0.3041 0.6426</td>
<td></td>
</tr>
<tr>
<td>Number Of Observations</td>
<td>120106 107952</td>
<td></td>
</tr>
</tbody>
</table>
The magnitude of the estimated coefficient on wages appears to be relatively consistent across both the balanced and the unbalanced panels. A related point concerns the magnitude of the estimated coefficient on wages which is small relative to that found by other researchers. It is apparent, however, that the availability of overtime working at this specific workplace may modify the wage effect stemming from changes in the basic wage accordingly.

The estimated coefficient on contractual hours indicates that the probability of absence rises as contractual hours increase. As described in Section 5.3, the results of Chaudhury and Ng (1992) indicate that contract type, as represented by the level of contractual hours, has an important effect on absence behaviour. Firms with more part-time workers are found to experience a lower level of absence. Hence, the estimated coefficient on contractual hours is consistent with the hypothesis which suggests that workers experiencing a longer working day are more prone to absence behaviour. The size of the estimated coefficient appears to be consistent across both specifications. The estimated coefficient on the variable representing a permanent employment contract is, however, insignificant.

The estimated coefficient on the variable 'overtime ban' is highly significant and positive in sign, suggesting that the imposition of such a ban raises the probability of absence. The theoretical analysis of Section 5.2 indicates how the effective inter-temporal cost of further absence is reduced once an overtime ban is operational. The empirical evidence supports this theoretical prediction. Furthermore, one should also note the relatively large magnitude of this estimated coefficient which suggests that the ban variable is a major determinant of absence behaviour.

Thus, the empirical results presented in Table 5.6 indicate that the existence of an overtime ban exerts a relatively large positive influence on the probability of going absent. Such findings suggest that the firm could alter the ban system such that rather than imposing a scheme whereby overlapping bans are instigated, the bans may be accumulated consecutively. Thus, an individual who faces a ban in periods 1 and 2 and goes absent in period 1, will have his/her ban extended to periods 3 and 4, rather than to period 3 only.

The estimated coefficient on the female dummy is significant and the positive sign is consistent with that of other studies. Empirical studies have typically found, for example, that women exhibit a higher degree of absence than men [such as Allen (1981a, 1984), Leigh (1981,1991) and Paringer (1983)]. In contrast, the estimated coefficients on the marital status dummy and the interactive dummy variable prove to be statistically insignificant.

The results of Table 5.6 indicate that younger workers are associated with a higher probability of absence. These results are consistent with those of Dunn and
Youngblood (1986) and Allen (1981a, 1984). In addition, Dunn and Youngblood (1986) find that absence declines with age except in the case of the oldest workers. This result is consistent with the sign of the estimated coefficient on age squared. In sum, the results are consistent with a quadratic rather than linear relationship between absence and age. Tenure and tenure squared, on the other hand, are found to be insignificant determinants of the probability of absence in the current empirical specification.

Following Barmby et al (1991), absence lagged one period is included in order to explore the phenomenon of state-dependence whereby the realisation of sickness may be correlated over time. The estimated coefficient on lag-absence is positive implying that absence in the previous period exerts a positive influence on the probability of current absence.

The magnitudes of the likelihood ratio test statistics suggest that the hypothesis that the explanatory variables have no influence on the probability of absence behaviour can be rejected. In addition, the goodness of fit measures suggest that the models are characterised by relatively good predictive powers, especially in the case of the balanced panel of data.22

As a point of reference, further empirical analysis was carried out exploring a data set consisting of all employees, i.e. both full-time and part-time workers. Due to the magnitude of the data set, a logistic analysis was carried out on weekly data, whereby the dependent variable took the value of one if an employee was absent in a given week, otherwise the dependent variable was zero. The results pertaining to the entire work force are set out in Table 5.7 below. Analysis at such a level of aggregation was conducted in order to determine the general difference in the absence behaviour across the two groups of workers; namely the full-time employees who face the absence penalty system and the part-time employees. It is interesting to discover that the estimated coefficient representing a full-time contract is negative in sign. This result contradicts the findings of other studies which suggest that employees working shorter hours exhibit less absence behaviour. Given the nature of the absence control system instigated by the company, i.e. one that is operational for full-time employees only, it is not surprising that full-time employees are less prone to absence. The findings, therefore, suggest that the control system is effective in the sense that it exerts a moderating influence on the absence behaviour of full-time employees.

22 Since the estimates from the unbalanced panel of data will be to some extent influenced more heavily by the behaviour of individuals who quit the firm and that of new recruits whose behaviour is more likely to be conditioned by unobserved influences, one might expect better predictions from a model estimated from the more homogeneous set of individuals.
Table 5.7: Standard Logistic Model:
Dependent Variable = Weekly Absence
Sample = All Workers

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Unbalanced Panel of Data</th>
<th>Balanced Panel of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated Coefficient</td>
<td>T-Ratio</td>
</tr>
<tr>
<td>weekly wage</td>
<td>-0.9665E-02</td>
<td>-6.9837***</td>
</tr>
<tr>
<td>full-time</td>
<td>-0.2232</td>
<td>-2.8432***</td>
</tr>
<tr>
<td>permanent</td>
<td>-0.4937</td>
<td>-13.6975***</td>
</tr>
<tr>
<td>married</td>
<td>-0.0806</td>
<td>-1.0004</td>
</tr>
<tr>
<td>female</td>
<td>0.1345</td>
<td>2.7712***</td>
</tr>
<tr>
<td>female*married</td>
<td>-0.1148</td>
<td>-1.3162</td>
</tr>
<tr>
<td>lag-absence</td>
<td>1.1216</td>
<td>27.3875***</td>
</tr>
<tr>
<td>tenure</td>
<td>-0.0536</td>
<td>-7.3291***</td>
</tr>
<tr>
<td>tenure²</td>
<td>0.1341E-02</td>
<td>5.2499***</td>
</tr>
<tr>
<td>age</td>
<td>-0.0515</td>
<td>-6.1423***</td>
</tr>
<tr>
<td>age²</td>
<td>0.6095E-03</td>
<td>5.1597***</td>
</tr>
<tr>
<td>constant</td>
<td>-1.3339</td>
<td>-7.8368***</td>
</tr>
<tr>
<td>Likelihood Ratio Test</td>
<td>1908.4***</td>
<td></td>
</tr>
<tr>
<td>Maddala R²</td>
<td>0.0206</td>
<td></td>
</tr>
<tr>
<td>Maddala R² / Range</td>
<td>0.0571</td>
<td></td>
</tr>
<tr>
<td>Cragg-Uhler R²</td>
<td>0.0373</td>
<td></td>
</tr>
<tr>
<td>Number Of Observations</td>
<td>91576</td>
<td></td>
</tr>
</tbody>
</table>

Other interesting results from Table 5.7 include the estimated coefficient of the dummy variable, permanent, which indicates a negative and statistically significant association between a permanent contract and the probability of absence. This implies that individuals employed under temporary contracts are characterised by a higher probability of absence. Individuals employed under temporary contracts, which are generally of a short-term nature, are more likely to devote resources to job search in order to find more secure employment. The extent to which the behaviour of individuals employed under permanent contracts differs from that of individuals employed under temporary contracts is explored more fully from a theoretical viewpoint in Chapter 6.
Once again, the size of the likelihood ratio test statistic confirms the joint significance of the explanatory variables (excluding the constant) in the case of both sets of estimates. It should be noted, however, that the predictive capacity of both sets of estimates is poor. One might expect this to be the case since the aggregation from daily to weekly data clearly involves the suppression of a great deal of information.

To summarise, the empirical results presented in this Section are consistent with the findings of other economic studies of absence behaviour which suggest that characteristics of the employment contract appear to be major determinants of absence behaviour. In addition, as Allen (1981a) discovers, age appears to be one of the most easily observed personal characteristics of workers which is related to absence behaviour.

5.6 Concluding Remarks

The aim of this Chapter is primarily to acknowledge the temporal nature of absence decisions from both a theoretical and empirical perspective. From the theoretical analysis presented in Section 5.3, it is evident that absence control mechanisms whereby current absence implies future penalties implicitly introduce inter-temporal links between current and future absence behaviour. The analysis of Section 5.3, therefore, acknowledges the existence of such links and focuses on their implications for the absence decision-making process.

The empirical analysis presented in Sections 5.4 and 5.5 explores the determinants of absence by investigating a firm-specific panel of data. This data set is interesting since it presents an opportunity to analyse the determinants of daily absence decisions. The scarcity of such micro data sets has, unfortunately, led many researchers to analyse absence rates of individuals or work places observed over a specified period of time. It is reassuring to discover, however, that the results of the current study appear to confirm the findings of previous research. More specifically, the results are broadly in line of those of Allen (1981a) and Kenyon and Dawkins (1989) which suggest that characteristics of the employment contract are key determinants of absence behaviour.
It is important to acknowledge a particular shortcoming of the logistic model specified above for the analysis of daily absence decisions. This weakness concerns the fact that the logistic model does not take account of unobserved heterogeneity. This implies that the model may be mis-specified since it is clear that individuals may differ in systematic but unobserved ways. Moreover, given the relatively small amount of information regarding the personal characteristics of employees available in the personnel records of the firm, it is apparent that omitted variables such as the presence of dependent children may have important consequences for absence behaviour. Hence, it is important to distinguish between systematic variation, which can be attributed to missing explanatory variables, and pure random variation due to other factors. A second type of model based on the logistic function but with an additional case-specific random error term included in order to account for omitted variables and, hence, unobserved heterogeneity, is analysed in this Appendix. The analysis is undertaken in order to test the robustness of the empirical results presented in Tables 5.6 and 5.7, once one accounts for unobserved heterogeneity. The case specific random error term is incorporated into the model by including an additive random variable in the intercept of the regression equation.

In terms of the analysis presented in Sections 5.4 and 5.5, emphasis was placed primarily on exploring the determinants of the probability of absence (i.e. the probability that $d_{it} = 1$) which can be expressed as follows:

$$pr(d_{it} = 1) = F(\beta'X_{it})$$ (A5.1)

where $F(\beta'X_{it})$ represents the specified distribution function which is a function of the set of explanatory variables (including the intercept term, $\beta_0$). Clearly, variables which are not contained in the data set may exist which influence absence behaviour - such variables, however, have to be regarded as unobservable. In order to allow for the existence of such variables, a random intercept term, $\beta_{0i}$, is incorporated into the set of explanatory variables and can be defined as follows:

$$\beta_{0i} = \beta_0 + \epsilon_i$$ (A5.2)

1 The simulation study of Davies and Pickles (1985) indicates that it is important for this type of discrete choice model to incorporate an error structure which represents the effects of omitted variables.
i.e. a random intercept term, $\beta_{0i}$, exists for each individual where the error term $\varepsilon_i$ is characterised by zero mean and constant variance:

\[ E(\varepsilon_i) = 0 \]  
(A5.3)

\[ E(\varepsilon_i^2) = \sigma^2 \]  
(A5.4)

Hence, the modifications imply that the probability of an individual being absent can be expressed as follows:

\[ pr(d_i = 1) = F(\beta'X_i + \varepsilon_i) \]  
(A5.5)

where the additional variable, $\varepsilon_i$, allows for observationally equivalent individuals to differ systematically in their choice probabilities.

In order to estimate such a model, a specific distribution for the $\varepsilon$'s over the population has to be assumed, $f(\varepsilon)$. Such a 'random effects' model, the logistic normal mixture model, has the following marginal likelihood for the series of events for the $i^{th}$ case:

\[ L_i(\beta) = \prod_{t=1}^{T_i} \left\{ \frac{\exp(\beta'X_{it} + \varepsilon_i)}{1 + \exp(\beta'X_{it} + \varepsilon_i)} \right\} f(\varepsilon) \]  
(A5.6)

where $f(\varepsilon)$ is the probability density function or 'mixing' distribution of the error term, $\varepsilon$, and $T_i$ represents the length of the sequence of events. Thus, in order to allow for unobservable variables, an additive random variable, $\varepsilon$, is introduced across individuals which is incorporated in the intercept of the regression equation.

