

**Bangor University**

## **DOCTOR OF PHILOSOPHY**

**Three empirical essays on absenteeism.**

Audas, Richard Peter

*Award date:*  
1999

*Awarding institution:*  
Bangor University

[Link to publication](#)

### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

### **Take down policy**

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

**Three Empirical Essays on Absenteeism**

**By  
Richard Peter Audas  
[BBA, MBA, MA in Economics]**

**A Thesis  
Submitted to the University of Wales  
In Fulfilment of the Requirements for the  
Degree of Doctor of Philosophy**

**School of Accounting, Banking and Economics  
University of Wales, Bangor  
United Kingdom**

**September 1999**

## Summary

Absenteeism is a widely observed phenomenon that has received a great deal of attention from academics who argue that it is an excellent proxy for individuals' attitude to work and commitment to their jobs. Unfortunately, very little of this work has been done by economists. The little economics that has been done has tended to view absenteeism as a measure of the supply of effort.

Given the paucity of economic analysis on absenteeism, the psychology, sociology and management literature is reviewed to examine the extent to which their approach and that of an economist have common ground. Upon careful reading, it becomes evident these disciplines offer similar perspectives.

Probably the most researched area of absenteeism is the relationship between absence and turnover. Although there is much contention as to what the relationship between these two phenomena should be, most researchers view this as a means to test the hypothesis of withdrawal. This thesis examines the problem somewhat differently and suggests that the approach of much of the empirical work is misguided. An alternative methodology to examine these phenomena is suggested and tested using a very large and detailed database. The results suggest there is a positive correlation between absence and turnover, although the relationship is more complex than described in the literature.

One area where economists have made a great deal of theoretical progress is in the examination of why absence might vary across firms. The key insight is that production technology may affect the shadow cost of absence and if the costs of absence differ across firms, then there will be different levels of motivation to reduce it.

It is argued that not only will the shadow cost of absence vary across firms, it will also vary over time and a theoretical model is developed to demonstrate this. There is a presumption in the literature that absenteeism is inversely related with the business cycle. However, the empirical work on the subject only models absence as a supply side phenomenon. This introduces a significant identification problem. At the very time when individuals are least likely to go absent, firms' demand for reliable labour will be at its lowest. The empirical work in the chapter models absence from both the supply and the demand side and the findings confirm that both play a significant role in determining absence.

The finding that firms' demand for reliable labour may vary through the business cycle is novel and receives further investigation. The data is disaggregated to determine the robustness of the relationship between demand side factors and the business cycle. At broad levels of disaggregation, the results remain quite strong, although there does appear to be a difference between unionised and non-unionised workers. At finer levels of disaggregation the results are not as conclusive. This is attributed to the relatively small samples used to derive the individual absence series and the resulting increased volatility that emerges due to increased variability from the use of small samples.

## Table of Contents

Preface	p. 1
Acknowledgements	p. 2
Chapter One: Introduction	p. 3
Chapter Two: Theoretical and Empirical Foundations	p. 8
2.1 Introduction	p. 8
2.2 Steers and Rhodes (1978)	p. 10
2.3 Critiquing Steers and Rhodes	p. 16
2.4 Motivation to Attend	p. 27
2.4.1 Satisfaction with the Job Situation	p. 27
2.4.2 Predicting absence using personal and job factors	p. 37
2.5 Pressure to Attend	p. 51
2.6 The State of the Literature	p. 67
2.7 Conclusion	p. 69
Chapter Three: An Economic Analysis of Absence from Work and Voluntary Turnover	p. 70
3.1 Introduction	p. 70
3.2 Schools of Thought	p. 71
3.2.1 The Psychologists' View	p. 71
3.2.2 An Economist's View	p. 75
3.3 Theoretical Model	p. 85
3.3.1 Firing Model	p. 85
3.3.2 Promotions Model	p. 90
3.4 Empirical Strategy and Data	p. 94
3.4.1 Empirical Technique	p. 94
3.4.2 The Data Source	p. 96



3.5 Empirical Analysis	p. 105
3.5.1 Graphical Comparison and Simple Differences	p. 105
3.5.2 Econometric Results	p. 117
3.6 Discussion	p. 121
3.7 Alternative Theories of the Absence Turnover Relationship	p. 125
3.8 Conclusions	p. 130
Appendix 3.1 Weekly Absence Rates April 1991-March 1994	p. 133
 Chapter Four: Absence, Seasonality and the Business Cycle	 p. 134
4.1 Introduction	p. 134
4.2 Absence Behaviour: A Theoretical Model	p. 141
4.2.1 The Individual Absence Decision	p. 142
4.2.2 The Firm's Monitoring Intensity	p. 149
4.3 Empirical Model and Data	p. 156
4.4 Unit Root and Cointegration Tests	p. 158
4.5 Conclusion	p. 170
Appendix 4.1 Simulated Seasonal Cycles	p. 174
Appendix 4.2 Definition of Seasonal Variables	p. 175
 Chapter Five: Absence, Seasonality and the Business Cycle: A Disaggregated Analysis	 p. 176
5.1 Introduction	p. 176
5.2 Seasonality and Absence	p. 178
5.3 Absence and the Business Cycle: Three Broad Sectors	p. 178
5.4 Absence and the Business Cycle: Unionised and Non-unionised Workers	p. 186
5.5 Absence and the Business Cycle: 10 Industrial Sectors	p. 194
5.6 Conclusions	p. 211

Appendix 5.1 Means and Standard Deviations of Disaggregated Absence Series	p. 215
Appendix 5.2 Series Plots and Descriptions: Three Broad Sectors	p. 216
Appendix 5.3 Series Plots and Descriptions: Unionised and Non-unionised Workers	p. 218
Appendix 5.4 Series Plots and Descriptions: 10 Industrial Sectors	p. 219
Chapter Six: Conclusions	p. 229
References	p. 237

## **List of Tables and Figures**

### **Tables**

Table 2.1 Farrell and Stamm's (1988) Meta-Analysis Findings for Total Time Lost	p. 38
Table 3.1 Absence by Grade	p. 100
Table 3.2 Quits by Month	p. 103
Table 3.3 Grade Distribution (by Gender)	p. 104
Table 3.4 Performance Evaluation Distribution (by Gender)	p. 104
Table 3.5 Summary of Differences in Absence Rates	p. 114
Table 3.6 Econometric Results (Probability of Absence)	p. 118
Table 3.7 Chi-Square Tests of Significance of Quit Month	p. 120
Table 3.8 Gupta and Jenkins (1982) Results	p. 123
Table 4.1 Marginal Effects	p. 147
Table 4.2a Tests for Seasonal Integration (Absence, Production and Unemployment)	p. 162
Table 4.2b Tests for Seasonal Integration (Wages and Critical Values)	p. 163
Table 4.3 Johansen Tests for Cointegration	p. 167
Table 4.4 Coefficients of the Cointegrating Vector	p. 168
Table 4.5 Maximum Likelihood Estimation	p. 169
Table 5.1 Tests for Stationarity at all Frequencies for Manufacturing Service and Public Sector Absenteeism	p. 180
Table 5.2 Johansen Tests for Cointegration	p. 184
Table 5.3 Estimated Cointegrating Relationship	p. 185
Table 5.4 Tests for Stationarity at all Frequencies for Union and Non-Union Levels of Absenteeism	p. 189
Table 5.5 Johansen Tests for Cointegration	p. 191
Table 5.6 Estimated Cointegrating Relationship	p. 192

Table 5.7a Tests for Stationarity: Machinery	p. 198
Table 5.7b Tests for Stationarity: Wood and Wood Products	p. 199
Table 5.7c Tests for Stationarity: Paper and Paper Products	p. 199
Table 5.7d Tests for Stationarity: Food, Beverage and Tobacco	p. 200
Table 5.7e Tests for Stationarity: Electrical Machinery	p. 200
Table 5.7f Tests for Stationarity: Transport Equipment	p. 201
Table 5.7g Tests for Stationarity: Chemicals, Rubbers and Plastics	p. 201
Table 5.7h Tests for Stationarity: Basic Metals	p. 202
Table 5.7i Tests for Stationarity: Textiles, Clothing and Leather	p. 202
Table 5.7j Tests for Stationarity: Electricity, Gas and Water	p. 203
Table 5.7k 5% Critical Values	p. 203
Table 5.8 Summary of Results	p. 205
Table 5.9a Johansen Tests for Cointegration	p. 208
Table 5.9b Johansen Tests for Cointegration	p. 209

## **Figures**

Figure 3.1 Trade off Between Absence and Wages	p. 78
Figure 3.2 Daily Absence (All Leavers)	p. 106
Figure 3.3 Daily Absence (Matched Stayers)	p. 106
Figure 3.4 Absence Differences	p. 108
Figure 3.5a Managerial Leavers' Absence	p. 110
Figure 3.5b Managerial Stayers' Absence	p. 110
Figure 3.5c Managerial Absence Differences	p. 111
Figure 3.6a Staff Leavers' Absence	p. 112

Figure 3.6b Staff Stayers' Absence	p. 112
Figure 3.6c Staff Absence Differences	p. 113
Figure 4.1 Absence Production and Unemployment US, 1979-1993	p. 136
Figure 4.2 Expected and Actual Output and Profit	p. 154
Figure 4.3 Effect of an Increase in Expected Aggregate Demand	p. 155
Appendix 4.1 Simulated Seasonal Cycles	p. 174
Appendix 5.2 Series Plots and Descriptions: Three Broad Sectors	p. 216
Appendix 5.3 Series Plots and Descriptions: Unionised and Non-unionised Workers	p. 218
Appendix 5.4 Series Plots and Descriptions: 10 Industrial Sectors	p. 219

## Preface

“The Plant Manager introduced the man in charge of over-seeing worker attendance. In contrast, he didn’t seem happy at all. The attendance man unveiled a large chart illustrating the trends in absenteeism. With a long pointer, he traced the roller coaster tendencies of the unexcused absence. He pointed to Monday, which slung low to the bottom of the chart. Monday was an unpopular day, attendance-wise. He moved the pointer over to Tuesday and Wednesday which showed a significant gain in attendance. The chart peaked way up high on Thursday. Thursday was pay night. Everyone showed up on Thursday.

“Then we arrive at Friday,” the attendance man announced. A guilty wave of laughter spread through the workers. None of the bossmen appeared at all amused. Friday was an unspoken Sabbath for many of the workers. Paychecks in their pockets, the leash was temporarily loosened. To get a jump on the weekend was often a temptation too difficult to resist. The Corporation saw it quite differently.

The attendance man took his pointer, which was resting triumphantly on the snow-capped peak of Thursday evening and, following the graph, plunged the pointer straight down through Friday, a motion that resembled falling off a cliff. Again there was much snickering.

“Unfortunately, this is not a subject that lends itself to any amount of humour,” the attendance man bristled. “Absenteeism is the single largest factor in poor quality. No replacement, no utility worker can perform your job as well as you. Each time you take an unexcused absence, you damage the company along with the security of your own job!” With that said, he packed up his graphs and charts and stalked off the stage to make way for the techno-cretins. The veins in his neck were visible all the way back to the doughnut table.”

*(From Ben Hamper’s “Rivthead”)*

## **Acknowledgements**

There are a number of people who have been instrumental in helping me complete this thesis.

My supervisor, John Treble, provided me with a great deal of encouragement and support throughout. From him I have learned a great deal.

My employers Tim Barnby, Peter Dolton, and John Treble (again) have also been extremely understanding regarding giving me the time necessary to complete this project. Tim also lent a lot of intellectual support.

A particular debt is owed to John Goddard, who managed to teach me some of the subtleties of time series econometrics. This support was instrumental.

Thanks also to my parents and my parents in-law. They are probably happier than me to see this completed.

Finally and most of all, a special debt of gratitude goes to my wife Moira. She has endured a lot of inconvenience, lonely nights and weekends and my neuroses while I have attempted to get this thesis completed. She has also served as my main source of encouragement, support and has given me the focus to see this project through. Without implicating her, this project is as much hers as it is mine.

## **Chapter One: Introduction<sup>1</sup>**

Employee absenteeism is a widespread and observable phenomenon with very tangible implications for economic behaviour. Yet despite this, it has long been a subject virtually ignored by economists. Most researchers studying absence believe it to be a proxy for the supply of effort, although they might not refer to absence in these terms. They talk about absence in terms of “withdrawal” or “organisational commitment”, but after a careful reading of much of this literature, it has become apparent that withdrawal and commitment essentially mean the supply of effort.

A key problem in the study of absence is that some time away from work (and perhaps most) is legitimate. Distinguishing between legitimate absence and shirking is at best difficult and in most cases, impossible. Workers do not call in and announce to their employers that they are not coming in to work that day because they are ‘skiving.’ They claim that they are ill and in most circumstances there is no way to validate this claim. In fact the issue may even be more muddled than this. An individual may be poorly, but there is no way of determining if they are sufficiently sick that they are unable to attend work. Again there are few ways in which the employer can validate this claim (particularly if the absence is short term). This difficulty in separating legitimate absence from shirking (which would be of particular interest to economists) may explain why the profession has been slow to see absence as a potential way to examine many rich lines of theoretical inquiry that have received very little by way of rigorous empirical testing.

---

<sup>1</sup> Note that throughout this thesis “absenteeism” and “absence” are used interchangeably.



Still, this remains surprising. Given that at least some portion of absence is malfeasant, and as such may allow economists to say something about factors determining individual effort and shirking. Shirking is a subject that economic theorists have devoted a great deal of attention, while at the same time it receives very limited empirical investigation<sup>2</sup>. Conversely, applied psychologists have a long tradition of studying attendance patterns of workers and attempting to predict factors that may influence employee absenteeism. In addition, the way firms organise their manpower, given that they know some portion of their workforce may be absent on any given day can provide a great deal of insight to researchers on the nature of their productive processes.

The over-riding theme of this thesis is to explore two broad strands within the absenteeism literature. A key problem in these empirical studies is the under-identification of the phenomenon they purport to be examining. For instance, in the absence and the business cycle literature, the relationship is modelled strictly from a supply side perspective. That firms may alter the vigilance with which they monitor absence is not included in the equation. From another perspective, most of the vast literature examining the relationship between absence and turnover compares rates of absence between those who leave the firm and those who remain, rather than examining how attendance patterns differ between leavers and stayers over time. In addition, much of the empirical work on absence is somewhat dated and as such, I use more sophisticated statistical

---

<sup>2</sup> See, for instance, Shapiro and Stiglitz (1984) or Diamond (1981).

techniques and new and better data sources. This may lead to differing theoretical predictions and subsequently estimation techniques. Many of the findings of this thesis do call into question the earlier work done in the area and will contribute to the way that absenteeism is modelled by other social scientists and add more broadly to the literature on malfeasance and shirking.

The format of this thesis is as follows: Chapter Two examines the economic theory surrounding employee absenteeism and some of the key empirical studies. To do this one of the seminal papers examining absence, Steers and Rhodes (1978) "Process Model" is used to form the framework for the investigation. Absenteeism typically has been modelled as a labour supply phenomenon. That the demand for labour may also have some implications for attendance behaviour has been only considered recently (see Coles and Treble, 1993 and 1996). As such, I draw particular attention to this work. Chapter Two also discusses many of the seminal empirical works in the field and this work is set into a larger context of explaining absence behaviour. Given that the applied psychologists have dedicated an enormous amount of effort in studying absenteeism, I spend a great deal of time explaining their perspective and how it is similar to and differs from the approach economists have taken.

Chapter Three explores absenteeism and turnover. This is an area that has been studied in great detail by applied psychologists, without arriving at any clear empirical conclusion. In this chapter, the basic theoretical constructs that researchers have used to explain this relationship (whether they have found a

positive, negative or null relationship) are given an economic interpretation. Then a theoretical model is developed that offers a clear prediction of the relationship between absence and turnover. Next a detailed empirical analysis of resigning individuals' attendance patterns over their last 400 working days is conducted. The empirical work in this chapter takes the best methodologies used in the absence literature and attempts to make improvements upon them. The findings support claims of a positive relationship between absence and turnover, although the results suggest the pattern may be more complex than the literature, to date, has recognised.

Chapter Four explores aggregate absenteeism through the business cycle. To date, every study of absence through the business cycle has focused strictly on the supply side of this phenomenon. In this chapter a theoretical model incorporating both supply and demand factors is developed. Empirically, particular attention is paid to the seasonality that the data display. The results suggest that that demand factors are significant in determining how absence varies through the business cycle.

Chapter Five uses the same data as was used in Chapter Four, yet attempts to focus more on the demand side influences of attendance behaviour. This is done by disaggregating the data in several ways and examining the robustness of the empirical findings from Chapter Four.

Chapter Six summarises the key empirical findings and places them in context with the established literature.

Since each of Chapters Three, Four and Five are intended to be distinct studies (although on the same general topic) the literature relevant to these sections is discussed within these chapters to put the work presented in its proper context.

## **Chapter Two: Theoretical and Empirical Foundations<sup>1</sup>**

### **2.1 Introduction**

In this chapter the sparse literature on the economics of absenteeism is reviewed, with particular emphasis given to the key theoretical works and methodological advances that have been made in this area. As mentioned earlier, many other academic disciplines have spent a great deal of time examining absenteeism, and while the language used to describe the phenomenon is quite different from that which an economist might use, many of the concepts and ideas are very similar.

Perhaps the best survey of the literature, and attempt to construct a unifying theory to explain absenteeism is Steers and Rhodes (1978). They developed a “process” model derived from the large volume of empirical work that had been conducted up to the time of writing. The Steers and Rhodes model offers a very effective way to examine the field. It was derived from the literature which was available to them when writing, and while absence research has developed considerably over the past 20 years, the broad outline which they offer remains a comprehensive review of the majority of the empirical and theoretical examinations of employee absenteeism.

---

<sup>1</sup> Sections of this chapter are used by John Treble and myself in “The Psychology and Economics of Worker Absenteeism”, SABE, University of Wales, Bangor Working paper 99/21.

The outline of the chapter is as follows. Section 2.2 contains a description of the Steers and Rhodes model. As applied psychologists, their approach is different from that taken by economists, and as such, I add some economic interpretation to their work. While the Steers and Rhodes model does provide an effective means to review the literature, the model itself is the subject of considerable criticism. Section 2.3 provides details of some of the critiques of Steers and Rhodes, and summarises Steers and Rhodes response to this criticism.

Although the criticisms of their model are justified, their study does provide an excellent framework to review the literature. The Steers and Rhodes framework suggests that absence is a function of:

- individuals' satisfaction with the job situation;
- pressure on the worker to attend.

The literature is divided along these two main strands and is explained in terms of how they impact individuals' satisfaction with the job situation or how they impact the pressure placed upon individuals to attend. While all the literature does not fit neatly into this framework, and some arguments clearly straddle both these effects, this provides a general framework to review the established literature. The chapter concludes with an overview of the state of the literature, with a particular emphasis on the methodological advances that have been made.

## **2.2 Steers and Rhodes (1978)**

Given the way the literature on absence has progressed, perhaps the most important paper written on the subject is Steers and Rhodes' (1978) "process model" of employee attendance. Prior to this, a vast volume of empirical research in the field (although very little of it by economists) had accumulated, however this paper is important as it offers a unifying theoretical model incorporating supply and demand factors to attempt to explain absenteeism. Despite the vintage of the paper and its imperfections (which will be discussed below), it remains an important source for those wishing to take a systematic approach to explain employee absenteeism.

Steers and Rhodes, who had been very active researchers in absenteeism leading up to (and following) the writing of their landmark paper, realised that despite the volume of research in the area, there was nothing by way of a unifying theory about absence. At the time they wrote this article, they noted that much of the work on absence had been focused on using it as a measure of "withdrawal" from the work situation and saw it as a potential predictor of turnover at some point in the future<sup>2</sup>. Essentially absence was viewed as the manifestation of an individual's dissatisfaction with their present job. At the time of writing, they observed that had been very little effort made in terms of a comprehensive theory or model to explain the absence phenomenon.

---

<sup>2</sup> The next chapter examines the relationship between absence and turnover in much more depth.

Although a great deal of research had focused on examining absence as a proxy for an individual's dissatisfaction with their current job, a number of other researchers had taken somewhat different views of absenteeism. Steers and Rhodes' basic idea was to examine all the different perspectives which had been taken on absenteeism and try to develop a broad theoretical framework of the factors which influence attendance or non-attendance from the various empirical perspectives from which absenteeism had been studied.

They note that absence is a function of individuals' motivation to attend and their ability to attend. It is interesting to note that they express these in this order, since it seems the ability or inability to attend (the non-malevolent portion of absence) receives limited attention in this study. My interpretation of their model is that the motivation to attend has greater importance than the ability to attend.

The process model further breaks down these two key factors into seven influences on attendance. These are:

1. **The job situation.** This essentially captures most of the attributes of the job, *per se*. The authors argue that job scope, job level, the degree of stress employees face in their job, the size of the work group, the leadership style used by supervisors, the relationship the individual has with his/her co-workers and the individual's opportunities for advancement comprise the job situation. Empirically, Steers and Rhodes note that job content (what the individual actually



does) plays a much bigger role in predicting absence than does job context (the environment in which one works).

2. **Employee values and expectations.** The basic idea of values and expectations is that every individual, when taking on a job, will form a set of criteria (regarding the attributes of the job) upon which they will evaluate the job. Expectations form the benchmark against which the actual attributes of the job will be measured.
3. **Personal characteristics.** Steers and Rhodes assert that the individual's expectations about the job will be largely influenced by personal characteristics. In particular, they note that education, tenure, age, gender and family size, may all influence the expectations one has about their job. For instance, they argue that individuals with university degrees would expect jobs of a broad scope and with opportunities for advancement.
4. **Satisfaction with job situation.** In this context Steers and Rhodes refer to the extent to which the job attributes listed above actually meet the individual's expectations for the job they do. This is something of a theme for Steers, as he and Porter (1973) go to great lengths to discuss the idea of "met expectations" arguing that the extent to which a job fails to meet the individual's expectations, the more likely the individual is to take absence. From an economist's perspective, this sounds like a matching story. They argue that individuals in "poor" matches (poor to the extent that they don't meet the individuals' expectations) are more inclined to take absence.

5. **Pressure to attend.** Steers and Rhodes argue that outside the extent to which the individual is well matched in their job, there is a second class of factors which exerts influence on the attendance decision, which they refer to as “pressure to attend.” This includes the overall economic environment, arguing that in times of high unemployment individuals will have greater incentives to attend since losing one’s job in a recession is more likely to lead to a lengthy spell of unemployment. They also suggest that the incentive/reward system used by the employer to reward good attendance and penalise poor attendance have implications for the individual’s decision to go absent. The evidence they present suggests that positive rewards for good attendance tend to have a stronger effect than penalising poor attendance. They also suggest that work group norms, which is the pressure exerted on one by one’s co-workers to attend, have an impact on the individual attendance decision. They argue that this is a function of the level of cohesiveness in the group. An economist might think of cohesiveness as being akin to worker complementarity, in which case, this actually suggests that the greater the cohesiveness (or complementarity) the greater the impact the absence has on the individuals in that work group who do turn up that day. Within this broad class of factors, Steers and Rhodes also include individuals’ personal work ethic (the individual’s inherent value system) and organisational commitment which they define as “...an agreement on the part of the employees with the goals and objectives of an organisation and a willingness to work towards these goals.” It occurs to me that commitment to the organisation and work ethic might both be largely influenced by the extent to which the job in which the individual is

working actually matches with their prior expectations of the job's attributes. If an individual believes that the job they are in does not actually offer them the full range of pecuniary and non-pecuniary benefits that they seek, then it would not be surprising to observe lower work ethic and organisational commitment. Although they cite studies that seem to suggest that the individual's work ethic and commitment do have significant effect on absence, it appears that these studies do not simultaneously examine the quality of the job match. In effect, these measures of commitment and work ethic are actually capturing the individual's dissatisfaction with the quality of the job match. This is a problem that occurs regularly in empirical studies of absence. The models tend to rely on too few variables and as such, it is impossible to determine the 'real' nature of the effects they are trying to measure. The variable being used is likely serving as a proxy for several factors.

6. **Attendance motivation.** In the process model, attendance motivation is a function of the individual's satisfaction with the work situation (i.e. the extent to which the job meets the individual's expectations) and the pressure to attend from outside sources. A high level of satisfaction, could be offset if the pressure to attend is low. For instance, a highly satisfied worker in an organisation that has few rewards for good attendance (or sanctions for poor attendance) would be more inclined to take absence than an employee with a similar level of satisfaction, but facing greater rewards for attendance (or penalties for absence).

7. **Ability to attend.** An individual's ability to attend work is viewed independently from their motivation to attend. It incorporates factors such as health, family circumstances (which are a function of the individual's personal characteristics) and transportation problems. Health seems quite obvious. An individual could be as satisfied as possible with their job and also face significant external pressure to attend and still not be physically well enough to go to work. One could argue that there is some interaction between the motivation to attend and the individual's state of health on a given day. That is, an individual who is highly motivated to attend might be more likely to work through illness than an individual who has a lower level of motivation to attend. Family circumstances, such as the presence of sick children may inhibit one family member's ability to attend on a given day. This responsibility tends to fall much more unevenly to females and particularly those with young children.
8. **Attendance.** Attendance is determined by the interaction between one's motivation to attend and one's actual ability to do so. Ability to attend is driven by an individual's personal characteristics and the state of their health on any given day. Their motivation to attend is a function of their satisfaction with their job. The fundamental question being: How do the jobs in which they are working meet the expectations that they (the individuals) have from employment and to what extent is there pressure to attend? Steers and Rhodes argue that the expectations that one has from one's job will be determined by their personal characteristics. Pressure to attend can either be internal (commitment and work

ethic) or external (work group norms, economic environment, rewards and penalties based on attendance).

### **2.3 Critiquing Steers and Rhodes**

From an economist's perspective, the Steers and Rhodes approach is interesting as it incorporates both labour supply and labour demand factors. Hitherto, absence has been considered largely from the perspective of the individual's decision to supply labour<sup>3</sup>. It is also interesting in that it attempts to take a comprehensive view of the individual's decision to supply effort in the form of attendance. To this point, there had been no integrated theory or framework to examine the absence phenomenon. Steers and Rhodes made a significant step forward in developing this model.

Having said that, it is not beyond criticism. To a large extent it has the feel of trying to incorporate every hypothesis ever directed towards employee attendance and many of the empirical studies, upon which their model is based, lacked the rigour to make the findings sufficiently robust. Steers and Rhodes themselves point out that many of the studies are simple bivariate correlations. In fact it is something of a "catch-22" in the sense that the empirical results that piece together the model might not stand up to the empirical testing that the Steers and Rhodes model suggests is necessary to test its validity.

---

<sup>3</sup> A notable exception is Deardorff and Stafford (1976).

Another problem that seems to receive little attention is the potential for endogenous relationships within the model. This is alluded to earlier with particular reference to motivation and work ethic, which are seen as independent from the extent to which an individual is satisfied with one's job.

One other key problem with this model is the extent to which it is testable. Many factors included in the model, such as measures of health, organisational commitment and work ethic are difficult to measure, making empirical scrutiny of the model all but impossible. In particular, the extent to which individuals' expectations about the job are met, which strikes me as a crucial element of this model, seems potentially a very difficult characteristic to measure.

Treble (1990) offers the following critique:

“The question that an economist would routinely ask about a theory is: is it capable of falsification? In the case of the Steers/Rhodes model the answer must be no. Many of the variables used as primitive concepts in the structure are poorly defined and incapable of measurement: ‘Role stress’, ‘work group norms’, and ‘personal work ethic’ are all examples. In addition, the direction of many influences is not specified. Does pressure to attend increase or decrease attendance? Do ‘family responsibilities’ increase or decrease attendance?

“Thirdly, Steers and Rhodes themselves have some harsh things to say about the quality of the empirical work on which their results are based. At the time of writing, studies had been largely based on the examination of simple bivariate correlations, there are problems of comparability (partly caused by

poor reporting practices), and a failure in experimental work to design experiments carefully.”

Fichman (1984) also criticises:

“The Steers and Rhodes model extends earlier attitude-behaviour models with attendance behaviour a function of *motivation to attend* and *ability to attend*. Steers and Rhodes accept the tacit theoretical premise that absence events reflect the balance of rewarding aversive forces operating in the individuals life space. Their contribution is explicating the factors people have looked at, identifying constraints that may attenuate the attitude-behaviour relationship, and emphasising the need for multivariate studies of absence. The univariate studies they review are weak, often nonsignificant and frequently contradictory. No studies they review approach a reasonable test of their model.”

However, despite his criticism, Fichman concedes: “the Steers and Rhodes model has generated substantial research interest.”

While these criticisms are valid, the Steers and Rhodes model needs to be examined as a starting point, rather than as a definitive result. It is also significant in that it examines the efficiency aspect of absence. Brown and Sessions (1996) state:

“...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 contribution because even today, many commentators, particularly in the field of management, regard absence as unequivocally bad.”

This essentially follows on Steers and Rhodes comment:

“...some absence may in fact be healthy for organisations in that such behaviour can allow for temporary escape from stressful situations...rigid

efforts to ensure perfect attendance may lead to unintended and detrimental consequences on the job...”

***Fichman’s theoretical assumptions in absence research (1984)***

Fichman (1984) argues that it may be a useful line of inquiry to classify the research on absence by the assumptions behind the theoretical constructs. At the time of writing, Fichman identified six categories of absence studies. These are:

1. **Absence as an approach-avoidance behaviour.** Fichman asserts that this is the basic premise of absence being symptomatic of withdrawal, or the consequence of dissatisfaction with the current work situation.
2. **Absence is the result of a decision process.** The basic idea of this approach is that the individual decides on any given day whether or not to attend work. He asserts that this is the approach labour economists take when considering that absence on a given day is the result of the benefits of the day off yielding greater utility than attending work on that particular day.
3. **Absence is the outcome of an adjustment process.** Essentially this approach suggests that as job conditions change, employees re-negotiate the “psychological contract” to reflect the changing nature of the job. In economic terms, absence is viewed as a compensating differential to redress some negative attributes of the job, such as hazardous, or unpleasant conditions, or particularly stressful aspects of the job.



4. **Absence is a habit.** This suggests that absence is a “learned response” to organisation conditions. Habit suggests that it is relatively few individuals who are “absence-prone” which contribute most of the absence. Fichman finds this idea intuitively appealing, although there is no empirical substantiation of its validity.
5. **Absence as a consequence of an apparently unrelated event.** Fichman suggests that absence may be a function of “apparently unrelated events such as a family crisis (for example, divorce or death in the family) or some behavioral disorder (for example, alcoholism).” The causes of these events may have little or nothing to do with the organisation in which the individual works, although the effects on the workplace may be significant.
6. **Absence is phenomenologically unique.** Fichman states: “Ostensibly similar actions may have different causes and consequences and different meanings for the individual and should be treated as distinct.” He takes the example of withdrawal and asks to what extent absence provides escape, arguing that the differing underlying factors may result in similar “surface behaviour.”

In light of his criticisms of Steers and Rhodes, Fichman offers an alternative theory in which he asserts:

“...absence itself may best be treated as one possible behavioural event in a multivariate conceptual space of multiple motives and behavioural alternatives jointly determining the allocation of time and effort across activities.”

Fichman argues that the analysis of absence must be dynamic and reflect that in every situation the motivation (or incentives) will be different. My interpretation of this is that Fichman is arguing that the potential utility from any of the alternative ways an individual can allocate time is constantly changing. The influences on the respective utilities of this range of activities could be affected by factors as disparate as the weather, the type of work the individual is expected to do that day, the individual's ability to co-ordinate time away from work with other individuals, *et cetera*.

Fichman's framework is not a "model" in an economists' sense of the word, where specific parameters would be defined to explain how one might expect absence behaviour to change given the presence of some particular characteristic. Instead, he prescribes certain features of what he believes a model of absence should include. It could be argued that while his critique of Steers and Rhodes is valid, the alternative he offered was not a remarkable improvement.