Models which incorporate individual-specific error terms are difficult to apply to empirical analysis. One major problem concerns the fact that the individual specific error terms and the structural parameters cannot be estimated simultaneously. Further problems arise with computing the individual specific error terms due to the potentially very large number of such parameters to be estimated. If it were computationally possible to estimate both sets of parameters simultaneously, the estimates of the structural parameters would, however, be biased since the number of individual error terms would rise with the number of observations [Neyman and Scott (1948)]. Thus, the error terms have to be eliminated prior to the maximisation of the model.
In order to estimate such a model, a specific distribution is assumed for the additive random variable over the population. The SABRE program [see Barry et al (1990)], which uses quadrature to numerically evaluate each likelihood integral assuming that $f(\varepsilon)$ is normally distributed, was employed to implement the regressions. Tables A5.1 and A5.2 below present the results obtained by specifying the logistic-normal mixture model.

The results presented in Table A5.1 are comparable to those presented in Table 5.6. It is apparent from the results presented that the daily wage and the overtime ban variable appear to be the most robust determinants of absence behaviour once one allows for unobserved heterogeneity. The estimated coefficient on wages suggests a negative association between wages and the probability of absence which confirms the results from the analysis of the logistic model which suggests that the substitution effect dominates the income effect. In addition, the estimated coefficient on the overtime ban confirms the previous result which suggests that once a ban is in place, an individual may have a relatively greater incentive to engage in absence behaviour. To summarise, once one allows for unobserved heterogeneity, it appears that the characteristics of the employment contract remain important determinants of absence behaviour.

The analogous exercise was conducted in order to explore the robustness of the results presented in Table 5.7 which presents the results of the analysis of the determinants of absence behaviour of all employees of the firm (i.e. both part-time and full-time). The results from specifying the logistic normal mixture model are presented in Table A5.2 below. Analysis at such a level of aggregation was conducted in order to determine the general difference in the absence behaviour across the two groups of workers; namely the full-time employees who face the absence penalty system and the part-time employees. The results from the logistic normal mixture model support those from the standard logistic model, in that the estimated coefficient representing a full-time contract remains negative in sign. Hence, even accounting for unobserved heterogeneity, it would still appear that the control system is effective in the sense of moderating the absence behaviour of employees.

\[ F(x) = \int_0^1 f(x, t) \, dt \]

Numerical quadrature can be used to approximate the integral by a weighted sum of function values at selected points which lie between the range of integration:

\[ \int_0^1 f(x, t) \, dt \approx \sum_{j=1}^M \omega_j f(x, t_j) \]

where \( \omega_j \) represents a set of weights and \( t_j \) represents a set of values of \( t \) which lie on the unit interval, i.e. \( 0 \leq t_1 \leq \ldots \leq t_m \leq 1 \) [see Gill et al (1981) for further discussion of quadrature methods].
full-time employees. Furthermore, the coefficient estimated from the mixture model is larger than that estimated from the standard logistic model, which implies that allowing for unobserved heterogeneity leads to an even more pronounced difference between the behaviour of the two types of worker.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Unbalanced Panel of Data</th>
<th>Balanced Panel of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated Coefficient</td>
<td>T-Ratio</td>
</tr>
<tr>
<td>wage</td>
<td>-0.0196</td>
<td>-2.1219**</td>
</tr>
<tr>
<td>chrs</td>
<td>0.1385E-01</td>
<td>0.4742</td>
</tr>
<tr>
<td>overtime ban</td>
<td>0.1943</td>
<td>2.3551**</td>
</tr>
<tr>
<td>permanent</td>
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<td>0.5443</td>
</tr>
<tr>
<td>married</td>
<td>0.1671E-01</td>
<td>0.1542</td>
</tr>
<tr>
<td>female</td>
<td>0.1999</td>
<td>1.6561*</td>
</tr>
<tr>
<td>female*married</td>
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<td>-0.7914</td>
</tr>
<tr>
<td>lag-absence</td>
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<td>7.8422***</td>
</tr>
<tr>
<td>tenure</td>
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</tr>
<tr>
<td>tenure2</td>
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<td>0.2227</td>
</tr>
<tr>
<td>age</td>
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<td>-1.4275</td>
</tr>
<tr>
<td>age2</td>
<td>0.4042E-03</td>
<td>1.4991</td>
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<tr>
<td>constant</td>
<td>-5.3738</td>
<td>-3.9930***</td>
</tr>
<tr>
<td>end point 0(ψ₀)³</td>
<td>0.1691</td>
<td>4.8207***</td>
</tr>
<tr>
<td>end point 1(ψ₁)</td>
<td>0.0000E+00</td>
<td>-</td>
</tr>
<tr>
<td>Number Of Observations</td>
<td>120106</td>
<td></td>
</tr>
</tbody>
</table>

3 The estimated end point parameters can be used to estimate the proportion of stayers in either state zero or state one. The estimated proportion of perfect attenders characterised by dₜ, always equal to zero is as follows:

\[ p_0 = \frac{\psi_0}{1 + \psi_0 + \psi_1} \]

Thus, \( p_0 \) for the unbalanced panel of data equals 0.144 and for the balanced panel of data equals 0.141.
<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Unbalanced Panel of Data</th>
<th>Balanced Panel of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated Coefficient</td>
<td>T-Ratio</td>
</tr>
<tr>
<td>weekly wage</td>
<td>-0.3616E-02</td>
<td>-1.6542*</td>
</tr>
<tr>
<td>full - time</td>
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<td>-3.2265***</td>
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<tr>
<td>permanent</td>
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<td>-9.7623***</td>
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<tr>
<td>married</td>
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</tr>
<tr>
<td>female</td>
<td>0.2273</td>
<td>3.0993***</td>
</tr>
<tr>
<td>female*married</td>
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<td>-1.0148</td>
</tr>
<tr>
<td>lag-absence</td>
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</tr>
<tr>
<td>tenure</td>
<td>-0.0606</td>
<td>-4.7363***</td>
</tr>
<tr>
<td>tenure²</td>
<td>0.1487E-02</td>
<td>3.2229***</td>
</tr>
<tr>
<td>age</td>
<td>-0.0430</td>
<td>-3.2613***</td>
</tr>
<tr>
<td>age²</td>
<td>0.4976E-03</td>
<td>2.6981***</td>
</tr>
<tr>
<td>constant</td>
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<td>-6.52128***</td>
</tr>
<tr>
<td>end point 0((\psi_0))²</td>
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<td>2.4464015**</td>
</tr>
<tr>
<td>end point 1((\psi_1))²</td>
<td>0.87223E-03</td>
<td>0.9667062</td>
</tr>
<tr>
<td>Number Of Observations</td>
<td>91576</td>
<td></td>
</tr>
</tbody>
</table>

It should be stressed, however, that there is a major shortcoming with the logistic-normal mixture regression model which concerns the fact that if the distributional specification for \(f(\varepsilon)\) is incorrect, then the estimates derived from the model may be inconsistent [Barmby et al (1991b)]. Thus, the analysis presented in this Appendix should be regarded as illustrative rather than definitive, with the aim being to explore the robustness of the results presented in Tables 5.6 and 5.7. To summarise, it appears from this analysis that the characteristics of the employment contract are relatively important determinants of absence behaviour.

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4 The estimated proportion of perfect attenders characterised by \(d_n\) always equal to zero is equal to 0.029 for the unbalanced panel of data and 0.062 for the balanced panel of data.
Chapter 6: Absenteeism, On-the-Job Search and Quit Behaviour

6.1 Introduction

The empirical results presented in Table 5.7 of the previous Chapter suggest that differences exist between the absence behaviour of workers employed under permanent contracts and of those workers employed under temporary contracts. To be sure, the results indicate that individuals who are employed under a permanent contract are significantly less prone to absence than their temporary counterparts, the absence rate (i.e. days absent as a proportion of total work time) for each type of worker being 0.021 and 0.038 respectively.1

It is interesting to explore such differences from the viewpoint of job search theory. As highlighted in the introductory Chapter of this Thesis, economists have, in general, modelled absence behaviour within the neo-classical labour supply framework. Recently, however, attempts have been made to analyse absence from the worker discipline viewpoint according to which voluntary absence on the part of the worker attracts a penalty if detected. A major distinction between this and the conventional approach concerns the role of the wage rate. In the labour supply framework an increase in the wage generates conflicting income and substitution effects whereas, according to efficiency wage considerations, a wage increase unambiguously reduces absence. Furthermore, efficiency wage considerations introduce the effects of expected unemployment duration, a prominent feature of job search theory, into the realm of absence behaviour [Drago and Wooden (1992)].

Allen (1981a) analyses the fusion of the labour supply model and the job search model from a purely descriptive and speculative viewpoint. He argues that if some degree of absence is a 'by-product' of job search activity, then higher wages will clearly reduce the chance of finding a better opportunity elsewhere which, in turn, would imply a moderating effect on absence - the result postulated by the efficiency wage approach. Hence, within this framework higher wages and longer expected unemployment duration concur to reduce absence.

Drago and Wooden (1992), who analyse absence behaviour using self-reported survey data, include a dummy variable in their analysis which equals one if 'the individual perceives the availability of alternative employment opportunities to

---

1 It is important to analyse the labour market behaviour of temporary workers since there has been a dramatic increase in temporary employment over the last decade [Golden and Appelbaum (1992) and Dale and Bamford (1988)]. One explanation for this rise lies in the claim that temporary employment contracts enhance the flexibility of the firm over the business cycle [see Pollert (1988) for further discussion of this issue].
be good’. This is regarded as a proxy for the expected duration of unemployment. As predicted by both efficiency wage and job search considerations, the estimated coefficient for this variable is found to be positive and significant, lending support to both hypotheses. Such findings suggest that a fruitful line of enquiry may be to examine the inter-relationship between absence behaviour and job search at a more formal level.

This Chapter is set out as follows. Given the impact of job search behaviour on quits, the following Section sets out some background issues relating to these two activities. Section 6.3 introduces the theoretical model analysed in this Chapter and motivates the salient features of the model. Section 6.4 explores the empirical relationship between quit rates and absence behaviour using a panel of firm-level data. Section 6.5 concludes with a discussion on policy implications and avenues for further research.

6.2 Background

On-the-job search and quit behaviour have been modelled extensively in the economic literature as a means for workers to counteract dissatisfaction with current employment contracts. Mobility between jobs has attracted attention from both theorists and empiricists. Empirical evidence suggests that on-the-job search is an important phenomenon; analyses by Mattila (1974) and Clark and Summers (1979), for example, suggest that 50-60% of employees who change jobs secure their future jobs prior to leaving their current employer. Layard et al (1991) report the results of Daniel (1983) who analyses a cohort survey; one-third of the participants said that they continued to engage in job search after finding employment. Furthermore, three-quarters of those who conducted on-the-job search changed job. According to some of the respondents, job offers are often accepted as a ‘stop-gap’ since they provide a more secure base than unemployment from which to obtain a more satisfactory job-match.

Similarly, Pissarides and Wadsworth (1994) remark that voluntary job quitting accounts for the majority of labour turnover with job-to-job changes accounting for approximately two-thirds of job quits. Moreover, such decisions are rational on the part of job seekers in the context of the evidence presented by Layard et al (1991) which suggests that employed job seekers obtain job offers at a faster rate than their unemployed counterparts despite the fact that the unemployed have more time available to devote to search activities. The suggestion that search is more effective if employed may be due to employers discriminating against unemployed job seekers. A survey analysed by Meager and Metcalf (1987) indicated that one-
half of employers regarded unemployment as an undesirable characteristic of an applicant.

It is apparent, therefore, that interdependencies exist between quit behaviour and on-the-job search both of which have implications for job tenure. It has been established empirically that the probability of quitting a job declines as tenure increases [references include Marshall and Zarkin (1987), Borjas and Rosen (1980) and Mincer and Jovanovic (1981)]. Thus, it is not surprising that job tenure is an important determinant of on-the-job search with a negative relationship between tenure and the incentive to engage in job search. Pissarides and Wadsworth (1994) find evidence which supports this hypothesis, on-the-job search being very low amongst full-time employees with long tenure.

The decline in quit rates with respect to tenure may be due to the positive relationship between wages and tenure. One explanation for this latter alliance may lie in the accumulation of a worker’s firm specific human capital over time with the causality running from tenure to remuneration [see, for example, Becker (1962)]. Job search theories, however, suggest the opposite causal relationship with a high relative wage reducing an individual’s propensity to quit. Burdett (1978), for example, presents a theory of optimal wage search in which some employed workers search. If these workers receive an offer which is superior to their existing employment contract they will quit. Clearly, the higher is the individual’s current wage, the more likely it is that he/she will remain with the current employer.

The association between tenure and turnover has also been explained by the existence of a ‘productivity effect’ intrinsic to the match of worker and firm with the value of any particular match imperfectly observed by both parties [Flinn (1986)]. As tenure increases both the worker and the firm gain more knowledge regarding the match. The accumulation of information is typically modelled as a Baysian learning process which is characterised by the property that additional information leads to ever declining revisions in the posterior evaluation of the quality match. Thus, turnover is more likely to occur at low tenure levels when received information leads to relatively larger revisions in the estimated quality match.

A similar approach is adopted by Wilde (1980) and Lippman and McCall (1978) according to which workers learn about characteristics of the job after accepting the offer of employment. If the value of such characteristics is low enough, the worker quits. Clearly, non-wage job characteristics such as working conditions may affect turnover in this way [Viscusi (1979)]. It is apparent that job search is unlikely to yield much information on such aspects of the employment relationship. Hence, in order to ascertain such conditions the searcher will have to accept the job and observe what transpires. Holmlund and Lang (1985), who explore the relation between quits and tenure by incorporating an element of
learning into their model, assume uncertainty regarding non-wage characteristics within a search framework. The non-wage characteristics can only be evaluated from job experience. If the non-wage characteristics turn out to be ‘satisfactory’ the individual will remain with the employer whilst if this is not the case the individual will engage in further job search. Holmlund and Lang demonstrate how the probability of quitting falls as tenure rises with wage rates held constant, since individuals with longer tenure are more likely to be those who found the non-wage attributes ‘satisfactory’.2

To summarise, an individual will accept an offer of employment if the expected utility from the contract exceeds that from alternative options. If the contract is such that the individual is over-employed if he/she accepts the contract then the following lines of action may be taken. The individual may go absent in order to supply an amount of labour which is in accordance with that which maximises his/her utility. The individual may also engage in job search in order to find a contract which implies a higher level of utility. If an individual has accepted a job offer then ‘on-the-job’ search may be undertaken. Furthermore, an employee may absent himself/herself from the workplace in order to engage in job search. If this is the case, then absence behaviour may precede the quit decision.3

Burke and Wilcox (1972) explore the notion that a spate of absences may precede the decision to quit. As argued by Johns and Nicholson (1982) the extent to which this may be the case depends on factors such as the opportunities for alternative employment, which will determine the individual’s perceived benefits of job search. Furthermore, the extent to which job search can be performed at work will determine the observed pattern of behaviour:

... the likelihood of absence preceding the act of quitting will depend partly on job search opportunities in one’s present job (e.g. access to a telephone). [Johns and Nicholson (1982), p. 149].

It is apparent that on-the-job search may not be possible for some workers. Production workers, for example, typically have little or no access to facilities such as telephones. Faced with such constraints an individual may go absent in order to search ‘off-the-job’. Since sick pay is generally greater than unemployment benefit,

2 Datcher (1982), however, analyses how knowing someone at the place of employment before being hired provides information about the workplace which is difficult to determine prior to hiring. Such information may improve the quality of match between individuals and jobs and, thereby, lower the probability of quit behaviour.

3 Reza (1974) remarks that ‘... employees have the option of quitting their jobs or to practise absenteeism if they are dissatisfied with their employer’s requests.’ [Reza (1975), p. 238]. The latter action is ignored by Georgellis (1994) who analyses the implications of non-wage attributes for tenure. Georgellis assumes that any deviation between desired and actual hours of work leads to job dissatisfaction which in turn leads to workers quitting their jobs and, therefore, implicitly ignores the option of absenteeism.
sick pay may in fact be serving to subsidise off-the-job search activities. Such behaviour would indeed imply that a spell of absences will precede the quit decision.

It is apparent that the extent to which an individual has an incentive to engage in off-the-job search when absent is influenced by a number of factors. Kenyon and Dawkins (1989), for example, comment that the composition of the work force may have important implications for absenteeism:

... younger workers turn over jobs more frequently and job search might be undertaken off-the-job through labour absence. [Kenyon and Dawkins (1989), p.235].

In terms of search theory, relatively inexperienced, younger workers are more likely to engage in ‘job-hopping’ in an attempt to find their most preferred match. Although on-the-job search is certainly feasible, it may be rather more problematic for younger, less tenured workers [Layard et al (1991)]. Moreover, it has been argued that the individuals most likely to conduct off-the-job search are those, such as the relatively low paid young, with relatively high replacement ratios [Joll et al (1983)]. Indeed, the costs of searching for such workers will be generally small, with low foregone wages and long potential income streams to successful matches.

The economic climate may also affect an individual’s incentive to engage in job search. Chaudhury and Ng (1992) point out that during a recession workers may absent themselves less often on account of the increased perceived costs of dismissal. On the other hand, workers may predict future lay offs. Hence workers may go absent more frequently in order to search for alternative, more secure, employment.

Job search and quit behaviour have been modelled extensively in the economic literature as a means for workers to counteract dissatisfaction with employment contracts. Likewise, absence behaviour should be recognised as a symptom of dissatisfaction with the employment contract since it implies a degree of mismatch between the employment contact and the individual’s ‘ideal’ or utility maximising strategy. Absenteeism should, therefore, be analysed within the broader context of the manifestation of worker behaviour which is a consequence of dissatisfaction with contractual requirements. Kenyon and Dawkins (1989) argue that absenteeism is a warning of job dissatisfaction, and may be regarded as a substitute for industrial action or, indeed, a signal for future industrial unrest. This hypothesis is tested by the inclusion of a variable representing working days lost per worker due to industrial disputes. This variable is found to exert a significant positive effect on absence.
In a similar vein, Hyman (1972) regards absenteeism and turnover as forms of industrial conflict along with other forms of conflict such as strikes and go-slows. Absenteeism and turnover, however, are regarded as 'unorganised' conflicts where the worker takes action as an individual. This is suggestive of an inverse relationship between 'organised' and 'unorganised' conflict since they may be regarded as substitutes. It is apparent that workers may, in the short term, turn to absenteeism as a means to counteract dissatisfaction with contracts. In the long term, however, workers may take collective industrial action in order to deal with their dissatisfaction.

In the field of applied psychology much research has been undertaken into the relationship between job performance and job retention [See Kanfer et al (1988)]. Absence behaviour has been regarded as one determinant of performance assessment. Keller (1984) and Stumpf and Dawley (1981), for example, conduct studies of clerical and professional turnover and found that 'stayers' were less prone to absence than 'leavers'. The basic premise behind such studies relies on the existence of a progression of behavioural withdrawal from absenteeism to turnover. Rosse (1988) explores the progression of this 'withdrawal hypothesis', according to which an individual may exhibit a hierarchical sequence of withdrawal - specifically lateness to absence to quitting. The hypothesis was tested by comparing the conditional probability of subsequent behaviour given the past behavioural record. The results suggest a simple progression from lateness to absence, whilst turnover progression only occurred after multiple absence or lateness.

Kanfer et al (1988) conduct an investigation into the relationship between performance and retention at different levels of tenure. The relationship between performance and retention was found to be of greater significance at intermediate levels of training i.e. after an initial level of training. These results were consistent with those of Ferris and Rowland (1987), the basic hypothesis being that as workers learn more about job and working conditions, they are more likely to respond to organisational influences such as absence control mechanisms.

There are, however, critics of the withdrawal approach who argue that absenteeism and turnover reflect two distinct and unique types of behaviour and which should, therefore, be analysed as separate phenomena [see, for example, Steers and Mowday (1981) and Price and Mueller (1981)]. Indeed, the positive relationship between absenteeism and turnover, as hypothesised by the withdrawal

---

4 Turnbull and Sapsford (1992) explore the relationship between absenteeism and other forms of industrial conflict for British dock workers. The evidence suggests that strikes, absence and other forms of conflict were 'additive' as opposed to 'alternative' ways of expressing dissatisfaction.

5 In the seminal paper by Steers and Rhodes (1978), for example, tenure was included as an influence on absence behaviour.
approach, has not been universally accepted. Absenteeism has been regarded as an alternative to turnover which implies a negative association between these two types of behaviour [see, for example, Fitzgibbons and Moch (1980)]. In addition, absence may increase only after a decision to quit has been made [Farell and Peterson (1984)].

Mitra et al (1992) adopt a meta-analytic approach in order to determine whether or not absence behaviour and turnover should be analysed on a joint basis. Their empirical results indicate a positive relationship between absenteeism and turnover which suggests support for the withdrawal hypothesis. Despite such debates one should note that the applied psychology literature, in contrast to the economics literature, has identified the importance of a link between absence behaviour and turnover. It should be stressed, however, that although the applied psychology literature has recognised this link it may have suffered from the lack of formal theoretical foundations (recall Section 2.3.2, Chapter 2).

In this Chapter the implications of job search for absence behaviour are analysed adopting a partial equilibrium approach in order to highlight the interaction between these types of worker behaviour which to date have been analysed as separate phenomena. The interaction between absence behaviour and job search is analysed within a two-period framework in the context of two distinct employment contracts; a single-period ‘temporary’ employment contract and a two-period ‘permanent’ employment contract. In the case of employment under the temporary contract, the individual is aware of when the contract ends and this knowledge may serve to encourage job search prior to the expiration of the contract [see Burgess and Low (1992) who discover that pre-unemployment search propensities are higher in groups where notice was given than in groups where no notice was given]. In the case of employment under the permanent contract outlined in Section 6.3 below, the individual has already secured employment for the following period. The undertaking of job search in such a context is, therefore, more akin to the Burdett (1978) model where, if the costs of search are outweighed by the perceived benefits, the individual will seek a more attractive contract and, if such a contract is discovered, will quit the current job.

6.3 The Interaction Between Absenteeism and Job Search

6.3.1 Introduction

The aim of this Section is to explore the theoretical implications of job search for an individual’s absence behaviour in the context of a two period model; period one represents the present and period two represents the future. Individuals are
assumed, for simplicity, to be risk neutral with utility functions of the following form:

\[ U_i = (1 - \sigma_i) c_i + \sigma_i l_i \quad \text{where } i = 1, 2 \]  
(6.1)

where \( i \) represents the time subscript, \( c_i \) represents consumption in period \( i \), \( l_i \) represents leisure in period \( i \) and \( \sigma_i \) represents an index of sickness in period \( i \). Utility is assumed to be increasing with respect to consumption and leisure and decreasing with respect to sickness.\(^6\) As has been the case throughout this Thesis, individuals are assumed to value leisure (consumption) more (less) the sicker they are.

In Section 6.3.2 the analysis is firstly concerned with a worker who is employed in period one under a single period 'temporary' contract. This contract specifies that the individual is employed by the firm in period one with wage \( w \), sick pay \( s \) and contractual hours \( h \) where \( w > s \). Sick pay is assumed to be set at some minimum level, \( s \), exogenously determined by the government (such as statutory sick pay). Once period one has commenced, the individual has two decisions to make; whether to attend work or not and whether to engage in job search or not. In the following Sections the aim of the analysis is to demonstrate the interaction which exists between these two decisions.