#### *Steers and Rhodes revisited (1984)*

Although their process model reshaped the way researchers looked at absence, it also generated a considerable amount of criticism (in addition to that described above). Most notable amongst the critics were Chadwick-Jones, Brown and Nicholson (1982) who argued that the model focuses too much on the individual's circumstances and characteristics and gives insufficient attention to social factors, in particular work group norms. That the Steers and Rhodes model came under heavy

scrutiny is not surprising given the ambition of the paper in terms of the variety of different influences they incorporated into their process model. As well, given that the model was derived from a large number of empirical studies, often of dubious quality, the model was an easy target for critics.

To answer some of these critics, they revisited their model and acknowledged certain weaknesses. They begin their review with an overview of the state of knowledge about absenteeism. They identify four aspects of absenteeism where they are confident of the robustness of the evidence. These are:

1. Absenteeism is pervasive across nations and types of organisations. Despite this pervasiveness, they note that the international and organisational variation in reported levels of absence is significant.
2. Absenteeism is expensive. They cite several studies that attempt to associate a cost with reported levels of absenteeism. The figures produced are massive, although these approaches tend to be of limited practicality as they do not suggest that there may be a significant cost incurred in reducing these reported absence levels<sup>4</sup>.
3. At the time of writing, Steers and Rhodes were able to identify 209 different variables which had been used to attempt to predict levels of absence, suggesting that there exists a wide variety of potential predictors for absenteeism.

---

<sup>4</sup> A discussion of this will follow, examining the work of Coles and Treble (1993, 1996).

4. Absence can have serious consequences for workers, co-workers and firms. Steers and Rhodes cite evidence suggesting that absenteeism may affect individual's careers, their co-workers' effort levels and costs associated with production in the firm.

They proceed to examine the state of the literature to develop a consensus on the emerging stylised facts. They draw several conclusions:

- “Job involvement” appears to be a better predictor of absence than “job attitude.” This suggests that the extent to which an individual identifies with their particular set of tasks and work environment, has a much greater role in predicting absence than does an individual's opinion about their job. From an economist's perspective, it might be concluded that the quality of the job match (which would be akin to involvement) is a better predictor of absence than an individual's level of job satisfaction, *ceteris paribus*.
- Deteriorating economic conditions result in increased levels of attendance.
- “Positive” rewards systems (for instance schemes which reward good attendance) tend to reduce absence, although Steers and Rhodes note that little by way of cost/benefit analysis has been conducted to determine if these programmes actually save firms money. “Negative” punishment systems (for instance those penalising poor attendance) have a less clear impact on observed attendance.
- Largely due to the criticism of Johns and Nicholson (1982), Steers and Rhodes examine the role of “work group norms.” Johns and Nicholson state:

“More enlightening may be the identification of distinctions between identifiable aggregates. As such an ‘absence climate’ or ‘absence culture’ might be conceived as the net interactive effect of the normative forces that exist in the various relevant portions of employees’ role sets and common non-normative influences”

Johns and Nicholson argue that many of the studies which report limited or null correlations between absence and individual factors actually suggest that there may not be significant variation across individuals. However, since the individuals in most studies are often part of the same work group, it may be that the effects on the group as a whole may provide more meaningful insight than measures directed towards the individual.

- Steers and Rhodes observe that few consistent patterns have emerged relating the characteristics of individuals to observed absence. Family size and gender being two notable exceptions<sup>5</sup>. They cite a study by Youngblood (1984) who examines the relationship between absence and individual’s value of their leisure time. He finds that there is a strong positive correlation between absence and the value individuals place on their non-work activities. An economist would argue that this is fundamental to their line of thinking. Individuals who place more value on their non-work activities presumably do so because they gain more utility from these activities. It follows that these individuals would have greater incentives to take time away from work to participate in these activities.

---

<sup>5</sup> Absence is consistently higher for women and those with larger families.

Steers and Rhodes then turn to an examination of studies that have conducted partial tests of their original process model. At this point they agree with what many other commentators suggest: that the process model is of limited benefit, since it is unlikely that it can ever be tested in its entirety. While conceding this point, they argue that their model is still relevant in terms of explaining different aspects of the absence phenomenon. Generally, the empirical evidence supports the various aspects of their model which were predicted to have an influence on attendance. Interestingly, the results were not always the same direction as Steers and Rhodes might have predicted. In particular, a study by Hammer, Landau and Stern (1981) found that job satisfaction and absenteeism were positively correlated.

In light of the criticism their model faced, and the empirical evidence that has emerged subsequent to its publication, Steers and Rhodes offer several ways in which their model could be improved. In particular they suggest that more could be done to explicitly incorporate work group norms, although they point out that there remains little empirical justification to the claim that these are important predictors of absence. They also note that job involvement appears to be a better predictor of absence than is job attitude and suggest this requires further explanation. Finally, they note that 'perceived' ability to attend might be more important than "actual" ability to attend, and believe this to be a critical distinction.

They also answer some of the criticisms that have been levelled against their model. First, it has been suggested that the “withdrawal process” rather than absence itself should be the focus of the research. The fundamental point is the assertion that absence, lateness and turnover all share similar roots and are essentially manifestations of the withdrawal phenomenon. Steers and Rhodes argue that this is not necessarily true (with which most economists would agree) and that absence does not necessarily imply withdrawal.

Steers and Rhodes then go on to argue that in many ways their model has been misinterpreted and argue that in several respects the criticisms of it are unjustified. They do take some of the blame for this lack of clarity and offer a simplified schematic flow diagram which asserts that attendance motivation is a function of work-related attitudes, economic and market factors, organisational control systems, personal factors and absence culture and work group norms. Attendance motivation interacted with perceived ability to attend determines absence.

Steers and Rhodes arrive at an important conclusion that has fundamental consequences for economic considerations of absence. They state:

“It is possible, however, that some absenteeism may in fact be healthy for organisations in that such behaviour can allow for temporary escape from stressful situations (perhaps through the provision of personal days off), thereby potentially contributing to the mental health of employees... In fact rigid efforts ensure perfect attendance (such as through behaviour modification) may lead to unintended and detrimental consequences on the job, such as reduced product quality, increased accidents, and so forth.

Hence, it would be helpful if future studies could examine the extent to which changes in absence rates have adverse consequences for other aspects of organisational effectiveness. If reduced absenteeism is accomplished at the expense of product quality, accident rate, strike activity, or employee mental health, serious cost-benefit questions must be raised concerning the desirability of initiating efforts aimed at reducing such behaviour on the job.”

From a simple cost/benefit analysis point of view, Steers and Rhodes are arguing that vigilant monitoring of absence may not be efficient for the firm. Extreme vigilance in monitoring may result in a variety of negative consequences that exceed the returns to good attendance.

## **2.4 Motivation to Attend**

In this section I use the elements of the Steers and Rhodes process model broadly classed as “motivation to attend” to examine how the literature has developed. Particular emphasis is given to economists’ contributions.

### **2.4.1 Satisfaction with the Job Situation**

In this section I examine the literature looking at how individuals’ satisfaction with the job situation affects absenteeism. Individuals’ satisfaction with the job situation is a function of the job itself (the attributes of the job), the individuals’ personal values and characteristics, and the extent to which the job in which the individual works meets his/her expectations. There are several ways that an economist might choose to think about the individual and the job situation. The most obvious is thinking about absence from work as a labour supply phenomenon. In addition, Becker



(1965) developed a model of the allocation of time, which could be adapted in this framework. Finally, the absence phenomenon could be thought of as an insurance phenomenon. These arguments will be outlined below.

Individual and job characteristics have formed the basis of a well-developed literature on absenteeism. One of the principal areas of interest has been the relationship between absenteeism and turnover. Other significant strands that have developed which also take the perspective of trying to use individual and job characteristics to explain absenteeism include analysis of job characteristics and an examination of the role of trade unions. These strands will also be studied in depth later in this chapter.

### *Absenteeism and Labour Supply*

Brown and Sessions (1996) point out that most economic studies of absence behaviour tend to view it as a labour supply phenomenon. Essentially the shirking model described above, particularly as it relates to absence has implications for labour supply. The basic labour supply model is outlined in Killingsworth (1983).

This model shows that individuals make a decision where they simultaneously choose the hours they want for leisure and the amount of consumption they desire (which is determined by the wage rate and the number of hours worked). The potential for absence exists when the individual is unable to find a contract for his/her desired number of hours. If the workers have contracts for too few hours, they have an

incentive to moonlight and if workers have contracts for a greater number of hours than they wish to supply, they have an incentive to take absence. This “mis-match” in the quantity of labour supplied, particularly in a regime where workers are not paid for their absences is intuitively appealing and matches up well with observed contracts on offer in most labour markets. Despite the growing popularity of job sharing arrangements, most workers tend to work a “full-time” work schedule (often 35, 37.5 or 40 hours per week) or a part-time contract (for instance 12, 15, or 18 hours per week). It is argued that if a worker is constrained to working more hours than they desire, then the probability of them going absent increases.

Allen (1981a) identifies three ways in which the firm can affect labour supply to reduce absenteeism. First, they can make it more costly for workers to go absent by reducing sick pay, denying promotion and increasing the probability of dismissal. *Ceteris paribus*, the same worker will be less likely to go absent if he/she know the firm has made the penalties they will bring to bear against him or her increasingly severe. The second way absence can be reduced is to make schedules more flexible. The basic argument here is that employees may be less likely to go absent if they have a schedule that allows them to work the hours they desire at a time that might be more convenient for them. If we think of formal models of household labour supply, there may be times when the utility gained from being away from work exceeds the cost of turning up. If there is limited complementarity of workers in production, then the firm will not suffer from having employees choose their own hours. Workers will

choose their hours such that they do not conflict with other demands on their time (such as childcare). The third way that absenteeism can be reduced is to screen workers at the point of hiring to ensure that the firm hires good attenders. Although this procedure may yield a lower level of absenteeism, the firm may have to pay a wage premium to attract sufficiently-capable, high-attendance workers. If good attendance is a desirable trait, then firms should be willing to pay a premium for it.

Allen's model has become, more or less, the standard model of labour supply and absenteeism. This model has been regularly adapted and modified by other economists (see for instance Brown and Sessions, 1996 and Chapter Three of this thesis). The model (using Allen's notation) is as follows:

$$U = U(x, L) \tag{1}$$

(1) represents the basic utility maximising function that individuals face.  $x$  is a vector of consumption goods that the individual desires and  $L$  is leisure time. The individual maximises this utility function subject to the following budget constraint:

$$R + w(t^c - t^A) - D(t^A) - x = 0 \tag{2}$$

Where  $R$  represents income from other sources,  $w$  equals the wage rate,  $t^c$  represents the number of contracted hours,  $t^A$  is absence from work and  $D$  is a penalty paid for absence time taken.  $D$  is quite a crucial point as it makes the case that workers who go absent do not merely (in this case) trade income for leisure, but they are required to bear some cost. Allen notes that this penalty will typically be manifested as

decreased probability of promotion, a smaller merit pay raise or increased probability of termination.

Workers also face a time constraint:

$$t - t^c - t^L = 0 \quad (3)$$

Where  $t$  is the total time available and  $t^L$  is leisure time when  $t^A$  is 0.

Allen substitutes (2) and (3) into (1) and differentiates with respect to  $t^A$  to find

$$U_L - (w + D')U_k = 0 \quad (4)$$

Where  $U_k$  is the partial derivative of  $U$  with respect to  $L$  (leisure) and  $x$  (consumption).

Allen concludes that a worker will be absent on any given day as long as the marginal value of the extra leisure is more valuable than the sum of the lost wages and lost future income (from reduced promotion prospects, lower merit pay increases and increased probability of termination).

By differentiating the first order conditions, (2) through (4), Allen finds that absence is increasing with respect to other income sources and contracted hours. It is decreasing with respect to the penalties incurred for being absent and is indeterminate with respect to a change in wages. The final effect is due to income and substitution effects from an income change having opposite influences on attendance motivation.

This labour supply model would make rather more sense in a system where workers do not receive some form of sick pay. However, workers tend to get most, if not all, of their earnings replaced if they do not attend work on a given day. Given that there are the utility gains from leisure or household production which are always available, and they are likely to receive nearly full replacement of their wages, it would seem that the rational utility maximising individual should take as much time away from work as is possible.

Indeed Allen goes on to point out that if sick leave is available (and it appears that he assumes full replacement of wages) then there is no lost income and *ceteris paribus* absenteeism will unambiguously rise. Indeed, Buzzard and Shaw (1952) show that absenteeism in a UK ordinance factory increased by approximately half from one year to the next when a sick pay scheme was introduced.

Finally, Allen notes that the degree of flexibility an individual has in his/her work schedule will affect the propensity to go absent. He argues that “absenteeism acts, in effect, as an alternate means of obtaining work schedule flexibility.” Brown and Sessions contrast the difference between firms that require a high degree of complementarity between workers, resulting in rigidly defined schedules to those firms which require little complementarity and co-ordination. Using university academics as an example, they suggest that workers with very low degrees of complementarity should be free to work the hours they want, provided they reach

some contractual minimum. Constraining workers with low degrees of complementarity to work specified hours will serve to increase incentives to take absence and offer little benefit.

### *Absenteeism and Insurance*

Fundamentally, a sick pay arrangement is a form of insurance. Generally sick pay for short absence spells is underwritten by employers. If we assume workers are paid their marginal product, then in a system that has no sick pay provisions, if they do not turn up for work, then they do not get paid. Again, if we assume that workers are risk averse and firms are risk neutral, then an equilibrium arrangement should emerge where the firm will underwrite a sick-pay scheme and the premium will be paid in the form of lower wages to the worker. More risk averse individuals should accept lower wages in exchange for a more generous sick pay scheme, while risk neutral individuals should prefer higher wages with a more limited sick pay coverage if they miss a day's work.

Sick pay is typical of most forms of insurance as it offers the opportunity for moral hazard. The typical sick pay regime usually requires workers to be sick for a certain number of days before they are required to produce a medical certificate to verify their absence as legitimate. For the period before the absence requires medical

validation, the firm basically relies on the judgement of the worker regarding their wellness to work. Workers have a significant incentive to maximise their time away from work. They not only get paid for the time through their sick pay, but will also gain benefit from leisure, or some alternative form of production) and only they know if they are truly unable to go into work. As such, there is a significant information asymmetry that results in some portion of absence being malfeasant.

### *Absence and the Allocation of Time*

Becker (1965) developed a theoretical model to show how individuals allocate the total time they have available to them. Although Becker makes no specific reference to absence from work, he does draw several conclusions that have clear implications for ways in which we might think about employee absence. In his model, he looks at the interaction between income and consumption. His view is that leisure time may be spent in consumption intensive activities that require relatively little time, but rather more money (e.g. going to a movie) or time intensive activities which take rather more time, but do not require a great deal of money (e.g. reading a book). He states:

“...a compensated uniform rise in earnings would lead to a shift away from earnings-intensive commodities and towards goods-intensive ones. Since earnings and time intensiveness tend to be positively correlated, consumption would be shifted from time intensive commodities. A shift away from such commodities would, however, result in a reduction in the total time spent in consumption and thus increase the time spent at work.”

He also states:

“...economists increasingly recognise that a household is truly a “small factory”: it combines capital goods, raw materials and labour to clean, feed, procreate and otherwise produce useful commodities.”

The implication of these two statements is that the timing of consumption and the amount of time spent in non- (paid) work activities is influenced by the compensation one receives for their work time and the range of utility generating activities one has outside work. If we think of individuals as having competing demands for their time and the considerations of the time allocated require a specific period of time to be used (e.g. looking after a sick child) than in essence there are colliding production functions<sup>6</sup>. When production functions collide, the returns to absence increase, making it a more attractive alternative. Becker states:

“Instead of simply allocating time efficiently among commodities, multi-person households also allocate the time of different members. Members who are relatively more efficient at market activities would use less of their time at consumption activities than would other members. Moreover, an increase in the relative market efficiency of any member would effect a reallocation of the time of all other members towards consumption activities in order to permit the former to spend more time at market activities. In short, the allocation of time of any member is greatly influenced by the opportunities open to other members.”

One important way in which time may be re-allocated from work to home production is through absence from work.

### *Absence and Turnover*

This has been a particularly rich line of inquiry in the field of applied psychology and management, although it has been virtually ignored by economists<sup>7</sup>. The basic

---

<sup>6</sup> The idea of “colliding production functions” is John Treble’s.

<sup>7</sup> A notable exception is Brown (1995) who uses absence as a proxy for job search.



premise is that absence represents a process known as “withdrawal” from work and this withdrawal behaviour finally results in the individual quitting. As mentioned in the review of Steers and Rhodes (1984), many applied psychologists have taken the view that lateness, absence and turnover are different manifestations of the withdrawal phenomenon. Others have argued that while absence and turnover may be related, there are many reasons why an individual may take additional absence that have little or nothing to do with quitting one’s job.

In the Steers and Rhodes framework, withdrawal is a function of a mis-match between the attributes one desires in a job and the actual characteristics of the job. In this sense, the extent to which the job fails to meet the individual’s expectations, results in withdrawal and eventually turnover, although this view of the relationship between absence and turnover is by no means universal.

Although there has been an impressive volume of empirical evidence published on the subject, a great deal of it is not terribly convincing. Many of the papers rely on simple bivariate correlations and fail to account for the wide array of biases that may be present. Second, the samples used are often very small. Some of the most empirically rigorous studies involve samples of fewer than 20 workers. Finally, the approaches tend to be “static” comparing overall levels of absence between leavers and non-leavers, rather than looking at how attendance levels of leavers change over time and how this compares to those who remain in the firm.

A much more detailed analysis of this literature and an empirical examination of the relationship between absenteeism and turnover will follow in Chapter Three of this thesis.

#### **2.4.2 Predicting Absence Using Personal and Job Factors**

Vernon and Bedford (1928) and Vernon, Bedford and Warner (1931) examine the extent to which work conditions affect absence in ten UK coal pits. They find that the greater the depth at which the individual was required to work, the more absence they tend to take<sup>8</sup>. In addition, they found a positive correlation between average temperature at the work location (which is highly positively correlated with the depth at which the individual works) suggesting that job conditions play an important role in predicting attendance. They also compared the correlations of minor accidents and major accidents with work conditions. They find that minor accidents are negatively correlated with the quality of work conditions while major accidents exhibit no such correlation. They conclude that the minor accidents are easier to falsify and as such are more likely to be reported to claim compensation.

Again, the applied psychologists have developed a very active literature in this area, although the empirical methodology and the nature of the variables under consideration often lack an intuitive appeal to economists. In fact, there has even been an implicit *ex ante* recognition of Barmby, Orme and Treble's (1991) point

---

<sup>8</sup> Depth of work in the coal pits was associated with worse working conditions.

about identification in Farrell and Stamm (1988) where they suggest that the literature on absence has focused too heavily on individual attributes, while organisational attributes have received considerably less attention. Farrell and Stamm conduct a meta-analysis of the correlates of the influence of various factors in predicting absence. Their analysis incorporates the findings of 72 studies (none of which appeared in an economics journal) the findings of which are found in Table 2.1

**Table 2.1 Farrell and Stamm's (1988) Meta-Analysis Findings (Time Lost)**

Attribute	Number of Samples	N	Corrected Correlation	Chi square
<b>Psychological Factors</b>				
Job Satisfaction	12	3732	-.24	248.98*
Commitment	11	1117	-.12	31.26*
Job involvement	7	1076	-.17	60.14*
Psychological stress	4	358	.32	78.14*
<b>Demographic factors</b>				
Age	27	5274	-.06	35.78
Tenure	28	5827	-.05	109.60*
Sex (1 = female)	6	2419	-.11	8.93
Absence history	10	2653	.71	1120.57*
<b>Work environment</b>				
Task significance	4	1207	.05	77.57*
Task variety	4	1051	-.13	16.37*
Task autonomy	6	3433	-.13	73.91*
Task identity	3	920	-.24	.00
Feedback	4	1061	-.10	21.04*
<b>Organisation factors</b>				
Pay	4	2689	-.19	38.22*
Control Policy	12	1313	-.46	.00
Shift (0=day, 1=other)	10	6807	.12	189.01*

\* denotes significance at the 5% level

Farrell and Stamm's findings show that the psychological factors relating to job satisfaction, commitment and involvement are each inversely related to absence, indicating that high absence is associated with low job satisfaction, low job commitment and low job involvement. Psychological stress is positively correlated with absence. Of the demographic factors tenure is positively correlated with absence, suggesting that the individuals who have been with the firm longer, tend to take more absence. The correlation between an individual's absence history and current attendance is highly positive, suggesting that those who take more absence in the past are more likely to take absence in the future. While this may seem obvious, it could also be interpreted as being counter-intuitive to the withdrawal argument, where individuals move from being low absence to high absence as a result of a shift in their level of satisfaction with their job. All of the environmental and organisation wide factors, with the notable exception of control policy and task identity showed significant correlations with the level of absenteeism. Again not surprisingly, those in "better" jobs tend to have lower absence. The evidence shows that those in jobs with greater autonomy, task variety and task significance, and higher pay, tend to take less absence. In addition, individuals working shifts outside the 'normal' day (e.g. 9 to 5) tend to be more likely to take absence.

Farrell and Stamm conduct a similar analysis for the frequency of absence and find broadly similar results. There are, however, a few notable exceptions. Job involvement, task significance, task variety, feedback and pay are not significant predictors of absence, while gender and job involvement (females and those with low

job involvement being more likely to take absence) are significant predictors of frequency of absence.

While the meta analysis does show many highly significant results, one consistent problem with a number of studies in this area tends to be the reliance on simplistic empirical techniques (often simple bivariate correlations). For instance, it is very likely that tenure, job satisfaction, commitment, involvement, task significance, variety, autonomy and pay are highly correlated with one another. Simple bivariate correlations may be capturing the well-established finding that those individuals in the “best” jobs tend to take less absence. While the results of the meta analysis do appear to be statistically significant, it is quite likely the studies from which they are drawn may contain results which would not stand up to a more rigorous statistical analysis. A multivariate approach which allows for consideration of these factors, whilst holding the others constant is the only way to capture the true direction of these effects.

Not unlike the rest of the absence literature, economists have surprisingly little to say in this area. Barmby, Orme and Treble (1991) suggest that prior to their study the only other analysis of absence using individual data and a standard leisure/labour trade-off model is Allen (1981a). The Allen paper is given lengthy consideration earlier in this chapter, however, given the paucity of analysis in this area, it is worth revisiting it. Allen finds that absence is significantly related to age, safety and health. Wage effects, union membership and gender are only significant for blue collar

workers. Barmby, Orme and Treble suggest that considering absence strictly as a supply side phenomenon ignores a potential identification problem. They argue that firms facing attendance problems will be inclined to take some form of action to induce different behaviour from the absent prone. The failure of researchers to identify and incorporate this results in the identification problem.

Barmby, Orme and Treble use firm attendance data which has a rather unique feature, that is a “points scheme” whereby workers accumulate penalties for unauthorised absence. Sufficient accumulation of points results in workers having a waiting period where they do not receive sick pay. In effect, this scheme incorporates information about the firm’s tolerance to absence and as such allows the individual’s attendance behaviour to be properly identified. The most detailed results provided are Weibull hazard functions of spell durations. They find that female and married workers tend to have longer spells, and that “acceptable” absences have longer durations<sup>9</sup>. They also find workers with no statutory sick pay waiting days tend to have longer absences, which they argue is attributable to these individuals being in worse health and also because points against them accumulate less quickly in the early stages of their absence spell.

Leigh (1985a) examined the contributions of economists into the examination of the effects of individual attributes on absence, although it should be noted that he did not

---

<sup>9</sup> An absence spell is acceptable when it is medically certified. Such certification implies the illness is more severe.

attempt to apply formal economic theory to the absence decision. He summarises the findings of several of his previous papers (Leigh, 1981, 1983a and 1983b) as well as the findings of Allen (1981a, 1981b) and Paringer (1983). Several common themes emerge from these empirical examinations. These include:

- Individuals who are in poor health or who work in hazardous conditions tend to take more absence.
- Union members tend to take more absence.
- The presence of sick leave is correlated with absence (which Leigh infers as evidence of malfeasance).
- Women with small children are more prone to absence than men or women who do not have small children.

Leigh uses the Panel Study of Income Dynamics (PSID) for 1978 and 1979 (pooled) to examine the effects of a number of factors on absence. Using a Tobit maximum likelihood technique he observes several significant effects. Union membership is positively associated with absence, as is having a disability, being female with young children, working in a dangerous blue collar occupation and being recently divorced or widowed. Absenteeism is negatively associated with being single or married<sup>10</sup>, higher levels of education and the local unemployment rate. He is unable to find a significant relationship between absence and wages.

---

<sup>10</sup> The marital status base case is having been divorced or widowed for more than one year.

### *Absence and Unions*

The effect of unionisation on employee absenteeism could be classified as a job attribute. However, it is quite different from other attributes of the job for which individuals may reasonably develop some expectations, which their current position may or may not meet. The effect of unions on absenteeism is considerably different, since unions govern the relationship between employers and employees and may have a considerable impact on the way in which firms discipline their workforce.

There are several competing theories as to what the relationship between absence and union membership should be. Chaudhury and Ng (1992) argue that the relationship should be positive (i.e. union members are more inclined to take absence) since “union members are generally better protected against disciplinary action than non-union members”. They argue that this protection reduces the firm’s ability to sanction the worker for absence, meaning the cost to the worker may be less. They also argue that there is a well-established inverse relationship between job satisfaction and union membership. Workers with lower levels of job satisfaction will be more likely to go absent. Allen (1981a) agrees with this general sentiment. However, he also suggests that the presence of chronic absentees will result in some sort of discontent amongst the regular attenders. As such it will be in the unions’ interest to “weed chronic absentees” which may offset some of the protection that the union may provide the employee against firms’ sanctions against absentee workers. Chaudhury and Ng’s empirical examination of absenteeism at the firm level suggests



that absence is higher in unionised workplaces. Barmby, Ercolani and Treble (1999) find similar evidence for Britain.

Allen's (1984) examines Freeman's (1976) extension of Hirschman's (1970) "exit-voice" model. Allen states:

"According to Hirschman's model, a divergence between desired and actual outcomes in any relationship presents individuals with a choice of action: exit or voice. In the labour market, the choice to exit, or terminate the relationship manifests itself as either a quit or a dismissal. The other choice, to voice an opinion or objection in order to eliminate the divergence, is manifest in the labour market, Freeman argues, by trade unions bargaining over contracts and implementing grievance procedures."

Allen argues that the inherent function of unions is to "voice" employee displeasure with the practices of the employer. He also points out that absence is not a particularly effective way to show dissent, since the reasons for malfeasant absence would seldom be truthfully reported, given the likely reprisal this would bring from employers. A worker who chooses absence due to some dissatisfaction with their work environment will, in all likelihood, claim that the absence was for legitimate reasons (for example, illness) to avoid losing sickpay and being subjected to discipline. In that sense, Allen argues that absence is not a terribly effective mechanism for workers to voice displeasure.

Allen suggests that in instances where absence is intended to avoid an undesirable work situation, rather than to change it, then absence is clearly "exit" behaviour. He suggests that the presence of unions as an effective voice mechanism, should result in unionised workers having lower absence levels than their non-unionised counterparts.

However, Allen also points out several other ways the presence of unions may impact the attendance decision.

- Unionised firms pay higher wages and as a result, the firm should have a large pool of applicants to choose from. Given this choice the firm will opt to hire workers they deem to be more reliable. Good attendance is a compensating differential for higher wages.
- In exchange for higher wages, the worker may have to take on additional constraints in the hours worked or work less desirable shifts which will mitigate the compensating differential from the higher wages.
- Wage rates tend to be standardised in unionised environments and promotions tend to be awarded on the basis of seniority rather than performance. This means there are few incentives for good attendance since workers are unlikely to be rewarded with higher wages for their efforts.
- If unions are successful in using their “voice” to change undesirable attributes of the work environment, levels of absence should decline. However, it is important to note that levels of dissatisfaction tend to be higher in unionised work places (see Freeman, 1978 and Borjas, 1979).
- Unions provide protection for workers and any worker who is subject to discipline by the firm, has the opportunity to appeal using a well governed-mechanism.

To test the relative strength of these conflicting influences of unionisation on absenteeism Allen uses production workers from three US data sets<sup>11</sup> that examine individual absence from work. His findings across each of the data sets shows that absence is positively correlated with union membership, even when allowing for personal characteristics, region of employment and wages. His most compelling findings come from the Quality of Employment Survey (QES) which also collects a great deal of information on individual workplace characteristics. Although the inclusion of these factors does weaken the correlation between absenteeism and unionisation (suggesting that there is a correlation between job factors that exert a positive influence on absenteeism and unionisation), unionisation remains positively correlated with absenteeism. Leigh (1981) draws a similar conclusion using data from the PSID.

Turnbull and Sapsford (1992) examine absence as a voice mechanism by studying the relationship between absenteeism and strike activity amongst dock workers over a 40 year period, the key point they make is that total absenteeism is an “index of industrial conflict.” They state:

“Whether conscious or unconscious, absenteeism, turnover, sabotage, and even accidents must alongside strikes, go-slows, a work-to-rule, the restriction of output, *inter alia*, as forms of industrial conflict... such action is usually spontaneous, reactive and above all not borne out of any calculative strategy.”

---

<sup>11</sup> Allen uses the 1973-78 Current Population Survey, the 1973 Quality of Employment Survey and the first 5 waves of the Panel Study of Income Dynamics.

In addition, Turnbull and Sapsford suggest that absenteeism may be a means of relieving frustration or tension, which may have a significant impact on the true cost of absence. If a worker chooses absenteeism rather than some more destructive form of conflict (such as sabotage), then at some level, absenteeism may be the least costly form of dissent in which an employee can engage.

Turnbull and Sapsford show that as the relationship between the dockers and their employers changed, so did the nature of industrial conflict. The employment relationship was described as casual from 1947-55. Workers were not truly casual in the sense that they were hired and fired as needed (which they were up to 1947). Rather they attached themselves to a particular employer and use non-attendance to exert some control over the kind of work they did (that is, they were absent if they knew they would be assigned an undesirable job). Although there was no systematic attendance data collected during this period, the anecdotal evidence suggests that forms of conflict were “additive rather than alternative mediums of dissension”.

In 1955, the National Dock Labour Board began to collect data on attendance and non-attendance of the dockers. Turnbull and Sapsford use this data to examine the correlation between quarterly absence and strike activity in two distinct periods. From 1955-67 (when casualisation practices ended) they found there to be a significant negative correlation between authorised absence, total absence and strike activity (defined as the number of strikes per 1000 workers). During this period, unauthorised absence is not significantly correlated with strike activity. They argue,

that this should not be interpreted as absenteeism and strikes being alternatives to one another, rather they argue it is a function of the proliferation of strikes held by small work units to increase wages for a particular job. Turnbull and Sapsford also argue that the casual nature of the employment relationship led to an accepted “absence norm” whereby it was deemed a right of workers to use their time as they saw fit.

In 1967, the nature of the employment relationship between the dockers and their employers fundamentally changed, effectively ending the casual nature of the work. Discipline of the workers shifted from the unions to the employers and increasing mechanisation and capital intensity increased the cost of absenteeism to the firms. Prior to these reforms, in the event of an absence, there was a pool of workers from whom employers could draw to make up their numbers, acting as an insurance mechanism against absenteeism. This was effectively removed as more formal employee-employer relationship was forged.

Clearly, this represented a fundamental change in the employment relationship, taking away much of the freedom which the dockers held dear. From 1967, the levels of total absence went into decline, although increasingly absence was being classified as unauthorised rather than authorised as employers were less likely to accept the reasons for absence that were deemed acceptable by the Port Labour Office (which was largely run by the unions). As a result, there is positive correlation between strike activity and unauthorised absence from 1967-89, which suggests an additive process in terms of industrial conflict.