For simplicity, it is assumed that on-the-job search is not possible. As mentioned in Section 6.2, this may be a plausible assumption to make in the case of production workers. It is further assumed that if the individual does not devote any resources to job search, then he/she will not receive an offer of employment in period two. Such an approach is also adopted by Arnott et al (1988) who assume that a worker cannot effortlessly receive an offer of employment. It seems plausible to assume that in order to receive a job offer the individual must make some sacrifice. This may entail sacrificing some non-work time in order to, for example, complete an application form or attend a job interview. Similarly Ito (1988), in a framework where search and quit decisions are endogenously derived, assumes that outside opportunities are revealed to the worker only after costly on-the-job search.\(^7\)

Search intensity is denoted by \( \tau \). For simplicity, \( \tau \) is assumed to be a discrete variable which equals either 0 or \( \alpha \) where \( \alpha \) represents the proportion of

\(^6\) In the case of the form of utility function specified in (6.1) a necessary and sufficient condition for \( \frac{\partial U}{\partial \sigma} < 0 \) is \( c > 1 \).

\(^7\) In contrast, Kahn (1985) assumes that outside opportunities are revealed to the individual without search costs.
non-work time devoted to job search activities. Table 6.1 below presents a detailed inventory of the relationship between search costs and the probability of specific outcomes:

| Table 6.1: Search Intensity and the Probability of Successful and Unsuccessful Search |
|---------------------------------|---------------------------------|---------------------------------|
| \( \alpha \)                  | \( \beta \)                   | \( (1 - \beta) \)               |
| 0                              | 0                              | 1                               |

where \( U_{2}^{\text{emp}} \) (\( U_{2}^{\text{unp}} \)) represents the level of utility available to the individual in period two from employment (unemployment) and \( \beta \) \( (1 - \beta) \) represents the probability of employment (unemployment) given \( \tau = \alpha \) \( (\tau = 0) \).

The individual is assumed to choose his/her search intensity in period one given the probability of obtaining employment in period 2. Search is assumed to be costly in terms of leisure and hence reduces current period utility \( (\partial U_{t}/\partial \tau) < 0 \). If the individual decides to search when absent in period one then utility in period one will be reduced, i.e. the costs of search are incurred in period one whilst any potential benefits will be reaped in period two. If the individual employed under a single period contract in period one goes absent and chooses to devote resources to job search, then utility in period one will be as follows:

\[
U_{1}^{A} \bigg|_{\tau = \alpha} = (1 - \alpha)s + \alpha(1 - \alpha)T
\]

It is apparent from Equation (6.2) that utility in period one falls as the value of \( \alpha \) increases. Moreover, the higher is the realisation of sickness, the greater is the reduction in utility caused by an increase in \( \alpha \). Intuitively this makes sense, as an individual becomes sicker the greater is the fall in utility experienced as he/she devotes non-work time to job search as opposed to recuperation. It seems particularly plausible to assume that off-the-job search is costly in terms of leisure as opposed to income since individuals who are absent or unemployed are relatively well-off in terms of leisure time but are relatively poor in terms of income. Hence

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8 Similarly, Ito (1988) models search intensity as an all or nothing decision.
9 The event 'being offered a contract' can be regarded as a random variable with a binomial distribution where the number of trials is one, i.e. only one search is undertaken and the worker is concerned with the probability of a single success.
10 Empirical evidence analysed by Layard et al (1991) indicates that the majority of unemployed people spend relatively small amounts of money on job search.

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due to the assumed diminishing marginal utility of leisure and income an absentee will experience a smaller decrease in utility by giving up an hour of non-work time than if he/she incurred the equivalent cost in terms of money.

Sections 6.3.2 and 6.3.3 below explore how the individual’s absence decision in period one is affected by the possible future consequences of the individual’s decision to attend work in period one and the individual’s decision to devote resources to job search, if absent, in period one. Once period one starts the individual knows the value of $\sigma_1$, the realisation of sickness in period one, and the nature of the probability density function of $\sigma_2$, $f(\sigma_2)$. For simplicity, the realisation of sickness in both periods is assumed to be determined by $f(\sigma_i)$ which represents the uniform distribution:

$$f(\sigma_i) = \begin{cases} 1 & 0 < \sigma_i < 1 \\ 0 & \text{otherwise} \end{cases} \quad (6.3)$$

As soon as period two begins, the individual knows the value of $\sigma_2$. Hence, the analysis collapses to the single period case.

6.3.2 Case One: The Nature of a Job Offer is Known with Certainty

In order to make his/her absence decision the individual uses the concept of the reservation sickness level. The reservation sickness level in period one is defined as the value of $\sigma_i$ such that utility from attending work in period one plus expected utility in period two conditional on attendance and, therefore, no job search in period one, is equal to utility from absenting oneself in period one plus the expected utility in period two conditional on going absent and engaging in job search in period one. In this Section the implications for the reservation sickness level if the individual chooses $\tau = \alpha$ in period one are analysed. Given that attendance in period one precludes the possibility of job search and, therefore, guarantees unemployment in period 2, the reservation sickness level, $\sigma_{i1} | _{\tau=\alpha}$, is the value of $\sigma_i$ such that:

$$\left[1 - (\sigma_{i1} | _{\tau=\alpha})\right]w + (\sigma_{i1} | _{\tau=\alpha})(T - h) + \left(\frac{1}{1 + \rho}\right)E[U_{2\text{emp}}] =$$

$$\left[1 - (\sigma_{i1} | _{\tau=\alpha})\right]s + (\sigma_{i1} | _{\tau=\alpha})(1 - \alpha)T + \left(\frac{1}{1 + \rho}\right)E[U_{2\text{search}}] \quad (6.4)$$
where $E[U_{t}^{\text{search}}]$ is the expected utility available to the individual in period 2 given search in period 1. Equation (6.4) can be rearranged as follows:

$$
\sigma_{t|t-1} = \frac{w - s + \left( \frac{1}{1+\rho} \right) \left( E[U_{t}^{\text{sup}}] - E[U_{t}^{\text{search}}] \right)}{w - s + h - \alpha T} \quad (6.5)
$$

where $\rho$ represents the individual’s subjective rate of time preference.

The reservation sickness level is defined as the value of $\sigma_{i}$ such that the expected lifetime utility from attendance in period one is equal to the expected lifetime utility from absence in period one. This pivotal level of sickness is used as the absence decision making rule. If $\sigma_{i}$ is greater than the reservation sickness level then the individual maximises utility by being absent and engaging in job search activities, i.e. the individual places relatively more weight on leisure time as opposed to income. If $\sigma_{i}$ is less than the reservation sickness level then the individual maximises utility by attending work since the individual places relatively more weight on income as opposed to leisure. In the context of this model, the individual is assumed to face an either/or decision regarding attendance. Once the individual has decided to attend work, he/she is not able to adjust the amount of labour supplied.

It is assumed that contractual hours exceed the proportion of time devoted to job search activities (i.e. $h > \alpha T$).\(^\text{11}\) It is also assumed that $s > b$ where $b$ represents unemployment benefit.\(^\text{12}\) In Equations (6.4) and (6.5), $E[U_{t}^{\text{sup}}]$ represents the expected utility in period two if the individual does not engage in job search in period one - that is, the expected utility of unemployment in period two. Similarly, $E[U_{t}^{\text{search}}]$ represents the expected utility in period two if the individual devotes resources to job search in period one. Expected utility in period two is assumed to be discounted at the individual’s subjective rate of time preference, $\rho$.

If a job offer is made, expected utility in period two is expressed as a weighted average of the expected utility of an attender and the expected utility of an absentee where the weights are the probability that $\sigma_{i} < \sigma_{i}^{*}$ and the probability that $\sigma_{i} \geq \sigma_{i}^{*}$.

\(^{11}\) This may be a plausible assumption to make since empirical evidence presented by Layard et al (1991) indicates that there is a skewed frequency distribution of search intensity with the majority of individuals spending relatively little time searching for a job.

\(^{12}\) This also seems a plausible assumption to make. If weekly earnings are in excess of £58, for example, statutory sick pay is equal to £52.50 per week whereas unemployment benefit for an individual of 25 years and over is £44.65 per week. For individuals under the age of 25, unemployment benefit is set at an even lower level.
respectively, where $\sigma^*_2$ represents the reservation sickness level in period two.\footnote{Note that if no search is undertaken in period one then the period one reservation sickness level, $\sigma^*_1|_{t=0}$, will be equal to Equation (6.8), i.e. $\sigma^*_1|_{t=0} = \sigma^*_2$.} The individual is assumed to evaluate the expected value of consumption and leisure in the case of attendance and absence using the conditional probability distributions to determine the expected value of $\sigma_2$. In the case of an absentee the expected value of $\sigma_2$, conditional on $\sigma_2$ being between $\sigma^*_2$ and one, is substituted into the utility function. Conversely, to determine the expected utility of attending work the expected value of $\sigma_2$, conditional on $\sigma_2$ being between 0 and $\sigma^*_2$, is used. Hence, $E[U^\text{search}_2]$ and $E[U^\text{unemp}_2]$ can be expressed as follows:

$$E[U^\text{search}_2] = \beta\{E[U^\text{emp}_2]\} + (1 - \beta)\{E[U^\text{unemp}_2]\} \tag{6.6}$$

where:

$$E[U^\text{emp}_2] = \sigma^*_2\left[1 - \frac{\sigma^*_2}{2}\right]w + \left(\frac{\sigma^*_2}{2}\right)(T - h) + \frac{\left(1 - \sigma^*_2\right)\left[1 - \frac{1 + \sigma^*_2}{2}\right]s + \left(\frac{1 + \sigma^*_2}{2}\right)T}{(1 - \sigma^*_2)\left[1 - \frac{1 + \sigma^*_2}{2}\right]s + \left(\frac{1 + \sigma^*_2}{2}\right)T} \tag{6.7}$$

$$\sigma^*_2 = \frac{w - s}{w - s + h} \tag{6.8}$$

$$E[U^\text{unemp}_2] = \left(\frac{1}{2}\right)[b + T] \tag{6.9}$$

The expected utility function $E[U^\text{search}_2]$ is based on the premise that if an employment contract is offered it will specify with certainty wage $w$, sick pay $s$ and contractual hours $h$. This implies that there is no risk regarding the characteristics of the contract, an assumption that is relaxed in Section 6.3.3. This simple specification of the model, however, serves to demonstrate some of the important implications of job search for absenteeism. Substituting Equations (6.6), (6.7), (6.8) and (6.9) into Equation (6.5) yields the following:

$$\sigma^*_2|_{t=\text{emp}} = \frac{1}{w - s + h - \alpha T}\left[(w - s) - \frac{\beta \theta}{1 + \rho}\right] \tag{6.10}$$
From Equations (6.10) and (6.11), it becomes apparent that incorporating the effect of the individual’s current decisions on the future, $\beta \theta$, serves to reduce the reservation sickness level relative to that of a single period scenario and hence, in the context of this model, make absence more likely. If the difference between the income received in period one when attending work and that received when absent, net of search costs, is less than $\beta \theta / (1 + \rho)$, the discounted difference between expected utility if unemployed in period two and expected utility in period two if job search is undertaken in period one weighted by the probability of successful search, then $\sigma^*_i|_{r=a}$ will be negative which means that the individual will never attend work in period one. On the other hand, the costs of job search represented by $\alpha T$ exert a positive effect on the reservation sickness level and raise the probability of attendance.

The existence of two contrasting effects makes it interesting to explore the comparative statics of $\sigma^*_i|_{r=a}$ in order to determine how the probability of absence is affected by the relative costs and benefits of job search. The differential specified in Equation (6.12) demonstrates how an increase in $\beta$, the probability of receiving a job offer in period two, affects the reservation sickness level:

$$\frac{\partial (\sigma^*_i|_{r=a})}{\partial \beta} = \left[ \frac{\theta}{(1 + \rho)(w - s + h - \alpha T)} \right] < 0 \quad \forall \sigma^*_i|_{r=a} \in [0, 1] \quad (6.12)$$

Clearly, an increase in $\beta$ decreases the reservation sickness level i.e. if the probability of receiving a job offer increases with the cost of search held constant at $\alpha T$, then this increases the expected benefits of job search and, therefore, makes absence more likely.

---

14 As mentioned at the start of this Section the analysis presented holds for the case when $r = \alpha$. The individual will choose to search when absent if the expected gains from search are outweighed by the costs of search incurred in period one:

$$E[U^s_{r=2}] - E[U^a_{r=2}] = \frac{\beta \theta}{(1 + \rho)} > \sigma_i(1 - \alpha)T = \left( U^A_{\tau = 0} \right) - \left( U^A_{\tau = a} \right)$$

If the above condition holds then the individual will maximise the sum of utility over the two periods when absent in period one by devoting resources to job search. A critical level of sickness can be derived where the costs of search equal the expected benefits:

$$\sigma^*_i = \frac{\beta \theta}{(1 + \rho)(1 - \alpha)T}.$$
Similarly the effect of an increase in $\alpha$, the fraction of leisure time devoted to
search with $\beta$ held constant is demonstrated below:

$$
\frac{\partial (\sigma^*_i|_{r=\alpha})}{\partial \alpha} = \frac{T \left[ (w - s) - \left( \frac{\beta \theta}{1 + \rho} \right) \right]}{(w - s + h - \alpha T)^{2}} > 0 \quad \forall \sigma^*_i|_{r=\alpha} \in [0,1]
$$

(6.13)

Equation (6.13) illustrates that an increase in $\alpha$ raises the reservation sickness level
and, therefore, reduces the probability of absence. An increase in $\alpha$ increases the
costs of search associated with the expected benefits of search held constant. Since
the costs of search rise, the impetus to go absent in order to search off the job is
reduced, hence, the probability of attendance rises.

The differential below illustrates how the reservation sickness level is
influenced by an increase in $\rho$, the individual’s subjective rate of time preference:

$$
\frac{\partial \sigma^*_i|_{r=\alpha}}{\partial \rho} = \frac{\beta \theta}{(1 + \rho)^{2}(w - s + h - \alpha T)} > 0 \quad \forall \sigma^*_i|_{r=\alpha} \in [0,1]
$$

(6.14)

It is apparent from Equation (6.14) that an increase in the individual’s rate of time
preference serves to increase the reservation sickness level and and, therefore, to reduce
the probability of absence. An increase in $\rho$ implies that the individual attaches
more importance to the costs of job search incurred in the present period and less to
the expected future benefits.

The relationship between $\beta$ and $\alpha$ may be explored in more detail. The
total derivative of the reservation sickness level defined by Equation (6.15) below is
set equal to zero in order to illustrate how an increase in $\beta$ must be compensated by
an increase in $\alpha$ in order to keep the reservation sickness level constant.

$$
d\sigma^*_i|_{r=\alpha} = \frac{\partial (\sigma^*_i|_{r=\alpha})}{\partial \alpha} d\alpha + \frac{\partial (\sigma^*_i|_{r=\alpha})}{\partial \beta} d\beta = 0
$$

(6.15)

Condition (6.15) can be rearranged to yield:

$$
\frac{db}{d\alpha}|_{\sigma^*_i|_{r=\alpha} = 0} = - \frac{\partial \sigma^*_i|_{r=\alpha}}{\partial \alpha} \frac{\partial \beta}{\partial \sigma^*_i|_{r=\alpha}} = \frac{T \left[ (1 + \rho)(w - s) - \beta \theta \right]}{\theta (w - s + h - \alpha T)^{2}} > 0 \quad \forall \sigma^*_i|_{r=\alpha} \in [0,1]
$$

(6.16)
It is apparent that the individual is choosing between two alternatives; devoting no time to job search which, therefore, implies no prospect of employment in period two and buying a probability of a job offer, $\beta$, at a price $\alpha T$. Condition (6.16) indicates that a locus of pairs of $(\beta, \alpha)$ exists which hold the reservation sickness level constant. This locus is upwards sloping illustrating how an increase in $\beta$ must be accompanied by an increase in $\alpha$ in order to hold the reservation sickness level constant. Further information regarding the shape of the locus can be extracted from the following second derivative:

$$\frac{d^2 \beta}{d\alpha^2} \bigg|_{\sigma_1^*} = \frac{T^2[(1 + \rho)(w - s) - \beta \theta]}{(w - s + h - \alpha T)^2} > 0 \quad \forall \sigma_1^* \in [0, 1]$$

Hence, Equation (6.17) demonstrates that the slope of the locus is increasing with respect to $\alpha$ implying a convex relationship between $\alpha$ and $\beta$. Figure 6.1 below illustrates the nature of the locus.

Thus, the locus of combinations of $\alpha$ and $\beta$ which maintain a constant reservation sickness level becomes steeper as $\alpha$ increases. Intuitively, increasingly larger expected benefits to search are required to compensate for successive increments in current period search costs.

Clearly in terms of the benefits to search specified in this Section an individual employed under a two period contract specifying $w$, $s$ and $h$ in each period would not benefit from search in period one. If search was undertaken there
would be no expected gain to offset the costs incurred in period one. Hence, a worker employed under such a two period contract has no incentive to devote resources to job search when absent from work in period one. An individual employed under such a two period contract would determine the value of the reservation sickness level in period one, \( \sigma_{1}^{*} \), assuming \( \tau = 0 \) for all values of \( \sigma \). Since absence behaviour in period one does not affect expected utility in period two, then the reservation sickness level in period one reduces to \( \sigma_{2}^{*} \).

In the context of the model described in this Section, the analysis illustrates firstly how the potential benefits of search affect the absence behaviour of workers employed in period one under a contract which lasts for one period; the potential net benefits of job search serve to raise the probability of absence. Assuming that on-the-job search is ruled out and that sick pay is greater than unemployment benefit, sick pay serves to subsidise off-the-job search and, hence, to increase the incentive to absent from the work place. Moreover, the individual will only engage in job search if his/her value of sickness exceeds the reservation sickness level despite the fact that the employment contract expires prior to the following period. The absence of search leads to unemployment in the future. This is in accordance with the analysis of Burgess and Low (1992) which indicates that whether advance notice stimulates pre-unemployment search is still dependent on factors such as length of notice, unemployment benefit and the relative efficiency of employed versus unemployed search.\(^{15}\) In terms of the theoretical framework developed here some employees will not search with advance notice of job loss. Burgess and Low (1992) also find that higher unemployment benefit significantly reduces pre-unemployment search for men. Similarly, in the model described in this Section, higher unemployment benefit in the future would increase the current period reservation sickness level, making current search less likely. Workers employed under a two period contract, however, do not have an incentive to engage in search activities since expected gains to search do not exist.

6.3.3 Case Two: The Nature of a Job Offer is Subject to Risk

In Section 6.3.2 the individual, when embarking on search activities, faces only one type of risk in addition to that regarding health realisations. This is the risk concerning whether an offer of employment will be made. It was implicitly assumed that if an offer is forthcoming then the characteristics of the offer, the

\(^{15}\) See Burgess and Low (1992) for a critique of the early studies of advance notice which generally assume that on-the-job search is only conducted by notified workers who immediately start to search after notification.
wage, sick pay and contractual hours, will be known with certainty. This is clearly an unrealistic assumption to make; there may be a range of possible wages, for example, which search may yield. The analysis presented below assumes that the individual faces risk regarding the wage specified in a given job offer. Both sick pay and contractual hours are assumed to be known with certainty, the former being set at the statutory minimum $s$ and the latter at the technologically constant $h$.\footnote{This assumption is made for simplicity. If the wage rate and contractual hours are both random variables, the question arises as to whether they are jointly or independently distributed. The possibility of tied wage-hours packages implies that these variables should be regarded as jointly distributed, i.e. a high wage may compensate for a rigid hours constraint which serves to over-employ an individual and vice versa [see Lundberg (1984)].}

With respect to contractual hours the number of potential employment contracts faced by an individual is typically relatively low, i.e. workers generally face a choice between either full-time or part-time hours. Hence, the assumption of certainty with respect to contractual hours may be plausible in some areas of employment.

If the individual chooses $r = \alpha$, then the wage specified in potential employment contracts is denoted by a random variable, $\omega$, with a discrete distribution such that:

\begin{equation}
\begin{aligned}
\text{if an offer is made then } & \quad \text{prob}(\omega = w) = (1 - \eta) \\
& \quad \text{prob}(\omega = \tilde{w}) = \eta
\end{aligned}
\end{equation}

where $\tilde{w} > w$. The relatively high wage, $\tilde{w}$, represents the maximum value of $\omega$, i.e. the individual does not expect to be offered a wage in excess of $\tilde{w}$. Hence, there is a chance that an individual who devotes resources to search in period one may be offered the maximum wage in period two. This may give workers employed under the two-period contract an incentive to engage in search in period one since the two period contract is assumed to be characterised by the relatively low wage, $w$.

The analysis below first explores the implications of specifying a discrete distribution of potential wage offers for the absence behaviour of a worker employed under the single period contract in period one who chooses to search in period one when absent. The reservation sickness level, $\sigma_1^{\omega}$, is defined implicitly as the value of sickness such that utility in period one from attendance plus expected utility in period two conditional on attendance in period one is equal to utility from absence in period one plus expected utility in period two conditional on being absent in period one and engaging in job search in period one:
If the individual chooses to search in period one when absent then expected utility in period two will be as follows:

\[
E[U_{2\text{search}}] = \beta \eta \left[ E[U_{2\text{emp}}(\tilde{w})] \right] + \beta (1 - \eta) \left[ E[U_{2\text{emp}}(w)] \right] + (1 - \beta) \left[ E[U_{2\text{emp}}] \right]
\]

where \( E[U_{2\text{emp}}(\tilde{w})] \) reflects the expected utility from a contract which specifies \( \tilde{w}, s \) and \( h \) which is defined as follows:

\[
E[U_{2\text{emp}}(\tilde{w})] = \tilde{\sigma}_2^* \left\{ \left( 1 - \left( \frac{\tilde{\sigma}_2^*}{2} \right) \right) \frac{\tilde{w}}{\tilde{w} - s + h} \left( \frac{\tilde{w}}{\tilde{w} - s + h} \right) + \frac{1}{2} \left( \tilde{w} - s + h \right) \right\}
\]

where:

\[
\tilde{\sigma}_2^* = \frac{\tilde{w} - s}{\tilde{w} - s + h}
\]

Expected utility from a contract which specifies \( \tilde{w}, s \) and \( h \) is a function of \( \tilde{\sigma}_2^* \) where \( \tilde{\sigma}_2^* > \sigma_2^* \) since:

\[
\frac{\partial \tilde{\sigma}_2^*}{\partial \tilde{w}} = \frac{h}{(\tilde{w} - s + h)^2} > 0
\]

i.e. the relatively high wage generates the greatest disparity between income received when absent and income received when attending work. Hence absence becomes less probable. The reservation sickness level in period one of an individual who chooses to search when absent, in the context of this discrete distribution of potential wages, is denoted by:

\[
\sigma_1^{\text{emp}}_{|_{\tau = \alpha}} = \sigma_1^{\text{emp}}_{|_{\tau = \alpha}} + \frac{\beta \eta \phi}{(1 + \rho)(w - s + h - \alpha T)}
\]
\[ \phi = E[U_{2,mp}^*(w)] - E[U_{2,mp}^*(\tilde{w})] = \frac{(w - \tilde{w})(\tilde{w} - s)(w - s) + h(\tilde{w} + w - 2s)}{2[\tilde{w} - s + h][w - s + h]} < 0 \]

(6.25)

The prospect of job search yielding the maximum wage rate adds a further impetus to lowering the reservation sickness level in period one and, hence, to increasing the probability of absence. This further impetus to engage in job search in period one is represented by the additional term, \( \beta \eta \phi \), which reflects \( E[U_{2,mp}^*(w)] - E[U_{2,mp}^*(\tilde{w})] \) weighted by \( \beta \eta \), the probability of receiving a job offer specifying the maximum wage, \( \tilde{w} \).