Sapsford and Turnbull (1994) again look at the absence rates of dockers and its relationship with industrial conflict to examine if absenteeism and strike activity are substitutes (“balloons”) or complements (“icebergs”). The substitutes or “balloons” argument suggests that there is some inherent level of industrial conflict and if there is an attempt to suppress one symptom of the conflict, then workers will find other ways to express their displeasure. The complements or “icebergs” argument suggests that absolute levels of industrial conflict are constantly changing. When workers are particularly dissatisfied with the employment relationship, manifestations of industrial conflict will increase. Strike activity, sabotage, pilferage and absenteeism are positively correlated. In times of greater industrial harmony, these factors will all decline.

Using aggregate quarterly data from 1955-89 they model absenteeism and strike activity and draw several interesting conclusions:

- There is a negative relationship between absence and strike activity, providing evidence supporting the “balloons” hypothesis.
- The Aldington-Jones reforms in 1972, by establishing a permanent (as opposed to casual) employment relationship between the dockers and their employers, led to a structural break in absence behaviour. When attached to a single employer, absence fell.

- They argue that institutional and industry specific factors are crucial. The manifestations industrial conflict are case specific and much of the understanding of it would be lost at broader levels of aggregation.

Edwards and Scullion (1984) examine absenteeism and the control of work. They begin with an examination of the established literature and conclude that it is quite unsatisfactory. They argue that the “conventional approach” has failed to develop any profound understanding of the social meanings of absenteeism. They argue that many studies are ‘managerialist’ in the sense that these studies view absence as a problem that needs to be solved, rather than a phenomenon that needs to be understood. They point out that little attention (at that time) had been paid to examining the effects of trying to reduce absenteeism. In particular, they suggest that if absenteeism is a relatively harmless form of industrial conflict, then attempts to reduce it may result in more serious actions to voice displeasure with the work situation, such as sabotage.

They believe that a broader view of absence needs to be taken. They state:

“The need is to examine absence, turnover and related phenomena as products of the character of the shop-floor relations in particular circumstances. This implies two points in terms of method. First, in addition to studying rates of behaviour, it is essential to assess social meanings through direct investigations of participants’ perceptions; this includes managers as well as workers. But, second, perceptions and orientations occur in concrete situations, and social meanings have to be related to social structure.”

They argue that the need is to focus on the 'labour process' which is the process by which the individual makes the decision to supply labour.

While the research methodology they employ (interviews and focus groups) is rather different than that used by economists it seems the issues they wish to examine are similar. These are: what motivates individuals to supply effort and what factors mitigate this process.

## **2.5 Pressure to Attend**

The literature in this area has focused on the ways which firms can exert influence over the individuals' attendance decision. There has also been considerable attention paid to "environmental" factors, such as the state of the economy and "work group norms."

### ***Labour Demand***

The demand side of the absence phenomenon is considerably less well developed. Deardoff and Stafford (1976) argue that certain kinds of production require certain quantities of labour to be present at a specified points in time, which has a clear implication on the demand for labour to be available. Without some critical mass of labour, production is not possible. It seems natural that any discussion of absenteeism should include the role of firms. Perhaps due to the coverage in the popular media, or in the management literature which suggests that any absence is unwelcome, it is assumed that there is no variation in firms demand for reliable



labour: absenteeism should be minimised. Ivancevich (1985) states that “absenteeism is a costly and disruptive withdrawal behaviour that is difficult to control.” This statement is broadly illustrative of the management view of absence. However, one of the implications of Deardorff and Stafford (1976) is that not all firms have the same requirement for worker reliability. If this is true, then the returns to monitoring worker behaviour, in terms of absence, will vary and as such firms will differ in the extent to which they engage in monitoring. This will result in variation in the level of absence across firms.

One of the principal aims of this thesis is to provide some empirical evidence to suggest that modelling absence strictly as a supply side phenomenon fails to address an important aspect of this market: the demand for reliable workers. This theme is picked up again later in this chapter and the again in Chapters Four and Five.

Ehrenberg (1970) examined the relationship between absence and firms requirement reliable labour. This paper is noteworthy for its consideration of the role in absence in the productive process. Ehrenberg was interested in examining the relationship between absenteeism and overtime. The prevailing view was that firms hired ‘standby’ workers to allow them to continue to meet production schedules without resorting to using overtime. However, given the stochastic nature of absenteeism, firms will not always have sufficient standby workers available to cover for those who are off sick.

Ehrenberg suggests that normally there are certain fixed costs associated with employment that result in it being inefficient to hire large numbers of surplus workers. He suggests that there are typically investments in hiring and training which need to be made as well as certain costs which must be borne, regardless of the number of hours that individuals work.

The paper works through two cases. In the first case, the rate of absence is known with certainty. Under this (unlikely) scenario, the effect on total employment is ambiguous since the benefit of saved overtime will be off-set by the extra employment costs associated with having additional employees. In the (more likely) case where absence is stochastic, it is shown that the optimal solution is to have a larger stock of workers and have lower hours of absenteeism per person. Ehrenberg argues that it is the non-symmetric way in which adding additional labour (as compared to paying overtime) adds to the marginal cost, which drives this result.

Weiss (1985) made a seminal contribution to the demand side of employee absenteeism. While demand for labour is implicitly included in the Steers and Rhodes (1978) model, in terms of “pressures to attend.” Specifically they make the point that the penalties and rewards associated with attendance must be a function of the firms’ demand for labour. Weiss offers a key insight into absence as it relates to the firm, rather than how it relates to the individual.

In his model, he uses the case of assembly line production where some minimum number of workers is required for any production to occur, although any excess workers beyond the minimum have a marginal product of 0. He constructs a simple simulation exercise in which he shows the profit maximising number of workers and their corresponding wage rates for a variety of absence rates (in this model the absence rate is treated as known). The implication of this model is that the wage package the firm would be prepared to offer for a given rate of absence is inversely related to the level of absence. Another key point in this paper is that Weiss expresses the cost of absence on a given day in terms of the probability (for a given rate of absence) that there are insufficient workers for production. The cost of absence is the probability that a pool of  $n$  workers at a given absence rate will not attend in sufficient numbers on a given day, multiplied by the value of the production line on that day. A final key point made by Weiss suggests rather than minimising absence, the firm may offer a variety of wage packages for different levels of absenteeism. Absenteeism is one component of the compensation package.

Coles and Treble (1993, 1996) published two papers that look at the nature of production and how this relates to firms' willingness to accept absence from work. In Coles and Treble's first paper they extend Weiss' (1985) findings to a somewhat more general case. They compare the expected wage/absenteeism contract that would be offered by firm whose production is constant returns to scale (CRS) to that

offered by an assembly line firm. In the CRS production method each worker is paid their marginal product and by assuming that workers are identical in terms of their productive capabilities, each additional worker adds the identical marginal product on the days when they work. Individuals can choose a high absentee contract or a low absentee contract. The high absentee contract pays a wage rate that is larger by the proportion of time the individual would be expected to shirk, if they had opted for the low wage contract. The individual receives a utility bundle in which those on the “low absentee contract” receive the utility generated from their higher wage. Individuals on the “high absentee contract” receive a lower wage, but also the extra utility gained from shirking (which could be exercised in the form of extra leisure or household production).

This is contrasted with an assembly line that (similar to Weiss) requires some minimum number of workers to turn up and without this minimum number, production will not occur. Employees showing up in excess of the minimum have a marginal product of 0. The cost of absence for each worker is the probability that the individual worker not showing up resulting in the firm not having the minimum number of workers to run the assembly line that day multiplied by the assembly line’s expected daily production.

They demonstrate that the cost of absenteeism will be higher for the assembly line than it will be for the CRS firm and suggest that the former will offer higher wages in return for reduced absenteeism. Coles and Treble (1993) state:

“The basic insight is that when workers are complements in production, a worker who goes absent reduces the productivity of the remaining workforce. In that case, a firm may be willing to pay higher agency costs to induce more reliable attendance by workers.”

Coles and Treble (1996) build on this idea:

“The central question posed here is why do some firms take a tougher line on absenteeism than others? The answer must be that some have a greater return in doing so.”

They model the firm’s contracting problem by showing that a firm with a given production technology will choose a wage rate and the number of workers to be hired. Simultaneously they will either explicitly or implicitly set an ‘acceptable’ level of absence (subject to the reservation utility of workers in the market). Firms requiring higher attendance will have to pay higher wages as a compensating differential for the foregone household production or additional utility from leisure that would be accrued from time spent away from work (as absence). They demonstrate that the optimal contract is conditioned on the nature of the production technology and that other things held constant, workers with the highest utilities from home production or leisure will sort into firms that offer high absence/low wage contracts (CRS or low complementary production). Conversely, workers with low outside opportunities will sort into firms that offer low absence/high wage contracts (assembly line type, or highly complementary production).

They use this theoretical finding to argue that the “cost” of absenteeism, as it is normally calculated (by adding together wage costs, the cost of replacement labour, additional taxes and fringe benefits) is not really accurate. They point out that in order to reduce absence considerable additional costs would have to be incurred, including extra costs of monitoring and higher wages. They argue the “true” cost of absenteeism to the firm is the amount the firm would be prepared to pay to reduce it.

### *Absence and Shirking*

The basic premise of virtually all economic studies of employee absenteeism is that at least some portion of it is malfeasant and as such has implications for economic models of shirking behaviour. Most of these models consider shirking to mean a lack of effort while the employee is at work. Shapiro and Stiglitz (1984) derive a formal model showing that efficiency wages and the threat of unemployment leads to increased discipline in the workplace. They argue that without unemployment, workers could easily move from one job to another. The threat of termination would not have any impact on eliciting greater effort. Subsequently, a “Shapiro-Stiglitz argument” has come to mean the threat of unemployment which results in workers being more disciplined (i.e. they shirk less) in fear of losing their jobs and experiencing a spell of unemployment.

Although Shapiro and Stiglitz's paper made no explicit mention of absence from work (it focused more on shirking on the job), this model has provided a broad theoretic framework for the study of absence. It could be argued that the case of malfessant absence actually provides a more compelling example of shirking than the individual rationing his/her effort on the job. Given that the range of utility enhancing activities in which one can partake while on the job are rather fewer than one can take outside the workplace, employee absenteeism offers a potentially enlightening source to examine incentives to work and how individuals respond to changes in these incentives. The fundamental assumption of most economic analyses of absenteeism, and certainly the view taken in this thesis, is that employee absenteeism represents a proxy for individual effort and motivation.

### *Absence as Moral Hazard*

In a system of employee self-reported absenteeism, where most or all of a worker's wages are replaced through some form of sick pay arrangement, employee absenteeism is essentially a moral hazard problem. The problem emerges because short spells of absence are normally self-reported. That is, the worker alone decides whether he or she is well enough to attend work on a particular day. Typically, it is only after the worker has been absent for several days that the firm requires medical documentation to validate the illness.

Milgrom and Roberts (1992) give an excellent description of the moral hazard problem. They define moral hazard as “the form of post-contractual opportunism that arises because actions that have efficiency consequences are not freely observable and so the person taking them may choose to pursue their private interests at others’ expense.” They identify three conditions that must hold for moral hazard to arise:

1. The potential must exist for some interests of the parties engaging in some contract to diverge.
2. There must be some basis for gainful exchange between the two parties.
3. There must be some difficulty in determining whether the terms of the contract are being met.

It is quite easy to see how absenteeism can be viewed as this type of problem. It is in the workers’ interest to maximise their time away from work, since that time can be used by the worker for leisure or some other form of production. Most firms only require medical validation for absence spells beyond a certain length (often 3 or 5 days)<sup>12</sup>. The efficiency loss to the firm would be some combination of extra costs in contracting a replacement worker and reduced output. Milgrom and Roberts argue that the moral hazard problem can be thought of as a breakdown of the agency relationship. In essence, the absentee worker (the agent) is failing to act in the best interest of the employer (the principal) to achieve the objectives of the latter (the

---

<sup>12</sup> In Britain, the rules in terms of medical validation for absence from work are governed by the National Health Service.



efficient operation of some work unit). Moral hazard occurs when the principal is unable to ascertain if the information being provided to the employer is accurate (and therefore in the principal's best interest).

### *Absence and Incentives*

There is a growing literature looking at the extent to which pecuniary and non-pecuniary conditions (incentives) in the workplace motivate better attendance. Again, the key point is that absence is a proxy for effort and if incentives are structured in such a way to reward good attendance or punish poor attendance, does this change the way in which individuals behave? The short answer appears to be "yes".

One of the earliest (and most convincing) studies in this area was conducted by Buzzard and Shaw (1952). Their study examined the effect of the introduction of a sickpay scheme among government industrial workers in September 1948. The immediate effect was a doubling in the level of absence. Buzzard and Shaw formulate nine further research questions they aimed to address in their study. Some of these are somewhat dated, but 6 of the 9 strike me as particularly interesting. These are:

1. What proportion of the population records sick absence?
2. How is the increase in sick absence distributed among people of different ages?
3. Do new entrants have a higher rate of sick absence than those of longer service?

4. Are the sick absence rates of those in the more responsible and skilled jobs less than those of the unskilled worker?
5. Is the rate for those on “incentive” pay (who revert to flat rates for sick pay) less than that of “time” workers?
6. Do workers take excessive sick absence before discharge or retirement?

Their research revealed the following answers to the above questions:

- The proportion of the workforce recording at least one absence jumped from 27% to 46% in the year following the introduction of the sickpay scheme. However, they note that the majority of the workforce still do not take any absence.
- While absence does increase with age, there does not seem to be any kind of structural adjustment in this pattern due to the introduction of a sick pay scheme.
- They note that new workers have a six-month probation before they qualify for the sick pay scheme and they compare this with the six-month period leading up to the introduction of the scheme for established workers. During this period, new entrants take less absence than established workers in the six months leading up to the scheme. By contrast, comparing the new workers after they have passed this probation period to established workers in the six months after the scheme reveals little difference between new and established workers.
- They divide the workforce into three broad classes and compared their levels of absence. They find that unskilled workers do tend to take more absence than skilled workers, but the introduction of the sickpay scheme does little to change the distribution of absence across these types of workers.

- They find that workers who are on incentive pay schemes tend to take less absence than those who are paid on an hourly basis.

Denerley (1952) examined absenteeism in two UK firms to examine the effects of paid sick leave on absence. One firm ('Company Z') had recently introduced a statutory sick pay scheme for all employees with at least 6 months service. The second firm ('Company V') had a long-standing sick pay scheme, but it was only awarded to a fixed proportion of the workforce. Eligibility for the scheme was determined on a variety of individual attributes, including job performance and previous absenteeism record, although medically validated absence spells were excluded from the selection criteria.

Denerley plots the monthly absence rates for all employees of Company Z as well as plotting them for the workers on the sick pay scheme and for workers off the sick pay scheme at Company V. The plots cover two years - one year before the sick pay scheme was introduced at Company Z and one year after. The results are striking. In the period prior to the introduction of the scheme workers at Company Z behave in a virtually identical fashion to workers in Company V who are not on the sick pay scheme. From the point of introduction of the scheme, the workers in Company Z begin to take more absence (it approximately doubles) so that they become virtually identical to workers from Company V who are on the sickpay scheme.

Denerley also examines the effects of financial incentives on absence. Over the same time period he compares workers from two different departments (in Company Z) that are about to be closed. In both cases the workers have been offered alternative employment. However for one of the departments, a bonus is offered if they pick up the work of other closing departments, although the bonus would only be available for a fixed period of time. During the time when the bonus was available the absence rate of the workers remained unchanged, while the absence rate in the rest of the factory doubles (which Denerley attributes to the introduction of the sickpay scheme). Once the opportunity to earn bonuses ends, the workers in this department took absence in similar proportions to the rest of the workers in their factory. By contrast, the workers in the other closing department (who were not offered a financial incentive) began to take more absence as soon as the sick pay scheme was introduced. During this period some of the workers were interviewed regarding their attitudes to work. Denerley reproduces two typical comments:

“We’re getting a good bonus now, but I doubt whether the men can keep this pace going. It’s too much for some of them, but they want the money.”

“Some of the men aren’t fit to be at work, but they know what’s in store for them, and they’re taking their chance while they can.”

These comments coupled with the empirical evidence provide compelling evidence that workers absence patterns are highly responsive to financial incentives.

Barmby, Brown and Treble (1998) examine a scheme whereby workers are denied access to overtime work (for which they are paid a substantial premium) if they

accumulate a certain number of unjustified absences over a given period of time. The evidence suggests that the workers alter their attendance in response to the incentive structure created by this system.

Brown, Fakhfakh and Sessions (1998) use French panel data to examine the extent to which employee participation influences absenteeism. Their results suggest that the use of profit sharing and employee stock ownership programs have an inverse relationship with observed levels of employee absenteeism. They argue that by linking individual incentives with those of the firm (in particular the financial performance of the firm) individuals will be less inclined to take absence as this will adversely affect the firm and subsequently result in reduced income for the individual. These findings generally support the conclusions drawn by Peel and Wilson (1991). They find that firms employing participation schemes tend to have lower levels of absence and turnover, than those who do not.

Jacobson (1989) examined the extent to which an attendance incentive plan influenced teachers' propensity to take absence. Using records of teachers' attendance one year before and one year after the introduction of such a scheme. The findings suggest that individuals significantly reduced the number of sick days taken. However, they did increase the number of "personal days" taken, although the reduction in sick days significantly exceeds the increase in personal days, which were not included in the scheme. Jacobson concludes:

“What this suggests is that teachers may have been substituting between these two categories in order to maximise their rewards with a minimum of effort.”

This strikes me as a very interesting finding. It shows not only that individuals respond to financial incentives to attend (even when they are relatively small) but that they will also shift absence types (sick to personal) if the incentives are structured to reward lowering one type of absence, but not the other.

Audas, Barmby and Treble (1999) use detailed personnel and daily attendance records from a large UK firm to examine the extent to which the probability of promotion and the expected wage increase in the event of promotion influence the level of absenteeism. The findings indicate that individuals do alter their effort (by reducing their propensity to attend) if the probability of promotion is low, or if the return to promotion (pay rises) is small, relative to their current salary.

### *Absence and the Business Cycle*

There seems to be a general presumption among most commentators that absence has an inverse relationship with the business cycle. The basic argument follows a Shapiro-Stiglitz line of reasoning. In times of high unemployment, the consequences of becoming unemployed are much greater than times of low unemployment. When unemployment is low, a laid off worker will have a relatively easier time finding a new job as compared to when unemployment is high. Since the consequences of becoming unemployed vary with the business cycle, it follows that individuals will alter behaviour that influences the probability of becoming unemployed. If malfeasant

absence increases the probability of becoming unemployed, then workers will indulge in this less (more) frequently when the cost of becoming unemployed is higher (lower).

Kaivanto (1997) develops an alternative model of the pro-cyclical absence by extending the household production function to incorporate variations in foregone earnings through the business cycle to arrive at similar result (procyclical absence) although through a different mechanism.

The empirical evidence that has been compiled examining absence through the business cycle suggests that this supply side relationship does hold. However, there are several fundamental problems with these papers. First and foremost, each of the papers treats the problem as strictly a labour supply phenomenon and no attention is paid to potential demand side issues. As has been discussed in this chapter, there is a growing theoretical literature examining absence and firms' demand for labour. However, there has been limited empirical evidence to examine the extent to which there is variation across firms and over time for the demand for reliable labour. The second principal problem with the empirical literature is the vintage of the papers and the lengths and sizes of the datasets which do not allow for the application of the advances in statistical analysis of economic time series.

A much more detailed discussion of the relationship between absenteeism and macro-economic factors follows in Chapters Four and Five.

## 2.6 The State of the Literature

While economists have been slow to see the potential to use absence as a interesting and informative economic variable, the tides are starting to turn. It is quite interesting to note that the paper that spearheaded the interest of economists was in applied psychology (Steers and Rhodes, 1978). This paper offered a theoretical structure to examine absence that, while flawed, showed the potential applicability of absenteeism as an economic variable.

The literature looking at absenteeism as a phenomenon of the individual decision to supply labour is far more developed than the literature which examines firms' demand for reliable labour. I believe this is largely due to the fact that it was commonly believed that firms' demand for reliable workers did not vary considerably. Firms want all workers to turn up all the time. Recent papers by Coles and Treble (1993, 1996) go some way in rectifying this, although the empirical evidence remains quite limited<sup>13</sup>.

Barmby and Treble (1989) examine absence in a manufacturing firm. Their results were somewhat disappointing which leads them to consider why this might be the case. They conclude that studies in absence are plagued by identification problems. They argue that there are two kinds of absence: controllable (in the sense that if a

---

<sup>13</sup> A notable exception is Barmby and Stephan (1998).



proper system of rewards and penalties made the cost of shirking so great that it could be eliminated) and uncontrollable (which they argue will be completely random). They state:

“Whatever the methods of absenteeism control might be, if they are successful they will reduce the importance of controllable absenteeism in determining the total. In fact, we could define a perfectly successful control system as one that achieved a level of absenteeism exactly equal to the uncontrollable element. It follows that if firms are pursuing a successful system of absenteeism control it will be difficult for the investigator to discover what the determinants of uncontrollable absenteeism are, because the effect of the relevant variables on the level of absenteeism will be reduced by the methods of control used. In the case of perfectly controlled absenteeism, all the data should reveal is random noise.”

They argue that the only way to understand uncontrollable absence is to study cases where the methods of control have been unsuccessful. However they point out that such cases may not be easy to find, given the concern that most personnel managers have with the level of absence and the vast literature on absence control.

Although the empirical evidence in the applied psychology and management literature is impressive in its volume, it is often of dubious empirical quality making the findings somewhat questionable. The aim of the chapters to follow is to examine two areas in which the empirical evidence has been particularly weak and use more rigorous techniques to examine the absence phenomenon.

## 2.7 Conclusion

The economics of absence, while somewhat slow to get started, has developed some momentum in recent years. Interestingly, the catalyst for this interest was a paper from the field of applied psychology. Steers and Rhodes (1978) “process model” gave rise to a number of economic implications that has resulted in a growing interest by economists. Allen (1981) developed a model of absence as a labour supply phenomenon that has been widely accepted in the literature. Weiss (1985) and Coles and Treble (1993, 1996) have added significantly to our understanding of the demand side of absence. Their arguments are subtle, as it is less obvious why firms’ demand for reliable labour may vary.

The empirical studies of absence have improved dramatically. A significant factor behind this is the availability of computerised personnel records that allow for a detailed analysis of individual absence records. A crucial point is that these records are collected by the firms, rather than being self-reported by employees, making them considerably more reliable. The availability of improved data has resulted in better constructed research questions and the use of advanced econometric techniques.

Two areas where the quality of empirical studies has lagged somewhat behind is in the analysis of absence and turnover and absence through the business cycle. In the chapters that follow, I attempt to redress some of this imbalance.

## **Chapter Three: An Economic Analysis of Absence from Work and Voluntary Turnover<sup>1</sup>**

### **3.1 Introduction**

Applied psychologists have had a long-standing debate on the relationship between absence and turnover. There have been dozens of empirical studies and several “meta analyses” attempting to determine the balance of the empirical evidence. On the other hand, economists have had little to contribute in this area, which would seem to lend itself well to economic analysis. The relationship between absence and turnover, which has been one of the richest lines of inquiry within the field of absenteeism, has been virtually ignored by economists. As such, the aim of this chapter is to apply economic reasoning and to improve upon the empirical studies that have been conducted in this area.

In this chapter the applied psychology and management literature is reviewed with an attempt to put an economists’ interpretation on the established empirical and theoretical ideas regarding the relationship between absence and turnover. Then a theoretical model is developed which provides a clear prediction of a positive correlation between absence and turnover (i.e. those who quit have higher levels of absence). Next, a very rich data set is used to conduct an empirical examination of the relationship between turnover and absence. The results demonstrate that there is a significant positive relationship, although it also becomes clear that the relationship

---

<sup>1</sup> A shortened version of this chapter is currently being prepared for submission to *The Academy of Management Review*.

is more complex than the model, or the established literature, would predict. Given this finding, alternative explanations of the relationship between absence and turnover are discussed.

## **3.2 Schools of thought**

### **3.2.1 The Psychologists' View**

In a recent review of the vast literature on absence and turnover, Mitra, Jenkins and Gupta (1992) describe the three distinct schools of thought on the nature of the relationship. These are discussed below.

#### ***Absence as Withdrawal Leading to Turnover***

Proponents of this school of thought argue that under different circumstances, absenteeism and turnover reflect different manifestations of the same fundamental phenomenon, which is referred to as *withdrawal*. They argue that absence and turnover need to be studied together, believing that if individuals have some sort of preference shift (i.e. they cease to “enjoy” their work) and subsequently adjust their attendance behaviour in some way to reflect this change in preferences. In the simplest of terms, there is no causal relationship between the two, absence and turnover are different (but related) manifestations of an individual’s dissatisfaction with their current employment. Proponents of this line of thinking point to papers by Beehr and Gupta (1978), Gupta and Jenkins (1982) and Rosse (1988), among others as empirical examples of a positive relationship between absenteeism and turnover.

An economist might look at this as being a story about job satisfaction. The preference shift emerges due to some sort of exogenous change in the individual's attitude toward his/her job. The individual who does not like his/her job becomes less likely to attend and presumably more likely to leave the firm, given that they are no longer happy with their current employment. This suggests that the individual becomes dissatisfied with his/her job and begins to increase absenteeism as a proxy for this dissatisfaction. At some point the dissatisfaction becomes so great that the individual quits. Increased absenteeism, it is argued, marks the beginning of a progression towards the decision to quit<sup>2</sup>.

#### *Absence and Turnover are not Related*

Proponents of this school of thought are highly critical of the withdrawal school. They argue that the process of taking absence and quitting a job are separate and should not be analysed together. They point to studies by Mobley (1977 & 1982), Price (1977) and Steers and Mowday (1981), among others that suggest that absence and turnover are unrelated. Mobley (1982) argued that there is a connotation with withdrawal that implies "escape" or "avoidance", which may not necessarily link absenteeism and turnover. He goes on to state that both absenteeism and turnover can result from alternatives other than avoidance and as such warrant separate consideration.

---

<sup>2</sup> Others (see Rosse (1988) for instance) have argued that absence is the second step on the withdrawal continuum with lateness preceding absence and turnover.

Porter and Steers (1973) discuss the idea of “met expectations.” They state:

“The concept of met expectations may be viewed as the discrepancy between what a person encounters on this job in the way of positive and negative experiences and what he expected to encounter. Thus since different employees can have quite different expectations with respect to payoffs and rewards in a given organisational work situation, it would not be anticipated that a given variable (e.g. high pay, unfriendly work colleagues, etc.) would have a uniform impact on withdrawal decisions. We would predict, however, that when an individual’s expectations - whatever they are - are not substantially met, his propensity to withdraw would increase.”

They offer compelling evidence of this hypothesis by reviewing 22 studies examining the relationship between absenteeism and turnover. Of these, only 6 were found to have a positive correlation. They argue that while there does appear to be an important relationship between “met expectations” and turnover, they argue that the case for absenteeism is not so clearly made, stating:

“Too often in the past absenteeism has been considered an analogue of turnover, and too often it has been assumed, without sufficient evidence, that the two shared identical roots.”

They argue absenteeism can be distinguished from turnover along three dimensions:

1. The negative consequences (for the individual) of absenteeism are much less than those associated with turnover. They argue that in a regime of complete or near complete replacement of wages with sick pay benefits, the employee can take absence at a relatively low cost, while turnover implies a complete severance of the employment relationship.
2. Absenteeism is more likely to be a spontaneous and easy decision, while quitting one’s job must, generally, require much more serious consideration.

3. Absenteeism may represent a form of temporary avoidance and as such be a substitute for turnover, particularly when alternative employment might not be readily available.

Their line of reasoning seems to suggest that absence and turnover may emanate from the same fundamental cause (dissatisfaction with one's job). However, the differences in the relative severity of the two actions suggest that it may be possible to observe a considerable amount of individual absence without necessarily observing the same individuals turning over. They also point out that absence may be a result of a variety of other phenomena that have very little to do with withdrawal. While there may be an association between absence and turnover, they argue that an observed increase in absenteeism does not necessarily (or even regularly) lead to a correct prediction of turnover.

#### ***Absence and Turnover as Substitutes***

The final school of thought argues that there should be an inverse relationship between absence and turnover, suggesting that they are *substitutes* for one another. Mitra, Jenkins and Gupta (1992) point to a study by Hill and Trist (1953) as the principal proponent of this school of thought. Hill and Trist state:

“Though leaving and absences may both provide a means of withdrawal from the work situation, absences are nevertheless the obverse of labour turnover. In contrast to leaving one place of work for the other, the represent being away from the job while still remaining with the same employing institution.”

They are arguing that when the individual becomes dissatisfied with his/her job they increase their absence as a means of compensation for this dissatisfaction. Absence becomes a compensating differential to counter the effects of an undesirable work situation. Workers who can take more absence, they argue, are less likely to turnover.

An alternative explanation of the same empirical phenomenon can be put forward. Assume high a level of absence (or a high tolerance to absence) is an attribute of the firm that would be highly valued by the individual and firms tolerating high absence tend to pay lower wages<sup>3</sup>. Then one would expect that individuals with a preference for “high wage/low absence” contracts would be more likely to resign to find an employer that appropriately values their reliability. This would provide a feasible theoretical argument explaining observed absence being lower among leavers compared with those who stay.

### **3.2.2 An Economist's View**

The second school of thought (no relationship) argues that the processes which drive absence and turnover are fundamentally different and while studying them simultaneously may explain some cases, the relationship between absence and turnover is by no means an iron-clad empirical regularity. In other words, a great

---

<sup>3</sup> Weiss (1985) develops a model for assembly line type processes that show that a workers wage is a decreasing function of his/her propensity to go absent. Coles and Treble (1996) show why a manager may be satisfied when a large proportion of their contracted workforce do not attend on a regular basis.



deal of absence can be observed without correctly predicting a resignation. What this suggests is that the processes are orthogonal, that is the processes are not fundamentally intertwined. Conversely, the first and the third schools of thought (withdrawal and substitutes, respectively) seem to suggest that the processes (absence and turnover) are endogenous. Observing higher absence has a natural implication for observed turnover, although there is a complete disagreement as to what this implication may be.

In each of these constructs the objective is to use absenteeism to predict turnover. However, plausible economic rationale can be used to explain these phenomena from a different perspective.

The withdrawal argument is essentially a story about job satisfaction. As an individual becomes less content with his/her job, he/she takes more absence, until eventually the dissatisfaction becomes so great that the individual resigns. Once the individual becomes dissatisfied and withdrawal begins (and the individual takes more absence) the individual simultaneously becomes more likely to resign.

Freeman (1978) uses two US panel data sources to examine the influence of reported job satisfaction on the probability of changing jobs (i.e. quitting). He observes:

“The calculations show that diverse other factors held fixed, the subjective level of job satisfaction is a significant determinant of the probability of quitting”

Freeman's finding that job satisfaction is a significant predictor of quit behaviour introduces another complication to the withdrawal argument. If low job satisfaction, as Freeman suggests, significantly increases the probability of turnover, it makes the identification of the absence/turnover relationship, in terms of a withdrawal process, highly difficult. For instance, if we observe an individual with low job satisfaction exhibiting higher absenteeism than quitting, the withdrawal proponents would argue, provides evidence supporting their hypothesis. However, later in this chapter an argument will be developed that shows lower job satisfaction<sup>4</sup> leads an individual to make the decision to quit (although there will be some period of time while the individual will remain in the firm before actually leaving). This, in turn, results in a relaxation of constraints on the individual, which naturally leads to an increased incentive for the imminent quitters to absent themselves more frequently in the period leading up to the actual day when he/she leaves their work organisation.