It is apparent from Equation (6.25) that \( \phi \) is negative, implying that the chance of receiving a job offer with the maximum wage serves to reduce the reservation sickness level. Therefore, the probability of absence in period one, for workers employed under the single period contract, increases since \( \sigma_{1|\tau=\alpha} < \sigma_{1|\tau=\alpha}^{*} \).

This result may be compared to the absence behaviour of an individual employed under a two period contract. Such an individual has to decide between three possible situations:

(i) to attend work;
(ii) to absent oneself and not to engage in job search, i.e. to choose \( \tau = 0 \);
(iii) to absent oneself and to engage in job search, i.e. to choose \( \tau = \alpha \).

In both cases (i) and (ii) the individual's period one reservation level will be equal to \( \sigma_{1|\tau=0}^{*} = \sigma_{1|\tau=0}^{*} = \sigma_{2}^{*} \). Hence, emphasis will be placed on the third case when the individual chooses \( \tau = \alpha \). The reservation sickness level in period one for the worker employed under the two period contract, \( \hat{\sigma}_{1|\tau=\alpha}^{*} \), is defined as the realisation of sickness such that utility in period one from attendance plus the discounted expected utility in period two conditional on attendance in period one is equal to utility in period one from absence plus the discounted expected utility in period two conditional on absence and undertaking job search in period one:

17 The analysis in this Section assumes that if the individual goes absent he/she will engage in job search. This will be the case if the expected gains in period two exceed the costs of search incurred in period one:

\[ E[U_{1,search}^{\alpha}] - E[U_{1,work}^{\alpha}] > \frac{\beta(1 - \eta \phi)}{1 + \rho} \cdot \sigma_{1}(1 - \alpha)T \cdot \left( U_{1|\tau=0}^{\alpha} - U_{1|\tau=\alpha}^{\alpha} \right) \]

If the above condition holds then the individual will choose to search when absent in period one.
\[
\hat{\sigma}_{|_{t=x}} = \frac{w-s}{w-s+h-\alpha T} + \left[ \frac{\beta \eta \phi}{(1+\rho)(w-s+h-\alpha T)} \right]
\]

(6.26)

such that:

\[
\hat{\sigma}_{|_{t=x}} = \sigma_{|_{t=x}} + \left[ \frac{\beta \theta}{(1+\rho)(w-s+h-\alpha T)} \right]
\]

(6.27)

The additional term in Equation (6.26), \( \beta \eta \phi \), represents \( E[U_{\text{emp}}(\tilde{w})] - E[U_{\text{emp}}(w)] \) weighted by the probability of receiving a job offer which specifies the maximum wage. It is clear that \( \phi \) is negative since expected utility is increasing with respect to the wage. Hence the inclusion of the extra term, \( \beta \eta \phi \), into the reservation sickness level of an individual employed under a two period contract serves to increase the probability of absence.\(^{18}\)

Thus, although the prospect of search leading to the relatively higher wage, \( \tilde{w} \), lowers the probability of attendance, the impetus to search amongst the temporary employees exceeds that of the permanent employees, as illustrated by Equation (6.27) since \( \hat{\sigma}_{|_{t=x}} > \sigma_{|_{t=x}} \) as \( \theta > 0 \).

In this Section, the analysis of Section 6.3.2 has been extended in order to incorporate the possibility that the worker, when devoting resources to job search faces risk with respect to the wage rate specified in a job offer. For simplicity, a discrete distribution of wages is assumed. Despite this simplifying assumption the analysis demonstrates that when one allows for the possibility of search yielding the maximum wage, \( \tilde{w} \), the reservation sickness level for workers employed under both contracts falls, thereby increasing the probability of absence. This negative influence on the probability of attendance stems from the term, \( \beta \eta \phi \). Clearly the higher is \( \eta \), the probability of receiving a job offer characterised by the relatively high wage, the lower is the reservation sickness level. Furthermore, the higher is the maximum wage, \( \tilde{w} \), the lower is the probability of attendance.\(^{19}\) Hence the

---

\(^{18}\) The analysis above deals with the effect on the reservation sickness level in period one when the individual chooses to search for a job when absent. This will be the case if the costs of search incurred in period one are outweighed by the expected gains in period two, i.e. if the condition specified below holds:

\[
E[U_{\text{down}}(w)] > \sigma_{|_{t=x}}(1-\alpha)T = \left( U_{1|_{t=x}}^{U} \right) - \left( U_{1|_{t=x}}^{u} \right)
\]

then individual will choose to search if he/she goes absent in period one.

\(^{19}\) The higher is the maximum wage rate, the greater is \( \phi \) in absolute terms and the more negative Expression (6.25) becomes. This is demonstrated formally by the following differential:
greater the expected utility from outside opportunities the lower is the current reservation sickness level.

6.3.4 Concluding Remarks

In the context of the model analysed in this Section, the interaction between absence and job search leads to a situation whereby sick pay serves to subsidise off-the-job search. Moreover, the potential benefits from search activities may lead to an increase in the probability of absence. In this Section, two types of contract have been compared; a single period contract and a two period contract. An individual employed under a single period contract has a relatively large incentive to devote resources to job search since failure to do so will render the individual unemployed in the subsequent period. This is consistent with the empirical evidence found by Pissarides and Wadsworth (1994) which suggests that temporary employment encourages on-the-job search by male workers:

Those temporary workers who do search, do so more extensively than other workers. Not only are temporary workers more likely to pursue indirect or random search, they also utilise more search methods in the process. The imminent termination of a job would indeed appear to induce greater search efforts. [Pissarides and Wadsworth (1994), p.393].

An individual employed under a two period contract, on the other hand, will only have an incentive to engage in job search if there is a chance of receiving a job offer with a wage in excess of the current level of remuneration.

Typically search behaviour is assumed to be the private knowledge of the worker. If the firm believes that workers employed under two period contracts are less likely to go absent than workers employed under a single period contract then the firm may prefer two period to single period contracts. It seems plausible to assume that workers employed under single period contracts have a relatively stronger incentive to go absent and search for a job since otherwise they will be unemployed in period two whilst individuals employed under the two period contract, on the other hand, do not face unemployment in the future period.

Moreover, employers typically find quits costly. Costs may arise due to factors such as re-advertising vacancies and re-training replacements. In the context of a heterogeneous work force, however, if a worker finds that he/she is not suited to the job then the individual may have a strong incentive to go absent in order to

\[ \frac{\partial \phi}{\partial \tilde{w}} = \frac{(\tilde{w} - \ddot{s})(2\ddot{h} + \tilde{w} - \ddot{s})}{2(\tilde{w} - \ddot{s} + \ddot{h})^2} > 0 \]
search for alternative employment. The employer may find it beneficial to encourage such an individual to search for an alternative job in order to replace the individual as soon as possible with someone who has less incentive to absent from the work place. Strand (1985), for example, presents a model in which the firm subsidises the search activities of certain employees who are poorly adapted to the job.

Finally, the employer may find it beneficial to weigh up the costs of providing the means to facilitate on-the-job search and absenteeism. If the firm finds absenteeism more costly than the worker’s on-the-job search activities then the firm may find it beneficial to encourage such activities by, for example, providing access to telephones in the work place.

To summarise, the results of the theoretical analysis illustrate the influences which arise from the interaction between the related aspects of job search and absenteeism, which in general have been analysed as separate phenomena. In the model presented in this Section this degree of interaction serves to encourage absence behaviour and, furthermore, the theoretical results suggest that absence behaviour may precede the decision to quit (the outcome of ‘successful’ search) suggestive of a positive association between absence rates and quit rates. The empirical analysis presented in the following Section aims to explore the relationship between quit rates and absence rates utilising an informative panel of firm level data.

6.4 Empirical Analysis

The aim of this Section is to explore the relationship between absence behaviour and quit rates by analysing a panel of firm level data constructed and originally analysed by Peel and Wilson (1991) to ascertain the implications of profit sharing schemes for absenteeism and quit rates. The data set is industry specific, covering a sub-sample of 52 firms operating in the engineering and metal-working sector of the United Kingdom over a five year period (1978 to 1982). Pooling the data set across firms over time creates a panel of data characterised by 260 firm level observations. Given the relative paucity of data pertaining to absence behaviour, the panel represents one of the few informative firm level data sets available. Interviews were conducted with senior managers, supervisors and shop floor employees to elicit information pertaining to areas such as unionisation, the extent of profit sharing arrangements and the nature of the remuneration schemes implemented by these firms. In general, the results of Peel and Wilson (1991) suggest that firms operating employee participation schemes are characterised by lower rates of absenteeism and quits.
The aim of this Section is to ascertain the determinants of quit rates with reference to a set of explanatory variables pertaining to workplace and workforce characteristics. In contrast to Peel and Wilson (1991), the absence rate prevailing at the workplace is incorporated into the set of explanatory variables in order to explore the interaction between absence behaviour and quit behaviour. Instrumental variable techniques were employed in order to analyse these two types of worker behaviour from the perspective of a simultaneous equation system. Summary statistics relating to the set of regressors are presented in Table 6.2 below. Following Peel and Wilson (1991) and Mobley (1987), the dependent variable, quit, is defined as the number of employees giving notice as a proportion of total employees in a given year.

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<th>Standard Deviation</th>
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<tr>
<td>Wage</td>
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<td>0.9549</td>
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<td>Fringe Benefits</td>
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</tbody>
</table>

In order to derive estimates from the panel of firm-level data, the Dynamic Panel Data (DPD) Gauss matrix programme was employed [see Arellano and Bond (1988, 1991)]. The DPD programme is particularly appropriate for these requirements having been designed for situations where the number of time series observations is small yet the number of cross section observations is relatively
large. Instrumental variable techniques were employed given the simultaneous determination of quit rates and wages and the simultaneous determination of quit rates and absence rates which may arise.20

Although the aim of this Section is primarily to explore the implications of absence behaviour for observed quits rates, there have been a number of studies suggesting that quits rates are influenced by a myriad of factors. The ‘exit-voice’ hypothesis, for instance, proposed by Freeman and Medoff (1984) predicts a negative association between unionisation and quits. Essentially, an aggrieved union member can take his/her complaint to the trade union instead of quitting - the only method of resolution available to non-union workers - thereby, acting to reduce the firm’s level of turnover.21 The basic idea is that unionisation encourages workers to communicate their dissatisfaction, but that such dissatisfaction does not lead to quits since it represent the effects of politicising union members as opposed to the manifestation of genuine grievances. Borjas (1979) and Kochan and Helfman (1981) present evidence which supports this claim, with the association between job dissatisfaction and the propensity to quit being weaker for union than for non-union employees.

The exit-voice hypothesis has attracted considerable empirical support [see, for example, Sloane and Theodossiou (1993), Georgellis (1994), Hersch and Stone (1990) and Miller and Mulvey (1991, 1993)]. Similarly, Blau and Kahn (1981) control for collective bargaining coverage by incorporating a dummy variable which equals one if the respondent’s wages are determined by collective bargaining. The impetus behind the inclusion of such a dummy variable is concerned with the effect of collective bargaining on the nature of fringe benefits, working conditions and the provision of grievance procedures which may affect quit behaviour. The estimated coefficient of this variable suggests a negative association between collective bargaining coverage and the probability of quitting. Following this lead, a variable

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20 The first stage regressors of the instrumental variables estimates include all explanatory variables except the logarithm of the wage (in the case of the wage equation) and the absence rate (in the case of the absence rate equation). The instrument vector includes a set of output market characteristics, such as the perceived market share of the firm, direct exporting and import penetration, which may influence wage setting behaviour and the stringency of absence control. Other instruments include those related to the technology of the firm yielding information as to the nature of technology such as flow/assembly line production which in turn may condition wages and absence behaviour. In each case, the magnitude of the Sargan Test Statistic (recall A3, Chapter 3) endorsed the use of such instruments.