Those proponents who argue that absence and turnover are substitutes are essentially using a matching model to explain an inverse relationship between absence and turnover. Chapter Four demonstrates that in a system where workers get most or all of their wages replaced with a sickness benefit in the event of their absence, the individual has a significant incentive to take time away from work to gain extra utility from leisure or household production. The proponents of the substitutes line of

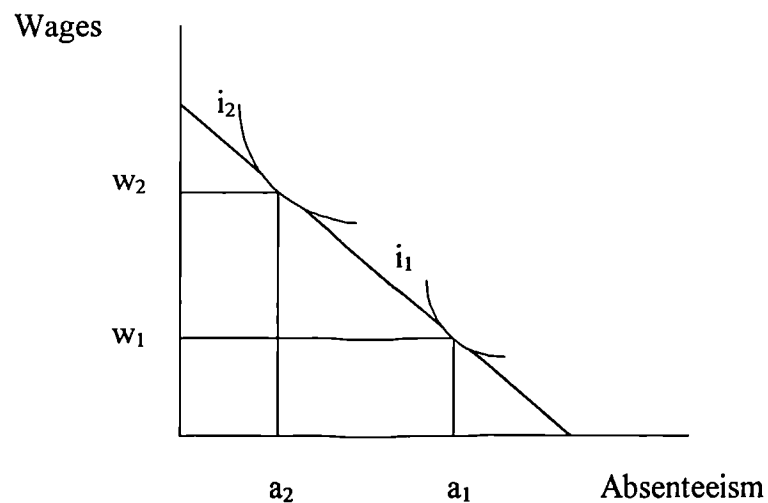
---

<sup>4</sup> It is important to note that the model is generalised to allow for quits for any reason. Job satisfaction is used here as an illustration. If we think of job satisfaction as being the extent to which the individual believes he/she is well matched in their current job then it may be thought of as a more robust definition.

thinking are essentially arguing that being in a workplace that tolerates high absence is desirable and as such an individual in this circumstance would be less inclined to leave voluntarily.

This is the idea developed by Coles and Treble (1993, 1996). They assert that workers have preferences along a wage/absence indifference curve that might look something like Figure 3.1 below:

Figure 3.1 Trade off Between Wages and Absence



This figure shows is that different workers may have different preferences along this curve. Some (for instance  $i_2$ ) prefer to be in high wage jobs that allow them little absence, while other individuals (for instance  $i_1$ ) may prefer to work for a lower wage, but in an environment which tolerates higher levels of absence.

While the case of the individual might be relatively straightforward, the case of the firm is somewhat less obvious. Coles and Treble (1993) state:

“...the equilibrium contract configuration can result in the assembly line firm paying higher average wages and reducing sick pay entitlements relative to the CRS (constant returns to scale) firms.”

The idea they develop is that firms with different production technologies (and hence different returns to scale and different levels of complementarity between workers) may find it cost efficient to pay a wage premium. However, in turn they offer reduced sickness benefits and place increased penalties on absence, in order to secure better attendance. They argue the cost of absenteeism is not the benefits paid to the worker for not turning up (which is the view in most of the popular literature), rather it is the foregone production that results from the worker not turning up. To illustrate the point they use the extreme example of assembly line production (where workers are near perfect complements) and assume production will only occur if some minimum number of workers show up. If more than this minimum turn up, the marginal value they add to production is zero, however if the firm is unable to get the minimum number of workers, production is zero. Contrast this with a firm using a CRS production function. The addition (or subtraction) of each worker adds (subtracts) their marginal product (i.e. the individual's marginal product is not a function of the number of co-workers that turn up) and the costs of absence are therefore less severe. As such firms operating in a CRS production environment should be less concerned with absence. These firms will receive lower returns in taking a tougher line (i.e. more stringent monitoring, greater penalties for absence or

rewards for attendance) against absenteeism (and hence pay a lower wage). In essence a higher tolerance to absence is a compensating differential for a lower wage.

Weiss (1985) examines the relationship between absenteeism and wages from the perspective of the firm. He notes:

“In evaluating the cost of absenteeism to the firm, the nature of the production process is critical.”

The obvious implication of this is that firms with different production processes will have different returns to the vigilance in which they monitor absence. Weiss goes on to show that workers' wages are a sharply decreasing function of his/her propensity to go absent.

Jovanovic (1979) develops a model where a job match is considered a “pure experience good”, that is, the attributes or the quality of the match are unknown until the worker actually begins the job. If one of the unknown attributes of the job is tolerance to absence (which one could imagine firms' not particularly wanting to publicise) then it is quite straightforward to see how the probability of a mis-match between desired absence tolerance and actual absence tolerance may occur. The individual who seeks a differently structured contract (in terms of the absence/wage trade off) will have a higher propensity to turnover and would also have a different propensity to go absent than those who are well matched with the firm.

The “no relationship” school assert that individuals take absence as the utility from being away from work exceeds the cost of absence (in terms of foregone earnings and other non-pecuniary benefits). If time spent at the workplace becomes undesirable or less than desirable, then the cost of going absent falls and individuals take more absence as a utility maximising activity. However, these proponents argue increased absence (and the additional utility from taking it) does not necessarily lead to a severance of the employment relationship. They do not go as far as saying that the capacity to take absence makes the job more desirable as do those who argue in favour of the “substitutes” theory. Those who argue that absence and turnover are substitutes believe the capacity to take absence actually increase the likelihood of staying in the firm.

The amassed volume of empirical literature on the subject is impressive. There have been at least five major reviews of the literature, beginning with Lyons (1972) and subsequently followed by Porter and Steers (1973), Muchinsky (1977), Gupta and Jenkins (1980) and by Mitra, Gupta and Jenkins (1992). Porter and Steers found that the evidence supporting withdrawal was weak, with only 6 of the 22 studies that had examined absence and turnover concurrently finding a positive relationship between the two. However, the remaining reviews found that there is evidence to suggest that the relationship between absence and turnover is positive.

Empirically, the issue boils down to who exhibits higher absence: those who leave the firm, or those who remain in the firm. Higher absence is believed to show evidence

of withdrawal (and thus supporting the first school of thought). Lower absence is interpreted as evidence that absence and turnover are substitutes. If absence and turnover exhibit no significant correlation, this is evidence of there being no relationship. The question is empirical.

However, I would argue that the issue is considerably more complex. Many of the studies focus on static rates of absence, meaning that they look at the level of attendance of an individual who leaves the firm and compares their absence record over a period of time to individuals who remain in the firm. A positive correlation between absence and turnover could be interpreted as withdrawal. Alternatively it could be a function of a mismatch between individuals wishing to take more absence (and being willing to trade off wages for this) and the firms in which they are employed wishing to have a more reliable worker (and being willing to pay a premium for this attribute). If we observe a low absence individual being more likely to turnover, then this could be interpreted as individuals with a preference for low absence/high wage contract being mismatched with a high absence/low wage firm.

It is possible to imagine both phenomena occurring simultaneously. That is, within a firm, some individuals prefer low absence/high wage contracts, so they quit the firm, which would be evidence that absence and turnover are substitutes. Other individuals in the firm may experience withdrawal, meaning their decreased job satisfaction results in them taking more absence and eventually resigning. There is nothing to suggest that these effects are mutually exclusive. The proportions in which they

occur, could result in an interpretation of any of these schools of thought. If withdrawal dominates matching, the evidence points to withdrawal. If matching dominates withdrawal, then those arguing from the substitutes perspective would use this as evidence to justify their position. Finally, if the two effects cancel each other out, then the evidence suggests a null relationship.

A more insightful line of inquiry would be to turn the question around and model the absence/turnover relationship as a “Bayesian” process. That is, given that an individual has decided to leave the firm, what would we expect his/her attendance behaviour to be leading up to the date of resignation. This is a somewhat different approach from the majority of previous studies in which absence tends to be used as a predictor of turnover. The empirical question changes from:

Do leavers tend to take more or less absence than stayers? To:

How do leavers’ attendance patterns differ from those of stayers in the period leading up to them leaving?

The results of this approach should remain comparable with the results of the aforementioned research, although it removes a significant identification problem that emerges if static rates of absence are compared across individuals, when what is really required is a comparison across individuals and over time. If those individuals who exit the firm alter their attendance pattern before quitting, then this could be useful in predicting turnover.



It is worthwhile to give some thought to the process of quitting one's job. As the "null relationship" proponents point out, severance of the employment relationship is a very drastic step and usually not one taken without a great deal of consideration. Pissarides and Wadsworth (1994) show that approximately two thirds of the observed quits involve individuals moving directly into other jobs. This implies that there must be some element of job search prior to leaving and the actual quitting process may last a long time, with the individual engaging in on-the-job search until receiving an offer suitable enough to allow them to quit.

The idea of explaining behaviour as a result of an exogenous preference shift (i.e. the individual ceases liking their job so they take more absence) does not typically rest well with economists. Lazear (1995) has made tremendous progress in developing formal economic models of personnel behaviour based on the structure of incentives. The focus of his work has been to demonstrate that changes in the incentives to supply effort (not surprisingly) have significant effects on the amount of effort supplied. The model developed in this chapter follows in this spirit.

In section 3.3 a formal model of predicted absence driven by information asymmetry and relaxed constraints is derived. The argument is that once the individual has made the decision to leave the firm, the incentives to attend diminish. In section 3.4 a detailed description of the empirical technique and the data used in this chapter is provided. Section 3.5 contains the empirical examination. Section 3.6 places the empirical findings in context with the literature and reviews the most comparable

studies. Section 3.7 examines alternative explanations of the relationship between absence and turnover. Section 3.8 concludes.

### **3.3 Theoretical Model**

Allen's (1981a) model argues that absence is bounded by individuals' expected future incomes. Individuals temper their absence in order to minimise the chance that he/she is terminated from their job or alternatively to enhance his/her chances of promotion. The models developed in this chapter show what happens if these constraints are relaxed. If an individual makes the decision to exit the firm voluntarily then the lure of promotion or the threat of the sack should have little influence on his/her propensity to take absence. Two models are developed to show the effects of "firing" and "promotion" separately, although the basic mechanics of the model do not change appreciably. The key idea that I attempt to convey in these models is that a job change is a way of "wiping out" an absence history. If the individual knows he/she is leaving the firm and in turn understands that by leaving the firm, their absence rate will not count against them (with their next employer), they are more likely to take absence in the period leading up to the quit.

#### **3.3.1 Firing Model**

The objective in this model is to examine the worker under two states. In the first state, the individual remains in the firm for two periods and in the second, the individual decides at some point in period 1, that he/she will exit the firm at the end of this period. The principal objective is to show how the incentives to take absence

differ under these two states. In this two period framework, the individual receives utility from three sources: consumption, leisure time and absence time. Therefore the individual has the following utility function:

$$U(x_1, t_1^L, t_1^A, x_2, t_2^L, t_2^A) \quad U_i > 0 \quad i = 1, 2, 3, 4, 5, 6 \quad (1)$$

Where  $x_1$  is period 1 consumption,  $t_1^L$  is leisure time in period 1,  $t_1^A$  is absence time in period 1,  $x_2$  is period 2 consumption,  $t_2^L$  is period 2 leisure and  $t_2^A$  is period 2 absence. An important feature of this model is that while absence is assumed to be a good, it is not necessarily the same as leisure time, that is all time away from work is not treated as equal in terms of utility.

The individual also faces the time constraint:

$$T - t_i^C - t_i^L = 0 \quad i = 1, 2 \quad (2)$$

Where  $T$  is total time and  $t^C$  is the individual's number of contracted hours.

For period 1 the individual's consumption can be written as:

$$x_1 = w_1^E(t_1^C - t_1^A) + w_1^K(t_1^A) + R_1 - S_1 \quad (3)$$

Where  $w_1^E$  is wages from employment in period 1,  $w_1^K$  is the sick pay rate the individual is paid when absent,  $R_1$  is any non-employment earnings the individual receives and  $S_1$  is savings made in period 1.

Period 2 consumption can be written as:

$$X_2 = \phi(t_1^A) \left[ w_2^e(t_2^C - t_2^A) + w_2^K(t_2^A) \right] + [1 - \phi(t_1^A)]B_2 + R_2 + S_1 \quad (4)$$

Where  $\phi$  is the probability that the individual is not terminated at the end of period 1 and this is dependent on the individual's level of absence in period 1 ( $t_1^A$ ). If the individual is retained he/she receives income  $w_2^e(t_2^C - t_2^A) + w_2^K(t_2^A)$  and if the individual is terminated he/she receives  $B_2$ , the exogenous unemployment benefit. By assumption  $\partial\phi/\partial t_1^A < 0$ , which suggests that the more absence the individual takes in period 1, the less likely they are to be retained by the firm in period 2.  $\phi(t_1^A)$  links period 2 utility with period 1 absence.

Over two periods the individual has the following utility function:

$$\begin{aligned} \text{Max}_{t_1^A, t_2^A, S_1} &= U(w_1^E(t_1^C - t_1^A) + w_1^K(t_1^A) + R_1 - S_1, t_1^L, t_1^A; \\ &\phi(t_1^A) \left[ w_2^e(t_2^C - t_2^A) + w_2^K(t_2^A) \right] + [1 - \phi(t_1^A)]B_2 + R_2 + S_1, t_2^L, t_2^A) \end{aligned} \quad (5)$$

Differentiating by  $t_1^A, t_2^A$  and  $S_1$  yields the following three equations:

$$\frac{\partial U}{\partial t_1^A} = U_1 \left[ -w_1^E + w_1^K \right] + U_3 + U_4 \left[ \phi' \left\{ w_2^E(t_2^C - t_2^A) + w_2^K(t_2^A) \right\} - \phi' B_2 \right] = 0 \quad (6)$$

$$\frac{\partial U}{\partial t_2^A} = U_4 \left[ \phi(t_1^A) \left\{ -w_2^E + w_2^K \right\} \right] + U_6 = 0 \quad (7)$$

$$\frac{\partial U}{\partial S_1} = -U_1 + U_4 = 0 \quad \text{therefore: } U_1 = U_4 \quad (8)$$

This allows us to substitute  $U_1$  for  $U_4$  into (6) and (7), which gives:

$$U_1 \left[ \phi(t_1^A) \left\{ -w_2^E + w_2^K \right\} \right] + U_6 = 0 \quad \text{and} \quad (9)$$

$$U_1 \left[ -w_1^E + w_1^K \right] + U_3 + U_1 \left[ \phi' \left\{ w_2^E(t_2^C - t_2^A) + w_2^K(t_2^A) \right\} - \phi' B_2 \right] = 0 \quad (10)$$

Which can be re-arranged to give:

$$\frac{U_3}{U_6} = \frac{1(-w_1^E + w_1^K)}{\phi(-w_2^E + w_2^K)} + \frac{\phi' \left[ w_2^E(t_2^C - t_2^A) + w_2^K(t_2^A) - B_2 \right]}{\phi(-w_2^E + w_2^K)} \quad (11)$$

$\frac{U_3}{U_6}$  is the marginal rate of substitution of absence between period 1 and 2.

To examine the effect of an individual quitting his/her job at the end of period 1 on absence in period 1 we examine the how  $\phi$  differs between leavers and stayers. Consider the case of two individuals who are identical in every way with the exception that one of the individuals has made the decision to quit the firm at the end of period 1 (the leaver), while the other individual wishes to stay in period 2 (the stayer). For the individual leaving the firm at the end of period 1, the firm's decision as to whether or not to retain the individual in period 2 has no impact on the attendance behaviour of the individual in period 1. For this individual  $\phi \equiv 1$  since he/she is choosing an alternative that must provide utility at least as great as he/she would receive by remaining in the firm in period 2. By leaving the firm for some alternative, they guarantee period 2 utility. The individual who remains in the firm must do so because the utility they will gain from staying in their job will be greater than that available from the alternatives. For this individual, the threat of termination

must have some effect and therefore  $0 \leq \phi < 1$  implying that his/her utility will be affected by the firm's decision to retain the individual.

To show these effects in the model, I compare the two expressions in (11) for case where  $0 \leq \phi < 1$  and also the case where  $\phi = 1$ . To show that there is an incentive to take more absence when the individual had made the decision to quit, it must be shown that (11) is larger when  $0 \leq \phi < 1$  as compared to when  $\phi = 1$ . This demonstrates there is a greater preference for absence in period 1 if the individual resigns at the end of period 1, showing that absence is more attractive in period 1 when  $\phi = 1$ .

To begin I will look at the first expression in (11). If  $\phi = 1$ , then the expression is simply the ratio of the difference between wages from work and the sick pay the individual receives if he/she is off work. If  $0 \leq \phi < 1$ , the denominator will become smaller and as such the ratio will get larger, demonstrating that the first expression must be larger if  $0 \leq \phi < 1$  as compared to the case where  $\phi = 1$ .

Next compare the second expression in (11) when  $0 \leq \phi < 1$  as compared to  $\phi = 1$ . When  $\phi = 1$  then  $\phi' = 0$  and the second expression in (11) becomes 0. To show that absence becomes more attractive in period 1 the second argument needs to be positive when  $0 \leq \phi \leq 1$ . This can be shown as follows:

$\phi' \leq 0$  implies that the individual is less likely to be retained in period 2 the more absence he/she takes in period 1.

$0 \leq \phi \leq 1$ , by definition as a probability. This means that  $\frac{\phi'}{\phi} < 0$ .

$w_2^E(t_2^C - t_2^A) + w_2^K(t_2^A) - B_2 > 0$  as long as wages earned from work plus benefits paid from sickness are greater than the exogenous unemployment benefit, which must be the case or there would be no incentive to work.

$-w_2^E + w_2^K < 0$  which holds as long as the wage rate in period 2 is greater than the

sick pay rate in period 2. Which implies that  $\frac{w_2^E(t_2^C - t_2^A) + w_2^K(t_2^A) - B_2}{-w_2^E + w_2^K} < 0$ .

Multiplying the two terms together must yield a positive value, which shows that there will be a greater incentive to take absence in period 1 if  $\phi \neq 1$ . This unambiguously shows that individuals who quit the firm at the end of period 1 have a clear incentive to take more absence than those individuals remaining in the firm, *ceteris paribus*.

### 3.3.2 Promotions Model

While the threat of termination may seem somewhat extreme, an alternative way of looking at this idea of period 2 wages being tied to period 1 attendance is to look at

how absence affects promotion probabilities or the probability of a wage rise. In this model it is assumed that the probability of promotion, and therefore the expected wage in period 2, is a function of absence taken in period 1. As such,  $\frac{\partial w_2^E}{\partial t_1^A} < 0$ , implying that expected wages decline with absence.

Similar to the firing model, this is a two period model where the individual gets utility from consumption, leisure and absence. As such they have the following utility function:

$$U(x_1, t_1^L, t_1^A, x_2, t_2^L, t_2^A) \quad U_{i>0} \quad i = 1,2,3,4,5,6 \quad (12)$$

$$T - t_1^C - t_1^L = 0 \quad i = 1,2 \quad (13)$$

Where T is total time and  $t^C$  is the individual's number of contracted hours.

For period 1 the individual's consumption can be written as:

$$X_1 = w_1^E(t_1^C - t_1^A) + w_1^K(t_1^A) + R_1 - S_1 \quad (14)$$

Where  $w_1^E$  is wages from employment in period 1,  $w_1^K$  is the sick pay rate the individual is paid when absent,  $R_1$  is any non-employment earnings the individual receives and  $S_1$  is savings made in period 1.

Period 2 consumption can be written as:

$$X_2 = w_2^E(t_1^A)(t_2^C - t_2^A) + w_1^K(t_1^A) + R_2 + S_1 \quad (15)$$



So over two periods the individual maximises the following utility function:

$$\begin{aligned} & \text{Max} \\ & t_1^A, t_2^A, S_1 = \\ & U\left[w_1^E(t_1^C - t_1^A) + w_1^K(t_1^A) + R_1 - S_1, t_1^L, t_1^A; w_2^E(t_1^A)(t_2^C - t_2^A) + w_2^K(t_2^A) + R_2 + S_1, t_2^L, t_2^A\right] \end{aligned} \quad (16)$$

Differentiating by  $t_1^A, t_2^A$  and  $S_1$  yields the following three equations:

$$\frac{\partial U}{\partial t_1^A} = U_1[-w_1^E + w_1^K] + U_3 + U_4[w_2^E(t_2^C - t_2^A)] = 0 \quad (17)$$

$$\frac{\partial U}{\partial t_2^A} = U_4[-w_2^E + w_2^K] + U_6 = 0 \quad (18)$$

$$\frac{\partial U}{\partial S_1} = -U_1 + U_4 = 0; \text{ therefore } U_1 = U_4 \quad (19)$$

In an identical fashion to the firing model, (19) can be substituted into (17) and (18)

to get:

$$U_1[-w_1^E + w_1^K] + U_3 + U_1[w_2^E(t_2^C - t_2^A)] = -w_2^E(t_2^C - t_2^A) + U_6 \quad (20)$$

Which can be rearranged such that:

$$\frac{U_3}{U_6} = \frac{-w_1^E + w_1^K}{-w_2^E + w_2^K} + \frac{w_2^E(t_2^C - t_2^A)}{-w_2^E + w_2^K} \quad (21)$$

As was the case in the firing model, the next step is to compare the effect of  $w_2^E$  of an individual remaining with their current employer and comparing this to an identical

individual that leaves their current employer. If the individual leaves their current employer at the end of period 1,  $w_2^E$  evaluates to 0 and the entire second expression drops out. If it can be shown that if the entire second expression is positive when  $w_2^E$  does not evaluate to 0, then this demonstrates that there is a cost of absence in the first period that ceases to have an effect if the individual leaves in period 2.  $w_2^E$  is negative by definition (wages in period 2 are a decreasing function of absence).  $t_2^C - t_2^A \geq 0$  must hold as an individual can not absent him or herself for more hours than they have been contracted to work. In conjunction this makes the numerator of the second expression negative. The denominator is also negative as long as sick pay is less than actual pay. This results in the second expression being positive and as such shows that there is a cost associated with absence in period 1 that only occurs for the individual remaining with the firm in period 2.

These two simple models provide a formal demonstration of the role of absence on current and future utility. If the individual wishes to remain with their current employer, then taking absence in period 1 has an associated cost of greater probability of termination (or lower probability of retention, as modelled here) or lower expected wages (through diminished promotion chances). If the firm loses the capacity to sanction the individual for absence (by termination or denial of promotion) then the individual will maximise utility by taking more absence in period 1, since period 2 utility has already been guaranteed from some other source. Much

of the cost of absenteeism (to the individual) has been removed and as such, the utility maximising individual should increase his/her absence.

The sections that follow provide an empirical examination of this unambiguous theoretical result.

### **3.4 Empirical Strategy and Data**

In this section the empirical technique and the data source for testing the relationship between absence and turnover are described.

#### **3.4.1 Empirical Technique**

Gupta and Jenkins (1982) use matched individual data to examine the relationship between absence and turnover. They cite the aforementioned problem of using static measures to analyse a dynamic problem. They use data from two firms and examine the attendance records of individuals who leave the firm matched with individuals who leave the firm and compare the difference in these rates. They match leavers against stayers from the same work unit and adjust their calendars so that the comparison captures the individuals at the same point in time, thus removing any seasonal aspect to their data. Their findings suggest that there is an increase in absence leading up to the quit. However, there are several problems with their empirical approach and the data they use to conduct their research.

First, the samples are very small (15 leavers in one firm, 18 in the other) and as is demonstrated later in this thesis, it is very difficult to get a reliable rate of absence using such a small sample of individuals. Second, the matching fails to account for any personal characteristics. It is quite likely that leavers are not a purely random sample of the employment population. Several of the factors that positively influence turnover, may also influence absence. For instance, Ferris and Rowland (1987) examined factors that moderate the absence/turnover relationship and found that tenure played a significant role.

A potentially interesting finding which Gupta and Jenkins do not exploit is that their data suggests that leavers have significantly higher absence 15 months prior to leaving. In addition, for months 14 and 16, the effect is also positive, although neither is significant at the 5% level<sup>5</sup>. It could be argued that this three month period is the dominant difference in attendance between leavers and stayers exhibited in this database, although the differences in months 7 and 8 are also both positive and significant at the 5% level.

Clegg (1983) uses survey data to construct a “multivariate caliper matching procedure<sup>6</sup>” (see Anderton, *et al*, 1980) to match individuals on several criteria, including sex, marital status, skill level, and job category as well as falling within a

---

<sup>5</sup> Month 16 is significant at the 10% level and month 14 narrowly misses significance at the 10% level.

<sup>6</sup> Multivariate caliper matching is a process by which individuals are matched on a variety of criteria to make them more comparable. For instance, females might be matched with other females, senior workers matched with other senior workers, etc.

specified range of age and tenure. The study uses 31 matched pairs to examine the relationship between absence and turnover. Although there does appear to be a positive correlation between the two phenomena, the results are not particularly robust. And while this sampling technique does correct for a significant number of biases, the use of cross-section rather than longitudinal absence data does not allow for a dynamic review of how leavers change their behaviour leading up to the quit date.

This chapter attempts to marry these two methodological approaches. That is a dynamic, rather than a static view of absence is taken (i.e. how the patterns of absence change over time). In addition, multivariate caliper matching is used to construct a large sample of matched pairs, However, the matching is done in a dynamic fashion, as will be outlined in section 3.4.3.

### **3.4.2 The Data Source**

The data used in this model come from the administrative records of a very large UK financial services firm with branches throughout the country. From these, I have been able to reconstruct daily attendance records for all full-time employees over a 35 month period. In addition, the records contain the individuals' date of birth, tenure in the organisation, marital status, job tenure, performance evaluation and position in the hierarchy from month to month<sup>7</sup>. The data on the individuals' personal

---

<sup>7</sup> The data is left censored. The individuals' rank in the hierarchy is known from January, 1989.

information are derived from monthly payroll files. The absence information was converted into daily attendance from computerised records containing data on the duration and reason for each spell of absence for each of the firm's full-time employees between April 1991 and March 1994, a period of 736 working days. In addition, data has been provided on each exit from the firm. This information includes the date of the resignation and the reason for the separation. Each individual has been assigned a unique identifier and the data is linked using this variable.

The firm operates an organisational hierarchy or internal labour market broadly consistent with that described in Doeringer and Piore (1971). There are six "staff" grades and seven "managerial" grades and promotion and (in a few cases) demotion is observable up and down the hierarchy by examining the grade the individual occupies each month. The firm evaluates the performance of its workers annually, with workers being classified into one of six categories ("Outstanding", "Excellent", "Satisfactory", "Not fully effective", "Unsatisfactory" and "Not graded"). The evaluation is done by the employee's supervisor and the outcome determines the size of the pay increment the employee receives for the upcoming year. There is also a bonus scheme used in the firm and each individual's allocation of their share of the bonus pool is determined by their evaluation. Very few individuals fell into the "Not fully effective" or "Unsatisfactory" category. The firm indicated that a "Not fully effective" or "Unsatisfactory" rating was generally a warning that if the individual did not perform better, he/she would be terminated.

The firm has approximately 40,000 full-time and 10,000 part-time employees in any given month, although during this period of analysis, there has been a shift of workers from full-time to part-time. Due to difficulties in reconstructing part-time employees' daily attendance (the records show us the days the part-time employees were absent, but not the days which they actually turned up) these employees are not included in the empirical analysis.

### *Dynamic Multivariate Caliper Matching*

The data contains 779 individuals who voluntarily quit the firm in the 12 month period between March 1993 and February 1994 and who had been with the firm at least 20 months prior to the resignation date. It is important to note that this analysis is restricted to those who employees who resigned voluntarily from the firm. Those who were terminated were excluded, as were those who resigned for medical reasons, those who went on maternity leave and those who retired. Restricting the analysis to only those employed a minimum of 20 months implies there was some degree of stability in the employment relationship (i.e. they were not hired as temporary workers). As well, it provides a considerable time period over which the dynamics of individual absence behaviour can be considered.

There are a number of potential biases in this type of a study. Audas, Barmby and Treble (1996), using the same data base find that grade in the firm (higher grade indicates less absence), gender (females tend to take more absence), and performance evaluation (those with the highest evaluations are less prone to absence) are all

significant predictors of absence behaviour. If individuals who exit the firm tend to be over-represented in these categories, then a systematic bias has been introduced.

A second potential source of bias occurs if the data exhibit a high degree of seasonality. The following two chapters of this thesis demonstrate that the pattern of absenteeism tends to exhibit a very pronounced seasonal pattern<sup>8</sup>. The crucial point is that a failure to account for these potential biases may contaminate the results. For instance, assume a high exit rate from the firm is observed in February and also assume a high absence rate is normally observed in January. It follows that if a high absence rate is observed in the January prior to the quit, it may not be possible to attribute this to a turnover effect, as it may just be picking up the normal seasonal increase. Alternatively, if a high proportion of the leavers come from the lower grades and a higher absence is observed in the lower grades, can this higher absence among leavers be explained as a result of the changing incentives due to resignation, or is it a grade effect? Table 1 below shows absence rates by grade over this time period (April 1991 to February 1994) it is important to note that the variation in absence over grades is considerable.

---

<sup>8</sup> Appendix 3.1 shows weekly absent rates for the firm from April 1991-February 1994. The plot shows a significant degree of seasonality.



**Table 3.1 Absence by Grade<sup>9</sup>**

Grade	Mean Absence Rate
1	.06315
2	.04576
3	.03884
4	.03632
5	.02723
6	.01978
7	.01346
8	.01108
9	.00842
10	.01336
11	.00249

The methodology employed here removes these types of biases. To do this, several characteristics of each leaver were collected at 3 points in time: 20 months prior to exit, 10 months prior to exit and at the time of exit. All individuals who remained with the organisation who matched each leaving individual on the criteria of gender, grade, performance evaluation and marital status at each point in time were pooled and the intersection was kept (i.e. individuals who matched on these 4 characteristics at all three points in time). Using three cross sections means that as the time varying covariates of the leavers changed, the characteristics of those staying on must also change. If not the individual was dropped from the pool of possible matches (which I will refer to as “twins”).

From the final pool of potential twins, the individual who was closest in age, number of months in their current position and tenure in the organisation to the leaver was

---

<sup>9</sup> Note that there were insufficient numbers of individuals in the top to points on the hierarchy to compute a meaningful rate.

retained as the “twin”. Therefore, the twins match the leavers in terms of grade, performance evaluation, and marital status at three points in time. They must also be the same gender as the leaver. If any of these characteristics change for the leaver (e.g. the leaver gets a promotion) then the potential twin must have received the same treatment, or they are dropped from the prospective pool of twins for that leaving individual. This is potentially very important because changes in these states will likely have a pronounced effect on the motivation to attend work or may also signal a change in behaviour. A check was done to make sure that no individual appeared as the twin to two different leavers. Good<sup>10</sup> matches could not be found 172 individuals, so they were removed from the sample, leaving 607 quitters and their corresponding twins. In both groups there are 254 males and 353 females.

In essence this can be thought of as a synthetically constructed experiment, with the experimental group (the leavers) being matched to a control group (the stayers or twins). At the individual level, the experimental and control group are observationally identical in terms of several characteristics which have been previously used to predict their absence. This matching has been done in a dynamic fashion (which is an improvement on the static multivariate caliper matching procedure which has been used in other studies, see Clegg, 1983) so that as the characteristics of the experimental group change, the characteristics of the matched

---

<sup>10</sup> In some instances there were no matches over the three cross sections, implying that the individual was unique with respect to the states they experienced over the 20 month period. In other cases the differences in ages, tenures and months in job between the leavers and the best prospective twin varied by such a considerable margin, that they were dropped from the sample.

individual in the control group must change as well. It is important to reiterate that changes in these variables (grade, performance evaluation and marital status) may have a considerable effect on absence. Accounting for these changes over time removes any bias that may result from a static matching procedure.

The leavers had their calendars adjusted to reflect the number of days they were away from the last day they worked in the organisation. Therefore, if the person's last day of work was 31 December, 1993 that would be considered "day 0" for that individual. If the next leaver's last day of work was 15 July 1993, than this would be "day 0" for this individual. 30 December 1993 would be "day 1" and 29 December 1993 would be "day 2" for the for the former individual and 14 July 1993 would be "day 1" and 13 July 1993 would be "day 2" for the latter individual. In this study the last 400 working days<sup>11</sup> are considered.

To avoid potential cyclical and seasonal biases, as well as aggregate effects which might influence absenteeism in the firm (e.g. bad weather, a corporate policy change, etc.) the quit day of the leaver is assigned to the matched twin and their calendar is subsequently altered in an identical manner. Therefore, to compare attendance between a leaver and his/her matched twin 100 days prior to the leaver exiting the firm, and this day happened to be 12 March 1993 for the leaver, the date of

---

<sup>11</sup> Non-contracted days such as weekends and holidays are removed.

comparison for the individual's matched twin will also be 12 March 1993.

The intuition between constructing such a set of matched pairs is that it will allow for a meaningful and unbiased interpretation of the difference in absence rates between leavers and stayers over time. Constructing a sample of dynamically matched pairs means that the significant observable biases, which could systematically corrupt an analysis of the relationship between absence and turnover has been removed. Any observed difference between leavers and stayers can be interpreted as a 'pure' turnover effect.

**Table 3.2 Quits by Month**

<b>Month</b>	<b>Staff</b>	<b>Managers</b>	<b>Total</b>
March 1993	30	9	39
April 1993	37	11	48
May 1993	38	20	58
June 1993	26	14	40
July 1993	40	18	58
August 1993	34	15	49
September 1993	51	26	77
October 1993	33	26	59
November 1993	29	23	52
December 1993	31	16	47
January 1994	28	13	41
February 1994	26	13	39
<b>Total</b>	<b>403</b>	<b>204</b>	<b>607</b>

From this table we observe that the distribution of quits during the year is not smooth, with managerial turnover being concentrated between July and November, while staff turnover is concentrated between May and September. The characteristics

of leavers are as follows<sup>12</sup>.

**Table 3.3<sup>13</sup> Grade Distribution (by Gender)**

Grade	20 Months prior		10 Months prior		At quit date	
	Males	Females	Males	Females	Males	Females
1	5	7	5	7	5	7
3	16	37	9	17	6	9
4	58	111	50	115	61	120
5	25	95	28	107	29	111
6	16	42	15	44	13	42
7	67	43	63	42	64	41
8	22	13	28	16	30	18
9	25	3	26	3	26	3
10	14	1	14	1	14	1
11	6	0	6	0	6	0
12	0	1	0	1	0	1

**Table 3.4 Performance Evaluation Distribution (by Gender)**

Rating	20 Months Prior		10 Months Prior		At Quit Date	
	Males	Females	Males	Females	Males	Females
Outstanding	4	27	5	43	6	48
Very Good	57	110	70	129	91	145
Satisfactory	94	111	120	119	117	132
Not fully effective	2	1	2	0	10	2
Unsatisfactory	0	0	1	0	5	1
Not rated	97	104	56	62	25	25

Tables 3.3 and 3.4 show that the distribution of these characteristics remains relatively similar over time. One notable exception is the number of “not rated” individuals shows a marked decline throughout the period under examination.

<sup>12</sup> Note that the characteristics of the leavers are identical to those of the stayers, with the exception of one senior management female, in this instance the “twin” was at one level higher in the hierarchy.

<sup>13</sup> During the time period under examination the firm attempted to automate a number of positions in the low end of the hierarchy and many of these individuals occupying these positions were offered alternate positions in the firm. As such, there are relatively few individuals (and subsequently leavers) in the lowest grades of the hierarchy.

Individuals when they first enter the firm or move to a new position are assigned a performance evaluation of “not rated”. As these individuals accumulate time in the position (typically one year), they get a performance evaluation.

### **3.5 Empirical Analysis**

In this section the data described above will be used to examine the relationship between absence and turnover. Section 3.5.1 will show the results of a graphical comparison of the changes over time and will also show the results from simple t-tests of the differences in attendance for leavers and stayers for 40 ten day periods. Section 3.5.2 reports a more formal econometric analysis.

#### **3.5.1 Graphical Comparison and Simple Differences**

The theoretical model predicts that individuals who quit voluntarily have fewer incentives to attend work than would their non-quitting counterparts. Figure 3.2 below shows daily absence rates for the individuals who leave the firm (with their individual calendars altered to reflect the number of days to quit). It is important to note that time moves from right to left, so as the plot moves closer to the y-axis, time is going forward. The absence rate immediately adjacent to the y-axis is the absence rate for the leavers last day of work, irrespective of the actual date on which this occurs.

Figure 3.2 Daily Absence (All Leavers)

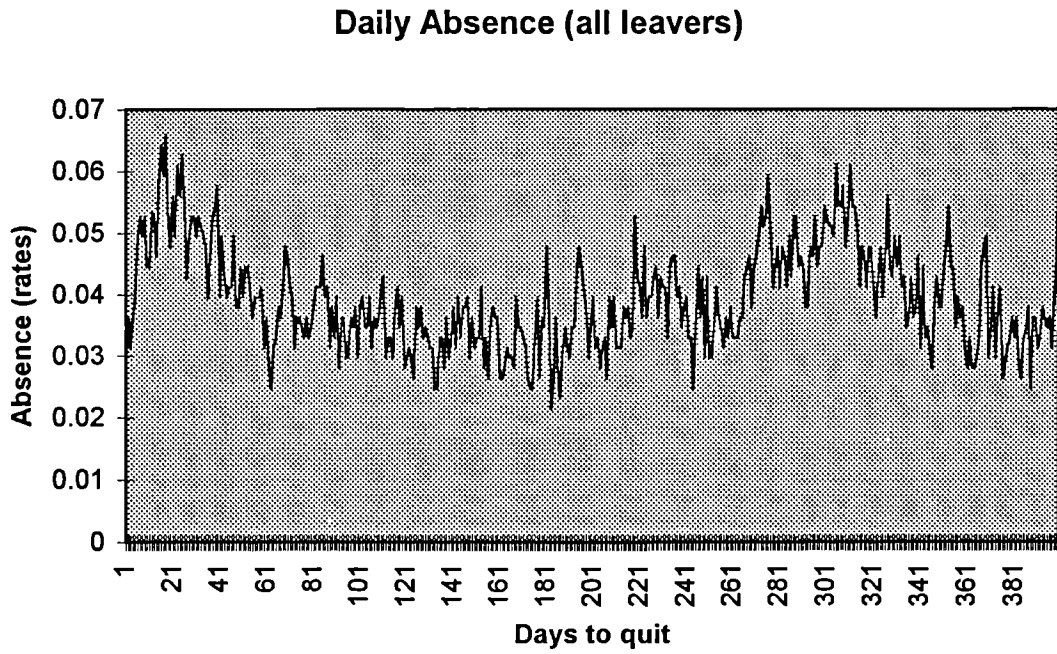
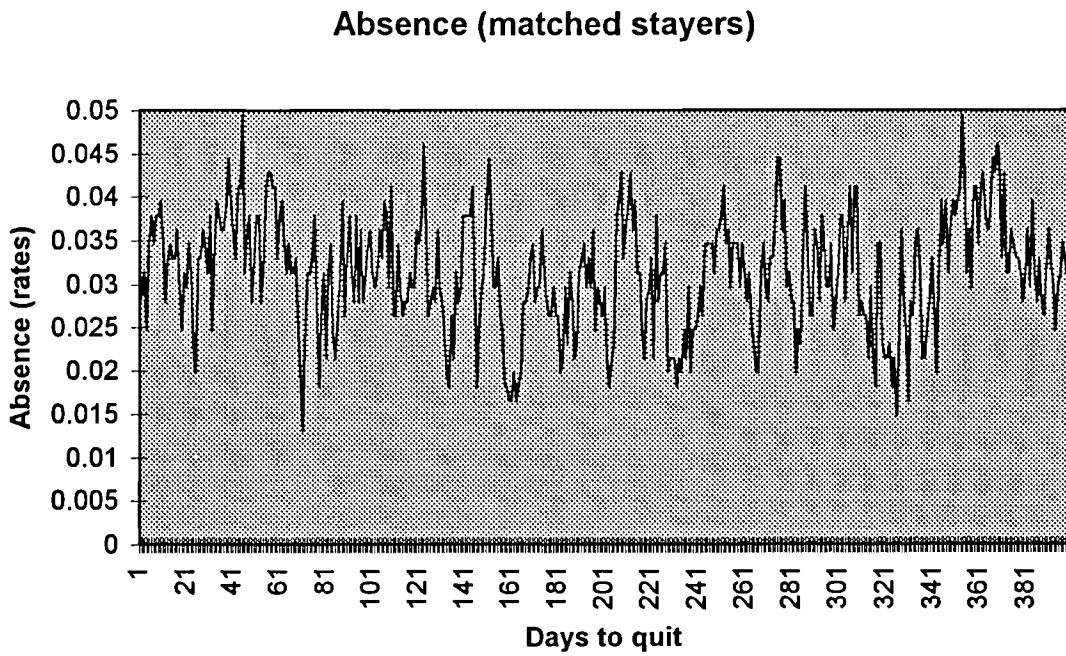


Figure 3.3 Daily Absence (Matched Stayers)



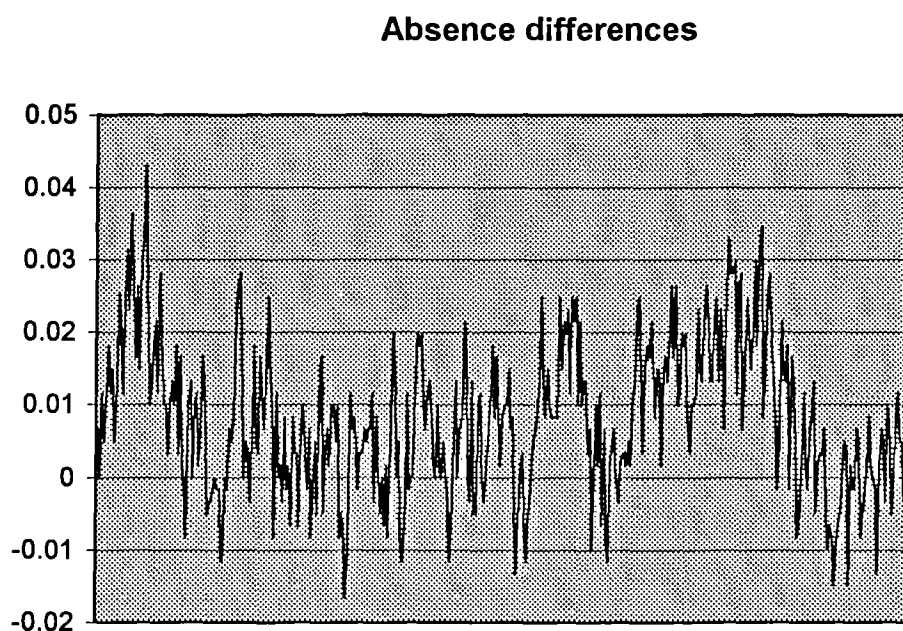
From Figure 3.2 two clear patterns emerge: First, absence increases leading up to the individuals' resignation day. Second, in addition to the predicted increase in absence leading up to the quitters' last day of work, there is substantial earlier increase in absence approximately 18 months prior to the quit date that lasts for approximately 5 months. This earlier increase raises several possibilities. One possible explanation of this is that the data is displaying certain amount of seasonality. If we return to Table 3.2, we observe that there is not a uniform distribution in the months of departure, implying the data could be influenced by seasonal variation. The figure in Appendix 3.1 shows, the data does exhibit a considerable amount of seasonal variation and if there is bunching in the turnover, this raises the possibility that this increase in absence could be influenced by seasonal patterns, rather than by changing incentives. The only way these results can have any meaning is to compare them with a control group. The control group, or twins (as described earlier) were carefully selected on a variety of criteria and had their calendars altered in the same manner as the quitting individual with whom they are matched. This removes all potential timing biases (seasonal or day of the week) since any bias the leaver may have (in terms of timing or personal characteristics) is imposed on the staying twin as well.

Figure 3.3 should be examined in a similar fashion to that of Figure 3.2, with time moving from right to left so as the plot moves closer to the y-axis, the individual moves closer to his/her twin's quit date. The attendance patterns of non-leavers shows no significant time trend. If the original theoretical argument held true, the earlier increase in absence by leavers would have been part of some overall increase



in absence which the organisation was experiencing as a whole, while the later increase (i.e. the one closest to the quit date) would be unique to the quitters. In fact it appears that both increases in absence are unique to the quitters.

Figure 3.4 Absence Differences



Consider the plot of the differences in the absence rates of the two groups (quitters and their matched twins) over time. The conclusion is the same: Leavers appear to alter their attendance behaviour at least 18 months prior to actually leaving the organisation. In addition, the pattern is not a single linear increase leading up to the individual's last day of work (which would be consistent with the theoretical model) but rather it follows a bimodal pattern. The leavers appear to alter their attendance patterns in quite a pronounced fashion, revert back to a pattern that makes them indistinguishable from those who remain in the firm, before undergoing a final increase leading up to their resignation. The results of these differences are

highlighted in Table 3.5 below, where t-tests of significant differences for ten day periods are displayed.

The earlier increase in absence amongst the quitters poses a considerable problem in interpreting the attendance differences between leavers and stayers. To determine if a particular group of workers is responsible for this earlier increase in absence, the leavers were disaggregated into “staff” and “managerial” workers (there are 403 staff workers and 204 managerial workers) to determine if both types of employees exhibited similar patterns of absenteeism leading up to resignation<sup>14</sup>. The exercise yielded considerably different results as is displayed in Figures 3.5a, 3.5b, and 3.5c as well as 3.6a, 3.6b, and 3.6c.

---

<sup>14</sup> The data were also disaggregated by gender, which is a very similar exercise, since the vast majority of managers are males and the vast majority of females occupy staff positions. The results are somewhat more compelling disaggregating along staff/management lines.

Figure 3.5a Managerial Leavers

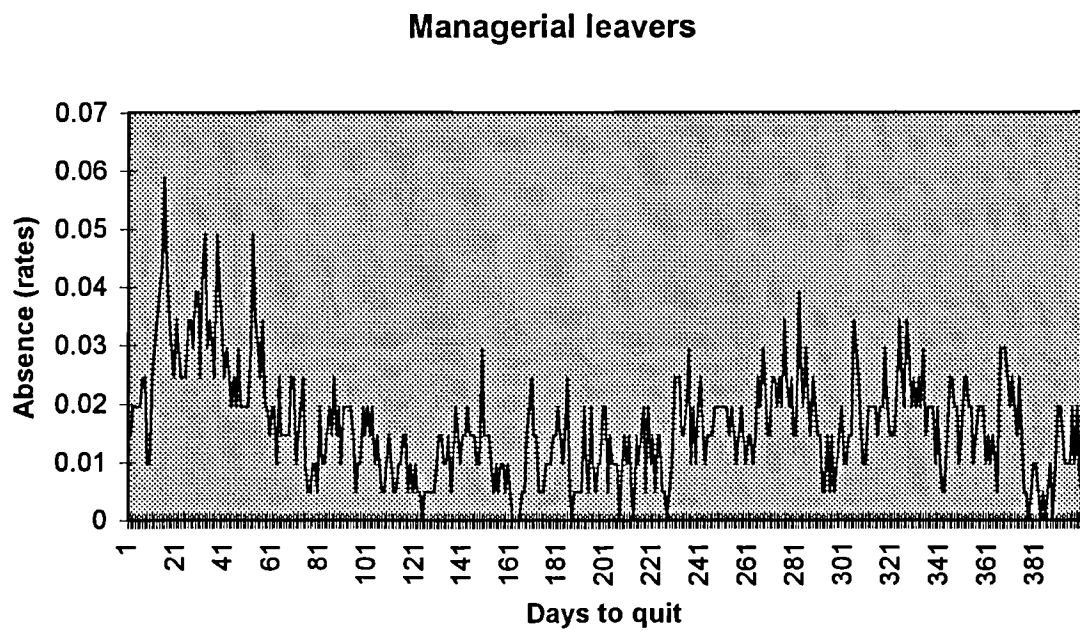
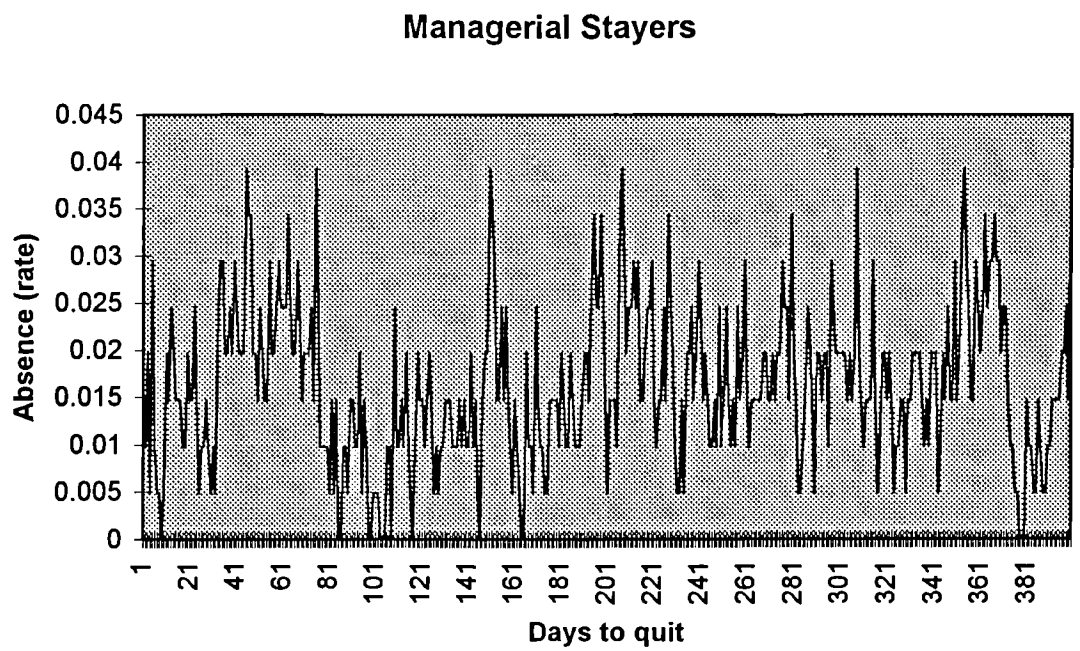
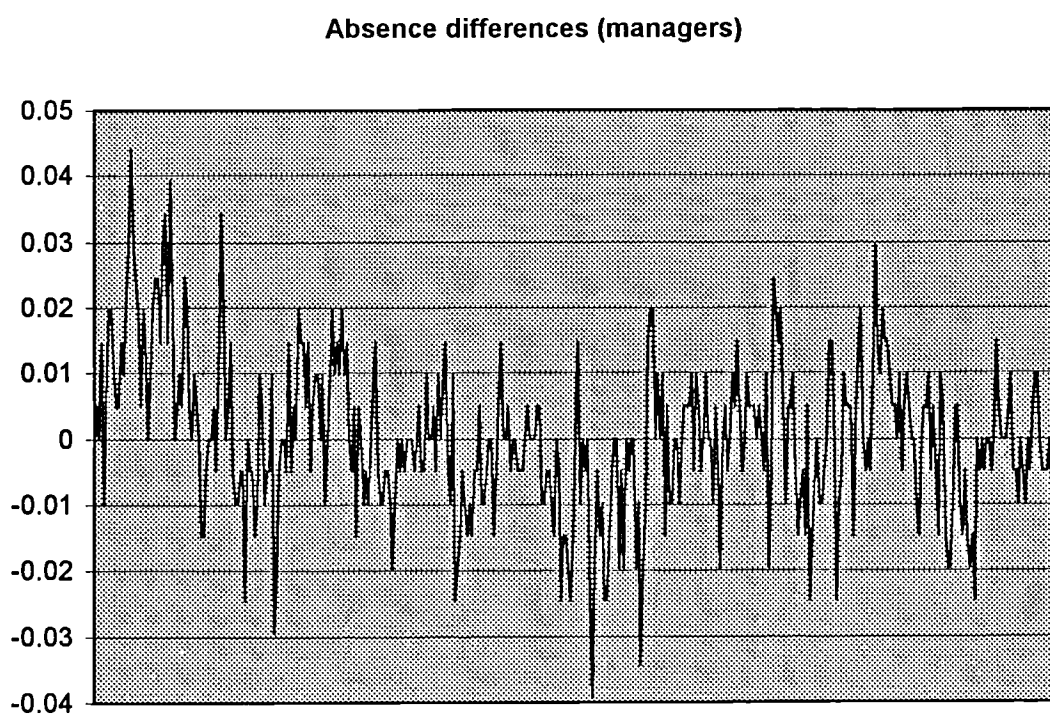


Table 3.5b Managerial Stayers



Managerial attendance patterns behave very much along the lines predicted in theoretical model. Leavers do tend to increase their absence as they get closer to their quit date, reflecting the relaxed constraint on their attendance. Although there is a slight increase in absence in the year prior to quitting, it is nowhere near as substantial as the absence increase in the year of resignation for the whole sample of leavers. The managers who do not quit show no remarkable trend in their attendance behaviour.

Figure 3.5c Managerial Absence Differences



The differences in managerial attendance indicate that there is no significant difference between leaver and stayer attendance until 40 days prior to the quit date.

The comparison of quitting and staying staff workers provides a sharp contrast to the managerial results.

Figures 3.6a Staff Leavers

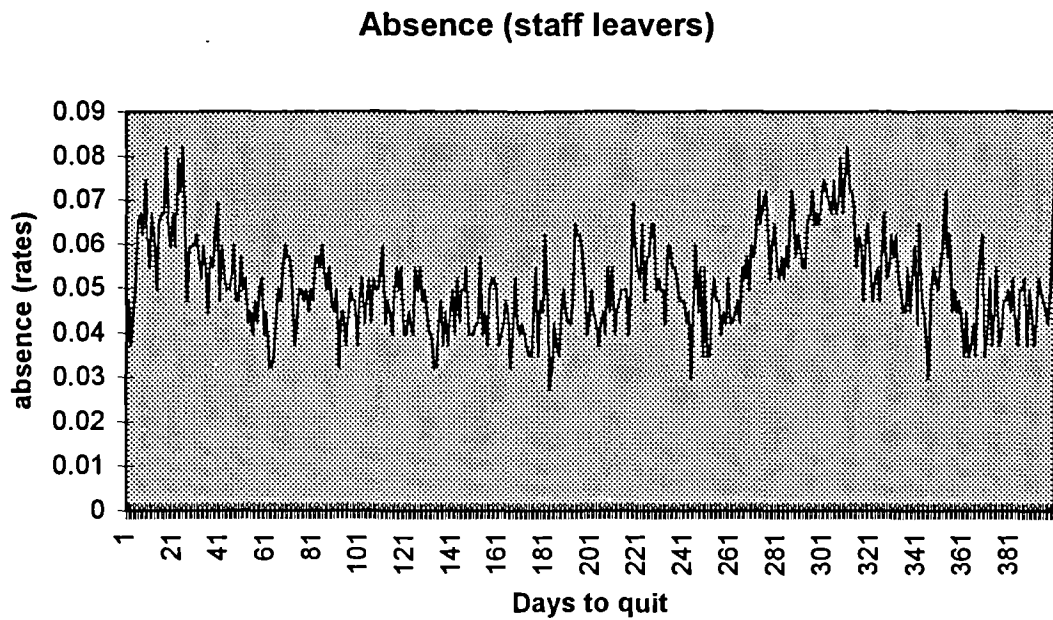


Figure 3.6b Staff Stayers

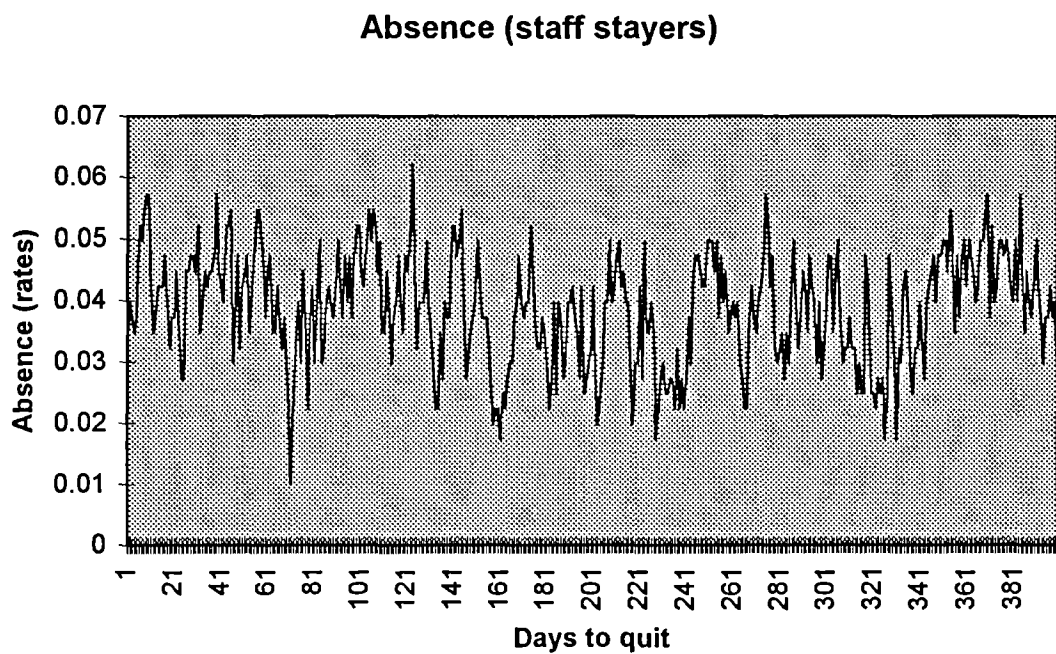


Figure 3.6a exaggerates the attendance patterns of the whole sample. With the earlier increase in absence among the quitters being even more pronounced. Again, those individuals who remain in the firm exhibit no pronounced pattern in their attendance over the sample period.

Figure 3.6c Staff Absence Differences

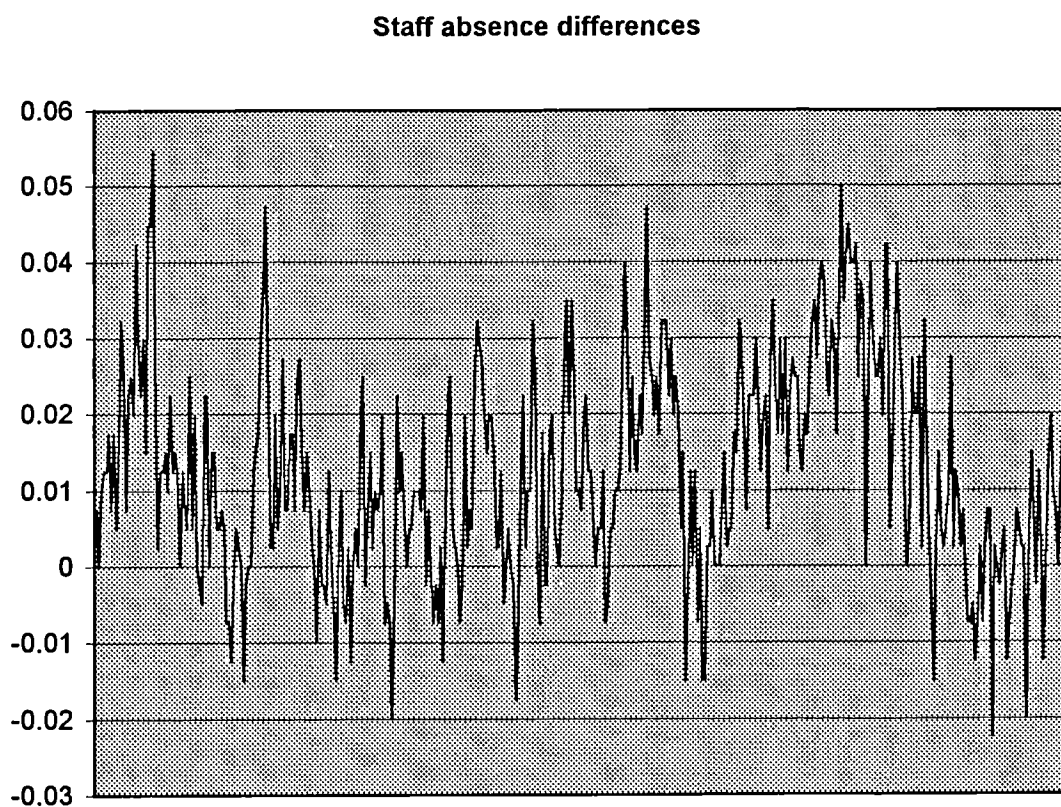


Figure 3.6c shows that leavers exhibit consistently higher absence rates throughout the whole 400 day period under examination, although the magnitude sharply differs over this period.

**Table 3.5 Summary of Differences in Absence Rates<sup>15</sup>**

Time Interval	All	Staff	Managers
Days 1-10	2.475**	1.891*	2.001**
Days 11-20	6.103**	4.833**	4.017**
Days 21-30	6.322**	5.045**	4.180**
Days 31-40	3.512**	2.475**	2.826**
Days 41-50	1.584	1.937*	-0.308
Days 51-60	0.565	0.053	1.108
Days 61-70	1.353	2.142**	-1.206
Days 71-80	2.544**	3.578**	-1.821*
Days 81-90	3.054**	3.053**	2.323**
Days 91-100	0.253	-0.434	1.868*
Days 101-110	0.888	0.312	1.958*
Days 111-120	1.537	1.905*	-0.785
Days 121-130	-0.152	0.481	-2.067**
Days 131-140	1.309	1.421	0.000
Days 141-150	0.800	0.928	0.127
Days 151-160	1.032	3.195**	-2.534**
Days 161-170	2.160**	2.432**	-0.849
Days 171-180	0.585	0.683	-0.303
Days 181-190	1.964*	2.479**	-0.871
Days 191-200	2.248**	3.918**	-3.092**
Days 201-210	1.032	2.322**	-2.666**
Days 211-220	1.339	2.842**	-2.993**
Days 221-230	3.837**	5.069**	-2.268**
Days 231-240	5.660**	5.938**	0.723
Days 241-250	1.097	0.984	0.496
Days 251-260	-0.050	0.164	-0.489
Days 261-270	3.504**	3.526**	0.734
Days 271-280	3.862**	4.326**	0.318
Days 281-290	5.262**	4.823**	2.140**
Days 291-300	4.081**	5.317**	-2.303**
Days 301-310	4.811**	6.333**	-0.695
Days 311-320	6.614**	6.765**	1.078
Days 321-330	6.574**	5.954**	2.816**
Days 331-340	4.356**	4.433**	0.827
Days 341-350	0.894	1.413	-0.625
Days 351-360	0.692	1.433	-1.409
Days 361-370	-1.662*	-0.908	-1.878*
Days 371-380	0.151	-0.161	0.909
Days 381-390	0.361	0.649	-0.901
Days 391-400	2.029**	2.804**	-1.397

\*\* denotes statistical significance at the 5% level

\* denotes statistical significance at the 10% level

<sup>15</sup> The details of how this calculation is done is found can be found in Ben-Horim and Levy (1984) p. 463-464.

Table 3.5 tests whether the observed absence in leavers is significantly different from that of stayers for each ten day period leading up to resignation. This is done by looking at each ten day period and testing if the absence rate for this period and testing if the difference in rates between leavers and stayers is significantly different from 0. The aim of this table is to add statistical evidence to show that the differences observed in the graphical analysis are significant and to determine if there are any additional patterns that are not readily observable from the plots.