21 Similar work has been undertaken in the field of applied psychology where research has centred on the issue as to whether the existence of grievance procedures provides a voice through which workers can express their dissatisfaction without resorting to absenteeism and exit behaviour. Neglect and turnover are regarded as consecutive phases in the process of withdrawal. An individual who voices his/her complaints and is unsuccessful may turn to neglect and then ultimately to exit [Withey and Cooper (1989)].
representing the extent of unionisation - the proportion of employees at the workplace belonging to a trade union - is included within the empirical specification. 

Competitive wages and training programs have also been proposed as important determinants of quit rates. Pencavel (1972) specified quit rates as a function of wages, educational attainment and unionisation. The results of Datcher (1982) suggest that higher wages lower the probability of quitting. Similarly, Parsons (1977) argues that quit rates decline as the wage rate and general skill level rises. Human capital considerations may also play a prominent role in the decision to quit with the quantity of employee-owned specific human capital exerting a negative influence on quitting. Furthermore, Stromback (1988) argues that the growth of wages over a worker's life cycle is partially due to the accumulation of specific human capital. Thus, the amount of expenditure on training per employee and the ratio of apprenticeships to the total number of employees are incorporated into the set of explanatory variables in order to capture such human capital considerations.

The labour turnover model proposed by Salop (1979) suggests that, within an efficiency wage framework, firms may under certain circumstances pay wages in excess of market clearing rates to reduce costly labour turnover. The higher is the relative wage paid by the current firm and the higher is the unemployment rate, the more reluctant workers will be to quit. In a model of identical firms, turnover may be diminished if all firms pay the same wage which is in excess of market clearing levels. Thus, a variable representing the average real wage at the workplace is included in the analysis - this variable represents the average basic wage plus any bonus payments which may be available. Since local labour market conditions are expected to influence quit rates through the perceived influence on job search outcomes, the regional unemployment rate, which gives an indication the availability of alternative employment, is also incorporated. A priori expectations would predict a negative relation between the regional unemployment and the quit rate.

It is apparent, however, that the wage rate is not the only important dimension of the employee's remuneration package. Other aspects are of considerable importance including the level of fringe benefits such as pension and share option schemes. Allen et al (1993) present evidence supporting the hypothesis

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22 The relationship between unionisation and job tenure is further complicated by the apparent ability of unions to protect members against lay-off. Abraham and Medoff (1984) present survey evidence indicating that such protection increases with tenure, with senior workers benefiting from better protection in union rather than non-union firms. Similarly, Addison and Castro (1987) utilise micro data to estimate retention rates and life-time tenure probabilities for union and non-union workers. Their results suggest that union workers are characterised by a higher probability of life-time employment than their non-union counterparts.
that workers in jobs characterised by pension schemes are less likely to quit, given the potential loss of pension wealth. Thus, non-wage costs per employee are entered into the model as a proxy for the level of fringe benefits. In addition, Allen (1981b, 1983) treats absenteeism as a non-pecuniary characteristic of the compensation package by developing the hedonic framework initiated by Rosen (1974) which suggests that absenteeism may implicitly represent one aspect of the employee’s remuneration package. Similarly, Turnbull and Sapsford (1992) cite evidence supporting the claim that, historically, some groups of workers view absenteeism as a job characteristic. Thus, the absence rate at each work place was included in the specification as a proxy for the extent to which employees may be able to withdraw temporarily from the work place. In contrast, Peel and Wilson (1991) treat quit and absence behaviour as separate phenomena.

Following Wilson et al (1990) and Peel and Wilson (1991), a dummy variable denoting the existence of a profit share scheme covering all employees is included according to the hypothesis that firms operating such financial involvement schemes will experience lower quit rates. Hammer et al (1981) explore the hypothesis that voluntary absenteeism declines following a transfer to worker ownership. If absenteeism is regarded as detrimental to organisational effectiveness, employee-owners should be motivated to attend work since financial and psychological commitment to the firm are of interest. The results suggest a decline in voluntary absenteeism following such a transfer.

Hashimoto and Raisian (1985) who consider the implications of firm size for job tenure and, therefore, for quit rates present evidence suggestive of a positive association between firm size and job tenure in the US and Japan. One explanation given for this relationship relates to the relatively high failure rate of small firms. Cable and Wilson (1990) argue that the implications of firm size for quit behaviour are ambiguous since large firm size may dilute group incentives and increase the incentive for free-riding. In addition, communications problems may arise and, consequently, employees may feel more alienated. On the other hand, a negative relation between firm size and quit rates may predominate since large firms may be characterised by more internal promotion opportunities and more attractive remuneration packages. Thus, in order to explore the implications of firm size for quit behaviour, a firm size variable - the number of employees at the work place - is incorporated into the analysis.

In addition, the level of supervision at the work place may influence quit behaviour. The effect of the degree of supervision on quit behaviour is, however, ambiguous. A high level of supervision may reduce the potential for employees to act on their own initiative, perhaps lowering the degree of job satisfaction and, thereby, raising quit rates. On the other hand, a high degree of supervision may
imply that the supervisor is able to form closer links with his/her supervisees which may lead to a more appropriate and effective allocation of tasks within the firm. To attempt to resolve the debate, a variable denoting the number of employees per supervisor is included in the analysis.

According to Jovanovic (1979) the least qualified employees tend to be characterised by higher quit rates. This is somewhat paradoxical since empirical evidence suggests that these individuals are characterised by the highest probability of unemployment [see, for example, Brown and Sessions (1994) and Pissarides and Wadsworth (1990)]. Thus, the proportion of unskilled employees is included in order to consider this proposition. In addition, the proportion of blue collar employees is included in the analysis.

The provision of overtime working presents a further important dimension of labour market behaviour as outlined in the previous Chapter. Thus, overtime hours as a proportion of standard hours are included in the analysis. Two potentially conflicting influences of overtime working for the level of quits can be cited. Firstly, overtime working may lower the quit rate via the opportunity it provides to enhance one's earnings. On the other hand, overtime working may lengthen the working day and, thereby, lower the degree of job flexibility which in turn may stimulate quit behaviour (see Section 5.2, Chapter 5 for a fuller discussion of these issues). A related variable which pertains to the proportion of employees involved in shift-working is included in the empirical specification. Once again ambiguous predictions concerning the influence on quit rates can be cited. Firstly, since shift-working involves frequent changes in the nature of the work schedule, it may be associated with enhanced flexibility which in turn serves to lower quit rates [Chaudhury and Ng (1992)]. On the other hand, the absence of a regular working routine may be regarded as a negative job attribute acting to increase quit rates.

Finally, Blau and Kahn (1981) explore micro data in order to determine the influence of race and sex on the probability of quitting. The results suggest that quit rates are higher for women and approximately the same for whites and blacks. The standard explanation for the higher quit rates amongst females lies in the nature of the traditional division of labour within the family with women being mainly responsible for domestic affairs and marriage and fertility decisions expected to exert a large impact on the quit behaviour of women. When other personal and job characteristics are controlled for with a probit specification, however, the quit rates of the sample of men and women appear to be the same whilst blacks appear to quit less frequently than whites. Evidence presented by Bradley and Wabe (1988) supports the hypothesis that the female quit rate has exceeded the male quit rate throughout the post-war period. Following this lead, a variable pertaining to the
proportion of male employees in the work force is included in the analysis. Unfortunately, information is not available regarding the ethnicity of the work force.

The results from the estimation procedure are presented in Table 6.3 below. Although the significance of the regressors taken individually is somewhat disappointing, the magnitude of the Wald Statistic lends some support to the joint significance of the regressors.

Table 6.3: Dependent Variable = ln(quit,)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimated Coefficient</th>
<th>T-Ratio23</th>
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<tbody>
<tr>
<td>ln(Absence Rate)</td>
<td>0.1701</td>
<td>1.9987**</td>
</tr>
<tr>
<td>ln(Wage)</td>
<td>-0.3330</td>
<td>-1.7230*</td>
</tr>
<tr>
<td>ln(Fringe Benefits)</td>
<td>0.9743</td>
<td>1.3436</td>
</tr>
<tr>
<td>ln(Unemployment Rate)</td>
<td>-0.6877</td>
<td>-1.7535*</td>
</tr>
<tr>
<td>ln(Blue Collar)</td>
<td>-0.0501</td>
<td>-0.7147</td>
</tr>
<tr>
<td>ln(Overtime)</td>
<td>-0.0013</td>
<td>-0.0131</td>
</tr>
<tr>
<td>ln(Apprenticeships)</td>
<td>0.1912</td>
<td>2.0723**</td>
</tr>
<tr>
<td>ln(Shift Working)</td>
<td>0.1617</td>
<td>1.8849*</td>
</tr>
<tr>
<td>Profit-Share Scheme</td>
<td>0.3054</td>
<td>0.8779</td>
</tr>
<tr>
<td>ln(Workers Per Supervisor)</td>
<td>0.2785</td>
<td>1.4828</td>
</tr>
<tr>
<td>ln(Unionisation)</td>
<td>-0.1271</td>
<td>-0.9775</td>
</tr>
<tr>
<td>ln(Training Expenditure)</td>
<td>-0.0039</td>
<td>-0.0533</td>
</tr>
<tr>
<td>ln(Unskilled)</td>
<td>-0.0758</td>
<td>-0.6002</td>
</tr>
<tr>
<td>ln(Male)</td>
<td>0.3476</td>
<td>1.0225</td>
</tr>
<tr>
<td>ln(Firm Size)</td>
<td>-0.6578</td>
<td>-6.0787***</td>
</tr>
<tr>
<td>Constant</td>
<td>0.8674</td>
<td>1.9046*</td>
</tr>
</tbody>
</table>

Number of Observations: 260

Sargan Test Statistic (df. = 12) 26.736778***
Wald Test Statistic (df. = 16) 66.162978***

23 The standard errors are corrected according to White's (1980) heteroskedasticity consistent covariance matrix.
It is apparent that the estimated coefficient on the variable representing the absent rate prevailing at the work place is significant at the 5% level and, moreover, the sign of this explanatory variable accords with a priori expectations suggestive of a positive relation between absence rates and quit rates.

Other variables which attain significance include the wage variable which is just significant at the 10% level. The sign of the estimated coefficient gives some support for the prediction from job search theory that remuneration and quit rates are inversely related. In addition, the negative coefficient on the variable representing regional rates of unemployment yields further support to the job search framework. The large and highly significant coefficient on the firm size variable supports the hypothesis that an inverse relation exists between quit rates and firm size.

Somewhat surprisingly human capital investment, which is proxied by the proportion of apprenticeships to total employment, appears to exert a positive influence on quit rates. One explanation for this may be that apprenticeships equip young, mobile employees with general rather than firm specific human capital. On the other hand, firms may be failing to retain apprentices once they are eligible for higher levels of remuneration which may be the consequence of a time inconsistency problem [Kydland and Prescott (1977)].

Unlike Bell and Hanson (1984), Peel and Wilson (1991) and Wilson et al (1990), however, the profit share dummy variable and the variable representing the extent of unionisation do not appear to exert a significant influence on quit rates. The insignificant results pertaining to the variables representing the skill and demographic composition of the work force tie in with those of Allen et al (1993), however, who find that sex and union membership are not significantly associated with turnover.

The results presented in Table 6.2 provide some support for the existence of a positive association between absence and quit rates. It is apparent, however, that the levels of significance are not particularly high and that the strength of such an association may be questioned. The data set is, however, characterised by some serious shortcomings, the main weakness being the limited number of cross-sectional observations curbing the extent to which generalisations may made from these results. Despite the fact that the data set contains detailed information regarding work place characteristics, information relating to the demographic composition of the work force is somewhat limited - information relating to the average age and ethnic origin of the work force, for example, is not available. In addition, the data set does not allow a distinction to be made between involuntary and voluntary absence which is of considerable importance to any empirical study of absence behaviour.
6.5 Conclusion

The aim of this Chapter was to consider the hypothesis that some absence may be undertaken for the purpose of engaging in job search. The theoretical analysis presented in Section 6.2 illustrates how incentives may arise which induce employees to absent from the work place and essentially to sacrifice leisure time for job search activities. If job search is a by-product of absence behaviour, then one would predict a positive association between absence and quit rates. Moreover, the fact that absence behaviour and quit behaviour are both symptomatic of job dissatisfaction further endorses the prediction of a positive association between such activities.

The empirical analysis presented in Section 6.3 suggests that such a positive association may, indeed, exist. These results should, however, be treated with a degree of caution since the data set analysed, which is characterised by relatively few cross-sectional observations, is by no means ideally suited to this task. A micro-data set would clearly be preferable since absence and quit decisions are predominantly the outcome of an individual's decision-making process. Since such a data set is not available, then the analysis had to be conducted using one of the few data sets containing information as to quit and absence behaviour, albeit at a firm level. The empirical results, however, are suggestive of a degree of interaction between these two consequences of job dissatisfaction which, hopefully, may be the subject of future research once a more appropriate data set becomes available.
Chapter Seven: Conclusion

It has become almost customary for economists to introduce their analysis of absence behaviour by citing evidence highlighting the significance of absenteeism for the industrial labour costs of developed economies - the current Thesis was no exception. It is important to acknowledge the magnitude and implications of these costs in this concluding Chapter in order, hopefully, to encourage future research into both the causes and consequences of labour absenteeism.

In Great Britain, the percentage of employees reported absent due to sickness absence in the given survey week in 1993 was estimated by Regional Trends at 5.075% [Regional Trends (1994)]. In 1993, the total number of employees in employment was 21,551 thousand which implies that approximately 1094 thousand individuals reported absence in the given survey week. The number of working days lost in 1993 due to industrial disputes (649 thousand in all industries and services over the entire year) pales into insignificance by comparison [Employment Gazette (1994)]. Such figures clearly suggest that absenteeism is a significant labour market phenomenon and as such warrants further research.

Related issues arise since the extent of absence behaviour does not appear to be uniform across regions, industries and occupations. Moreover, there has been very little research into the causes of the apparent regional, industrial and occupational disparities in absence rates. On the other hand, economists have invested significant resources into the analysis of unemployment; more specifically, much attention has been paid to the analysis of the extent and implications of disparities in unemployment rates across regions and demographic groups [see, for example, Pissarides and Wadsworth (1990) and, for a more recent analysis, Brown and Sessions (1994)]. Given the symmetry between the concepts of under-employment and over-employment, as highlighted in Chapter 3, it would appear that more attention should be paid to the analysis of over-employment which may manifest itself into absenteeism. It seems paradoxical and somewhat inefficient that certain groups of individuals in the economy actually desire to work fewer hours whilst individuals concentrated in other areas actually desire to supply more hours of labour.

It is apparent from Figure 7.1 below that there appears to be some variation in the absence rates across the northern and southern regions of the UK. In addition, the magnitude of the absence rates indicates that a significant percentage of working days were lost across all regions in the survey week.
Absence Rate

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<tr>
<td>5.2</td>
<td>5.3</td>
<td>5.1</td>
<td>5.4</td>
<td>5.1</td>
<td>5.3</td>
<td>5.2</td>
<td>5.1</td>
</tr>
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</table>

Figure 7.2: Absence Rates in Great Britain

The data is taken from *Regional Trends* (1994) and represents the proportion of employees reporting at least one day absent from work during the week prior to the survey interview.
The regional disparities become even more evident when one considers the absence rates prevailing across Great Britain which are shown in Figure 7.2 above. The country with the lowest absent rate in Great Britain was England with an absence rate of 4.7% in 1993, whilst Northern Ireland was characterised by the highest absence rate in 1993 of 5.7%.

Further disparities in observed absence rates appear to exist across occupations and industrial sectors with manual workers in manufacturing sectors recorded as having higher rates of absence than managerial staff in the service sector [Employment Gazette (1992)]. The CBI (1994) also calculates rates of sickness absence across industrial sectors. The oil/coal mining sector and Government agencies appear to register the highest rates of sickness absence at 5.1% in 1993 whilst the media and broadcasting sector is characterised by the lowest rate at 2.0%. In general, the rate of absence appears to be higher in the manufacturing than in the service sector.

To summarise, it appears that not only are the costs associated with absenteeism substantial, but in addition, such costs are not uniform across geographical regions, industrial sectors and demographic areas. Thus, questions immediately arise as to why absence rates are not uniform across regions. One explanation may lie with efficiency wage considerations, for example, which suggest that regional unemployment rates play an important role in determining an individual’s perceived expected costs of displaying ‘unreasonable’ workplace behaviour such as excessive rates of absence. Such questions and related explanations remain, however, largely unexplored and unchallenged.

As the EC is currently introducing initiatives in order to encourage movements towards standardising employment policies throughout Europe, it is apparent that, in addition to analysing absence behaviour across industries and regions, one should ideally aim towards a pan-European analysis.

The blame for the lack of economic interest in labour absence does not, however, lie entirely with economists. The paucity of economic research into absence behaviour may be partially explained by the distinct shortage of data pertaining to the absence behaviour of individuals. There is a shortage of not only microdata sets containing information related to individual absence behaviour but also of more highly aggregated data sets pertaining to absence rates across regions or industrial sectors. Consequently, researchers into absenteeism have often

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2 The lack of information on labour absenteeism is not only problematic for academic research, 'Given that absenteeism cost data are not published for industries in the same way that wage surveys, for example, are, there is little in the way of comparative data available for organisations to determine if their costs are out of line with some standard.' [Steers and Rhodes (1990), p.30].
relied on the relatively few employers who are willing to supply information on the absence behaviour of their employees for academic research.

Although these data sets provide an interesting and indispensable insight into observed absence behaviour, problems may arise since the results are consequently employer specific and, therefore, any generalisations made from such empirical analysis should be treated with caution. In addition, there may be a sample selection problem since employers experiencing difficulties controlling absence may be more likely to allow academics to analyse their records of employee behaviour than employers who are less concerned about absence behaviour. Even after putting such problems to one side, the gathering and cleaning of such data is a rather time consuming and financially costly process, since an employer’s records are highly unlikely to be in a format which directly lends itself to academic research. Furthermore, employers do not necessarily gather the type of information a researcher may ideally require access to. The more widespread use of data base systems within companies may, however, address some of the more practical issues raised. Thus, shortages over the availability of data may provide some explanation for the limited amount of research in the field of labour economics.

The aim of this Thesis was broadly to redress this imbalance by exploring the implications of some established areas of labour economics research, e.g. overtime provisions and job search, for absence decisions. To be specific, the series of models presented have explored the microeconomic aspects of an individual worker’s incentive to adopt absence behaviour. The range of absence control mechanisms introduced by the employer seek to modify this tendency to absent from the work place by manipulating such an incentive.

The empirical analysis presented in Chapter 3 suggests that a significant proportion of employees are constrained with respect to the amount of labour supplied. The results indicate that research into concepts such as labour absenteeism which are modelled as a direct response to constraints leading to over-employment may yield valuable insights into the way in which labour market contracts are established. Furthermore, it is apparent that employers may find absenteeism a costly phenomenon and, hence, may, if the expected benefits exceed the costs of the implementation of absence control, take measures to curb the extent to which individuals have an incentive to engage in absence behaviour.

The results pertaining to the influence of two specific means of absence control presented in Chapters 4 and 5 - the provision of experience rated sick pay and the operation of the overtime ban system - highlight ways in which employers may attempt to condition the absence behaviour of the work force by making future remuneration conditional on past absence behaviour. Moreover, the results
also suggest that employees, under some circumstances, may benefit from any 'loop-holes' which may characterise the control schemes operated by employers. In the case of the overtime ban system, an individual who is banned from engaging in overtime working is characterised by a higher probability of absence behaviour due to the nature of the scheme which leads to the accumulation of 'overlapping' rather than consecutive bans.

The nature of these two schemes highlights a further potential area of interest which concerns expanding the time horizon over which absence decisions are made. Although some progress has been made in this Thesis by setting the analysis within a multi-time period framework, there is still a long way to go in order to catch up with other areas in the literature. Current research is being undertaken in this area which places absence decisions into a more general dynamic context. Barmby et al (1995), for example, are currently exploring the implications of the overtime ban system explored in Chapter 5 for the absence decision making process in the context of a stochastic optimisation problem. The analysis presented in Chapter 6, which focuses on the implications of contract duration for absence behaviour - more specifically the implications of permanent and temporary contracts, represents a further important aspect of the temporal nature of absence behaviour. It is particularly important to explore this issue related to the nature and duration of employment contracts given the emphasis placed in the labour economics literature on the theoretical developments advanced to explain the observed decline of spot market contracts since the mid-1970's in favour of long-term contracts. Theories put forward to explain the existence of long-term contracts include human capital theory based on the investment in firm-specific training, implicit contract models based on different degree of risk aversion across workers and employers and models based on effort inducing factors such as bonding mechanisms.

In addition to placing the theory of absence behaviour into the realm of contract design, it also appears to be the case that the role of trade unions in the regulation of absenteeism is a further aspect to be explored more fully. As mentioned in Chapter 5, the overtime ban system proposed to curb excessive absence behaviour is regarded as a joint venture between the employer and the trade union. Moreover, the empirical evidence suggests that the presence of unionisation appears to exert a considerable influence on absence behaviour and it appears to the case that trade unions themselves may have vested interests in restraining the absence behaviour of specific poor attenders. There has been a partial recognition of the role of trade union behaviour in contract theory over the 1980s, but this is still an area of labour economics which is characterised by slow growth. Addison and Castro (1987), who utilise micro data to estimate retention
rates and life-time tenure probabilities for union and non-union workers, remark that:

... there is a pressing need to incorporate unions more fully within the corpus of contract theory. [Addison and Castro (1987), p. 403].

Thus, the acknowledgement of the significance of both trade unions and absence behaviour in the question of contract design may stir interest into this important area of labour economics.

The theoretical and empirical analysis conducted in this Thesis has indicated that observed absence behaviour appears to be conditioned by the employment contract which underlies the employer-employee relationship. Moreover, the evidence presented in this Thesis suggests that the employer is able to exert some degree of control over the employee's absence decision-making process. This further endorses the argument that research into absence behaviour focusing on the interaction between labour demand and labour supply may be a particularly fruitful line to pursue.\(^3\) Similarly, Steers and Rhodes (1990) conclude from their analysis that:

> If there is a lesson to be learned from our analysis it is that managers and organizations can do something to reduce absence at work if they are willing to approach the problem systematically and constructively. [Steers and Rhodes (1990), p.163]

Furthermore, as the responsibility for the provision of statutory sick pay falls further and further into the domain of the employer, rather than the Government, the employer's control over absence behaviour may be enhanced.

Since employers appear to recognise that influence may be exerted on the absence behaviour of the work force, it is worth emphasising that measures to reduce absence behaviour may, under some circumstances, impact negatively on the firm's performance. The analysis conducted in Appendix A4.1, Chapter 4, illustrates how employees, who are 'acceptably' ill may attend the work place due to the penalties which absence behaviour attracts. If employees who are unfit to carry out their duties attend the work place, then this may have adverse consequences for the firm, such as a decline in the productivity of the work force [see, for example, Kenyon and Dawkins (1987)]. Furthermore, the pressure to attend the work place is intensified during periods of recession when the prospect of securing alternative employment if dismissed for absence behaviour is not particularly high.

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\(^3\) The applied psychology literature is starting to focus on specific areas of the employee-employer relation which relate to contractual arrangements. One area of current interest, for example, concerns the implications of shift-working for absence behaviour which directly targets changes in the individual's hours of work regime [Steers and Rhodes (1990)].
In sum, the research conducted in this Thesis suggests that employers may be able to influence the absence decisions of their work force by altering characteristics of the employment contract. One should, however, acknowledge the potential adverse effects which may arise if employees who are ‘involuntarily’ as opposed to ‘voluntarily’ absent are subject to rigorous measures of absence control. Penalties which induce such individuals to attend the work place may be to the disadvantage of the firm as well as to the employee.
References


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