There are several points that should be made about the results in Table 3.5. First, looking at the entire sample of leavers, there is evidence of a marked increase in the leavers' last 40 days of employment. In addition there are several additional ten day periods when leavers exhibit significantly higher rates of absence than their staying counterparts. Perhaps the most striking characteristic of these statistics is the sustained significant differences between day 261 and day 340. These differences are much more prominent than the differences immediately preceding the quit. It is also interesting to note that in only one ten day period (day 361 to day 370) do the stayers exhibit significantly higher levels of absence than leavers.

Examining staff and managerial differences separately shows an interesting contrast between these two types of workers. Both the staff and the managerial leavers demonstrate a pronounced increase in absence *vis a vis* their staying counterparts in



the period leading up to their quit date<sup>16</sup>. However, the similarity in their propensities to go absent ends there. The staff leavers have several other sustained periods of significantly higher absence. Of particular note, the periods between day 61 and day 90; day 151 and day 240 (with the exception of day 171 to day 180) and day 261 to day 340. In no ten day period do staff stayers take significantly more absence than their leaving counterparts. The evidence clearly suggests that staff leavers tend to take significantly more absence for a sustained period leading up to their resignation.

Notwithstanding the similarity for the last 40 days on the job, the results for managers are completely different. Prior to managerial leavers' last 40 days on the job, they exhibit no sustained periods of greater absence than their staying counterparts. The only other sustained difference is in fact a negative difference (i.e. leavers are less likely to go absent than stayers) between day 191 and day 230. Prior to the managers' last 40 days on the job, there are 9 ten day periods where leavers are *significantly less* likely to go absent than their staying counterparts. In contrast, there are only 5 ten day periods where managers are significantly more likely to be absent. All of this suggests that apart from the two month period leading up to their resignation, managerial leavers actually have lower levels of absence than their staying counterparts.

---

<sup>16</sup> Staff leavers are significantly more likely to be absent for the 50 days leading up to the date of quit, while managerial leavers are more likely to be absent for the 40 days leading up to quit.

### 3.5.2 Econometric results

The next step in this analysis is to use the data to conduct a more formal econometric analysis. The data for the leavers and their matched twins was pooled and daily attendance was predicted using a probit model. Included on the right hand side of the estimation is a constant, a lagged dependent variable, three time trend variables (trend, trend squared and trend cubed), gender, management and quit dummy variables, dummy variables for the month of the quit (either real or synthetic quit date for the matched twins) and interaction terms between the quit dummies and the month of quit dummies. Finally, interaction terms between the time trend and the quit dummies are included to determine if the trends are unique to the leavers. One area of concern is the “initial conditions problem” first identified by Heckman (1981) which argues that an individuals’ state in the current period may be highly correlated with past state. However, Orme (1997) uses a Monte Carlo simulation to show that in cases covering a very long time period (which 400 working days surely does), the initial conditions problem can be ignored. The results are in Table 3.6.

One clear result is that leavers do have a higher propensity to be absent, even when accounting for gender and position in the organisational hierarchy. We also observe the time trend variables for the whole sample are not significant, while the interactions between the time trends and the quit dummy are each significant at the 5% level. I interpret this pair of results as confirmation the findings of the bimodal increase in absence through the sample period and demonstrates that this pattern is

unique to stayers. The only significant trends in the data are unique to those individuals who leave the firm.

**Table 3.6 Econometric Results (Probability of Absence)**

Parameter	Coefficient	t-statistic
Constant	-4.500**	49.43
Lagged Absence	4.929**	232.15
Quit (1 = yes)	0.553**	4.75
Sex (1 = female)	0.347**	14.18
Management (1 = yes)	-0.522**	18.87
Trend	-0.002	1.23
Trend <sup>2</sup>	6.48e-6	0.80
Trend <sup>3</sup>	-5.65e-9	0.43
Quit*Trend	-0.006**	3.14
Quit*Trend <sup>2</sup>	3.48e-5**	3.18
Quit*Trend <sup>3</sup>	-5.58e-9**	3.12
April	0.222**	2.88
May	0.117**	1.54
June	-0.010	0.17
July	0.224**	3.00
August	-0.006	0.08
September	0.060	0.82
October	-0.152*	1.83
November	0.012	0.15
December	0.241**	3.09
January	0.123	1.50
February	-0.081	0.92
Quit*April	-0.349**	3.35
Quit*May	-0.274**	2.67
Quit*June	-0.111	0.99
Quit*July	-0.391**	3.85
Quit*August	-0.130	1.20
Quit*September	-0.283**	2.86
Quit*October	-0.040	0.37
Quit*November	0.084	0.80
Quit*December	-0.368**	3.47
Quit*January	0.005	0.05
Quit*February	-0.044	0.38

\*\* denotes significance at 5%

\* denotes significance at 10%

The principal objective of this chapter was to examine differences in attendance rates over time between matched individuals leaving and staying in the firm. This is captured using the interaction terms between the quit dummy and the time trend variables. From the model, we expect the negative coefficient on the “Quit\*Trend” interaction. This indicates that as time moves farther away from the quit date, the propensity to be absent decreases. However, the positive significant quadratic term (“Quit\*Trend<sup>2</sup>”) indicates that the trend turns as we move farther away from the quit date and the propensity to go absent increases, which is in direct contrast to the theoretical prediction of the model. The cubic interaction term (“Quit\*Trend<sup>3</sup>”) is also negative and significant, indicating that at periods very early in the sample frame (i.e. farther away from quitting) those who resign alter their attendance pattern and become similar to stayers.

It is important to note that it is only the interaction terms between the time trend terms and the quit dummy which are statistically significant. None of the non-interacted trend variables approach statistical significance, indicating that the changes in behaviour leading up to the date of quit is unique to the leavers. The stayers do not exhibit any pronounced changes in their propensity to go absent throughout the period under investigation. What is particularly interesting about this finding is that it suggests that the pattern of leavers’ attendance is significantly different from those not leaving for at least 18 months prior to the date of quit. The results also demonstrate that managers are significantly less likely than staff to go absent and that females are considerably more likely than males to go absent on a given day.

The monthly dummy variables and their interaction terms capture the month in which the individual resigned from the firm. This variable is included to show whether individuals leaving the firm in a particular month differ in terms of their attendance behaviour from workers who exit in other months. Stayers are assigned the month of their quitting “twin”, thus capturing any seasonality that absence exhibits. To test if the seasonal effects for leavers are different from that of stayers for each month, the following hypothesis is tested using a Chi-squared test (March is left out as the base case).

$$H_0 = B_1 * \text{quit} - B_2 * \text{quit month} + B_3 * \text{quit month} * \text{quit} = 0$$

$$H_1 = B_1 * \text{quit} - B_2 * \text{quit month} + B_3 * \text{quit month} * \text{quit} \neq 0$$

The results are displayed in Table 3.7 below.

**Table 3.7 Chi-Squared Tests of Significance of Quit Month**

Month	Chi-square statistic
April	0.01
May	1.18
June	7.21**
July	0.20
August	7.19**
September	2.14
October	16.71**
November	15.32**
December	0.14
January	7.26**
February	11.17**

\*\* denotes significance at 5%

The results from Table 3.7 are mixed. In 6 of the 11 cases the null hypothesis is rejected in favour of the alternative hypothesis that the absence behaviour for

individuals quitting in that month is significantly different for those quitting in the base case month (March). However, for the remaining five months we are unable to reject the null. This suggests that those who resign in June, August, October, November and February are more likely to take absence (in comparison to those who resign in March). While these results suggest that the month of resignation has significant effect on the amount of absence taken, no clear seasonal pattern (e.g. those who quit in the summer) emerges.

Although this analysis has displayed clear evidence that the attendance of leavers does differ significantly from the behaviour of those who remain in the firm, it differs in a manner that is not necessarily consistent with that which the theoretical model would have predicted. If there had been a single increase in absence leading up to the date of quit, then it would have provided compelling evidence that changing incentives results in otherwise similar individuals behaving in different fashions. This finding clearly requires further consideration.

### **3.6 Discussion**

Empirically, this chapter adds several important points to the literature on the relationship between absence and turnover. First, it expands on the methodology used in the earlier research using a very large sample of workers and examines changes in attendance patterns in great detail over a long period of time. This combination of a large pool of workers and a lengthy (and detailed) time frame, reveals patterns which had not previously been noted. In addition, workers are

divided into junior (staff) and senior (managerial) categories to examine if the patterns of absence leading up to resignation are consistent across different types of employees. There are two main conclusions: First, it is clear that workers do change their attendance patterns in leading up to their resignation date. Of particular interest is the substantial increase in absenteeism amongst leavers beginning approximately 18 months prior to resignation. Second, the patterns in which they alter their behaviour are very different for staff and management workers. The increase immediately preceding the quit is common to both types of workers, however, the increase earlier in the study period is unique to the staff workers.

First consider the increase in absence 18 months prior to quit. A review of the literature found only two studies which would allow any kind of a comparison between leavers and stayers to examine if attendance patterns differed for as long a period as identified in this chapter. Gupta and Jenkins (1982) use monthly differences in average hours lost between leavers and stayers for blue-collar workers in a US manufacturing plant. Their results are reproduced in Table 3.8 below.

These results show a similar pattern to those found in this chapter. Non-managerial leavers exhibit different attendance patterns a very long time prior to actually leaving the firm. Perhaps more interestingly, the differences in their behaviour tend to be most pronounced 7-8 months and 14-16 months prior to leaving. This is consistent with the findings in this chapter, where the most pronounced difference between leavers' and stayers' attendance patterns among clerical workers occurs 13-18

months prior to leaving the firm. One rather striking difference is that in the three months leading up to the quit, the leavers do not appear to exhibit considerably different patterns of attendance compared to stayers. In the context of withdrawal, this strikes me as a rather curious finding, since the literature in support of withdrawal views the process as a continuum of increased absence leading to the decision to resign.

**Table 3.8 Gupta and Jenkins (1982) Results**

Month prior to quit	t-statistic
1	1.13
2	-0.91
3	1.38
4	3.73**
5	0.02
6	-0.53
7	2.14**
8	5.12**
9	0.97
10	1.65*
11	1.22
12	0.66
13	0.85
14	1.60
15	2.61**
16	1.73*
17	0.78
18	-0.83
19	0.14
20	1.68*

\*\* denotes significance at 5%

\* denotes significance at 10%

Waters and Roach (1979) also study differences in attendance patterns among clerical workers, however they do not do so in a detailed dynamic fashion (i.e. they do not look at how attendance patterns change). They do find that leavers have higher rates



of absence in the year of quit, as compared to those who remain in the firm. They also find that leavers had higher rates of absence in the year prior to the quit as well, again suggesting that leavers exhibit higher absence for a very long period of time leading up to resignation.

A second area of the literature that has not been developed is whether managerial and blue collar or clerical workers behave in a similar fashion in terms of the absence/turnover relationship. The vast majority of studies in this literature focus on the latter two types of workers, if they bother to distinguish along these lines at all. Oldham, *et al* (1986) examine the number of hours managers take away from work in the 18 months prior to resigning. They find that leavers do not take significantly more absence than stayers over this period, however there is no analysis of how leaving managers' attendance patterns might change over the 18 months prior to resignation. Comparing these findings with the findings of this chapter clearly demonstrate why a dynamic rather than a static analysis is necessary. As was identified earlier in this chapter, managers do take significantly more absence than their non-leaving counterparts in the period leading up to resignation. However, in the remaining 18 months prior to the quit (i.e. months 3 to 20), they actually take less absence than their staying counterparts. Turning back to Table 3.5, it shows that overall managers have 9 ten day periods when they take significantly more absence than their staying counterparts and 9 ten day periods where they take significantly less absence than their staying counterparts. A static view (such as that taken by Oldham, *et al*) would suggest that the attendance behaviour of leaving managers is no different

from that of staying managers, even when matching on several additional characteristics which may impact the propensity to go absent. A dynamic view suggests the relationship is more complex. The evidence presented in this chapter shows that managerial leavers take more absence in the ten day period leading up to the quit than individuals who remain in the firm. However, prior to this, they actually take considerably less absence than those who remain in the firm.

### **3.7 Alternative Theories of the Absence/Turnover Relationship**

The crucial finding of this chapter is that absence rates for individuals leaving the organisation does not follow a single upward trend as they move towards resignation, which the broad conclusion of most of the empirical work cited by proponents of the withdrawal argument. However, it must be noted that a great deal of this empirical work is flawed in that it does not examine how individual patterns change over the period leading up to the date of quit. In addition most studies do not consider potential biases such as individual characteristics or timing effects that may impact their results. This study is unique in that it is able to examine a very large proportion of workers over a very significant period of time. In fact, it is the inclusion of the second ten month period and the separate analysis of staff and managerial employees that provide the basis for this chapter's most interesting and noteworthy findings.

The natural question that follows is what is it about people who quit the firm that makes them adjust their attendance behaviour for several prolonged periods, then return to normal levels before increasing their absence again as they approach their

resignation date? If it was simply a matter of an individual becoming dissatisfied with their job and this dissatisfaction resulted in higher absenteeism (i.e. withdrawal), then one would expect the dissatisfied employee to maintain their higher level of absenteeism. The theoretical model developed in this chapter does not adequately explain this finding and the increase is so considerable, that it does require some further thought.

There may be several plausible reasons why the rate of absence might increase one year prior to the predicted pre-resignation increase. The most obvious of which is that there exists some seasonality in job openings. If there is a particular time in the year when certain jobs tend to be filled, then it would not be unreasonable to expect workers to be in the market for these jobs one year prior to actually getting a new position. Restated, individuals in the job market in the current period are more likely to have been in the job market in the previous year as well. In effect, the earlier increase is evidence of unsuccessful job search.

This fits quite nicely with the efficient job search literature (see Devine and Kiefer, 1991) which argues that job search is costly in terms of time and effort and efficient searchers will concentrate their efforts to periods when engaging in search is most likely to be successful. This is particularly true for on-the-job searchers who have considerably less time to allocate to search for alternate employment than their unemployed counterparts. It follows that if hiring patterns for certain types of

workers follow some seasonal pattern, then the search effort of an individual seeking to fill these positions should follow a similar pattern.

Burdett (1978) makes a seminal contribution to the job search literature when he introduces job search to the range of activities in which workers might engage while in the labour market. Previous search models had constrained individuals to work and not search, search and not work and neither search or work. Burdett notes that the cost of searching off-the-job may be different (presumably more costly) as it may involve a loss of earnings. Even when there is no direct loss of earnings associated with search, reallocating effort away from ones' specified duties towards job search may reduce the probability of promotion, adversely impact pay increases and increase the probability of termination. If this is the case than on-the-job searchers will concentrate their efforts in periods when the probability of success in finding suitable alternative employment are maximised.

Brown (1995) distinguishes between search on-the-job, which is actually done during working hours and search off-the-job, which is done away from the workplace, but while the worker is still attached to their current employer. She develops a model that demonstrates that if workers are engaged in search, they are more likely to go absent (in order to pursue alternative employment) than they would be otherwise. Devine and Kiefer (1991) note that over half of employment transitions (job changes) involve no intervening spell of unemployment. In addition, the findings of Pissarides and Wadsworth (1994) suggest that most quits result in the individual moving

immediately into some other job, without an intervening spell of unemployment. This implies that on-the-job search is an important consideration in analysing the behaviour of those individuals who leave firms. Clearly some search effort must be being expended in the period leading up to most individuals' resignations.

Brown (1995) used a panel of annual observations of 52 firms over 5 years to study the predictive power of absence on the rate of turnover. Her results indicate that absence and turnover are positively correlated, which she interprets as supporting her theoretical model linking absence to job search.

Turning back to the results of this chapter, it should be noted that the pattern of the increase in absence 18 months prior to the resignation date is unique to staff employees. Table 3.2 shows the distribution of quits over the year and does not seem to suggest any pronounced cycle in turnover, although quits are highest in September. However, it may be that there are different occupational hiring cycles. For instance, the employment market for clerks may peak in the autumn to handle the extra business around Christmas, while computer operators may see their best employment opportunities in the early winter so that they are in place for the tax season.

Another way of thinking about the differences in attendance patterns between leavers and stayers and in particular leavers' propensity to act very differently from those staying in the firm, then reverting back to behaving identically to stayers may be to consider "job attachment" and "job commitment". These are common themes in the

psychology literature (see Chapter Two, or Steers and Rhodes, 1978), but lack a certain degree of tangibility that tends to make them unpopular variables with economists. Individuals who quit their jobs are quite clearly less committed and less attached to their posts. It also seems safe to assume that the utility one might gain will not be constant throughout the year. For instance, time away from work may be more valuable around holidays, when the weather is nice, or when children are off school. An individual with reduced commitment might very well have a lower threshold to absent him/her self than an otherwise identical individual with a higher level of commitment. One could think of there being some minimum threshold of utility that time away from work must offer for an individual to go absent.

Given the *ex post* knowledge that the individual has quit, it would not be surprising that the minimum utility required for a day away from work to be sufficient to induce absence would be lower for a leaver than it would for an individual who stays on with the firm. It is also important to note that if there are pronounced seasonal patterns to the utility gains from absence (and one would expect this to be so, since good weather, children's time off school and holidays exhibit a very pronounced seasonal pattern) then this could be driving individuals with lower commitment (and thus lower thresholds to absence) to demonstrate a seasonal pattern to their attendance. However, there is no reason to think that each individual's seasonal propensities to attend work will be the same.

### **3.8 Conclusions**

The empirical work in this chapter indicates that the attendance patterns of individuals who quit their jobs are different from those who stay on with the firm. Two critical findings are worthy of re-emphasis. First, the attendance patterns of leavers are very different for managers as compared to non-managers. Quitting managers tend to take more absence than their staying counterparts in the period leading up to resignation, but prior to this period, they actually tend to take less absence than their staying counterparts. Staff leavers exhibit a similar increase in absence in the period leading up to resignation. However, they also tend to take considerably higher absence over several other periods leading up to their date of resignation. Particularly pronounced is the period 13-18 months prior to leaving the firm. The large earlier increase in absence does not appear to be unique to this study as two other papers have also found higher absence among leavers more than one year prior to quit. However, neither of these papers makes an attempt to explain why leavers may exhibit different absence so long prior to the quit, except to classify it as homogenous withdrawal, which strikes me as something of an over-simplification. The withdrawal argument suggests that absence among leavers should remain pervasively higher than that of stayers, however, there is little evidence to suggest that this is what actually occurs. Leavers appear to change their attendance patterns for certain periods, then revert to be indistinguishable from stayers. This suggests that the withdrawal argument considerably under-estimates the complexity of the relationship between absence and turnover. For the most part, the empirical studies on the subject do not allow for this type of examination. Those few that do, do not

tend to observe a pattern that strongly resembles withdrawal. The very nature of withdrawal suggests a deterioration or progression along a continuum moving towards resignation. Clearly this is not what happens and even the leading proponents of this school of thought would have difficulty justifying their empirical findings in this light.

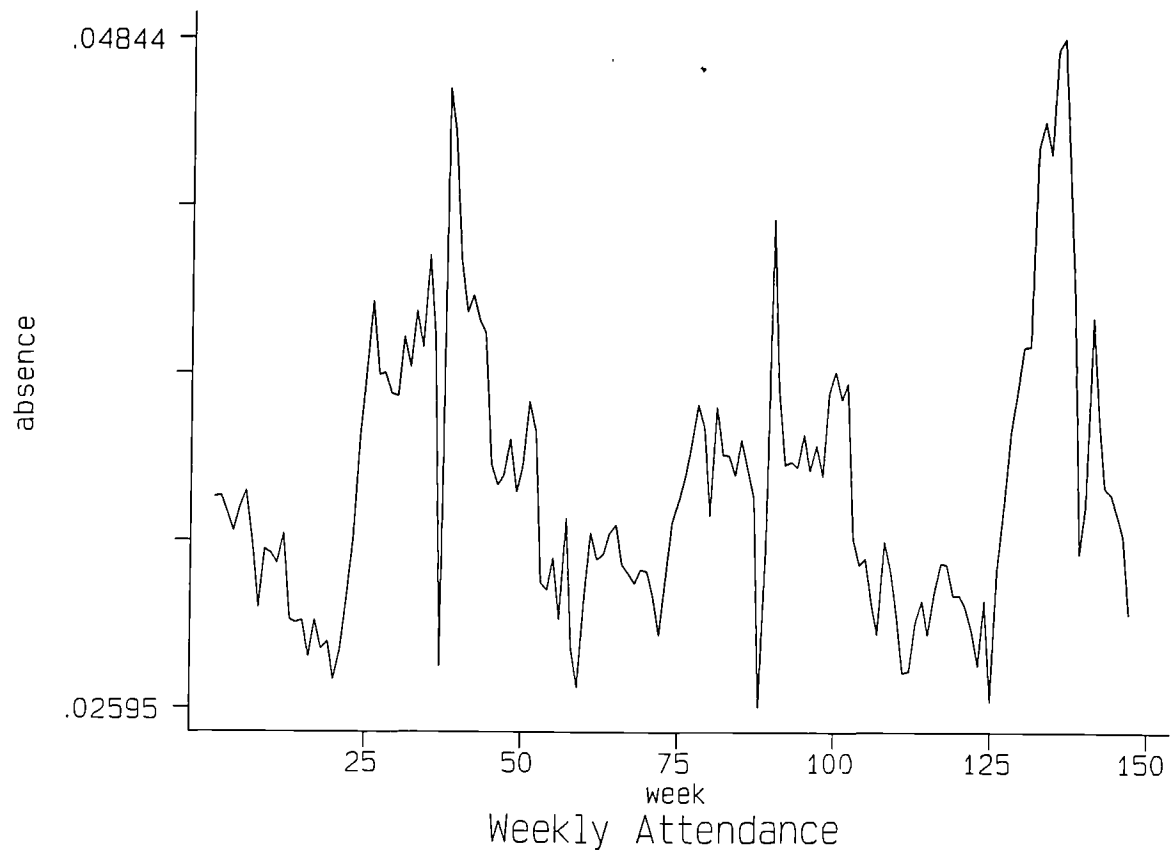
This study is unique in several respects. First, it examines the applied psychology literature and attempts to apply economic reasoning to the theoretical arguments which have emerged to explain and predict the relationship between absence and turnover. Then an alternative model is developed to offer another explanation as to why one would expect a positive correlation between absence and turnover. A key feature of this model is that it uses the quit to explain absence behaviour and not *vice versa*.

Second, it considers the attendance behaviour of far more individuals with much more detailed attendance information than has been used in previous studies. This allowed for a detailed and dynamic matching procedure to be used and also for a separate analysis of managerial and staff leavers and stayers. This breakdown along seniority lines revealed considerable differences in their attendance patterns leading up to resignation. A detailed search of the literature on this subject revealed that these findings are not unique, although the earlier studies tended not to emphasise the complexities of this relationship.



The results confirm the findings of much of the previous work showing that absence increases as individuals move closer to their date of resignation. More interestingly, however, the findings suggest that attendance behaviour of leaving staff workers differs from that of staying staff workers much earlier than might have been expected. In addition, within the same organisation, the patterns of attendance leading up to resignation differ considerably between managerial and clerical workers.

**Appendix 3.1 Weekly Absence Rates, April 1991 - March 1994**



## Chapter Four: Absence, Seasonality and the Business Cycle<sup>1</sup>

### 4.1 Introduction

Discussions of the implications of fluctuations in the business cycle for workplace discipline dates back as least as far as Kalecki (1943) who stated: "...under a regime of permanent full employment, the 'sack' would cease to play its role as a disciplinary tool." In essence he is arguing that if workers could seamlessly move from one job to another, as full employment would suggest, then the worker has no fear of losing their job and as a result, they may be more inclined to shirk. More recently, several papers in the efficiency wage literature (e.g. Calvo, 1979; Salop, 1979; Diamond, 1981; and Shapiro and Stiglitz, 1984) examine the risk of dismissal and the cost of a spell of unemployment if a dismissal occurs. They argue that the threat of unemployment provides a disincentive for workers to shirk, the magnitude of which varies (counter-cyclically) with the business cycle. Each of these papers direct their discussion to on the job shirking. I believe that these types of arguments can easily be extended to "off the job" shirking or absenteeism. In fact, it might even be a more compelling argument, since one can imagine there being greater utility gain from a day away from work (in terms of leisure or household production) than from on-the-job shirking. Time away from work gives rise to expanded opportunities ranging from child care and other home production to leisure. The utility generated from these activities should be greater than that generated from on-the-job shirking.

---

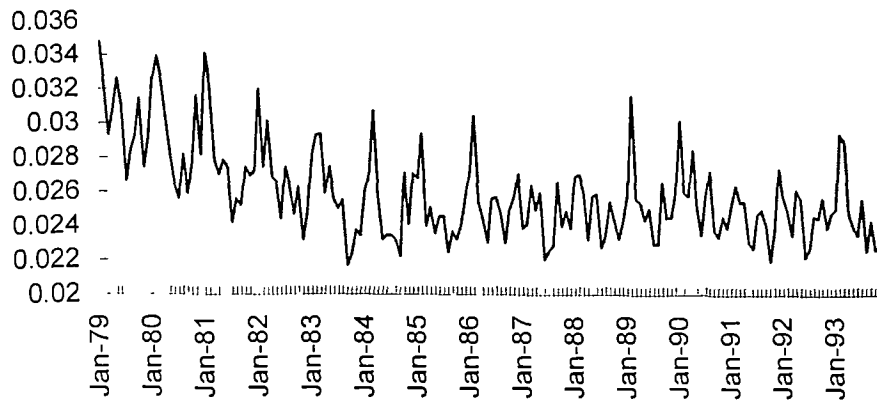
<sup>1</sup> This chapter is an expanded version of a paper co-authored by John Goddard. It is currently under consideration at the *Journal of Economics and Business*.

In this chapter, I attempt to explain employee absenteeism using macroeconomic variables that represent the business cycle. Barmby, *et al* (1995), amongst others, argue that some portion of absence is malfeasant and can be explained using incentive models. In a system of self-certification in which employers have imperfect information, some portion of absence is essentially a moral hazard problem, since the employee essentially determines whether or not he/she attends. This has been a central theme of this thesis. Later in this chapter, I develop a theoretical model that explains absence in a manner similar to on-the job shirking in the efficiency wage literature. The more novel aspect of this chapter is that a theoretical model is developed showing that firms' monitoring efforts should also be affected by business cycle factors. The basic idea is that cost of shirking (in the form of absence) to the firm will vary through the business cycle. Absence will be less costly to the firm in times of low demand, and conversely, the cost of absence will be higher in times of expansion. The empirical findings of this chapter suggest that modelling absence as simply a labour supply phenomenon, introduces an identification problem. Both labour supply and labour demand factors influence the rate of absence.

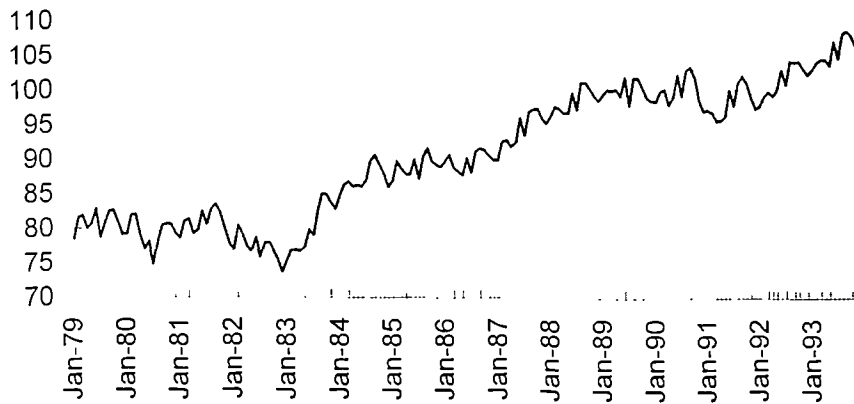
The theoretical link between the business cycle is established by deriving the effects of two main business cycle indicators (an aggregate production measure and a measure of the rate of unemployment) on these probabilities. Figure 4.1 shows plots of the of the US monthly absence rate, aggregate production and unemployment rate series used in our empirical analysis for the period 1979-93 (full definitions of the data are given in section 4.3).

Figure 4.1 Absence, Production and Unemployment US, 1979-1993

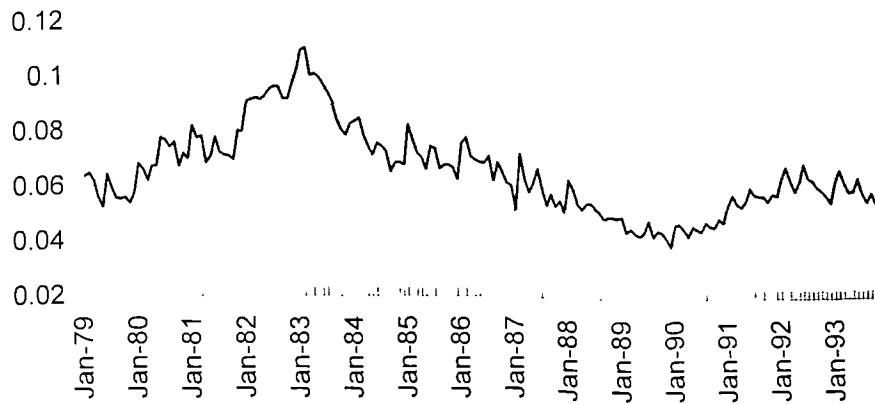
### Absence 1979-93



### Industrial Production 1979-93



### Unemployment 1979-93



Upon first sight, the data do not lend much encouragement for examining a link between cyclical indicators and the absence rate. The rate of absence does not appear to exhibit any clear cyclical trend, while the level of unemployment and the production series are highly cyclical. The theoretical model developed in section 4.2 copes with this feature of the data by demonstrating that the two business cycle indicators typically tend to push the level of absenteeism in different directions simultaneously. First, consider a period of expansion in the economy. During such an upswing firms will be under pressure to meet orders and as such will monitor absence stringently. This could take the form of workers being checked upon more vigorously by the firm since the cost of their absence may be greater in terms of lost production. At the same time, workers realise that during such a period, their absence may be more carefully noticed, than during slack periods. These effects can be thought of as increasing the likelihood that the employees' malfeasance will be detected. Next consider periods when the probability of dismissal for reasons *other* than malfeasance is low (i.e. the probability of layoff due to slack product demand). At the same time as the firm is facing increased demand for their products, the labour market will also be expanding, meaning the cost of becoming unemployed as a result of malfeasance is reduced, since the likelihood that another job can be found quickly is high. This reduced 'cost' of absence make it more attractive to workers.

Conversely, in times when demand for firms' products is low, the firm may monitor absence less stringently, since the cost of a worker not showing up will not be very high. At the same time the cost to the worker if he/she becomes unemployed for malfeasance is much higher, since jobs will be scarce. The basic

conclusion is that the overall effect of the business cycle on absenteeism is ambiguous. Any extra incentive the worker may have to attend, in terms of the costs of losing their job, is offset by the decreased incentives for the firms to monitor them stringently since their not showing up may have little or no cost.

I argue that the lack of any clear cyclical pattern in the absence series may therefore stem from a tendency for these pressures to largely offset each other over the cycle. However, this does not rule out the possibility of identifying the individual effects of our indicators on the absence series, for at least two reasons. First, movements in the production and unemployment series are not perfectly synchronised. For example, during the major recessions of the early 1980s and 1990s, the annual change in the real value of production troughed at -6.8% and -4.5% in October 1982 and March 1991, respectively. The peak rates of unemployment (in this data set) were 11.0% and 6.9% in February 1983 and June 1992 (4 and 15 months later than the trough in the production series), respectively. Thus demonstrating that the different indicators clearly do not perfectly match.

Second, the relative magnitudes of the movements in the two indicators are rarely the same in corresponding phases of different cycles. For example the ratio of the rise in unemployment to the fall in production was higher in the early 1980s recession than ten years later. This may provide an embryonic explanation as to why the absence rate in Figure 4.1 declined during the early 1980s, but showed no clear trend in either direction in the recession of the early 1990s. Supply side

factors dominated demand side factors, thus pushing absenteeism down as unemployment rose.

Although the cyclical nature of the absence series is unclear, it is evident from Figure 4.1 that there is a very strong seasonal component. It is useful at this point to consider why absence rates should exhibit seasonality. Clearly the non-malevolent component is likely to account for some part of the seasonal variation<sup>2</sup>. In this chapter we are not seeking to model non-malevolent absence directly. Rather I anticipate that these effects will be captured by deterministic seasonal variables in the empirical models, and I test to verify that deterministic seasonality is present.

There may also be reasons why malevolent absence may also contribute to the seasonal pattern. First, the perceived benefit of a day off work may be higher in the summer than in the winter, or during (rather than outside) school holidays. Secondly, firms' monitoring intensity may vary throughout the year due to the effects of labour hoarding, with monitoring effort being greatest when relatively little labour is being hoarded. Testing for seasonality in a variety of aggregate US series, Barsky and Miron (1989) find limited evidence of production smoothing throughout the year and significant seasonal variation in labour productivity, which they attribute to labour hoarding. Coles and Treble (1993, 1996) argue that the firm's monitoring effort should reflect the shadow cost of absence, which must fall if labour is being hoarded during periods of slack demand. If hiring and

---

<sup>2</sup> The incidence of illnesses such as colds and of influenza is higher in winter than in summer, although this may be offset to some extent by summer complaints such as asthma.



firing workers is not costless, it may be efficient for the firm to hoard workers across seasonal fluctuations in demand, treating (in terms of monitoring effort) malfeasant workers more (less) leniently when demand is low (high).

Empirical studies by Doherty (1979), Leigh (1985) and Markham (1985) have suggested that absence tends to follow a counter-cyclical pattern. Doherty, uses aggregate annual UK data for the period 1954-75, and models absence using the unemployment rate, the sickness benefit ratio, a morbidity measure (to capture the general health of the nation, thus attempting to model the non-malfeasant portion of absence) and a time trend as explanatory variables. The unemployment rate is found to have a significant negative effect on absence, but none of the other covariates are significant. Leigh (1985) uses US panel data to show that workers who were displaced in 1977 had higher rates of absence in 1976 than those not displaced. He also finds a significant negative correlation between annual changes in absence and changes in unemployment over the period 1968-78. Markham (1985) using US data to model monthly national absence rates against seasonally adjusted unemployment rates and a job vacancies index, also finds a negative relationship between absence and unemployment and a seasonal effect.

These studies can be criticised on both theoretical and empirical grounds. In each of these papers, to the extent that any sort of theoretical framework is developed, absence is modelled primarily as a labour supply phenomenon. Again the basic idea from the efficiency wage literature suggests that the cost of malfeasant absenteeism to the worker changes with the level of difficulty the worker will have in moving to a new job should they be terminated. This ignores the

possibility that the urgency of a firm's demand for labour may influence the effort with which the firm monitors absence, and subsequently have an effect on the observed rates of absenteeism. The theoretical relationship between the demand for labour and absenteeism has been investigated more fully by Weiss (1985) Coles and Treble (1993, 1996). By treating absence as a problem of malfeasance, it seems natural to include demand as well as supply side determinants in the theoretical model, which is developed in section 4.2

Empirically, the vintage of the papers reviewed (as well as the small datasets which were available) precludes them from exploiting any recent econometric developments in time series analysis. Noting the distinct seasonal pattern in the absence series in Figure 4.1, an important part of this empirical analysis is the application of methods developed by Hylleberg, Engle, Granger and Yoo (1990) and Beaulieu and Miron (1993) to test for unit roots in the presence of seasonality, which may be either deterministic or stochastic. After the data is described in section 4.3, these tests are further explained and results reported in section 4.4. The evidence from these tests leads to a cointegration analysis, before section 4.5 concludes.

## **4.2 Absence Behaviour: A Theoretical Model**

In this section a theoretical model of absence behaviour through the business cycle is developed. The most important feature of this model is that it incorporates firms' demand for reliable labour. The model of the worker is developed in Section 4.2.1 and the model of the firm is developed in Section 4.2.2

#### **4.2.1 The Individual Absence Decision**

In this section the individual decision to be absent is considered. The model begins by examining the choices made by individual members of the work force. It is assumed (given current wages and benefit rates) that each individual has a preferred option among three possible states:

1. Employed with zero absence (an 'attender')
2. Employed with a positive rate of absence (an 'absentee'); and
3. Voluntarily unemployed

This is a similar framework used in other studies in malfeasance literature, however, it is simplified by assuming that the choice between malfeasance and non-malfeasance is discrete and that there are no 'degrees' of malfeasance, which in this case would correspond to varying proportions of time spent absent.

Under states 1 and 2 there is a non-zero probability that the individual will experience spells of involuntary unemployment during his lifetime. It is assumed that each individual selects his preferred option by making comparisons between the present values of the expected income for each state. For simplicity, infinite time horizons are assumed and that individuals expect current values of income and transition probabilities between employment and unemployment to prevail at all times in the future.

### *The Case of the Attender*

An individual,  $i$ , who holds a job for the current period ( $t = 0$  to  $t = 1$ ) and is not an absentee earns income from employment of  $w_i$  paid at  $t = 1$ . Such an individual is henceforth described as an attender. For simplicity, it is assumed that an attender is dismissed at  $t = 1$  if his firm's profit for the period  $t = 0$  to  $t = 1$  falls below some minimum level,  $\pi_{\text{MIN}}$ , a contingency which is beyond the employee's control.  $\mu$  is the probability of this contingency, and therefore the dismissal probability for an attender.

If the job is retained for the period  $t = 1$  to  $t = 2$  (the probability of which is  $1 - \mu$ ),  $w_i$  is earned and paid at  $t = 2$ , when there is a further risk of losing the job, also with the probability  $\mu$ . If the job is lost at  $t = 1$ , the individual gains utility from leisure whose income equivalent is  $v_i$ , plus unemployment benefit of  $b$ , payable at  $t = 2$ .

At  $t = 2$  there is a probability of finding another job for the period  $t = 2$  to  $t = 3$  and the probability of this is  $\rho$  (in which case an income of  $w_i$  will be earned at  $t = 3$ ) and a probability of remaining unemployed of  $1 - \rho$  (in which case  $v_i + b$  is received at  $t = 3$ ).

With these assumptions the present value of lifetime income,  $x_{1i}$ , is:

$$x_{1i} = w_i(1 + d)^{-1} + (1 - \mu)x_{1i}(1 + d)^{-1} + \mu(v_i + b + \rho x_{1i}) \sum_{j=0}^{\infty} (1 - \rho)^j (1 + d)^{j-2}$$

Where  $d$  is the discount rate.

Simplifying:

$$x_{1i} = \{(d + \rho)w_i + \mu(v_i + b)\} \{d(\mu + d + \rho)\}^{-1} \quad (1)$$

This implies that lifetime utility is a function of the discounted wage rate for the periods that the individual is employed plus the utility from time gained when the individual is not employed.

### *The Case of the Absentee*

An individual who holds a job at  $t = 0$  and who is absent for a certain proportion of time,  $k$  (an absentee), earns an income and utility at  $t = 1$  whose income equivalent is  $w_i + kv_i$ . The probability of losing the job at  $t = 1$  is  $\mu + \eta$  where  $\eta$  represents the additional risk of dismissal resulting from detection as a malfasant employee. If the job is retained at  $t = 1$  (the probability of which is  $1 - \mu - \eta$ ),  $w_i + kv_i$  is received at  $t = 2$ ; if the job is lost at  $t = 1$ ,  $v_i + b$  is received at  $t = 2$ . As before, the probability of finding a job at  $t = 2$  is  $\rho$ . Letting  $x_{2i}$  denote the present value of lifetime income, and following a procedure similar to that for  $x_{1i}$ , we obtain:

$$x_{2i} = \{(d + \rho)(w_i + kv_i) + (\mu + \eta)(v_i + b)\} \{d(\mu + \eta + d + \rho)\}^{-1} \quad (2)$$

This implies that lifetime utility is again a function of income and time spent unemployed. However this individual is likely to forego some income as a result of being caught as an absentee and sacked. He/she will in turn receive extra benefit from more time away from work as an absentee in the periods in which the individual is employed.

### *The Case of the Voluntarily Unemployed*

The voluntarily unemployed individual obtains an income equivalent of  $v_i + b$  in all time periods from  $t = 1$  onwards. The present value is:

$$x_{3i} = (v_i + b)d^{-1} \quad (3)$$

This implies that the individual's lifetime utility is derived solely from the discounted unemployment benefit and the value time spent unemployed.

### *Who Chooses Malfeasance?*

It is assumed that the parameters  $\mu$ ,  $\eta$ ,  $d$ ,  $\rho$  and  $k$  are the same for all individuals, as is  $b$ , while  $w_i$  and  $v_i$  vary between individuals according to the joint density function  $\phi(w_i, v_i)$ . For all individuals,  $w_i$  is assumed positively related to  $w$ , some exogenous measure of average earnings from employment. From (1), (2) and (3) it can be shown:

$$x_{1i} > x_{2i} \text{ iff } w_i > b + \zeta_1 \text{ where } \zeta_1 = 1 + k\eta^{-1}(d + \rho + \mu);$$

Suggesting that an individual will prefer to be an attender rather than an absentee if the utility they get from income is greater than the benefit they would receive from being unemployed plus the extra (risk adjusted in terms of the probability of being sacked for shirking and the re-employment probability) utility they gain from being away from work.

$$x_{1i} > x_{3i} \text{ iff } w_i > b + v_i;$$

Suggesting that the individual will choose to be an attender rather than unemployed if the utility gained from income is greater than the benefit level plus the utility gained from time spent not working.

$$x_{2i} > x_{3i} \text{ iff } w_i > b + \zeta_2 v_i \text{ where } \zeta_2 = 1 - k.$$

Suggesting that the individual will choose to be an absentee rather than voluntarily unemployed if the utility from income is greater than the unemployment benefit plus the utility from time differential between contracted hours and the time taken as absence.

It follows that  $n_j$ , the proportions of individuals whose preferred option is state  $j$  (for  $j = 1, j = 2$  or  $j = 3$ ) are as follows:

$$n_1 = \int_{v_i=0}^{\infty} \int_{w_i=b+\zeta_1 v_i}^{\infty} \phi(w_i, v_i) dw_i dv_i = n_1 \{ \mu(-), \eta(+), \rho(-), d(-), k(-), b(-), w(+)\}$$

$$n_2 = \int_{v_i=0}^{\infty} \int_{w_i=b+\zeta_2 v_i}^{b+\zeta_1 v_i} \phi(w_i, v_i) dw_i dv_i = n_2 \{ \mu(+), \eta(-), \rho(+), d(+), k(+), b(?), w(?)\}$$

$$n_3 = \int_{v_i=0}^{\infty} \int_{w_i=0}^{b+\zeta_2 v_i} \phi(w_i, v_i) dw_i dv_i = n_3 \{ k(-), b(+), w(-)\}$$

The signs of the first order partial derivatives of  $n_j$  are shown in parentheses beside each argument. Henceforth we treat the parameters of  $d$  and  $k$  as fixed, and restrict the discussion to the other determinants of the number of absentees ( $n_2$ ). An increase in the dismissal probability,  $\mu$  increases absence since it makes dismissal more likely for all employees, reducing the incentive to be non-maleasant. An increase in  $\eta$ , the additional risk of dismissal for maleasant

employees has a negative effect on absence. An increase in  $\rho$ , the re-employment probability, reduces the cost to the individual of becoming unemployed, therefore encouraging absence. On the other hand, it also makes voluntary unemployment more attractive relative to malfeasant employment, which tends to reduce absence as some individuals previously choosing to absenteeism will withdraw from employment all together, choosing to be unemployed. The effect on  $n_2$  is therefore ambiguous. Similar ambiguities arise from a change in  $w$ . Higher wages make the cost of becoming unemployed higher for malfeasant employees ( $n_2$ ), causing them to choose  $n_1$ , while at the same time higher wages may draw some individuals out of voluntary unemployment ( $n_3$ ) and into malfeasant employment ( $n_2$ ). These results are summarised in Table 4.1 below

**Table 4.1 Marginal Effects**

Parameter	Attender	Absentee	Unemployed
$\mu$ , p(firm lays off worker)	Negative	Positive	n/a
$\eta$ , p(shirking worker gets sacked)	Positive	Negative	n/a
$\rho$ , p(sacked worker is re-employed)	Negative	Positive	n/a
$d$ , discount rate	Negative	Positive	n/a
$k$ , proportion of time spent absent	Negative	Positive	Negative
$b$ , the unemployment benefit	Negative	Unknown	Positive
$w$ , the wage rate	Positive	Unknown	Negative

Table 4.1 shows the effect of an increase in various parameters on the probability of being in a particular state. For instance, if we consider  $\mu$ , the probability that firm lays off the worker, as this probability increases, the worker is less likely to be an attender because they are likely to be laid off, suggesting they should maximise utility in the current period by taking more absence. For identical reasons, increased probability of a lay off makes being an absentee more



attractive. Next consider the probability of being sacked for being caught taking (malfeasant) absence. If this probability increases, being an attender becomes more attractive as the likelihood of being sacked for absence increases, making a spell of unemployment more likely. Conversely, it makes being an absentee less attractive as the individual taking absence is now more likely to be caught and subsequently sacked. An increase in the re-employment probability reduces the cost of absenteeism for the worker. The adverse impact of being caught shirking is less severe as the individual is more likely to quickly transit into another job. An increase the discount rate puts a greater emphasis on utility in the current period, suggesting the worker should take more absence as they are less concerned with future utility (which is the principal reason for being an attender). An increase in the unemployment benefit makes being an attender less attractive as the cost of being caught shirking decreases, since a greater proportion of the absentee's income will be replaced. The effect on being an absentee is indeterminate. Individuals who previously chose to be attenders may now find being an absentee a more attractive alternative. However, individuals who had previously chosen to be absentees may now view voluntary unemployment as a more attractive option. Finally an increase in the market wage rate results in the cost of becoming unemployed greater, given the increased differential between wages and the unemployment benefit. Conversely, it makes voluntary unemployment less attractive for the same reason (greater forgone wages). The effect on the proportion of workers choosing to be absentees is indeterminate. Higher wages are likely to draw individuals out of unemployment and into absentee employment, while simultaneously making being an attender more attractive than being an absentee.

Therefore the absence rate can be written as:

$$a = a\{\mu(+), \eta(-), \rho(+), b(?), w(?)\} \quad (4)$$

For the purposes of this model,  $b$  and  $w$  are treated as exogenous. It therefore remains to be shown how the probabilities  $\mu$ ,  $\eta$  and  $\rho$  are determined. It is assumed that these are driven by two macroeconomic aggregates, also treated as exogenous: aggregate demand and the rate of unemployment. Aggregate demand drives  $\mu$  and  $\eta$  through a stylised model of a representative firm based on linear production technology and mark-up pricing (as will be discussed below). These considerably simplify the exposition of the model without changing any of its fundamental properties.  $\rho$  is assumed to be inversely related to the rate of unemployment.

#### **4.2.2 The Firm's Monitoring Intensity**

In the model of the firm, the demand for the firm's products is assumed to be stochastic, and unknown at the time the firm decides how much labour to employ for the current period and what price to charge for its product. Therefore, profit is also stochastic. As before, the probability that realised profit falls below the minimum acceptable level ( $\pi_{\text{MIN}}$ ) and the firm closes is  $\mu$ .

The probability  $\eta$  is directly related to the level of employee monitoring. Monitoring affects employee behaviour in two ways. First, an increase in monitoring reduces the incentive to be a malfasant absentee and therefore

reduces the rate of absence (as in (4)). Second, however, the level of monitoring is interpreted by employees as an indicator of the extent of their employer's trust in them. An excessively vigilant monitoring regime suggests mistrust and has a negative effect on morale. This reduces the productivity of all employees by a proportion expressed by the function  $\sigma(\eta(+))$ .

The details of the model of the firm are as follows. Output,  $q$ , and the quantity of labour,  $\ell$ , are linked via a linear production function:

$q = c_0(1-a\{\mu(+), \eta(-), \rho(+), b(?), w(?)\}(1-\sigma(\eta(+)))\} \ell$ , where  $c_0 > 0$  or:

$$q = g\{\mu(-), \eta(?), \rho(-), b(?), w(?)\} \ell \quad (5)$$

We assume  $\delta g/\delta \eta > 0$  for  $\eta < \eta^*$  where  $\eta^*$  is the probability corresponding to an optimal level of monitoring, at which the marginal benefit to the firm of lower absence is just matched by the marginal cost of lower productivity due to perceived mistrust. For simplicity we assume  $\eta^*$  does not depend on  $\mu$ ,  $\rho$ ,  $b$ , or  $w$ . Total revenue is assumed to be linear in aggregate demand,  $y$ , and quadratic in  $q$ , so we can write:

$$TR = c_1 y q - c_2 q^2 \quad (6)$$

Where  $c_1, c_2 > 0$ . Labour is the only factor of production and the firm is assumed to hire labour at the average wage, so total cost is:

$$TC = w \ell = w\{g(\mu, \eta, \rho, b, w)\}^{-1} q \quad (7)$$

Given that  $y$  is unknown when the firm has to decide on  $\ell$  and its selling price per unit of output,  $p$ , the firm is assumed to base these decisions on  $y^e$ , the expected value of  $y$ . Considering the parameters of (7),  $\rho$  depends on the unemployment rate and is therefore exogenous, as are  $b$  and  $w$ . Not knowing whether aggregate demand will be higher or lower than expected, the firm assumes  $\eta = \tilde{\eta}$ . At this stage I assume some fixed value for  $\mu$ , which will be verified below. The firm adopts mark-up pricing, so its expected output is  $q^e$ , such that its chosen selling price,  $p^*$  is expected average cost plus the mark-up,  $\kappa$ :

$$p^* = c_1 y^e - c_2 q^e = (1 + \kappa) w \{g(\mu, \tilde{\eta}, \rho, b, w)\}^{-1} \quad (8)$$

Labour employed is therefore:

$$\ell^* = \{g(\mu, \tilde{\eta}, \rho, b, w)\}^{-1} q \quad (9)$$

Actual output,  $q^*$ , then depends on the realised value of  $y$ , and must satisfy:

$$p^* = c_1 y^e - c_2 q^e = c_1 y - c_2 q^*, \text{ which yields:}$$

$$q^* = q^e + (c_1/c_2)(y - y^e) \quad (10)$$

To produce  $q^*$ , in the short term monitoring is adjusted to  $\eta^*$  (which may be either above or below  $\tilde{\eta}$ ) such that:

$$g(\mu, \eta^*, \rho, b, w) \ell^* = q^* \quad (11)$$

Given the stochastic nature of aggregate demand, profit ( $\pi$ ) is also stochastic and dependent on  $y$ :

$$\pi = p^* q^* - w \ell^* = p^* (q^e + (c_1/c_2)(y - y^e)) - w \ell^* \quad (12)$$

Letting  $F_{\pi}(\cdot)$  denote the distribution function of  $\pi$  conditional on  $p^*$  and  $\ell^*$ , the system is closed by the condition:

$$F_{\pi}(\pi_{\text{MIN}}) = \mu \quad (13)$$

The value of  $\mu$  in (13) must be consistent with the value that was previously assumed in deriving (8).

The model of the firm is illustrated in Figures 4.2 and 4.3. In Figure 4.2, when expected aggregate demand is  $y^e$ , the firm employs sufficient labour to produce  $q^e$  units of output (assuming  $\eta \sim$ ), which produces a mark-up of  $\kappa$  on average cost. Total cost is  $TC^e$  and price is  $p^*$ . Actual aggregate demand may be  $y_1$  (above) or  $y_2$  (below)  $y^e$ , in which case actual output is  $q_1^*$  (higher) or  $q_2^*$  (lower) than  $q^e$ . The short-term adjustment to output is made without any change in total cost, by adjusting  $\eta$  above or below  $\eta \sim$ . The  $\pi - q^*$  locus AA shows the range of possible values for actual profit and output implied by the total revenue functions associated with different realised values of  $y$  (e.g.  $TR(y_1)$  and  $TR(y_2)$ ) and a total cost of  $TC^e$ . The probability  $\mu$  (which determines the position of TC) is the probability of being at a point on AA associated with a profit which is smaller than  $\pi_{\text{MIN}}$ .

Figure 4.3 illustrates the effect of an increase in expected aggregate demand from  $y_1^e$  to  $y_2^e$ , which shifts the total revenue and profit functions up. The improvement in expected profit reduces the probability that profit falls below  $\pi_{\text{MIN}}$

from  $\mu_1$  to  $\mu_2$ , reducing the absence rate and therefore causing a the total cost function to shift down. The overall effect is an increase in expected output from  $q^e_1$  (on the  $\pi - q^*$  locus AA) to  $q^e_2$  (on the new  $\pi - q^*$  locus A'A')

In summary, the model links the characteristics of the firm and of the individual to the business cycle and shows that both have incentives to alter their behaviour depending on the phase of the business cycle. The model of the individual shows that an increase in unemployment increases the consequences of being laid off, with the individual experiencing a longer spell of unemployment. With unemployment being more costly, the individual will take steps to minimise the probability of being laid off and will therefore shirk less. The model of the firm suggests that if firms hoard labour through economic downturns, then the cost of absenteeism to the firm will be lower when product demand is low. Costly monitoring will be reduced during these periods as the returns to it are lower.

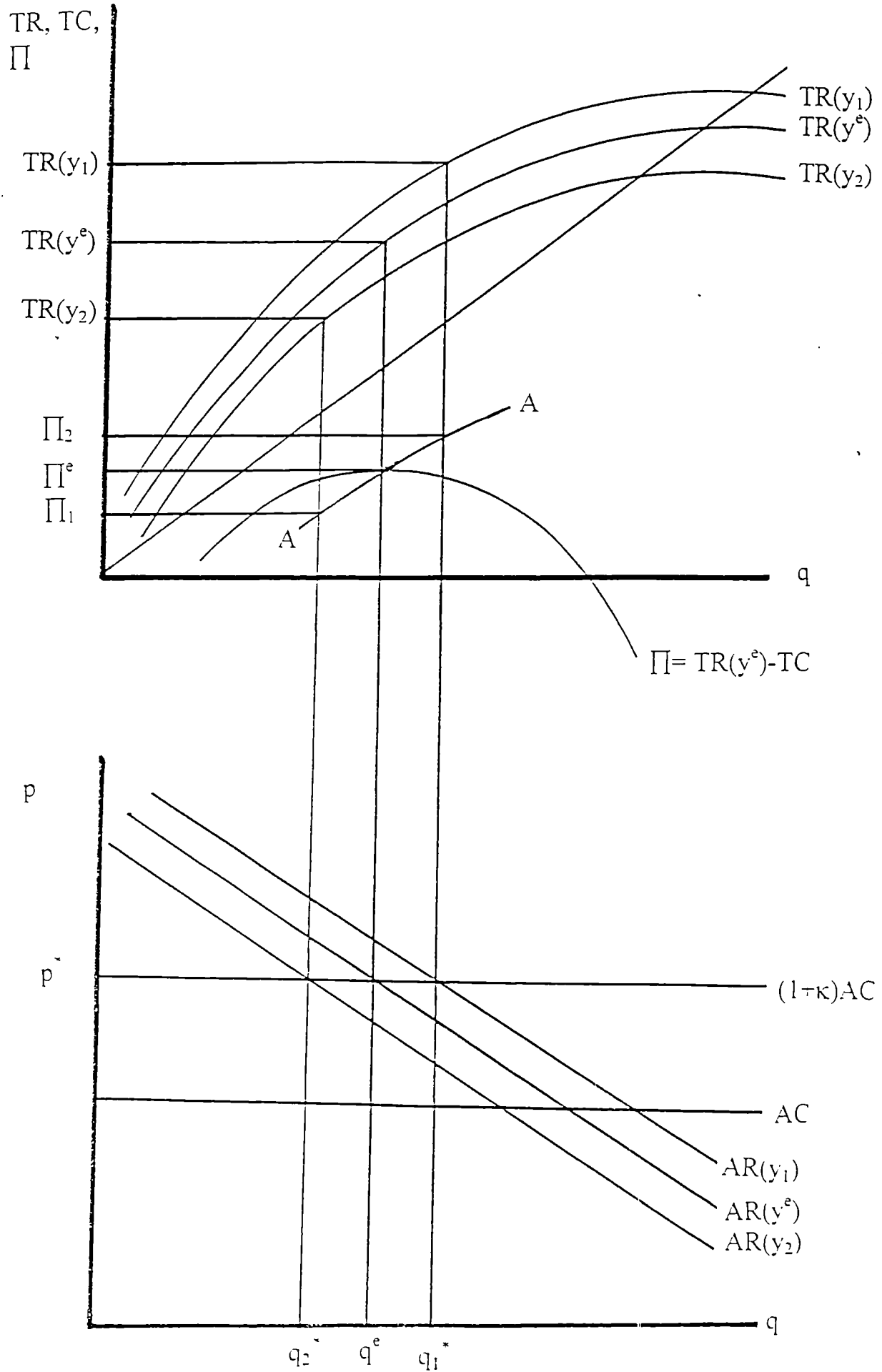


Figure 4.2 Expected and Actual Output and Profit

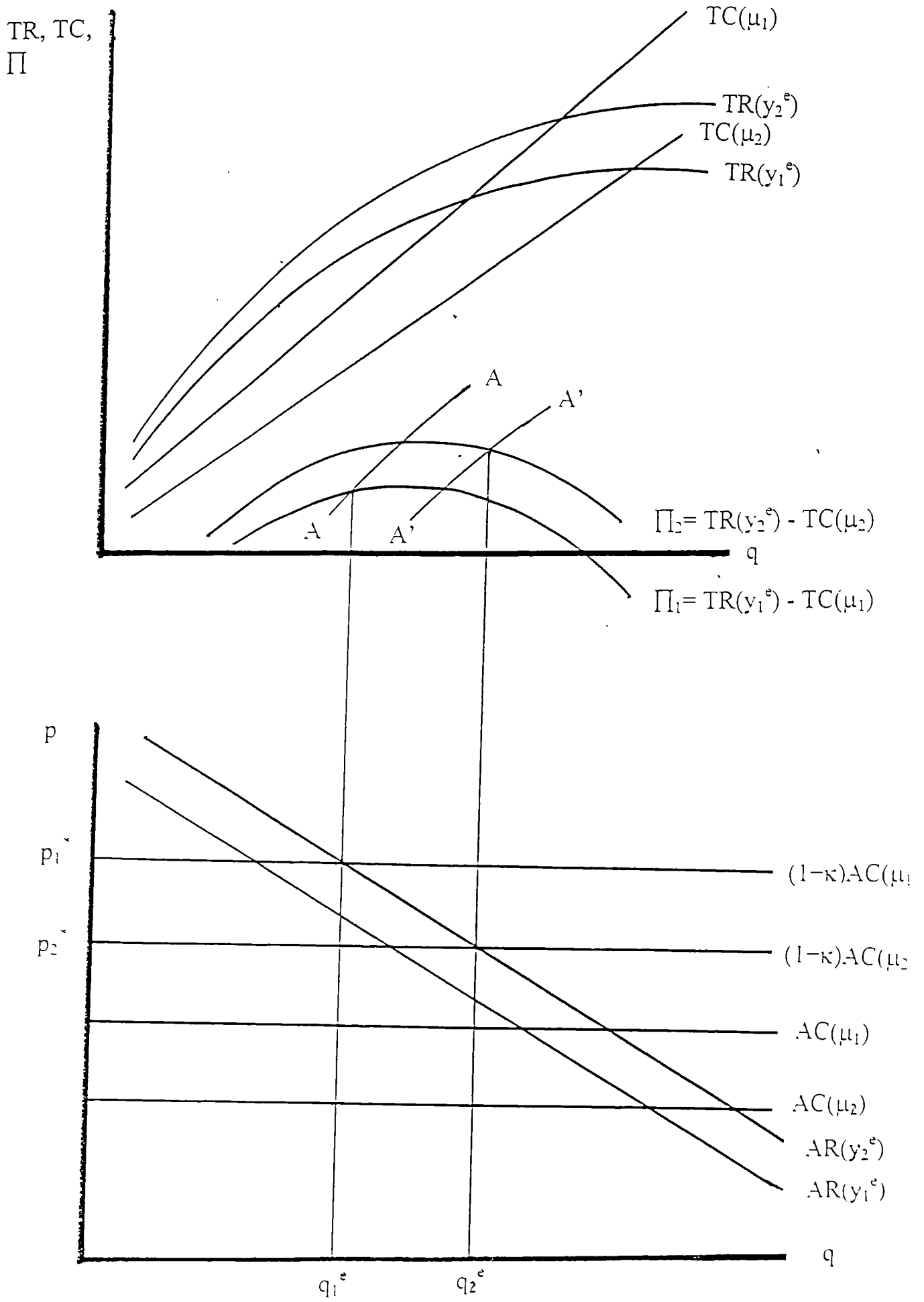


Figure 4.3 Effect of an Increase in Expected Aggregate Demand



### 4.3 Empirical Model and Data

In this section, equation (4) is developed into an estimable model for the rate of absenteeism. In section 4.2 it was assumed that  $\rho$ , the probability of becoming re-employed given a spell of unemployment, has an inverse relationship with the individuals incentive to go absent. In effect  $\rho$  is a direct function of the level of unemployment and as such we replace  $\rho$  in (4) with the rate of unemployment,  $u$ . It has been shown that in the long run, an increase in  $y^e$  leads to a decrease in  $\mu$ , which tends to reduce absence. In the short run, if  $y$  is above  $y^e$ , firms respond by increasing monitoring malfeasant absenteeism, adjusting  $\eta$  to a level that above its long run optimum,  $\eta^{\sim}$ , thereby reducing absence. Replacing the probabilities,  $\mu$ ,  $\eta$  and  $\rho$  in (4) with  $y^e$ ,  $y - y^e$  and  $u$  respectively, it can be written:

$$a = a(y^e(-), y - y^e(-), u(-), b(?), w(?)) \quad (14)$$

In the empirical analysis that follows in section 4.4, the functional form of (14) is assumed to be logarithmic. To avoid redefining notation,  $a_t$ ,  $y_t^e$ ,  $y_t$ ,  $u_t$ ,  $b_t$ , and  $w_t$  will be used to denote the natural logarithms of absence, expected demand, actual demand, unemployment, unemployment benefits and wages (with time subscripts) respectively.

The relationship between  $y_t^e$  and  $y_t$  is assumed to be  $y_t = y_t^e + \varepsilon_t$  where  $y_t^e$  depends on  $y_{t-1}$  and  $\varepsilon_t$  is random. In the empirical model,  $y_{t-1}$  (which appears in the error correction mechanism) and lagged terms of  $\Delta y_t$  (which will appear in the short run dynamics) will proxy for  $y^e$  and  $y - y^e$ , respectively in (14)

The dataset consists of 180 monthly observations for a 15 year sample period covering the period 1979-1993 (inclusive). The US monthly Current Population Survey (CPS) was used to obtain series for  $a_t$ ,  $u_t$  and  $w_t$ . The CPS contains information on approximately 17,000 individuals each month, covering a wide demographic and geographic base. The absence rate is calculated by subtracting the number of hours worked in the previous period from the number of hours normally worked and dividing by the normal number of hours worked. Not all shortfalls are included (for instance holidays and strikes are not recorded as absences). The unemployment rate is the number of unemployed divided by the sum of the unemployed, those who worked and those who did not work, but held jobs. The average real wage is calculated from the nominal wages of all workers employed for a minimum of 35 hours, converted into real terms (January 1979 = 100) using the Index of All Consumer prices (from *Datastream*).

Real monthly aggregate production (adjusted for the number of calendar days in the month, but otherwise seasonally unadjusted) obtained from *Datastream* (produced by the US Department of Statistics) is used to measure  $y_t$ . An expenditure measure of aggregate demand might have been a preferable measure in light of the interpretation of  $y_t$  in the theoretical model. However, seasonally unadjusted GDP figures are not available on a monthly basis and aggregate production is used as a proxy<sup>3</sup>. Finally, a seasonally adjusted nominal unemployment benefit series obtained from the Council of Economic Advisors and converted into real terms, is used to measure  $b_t$ . A seasonally unadjusted

---

<sup>3</sup> Thanks to Mike Jenkins for this tip.

series was not available and the use of adjusted data will necessitate the use of unit root test procedures different for those used for the other (unadjusted) series.

#### **4.4 Unit Root and Cointegration Tests**

Before proceeding to an empirical analysis of the relationship suggested by equation (14), it is necessary to investigate the univariate time series properties of each of the series. While it is clear that the aim of this chapter is to jointly model business cycle indicators effect on the rate of absence, the statistical strategy that will be adopted depends on the univariate properties of the series. The standard procedure in examining economic time series is to test for the presence of individual unit roots in each of the series. If the series are stationary (i.e. no unit roots) then they can be modelled using a straightforward least squares procedure. If any of the series are non-stationary (i.e. there is a unit root in at least one of the series) then the modelling strategy must change. In an OLS framework, this would result in using “levels” for the stationary series and “differences” for the non-stationary series. If all the series are non-stationary, it is possible to test for cointegration, which tests whether the non-stationary series have significant long run relationship. For the trend and cyclical components, the main issue is whether a deterministic or stochastic specification is appropriate. For series which do not also exhibit a seasonal component, the procedures for resolving the issue, which require tests for the presence of one or more unit roots at zero frequency, are routine.

For series exhibiting seasonality a further question arises, whether the seasonal component is deterministic or stochastic. In fact, there are three possibilities:

deterministic seasonality, stationary stochastic seasonality, and non-stationary stochastic seasonality. With deterministic seasonality (e.g.  $z_t = \delta_0 + \sum_{j=2}^s \delta_j s_{jt} + \varepsilon_t$ , where  $s$  is the number of seasons and  $s_{jt}$  are the seasonal dummies, assuming for simplicity no deterministic or stochastic trend components) the underlying seasonal pattern is regular throughout the series - there are peaks and troughs at regular seasonal intervals. Stationary stochastic seasonality (e.g.  $z_t = \nu z_{t-s} + \varepsilon_t$ , with  $|\nu| < 1$ ) implies that the seasonal pattern tends to change over time, although there is no tendency for the magnitude of the seasonal variation (between consecutive observations) to increase. With non-stationary stochastic seasonality (e.g.  $z_t = z_{t-s} + \varepsilon_t$ ), there is one zero frequency unit root and  $s-1$  unit roots at non-zero frequencies. The seasonal pattern again changes over time, and the typical magnitude of the variation between consecutive observations also tends to increase (but can also diminish from time to time due to chance fluctuations in the progression of the series). Appendix 4.1 illustrates the distinction between the three cases using simulated data with quarterly seasonality.

Miron (1990) argues that before recent developments in the literature on seasonal integration, econometricians tended to handle seasonality in an *ad hoc* (and possibly incorrect) manner. Abeyasinghe (1994) demonstrates more formally that the use of seasonal dummies to model a process whose seasonality is actually non-stationary, creates a spurious regression problem (in much the same way as the incorrect substitution of a deterministic for a stochastic trend can create a spurious regression problem). Therefore a correct diagnosis of the nature of the seasonal component is as important as for the trend component, although most

empirical evidence suggests that unit roots at non-zero frequencies (which produce non-stationary seasonality) are less common than unit roots at zero frequency (which produce stochastic trends).

Miron goes on to make a more fundamental point, arguing that historically the problems of seasonal data were thought to be uninteresting. He argues that in many ways the seasonal cycle may offer new insights into economic processes that can match patterns of the larger business cycle, meaning they may be interesting in and unto themselves, rather than being treated as a nuisance that should be modelled away with dummy variables.

For quarterly series, Hylleberg, Engle, Granger and Yoo (1990) develop a method (the HEGY procedure) which uses a single auxiliary regression to test for unit roots at zero and non-zero (i.e. seasonal) intervals unit roots, against alternatives which may incorporate a deterministic trend, deterministic seasonality (seasonal dummy variables) or both. Their method deals with quarterly series, although Beaulieu and Miron (1993) adapt the HEGY procedure to provide a methodology for testing for unit roots at zero and non-zero intervals for monthly series. The principal focus of the Beaulieu-Miron procedure is to test for the presence stochastic non-stationary (seasonal and non-seasonal unit roots) *versus* deterministic seasonality (seasonal dummy variation). Stochastic stationary seasonality is not tested as it can always be modelled through the inclusion of the appropriate lag structure.

The Beaulieu-Miron adaptation of the HEGY procedure to test a monthly series  $x_t$  for seasonal and non-seasonal unit roots involves running the following auxiliary regression:

$$z_{13t} = \gamma_0 + \gamma_1 t + \sum_{j=2}^{12} \gamma_j S_{jt} + \sum_{k=1}^{12} \pi_k z_{kt-1} + \sum_{h=1}^H \delta_h z_{13t-h} + \varepsilon_t \quad (15)$$

In this equation,  $z_{13t} = (1-\beta^{12})x_t$  where  $\beta$  is the lag operator. The deterministic trend and/or the seasonal dummies are optional.  $H$  is the number of lags of  $z_{13t}$  required to whiten the residuals; in practice we augment only with lags of  $z_{13t}$  which test significant. This is done by running the auxiliary regression (15) with a full set of 15 lags and eliminating those that are not significant one by one. This procedure is followed for each specification (intercept plus trend; intercept plus seasonal dummies; and intercept plus seasonal dummies plus trend) until all insignificant lags have been eliminated.  $Z_{1t} = ((1-B^{12})/(1-B)x_t)$  is interpreted as  $x_t$  adjusted for the 11 seasonal unit roots. Failure to reject  $H_0: \pi_1 = 0$  against  $H_1: \pi_1 < 0$  indicates the presence of a unit root at zero frequency (a stochastic trend). Similarly each of  $z_{2t} \dots z_{12t}$  is  $x_t$  adjusted for the non-seasonal and 10 of the seasonal unit roots (full definitions of which can be found in Appendix 4.2). To reject seasonal unit roots at all frequencies  $\pi_k$  must not equal 0 for  $k = 2$  or at least one element of each of the sets  $\{3,4\}$ ,  $\{5,6\}$ ,  $\{7,8\}$ ,  $\{9,10\}$ ,  $\{11,12\}$ . This can be tested individually with  $t$  statistics or jointly with  $F$  statistics obtained from the OLS estimation of (15). Failure to reject the null  $\pi_k = 0$  at any frequency (through either test) implies the presence of a seasonal unit root. The critical values are generated by running 10,000 replications of  $(1-B^{12})x_t = \varepsilon_t$ , for each of

the I,T; I,S; and I,T,S specifications and calculating the 95% confidence intervals from these simulations. The results are shown below in Tables 4.2a and 4.2b.

**Table 4.2a Tests for Seasonal Integration (Absence, Production and Unemployment)**

$$\text{Auxiliary Regression: } z_{13t} = \gamma_0 + \gamma_1 t + \sum_{j=2}^{12} \gamma_j s_{jt} + \sum_{k=1}^{12} \pi_k z_{kt-1} + \sum_{h=1}^H \delta_h z_{13t-h} + \varepsilon_t$$

	Absence			Production			Unemployment		
	I,T	I,S	I,T,S	I,T	I,S	I,T,S	I,T	I,S	I,T,S
lags	12	0	0	1,5,7, 12,13	0	0	2,3,12, 14	0	0
t( $\pi_1$ )	-2.37	-2.62	-2.15	-2.51	-0.39	-2.88	-2.79	-1.48	-2.70
t( $\pi_2$ )	-2.96*	-3.80*	-3.80*	-0.54	-3.87*	-3.95*	-3.52*	-4.32*	-4.32*
t( $\pi_3$ )	-3.12*	-5.27*	-5.27*	-1.98*	-4.04*	-4.23*	-1.34	-5.22*	-5.24*
t( $\pi_4$ )	-0.98	-0.85	-0.86	-0.10	-3.43*	-3.26*	-0.01	0.68	0.69
t( $\pi_5$ )	-3.93*	-5.50*	-5.50*	-1.74	-4.02*	-4.20*	-3.24*	-5.43*	-5.46*
t( $\pi_6$ )	2.53*	2.78*	2.47*	0.81	2.65*	2.56*	2.15*	1.30	1.21
t( $\pi_7$ )	-3.53*	-6.21*	-6.21*	-2.37*	-2.29	-2.75*	-1.05	-3.73*	-3.94*
t( $\pi_8$ )	1.20	1.25	1.21	-1.00	-4.80	-4.59	-1.83	-3.26	-3.13
t( $\pi_9$ )	-3.25*	-4.01*	-4.01*	-0.59	-6.15*	-6.28*	-4.39*	-5.01*	-5.06*
t( $\pi_{10}$ )	-1.75	-1.42	-1.41	-0.73	0.57	0.55	1.07	0.34	0.32
t( $\pi_{11}$ )	-1.77	-4.67*	-4.68*	-0.72	-0.98	-1.75	-1.44	-2.50*	-3.02*
t( $\pi_{12}$ )	0.00	1.13	1.07	-1.82	-5.14*	-4.96*	-1.76	-6.33*	-6.06*
F( $\pi_3 \cap \pi_4$ )	5.37*	14.48*	14.48*	1.97	15.29*	15.56*	0.97	13.98*	14.09*
F( $\pi_5 \cap \pi_6$ )	11.37*	19.67*	19.65*	1.84	12.51*	13.04*	9.07*	15.88*	15.90*
F( $\pi_7 \cap \pi_8$ )	7.05*	20.55*	20.50*	3.35*	15.03*	15.54*	2.21	13.36*	13.88*
F( $\pi_9 \cap \pi_{10}$ )	6.98*	9.29*	9.25*	0.45	19.19*	19.95*	10.01*	12.64*	12.85*
F( $\pi_{11} \cap \pi_{12}$ )	1.57	11.84*	11.79*	1.92	13.87*	14.42*	2.55	25.12*	25.83*
F( $\pi_1 \cap \gamma_1$ )	4.54	-	3.53	3.16	-	4.24	3.89	-	3.88

\* denotes estimated coefficient significantly different from zero at the 5% significance level.

**Table 4.2b Tests for Seasonal Integration (Wages and Critical values)**

$$\text{Auxiliary Regression: } z_{13t} = \gamma_0 + \gamma_1 t + \sum_{j=2}^{12} \gamma_j s_{jt} + \sum_{k=1}^{12} \pi_k z_{kt-1} + \sum_{h=1}^H \delta_h z_{13t-h} + \varepsilon_t$$

lags	Wages			5% Critical values		
	I,T 2,3,8, 11	I,S 0	I,T,S 0	I,T	I,S	I,T,S
t( $\pi_1$ )	-2.89	-1.55	-4.84	-3.29	-2.74	-3.23
t( $\pi_2$ )	-3.03*	-3.06*	-3.02*	-1.86	-2.71	-2.73
t( $\pi_3$ )	-2.12*	-2.93	-2.90	-1.87	-3.18	-3.17
t( $\pi_4$ )	-1.88	-2.23*	-2.14	+/-1.92	+/-2.18	+/-2.17
t( $\pi_5$ )	-4.58*	-5.45*	-5.81*	+/-1.92	+/-2.18	+/-2.17
t( $\pi_6$ )	-0.65	-1.16	-1.64	+/-1.92	+/-2.18	+/-2.17
t( $\pi_7$ )	-0.83	-4.15*	-4.66*	+/-1.92	+/-2.18	+/-2.17
t( $\pi_8$ )	-1.39	-4.38*	-4.09*	+/-1.92	+/-2.18	+/-2.17
t( $\pi_9$ )	-6.38*	-6.63*	-6.40*	+/-1.92	+/-2.18	+/-2.17
t( $\pi_{10}$ )	-0.50	-0.16	-0.32	+/-1.92	+/-2.18	+/-2.17
t( $\pi_{11}$ )	-0.93	-3.69*	-4.50*	+/-1.92	+/-2.18	+/-2.17
t( $\pi_{12}$ )	-1.64	-5.12*	-4.13*	+/-1.92	+/-2.18	+/-2.17
F( $\pi_3 \cap \pi_4$ )	4.21*	7.08*	6.75*	2.97	5.99	5.99
F( $\pi_5 \cap \pi_6$ )	10.65*	18.85*	18.98*	2.97	5.99	5.99
F( $\pi_7 \cap \pi_8$ )	1.30	20.86*	22.14*	2.97	5.99	5.99
F( $\pi_9 \cap \pi_{10}$ )	21.05*	21.98*	20.52*	2.97	5.99	5.99
F( $\pi_{11} \cap \pi_{12}$ )	1.78	22.89*	22.28*	2.97	5.99	5.99
F( $\pi_1 \cap \gamma_1$ )	4.20	-	12.15*	5.91	-	5.67

\* denotes estimated coefficient significantly different from zero at the 5% significance level.

First, turning our attention to identifying the correct data generating process (DGP), for the absence series, failure to reject  $H_0: \pi_1 \cap \gamma_1 = 0$  with intercept and trend (I,T) or intercept, trend and seasonals (I,T,S) and  $H_0: \pi_1 = 0$  in I,S suggests that I,S is the correct specification of the DGP and that there is a non-seasonal unit root. No seasonal unit roots are detected from the t or F statistics on  $\pi_2 \dots \pi_{12}$ . The seasonal dummies test significant, indicating that the seasonality in the absence series is deterministic. In line with the earlier discussion, we assume



that the seasonal dummies are capturing regularities in both non-maleasant and maleasant component of the absence series.

The diagnoses for the production and the unemployment series are the same as the absence series. The DGP is I,S and the presence of a non-seasonal unit root is detected. In the real wages series we reject  $H_0: \pi_1 \cap \gamma_1 = 0$  for the (I,T,S) DGP and hence conclude that it is the proper specification and also that the trend is deterministic, rather than stochastic (i.e. there is no non-seasonal unit root). Very marginally, I am unable to reject either  $H_0: \pi_3 = 0$  or  $H_0: \pi_4 = 0$ , although the joint hypothesis  $H_0: \pi_3 \cap \pi_4 = 0$  can be rejected, which suggests that the case for seasonal unit roots at these frequencies is not compelling. The real benefit series was unavailable in a seasonally unadjusted format, and as such any seasonality that the data may have exhibited has been removed from the data. As such, it is not appropriate to use this methodology so a standard Augmented Dickey Fuller (ADF) test is employed. The ADF test tests whether for the significance of lags in the dependent variable in the following estimated model:

$$\Delta y_t = \alpha^{\wedge} + \sum_{n=1}^n \rho_n^{\wedge} y_{t-n} + e_t$$

Where  $n$  is the number of lags of the independent variable. If  $\Sigma \rho_n^{\wedge}$  are jointly significant, then a unit root is present.

For the benefit series we also include a constant and an augmentation including the 4<sup>th</sup>, 11<sup>th</sup>, 12<sup>th</sup> and 13<sup>th</sup> lags. The calculated ADF statistic is -4.74 against a critical value of -2.88, strongly suggests that the series is stationary.

Having investigated the univariate time series properties of the data, I now turn to the cointegration tests developed by Johansen (1988, 1991) to investigate whether there is empirical evidence of a long run, cointegrating relationship between the absence rate and the other series. From the results of the unit root tests it is known that absence can only be cointegrated with other non-stationary series (production and unemployment) and not with the stationary series (benefit level and wages). The empirical model suggested that the predicted effects of the latter two variables on the level of absence was ambiguous. Higher benefits push non-malfeasant workers into the malfeasant workers category, while pushing malfeasants into the voluntary unemployed category. Higher wages push some voluntary unemployed to become malfeasant workers and in turn push some malfeasant workers to become non-malfeasant. Hence being able to eliminate them is not without justification from the theoretical model.

Enders (1995) asserts that the Johansen procedure is nothing more than a multivariate extension of the Dickey Fuller test. However, rather than run a single equation, it runs a system of equations and generates a matrix of parameters and tests are directed towards the rank of this matrix to determine the number of cointegrating vectors in the system (this is done with maximal eigenvalue, or trace statistics). In addition the parameter values for the cointegrated system (assuming there are cointegrating vectors) are identified.

For these systems comprising of three non-stationary I(1) series, each with a deterministic seasonal component (i.e. seasonal dummy variation), the Johansen method is based on the following vector autoregression (VAR) specification:

$$z_t = \alpha + \Gamma s_t + \sum_{m=1}^M \Phi_m z_{t-m} + \varepsilon_t \quad (16)$$

Again,  $z_t = (a_t y_{t-1} u_t)$ ,  $\alpha = \{\alpha_i\}$  is a  $3 \times 1$  vector of intercepts,  $\Gamma = \{\gamma_{ij}\}$  is a  $3 \times 11$  matrix of coefficients and  $s_t = \{s_{jt}\}$  is a  $11 \times 1$  vector of seasonal dummies,  $\Phi_m = \{\phi_{ij}^m\}$  for  $i, j = 1 \dots 3$  and  $m = 1 \dots M$  where  $M$  is the maximum lag length and  $\varepsilon_t = (\varepsilon_{1t} \varepsilon_{2t} \varepsilon_{3t})$ .

Before the cointegration tests can be conducted, it is necessary to establish the appropriate lag structure of estimations of (16) setting  $M = M_0$  against  $M = M_1$ , with  $M=M_1$  against  $M=M_2$ , (where the subscript denotes the lag length of the dependent variable) etc. to a maximum of 8. Essentially all this does is test if the quality of the model is improved by adding successive lags. These tests show that the appropriate number of lags is 4<sup>4</sup>. This implies (16) can be reparameterised (with  $M = 4$ ) as:

$$\Delta z_t = \alpha + \Gamma s_t + \sum_{m=1}^3 \Psi_m \Delta z_{t-m} + \Theta z_{t-1} + \varepsilon_t \quad (17)$$

Where  $\Psi_m = \{\psi_{ij}^m\}$  and  $\Theta = \{\theta_{ij}\}$  are  $3 \times 3$  matrices of coefficients:

$$\psi_{ij}^{(1)} = -\phi_{ij}^{(2)} - \phi_{ij}^{(3)} - \phi_{ij}^{(4)}, \quad \psi_{ij}^{(2)} = -\phi_{ij}^{(3)} - \phi_{ij}^{(4)}, \quad \psi_{ij}^{(3)} = -\phi_{ij}^{(4)}; \quad \theta_{ij} = \sum \phi_{ij}^{(m)} - 1 \text{ for } i = j$$

$$\text{and } \theta_{ij} = \sum \phi_{ij}^{(m)} \text{ for } i \neq j.$$

---

<sup>4</sup> These results are available upon request.

The next issue to be addressed is the number of cointegrating vectors linking the various absence series, aggregate production and the level of unemployment. This depends on whether restrictions on  $r = \text{rank}(\Theta)$  can be imposed in (17). A single cointegrating vector, for instance,  $e_t = a_t - \beta_0 - \beta_1 y_{t-1} - \beta_2 u_t$ , requires  $r = 1$ . Johansen's methodology provides two alternative tests for  $r$ , the first based on maximal eigenvalues and the second based on trace statistics. The results of these tests can be found in Table 4.3 below.

**Table 4.3 Johansen Tests for Cointegration**

$H_0$	$H_1$	Maximal Eigenvalue	Trace statistic
$r = 0$	$r > 0$	45.45**	60.27**
$r \leq 1$	$r > 1$	9.58	14.82
$r \leq 2$	$r > 2$	5.24	5.24

In both tests,  $H_0: r = 0$  is decisively rejected in favour of  $H_1: r > 0$ , while tests of  $H_0: r \leq 1$  fail to reject in favour of  $H_1: r \geq 1$ . As expected, the tests also fail to reject  $H_0: r \leq 2$  in favour of  $H_1: r \geq 2$  (which it should on theoretical grounds based on the findings of the tests for stationarity). Overall the tests suggest quite strongly that there is a single cointegrating vector. Table 4.4 below shows the estimated coefficients of the single cointegrating vector. The important implication of this is that it allows for readily interpretable parameter values, in the sense that there is a single statistically important relationship between the different time series. If there are multiple cointegrating vectors, this implies that there are multiple relationships between the series and makes interpreting parameter values rather more difficult.

**Table 4.4 Coefficients of the Cointegrating Vector  $a_t = \beta_0 + \beta_1 Y_t + \beta_2 U_t + e_t$**

$\beta_0 = -1.3402$	$\beta_1 = -0.6204$	$\beta_2 = -0.1733$
Likelihood Ratio Tests:	(i) $H_0: \beta_1 = 0$	$\chi^2(1) = 12.51^{**}$
	(ii) $H_0: \beta_2 = 0$	$\chi^2(1) = 6.35^{**}$

**\*\*** denotes significance at the 5% level.

Both coefficients are negative and significant, which is consistent with the predictions from the theoretical model. There is a negative and inverse long term relationship between absence from work, aggregate production (our measure of labour demand) and the rate of unemployment (our measure of labour supply). The size of the test statistics suggests that demand factors are least as influential than supply factors, implying that earlier literature looking at absence and the business cycle has ignored a key component of this cycle.

I now proceed to estimate a vector autoregressive (VAR) model (which is maximum likelihood estimation of  $\Delta a_t$  for (17) with the restriction of  $r = 1$  (a single cointegrating vector) imposed. Table 4.5 displays these results.

**Table 4.5 Maximum Likelihood estimation of equation for  $\Delta a_t$  in (17)**

$$\Delta a_t = \alpha^{\wedge} + \sum \gamma^{\wedge}_{12j} s_{jt} - 0.46^{**} e_{t-1} \quad (0.11)$$

-0.31 <sup>**</sup> $\Delta a_{t-1}$	-0.29 <sup>**</sup> $\Delta a_{t-2}$	-0.29 <sup>**</sup> $\Delta a_{t-3}$
(0.10)	(0.09)	(0.07)
+0.28 $\Delta y_{t-2}$	+0.82 $\Delta y_{t-3}$	-0.68 $\Delta y_{t-4}$
(0.48)	(0.48)	(0.47)
+0.02 $\Delta u_{t-1}$	+0.07 $\Delta u_{t-2}$	+0.15 $\Delta u_{t-3}$
(0.09)	(0.10)	(0.09)

n = 175     $R^2 = 0.54$     Adj  $R^2 = 0.48$     s.e. regression = 0.0586  
 serial correlation:  $\chi^2(1) = 0.38$      $\chi^2(2) = 0.66$      $\chi^2(3) = 0.85$      $\chi^2(12) = 14.00$   
 heteroskedasticity:  $\chi^2(1) = 0.88 \times 10^{-8}$

Standard errors of estimated coefficients are reported in parentheses

<sup>\*\*</sup> denotes significance at the 5% level.

nb. Estimates of the constant and the seasonal dummies are not reported. Serial correlation are Ljung-Box statistics based on the autocorrelation function of the residuals. The heteroskedasticity test is a Lagrange Multiplier test based on an auxiliary regression of squared residuals on squared fitted values.

With the exception of the lags of the dependent variable, the error correction model does not reveal any strong short run dynamic effects; in particular, no significant negative coefficients for any of the lagged terms of  $\Delta y_t$ , are found, as the theoretical model suggested. This implies that absenteeism does not fluctuate in the short term to reflect changes in production (or unemployment) from period to period. However, the error correction term  $e_{t-1}$  is correctly signed (negative) and highly significant. The diagnostics suggest that the specification used is satisfactory (i.e. the lag structure is appropriate).

#### 4.5 Conclusion

In this chapter, I have investigated the determinants of aggregate employee absenteeism from both a theoretical and empirical perspective, using more modern techniques and incorporating labour demand factors to go along with the stylised fact that absenteeism is inversely related to the level of unemployment. The evidence presented in this chapter also adds to the wider and more extensive literature on the topic of malfeasance. By considering absenteeism as a phenomenon with a significant malfeasant component, and because absenteeism (in contrast with most other types of malfeasance) is readily observable, the data problems which typically prevent researchers from subjecting other theoretical models of shirking to empirical scrutiny can be side stepped.

This chapter not only adds to the limited quantity of work which examines absenteeism specifically, but also updates the empirical methods used in the examination of absenteeism through the business cycle. The previous literature on absenteeism and the business cycle has examined it strictly as a supply side phenomenon, which introduces an identification problem as it only models half of the market for reliable labour. In addition, the plots of the absence series suggest that there is a significant seasonal pattern to the level of absenteeism.

The tests developed by Hylleberg, *et al* (1990) and modified by Beaulieu and Miron (1993) are employed to examine the nature of the seasonal process that the data display.

The theoretical model takes a view of malfeasant absence from the employee's perspective, which is similar to the treatment of on-the-job shirking in the efficiency wage literature, typified by Shapiro and Stiglitz (1984). The incentive to be an absentee depends on job transition probabilities of dismissal for reasons other than absence (i.e. layoffs), dismissal due to detection as a malfeasant employee, and re-employment if dismissal occurs (irrespective of the cause of dismissal). However, in contrast with the efficiency wage literature (where unemployment is determined endogenously so as to regulate the incidence and intensity of shirking) both aggregate demand and unemployment are treated as exogenous determinants of these job transition probabilities, and therefore of absence.

During an upswing, the incentive to be a malfeasant absentee is low because the probability of dismissal for any reason other than malfeasance is minimal. Conversely, if the probability of being laid-off by the firm due to slack demand conditions is high (i.e. profits are less than some minimum value so the firm closes), the individual may be inclined to take more absence, given that they are going to be laid-off regardless of their attendance behaviour. If actual aggregate demand is higher (or lower) than expected, the employer may also adjust the level of monitoring of malfeasant absence as a way of ensuring sufficient labour is available to meet production requirements.

On the other hand, when unemployment is low, and work is easy to find, the cost to the employee of dismissal is low, which removes the main disincentive against being malfeasant. A particularly interesting feature of this model is that wages



have an indeterminate effect on the absence rate. A wage increase would shift some portion of malfeasants into the non-malfeasant category, which in isolation, would reduce absence. However, higher wages would draw some individuals out of unemployment and into malfeasant employment, which in isolation would increase the absence rate. The level of unemployment benefits has a similar ambiguous effect.

From the theoretical model it can be shown that when labour demand as well as labour supply influences on absence are considered, no clear *a priori* inferences are possible concerning cyclical patterns which might be expected in the absence rate.

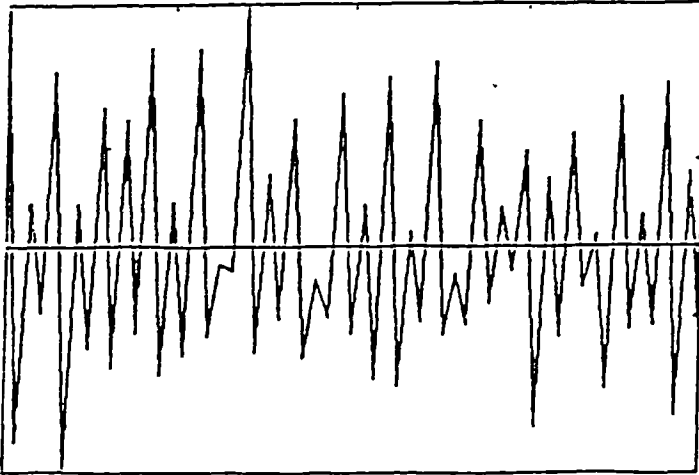
In the empirical analysis, monthly US time series data for the period 1979-1993 are used to test for the relationships between absence, production, unemployment, wages and benefits suggested in the theoretical model. Using methods developed by Hylleberg, *et al* (1990) and Beaulieu and Miron (1993) I test for the presence of seasonal and non-seasonal unit roots. Absence, production and unemployment are found to be integrated at order 1 (i.e. they are non-stationary) while wages and benefits, for which the theoretical model offers no *a priori* predictions, are found to be non-integrated series (i.e. they are stationary). As such the former series (absence, production and unemployment) are included in the subsequent cointegration analysis, while wages and unemployment benefits are excluded from the further analysis. The tests show that none of the series included in the cointegration analysis have evidence of a seasonal unit root at any frequency.

Using Johansen's (1988, 1991) approach evidence of a cointegrating relationship between absence, production and unemployment is found with the coefficients on unemployment and production being negative. This fits well with a theoretical model having the basic premise that both demand and supply side factors in the labour market are important in determining absence.

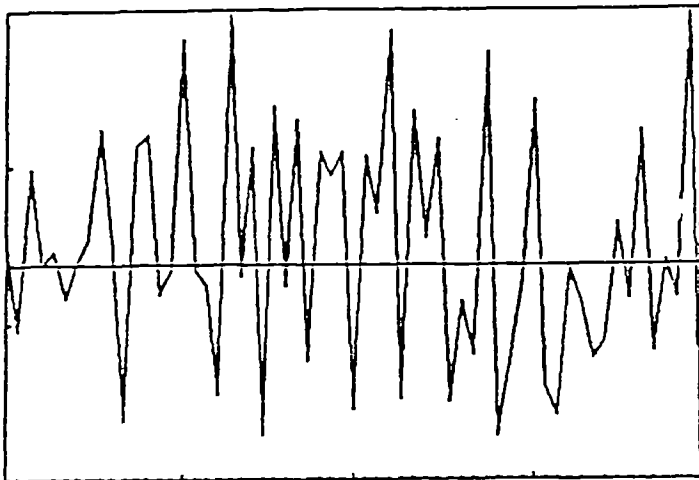
The model is also capable of explaining observed patterns of absence. Specifically, the recession of the early 1980s was marked by a very sharp rise in unemployment. This effect was much more striking than the fall in production that occurred during this same recession. Absenteeism fell during this recession because the workers feared a lengthy spell of unemployment if dismissed, and therefore sought to minimise the risk of dismissal. The production level, being somewhat smoother over this same period, did not necessitate firms altering their monitoring efforts in similar proportions. In effect the supply incentives dominated over the demand incentives, thus causing the sharp fall in absence we observe during this period. Subsequent to this period, the unemployment and production levels have been considerably more balanced and in turn there does not appear to be significant cyclical variation in the level of absence since the early 1980s.

# APPENDICES

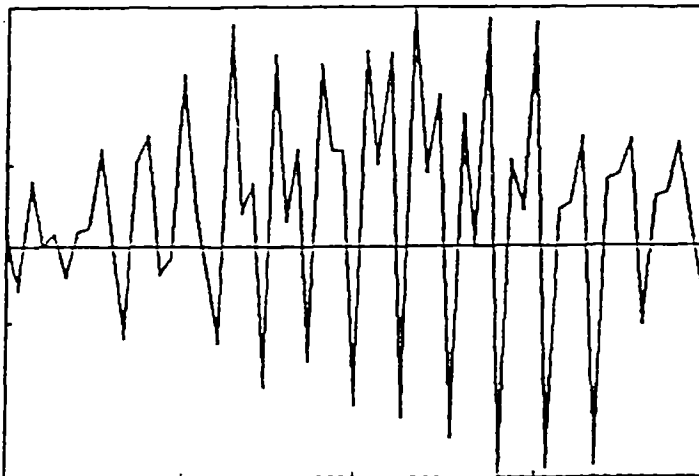
## Appendix 4.1 Simulated Seasonal Cycles



(a) DETERMINISTIC SEASONALITY  $z_t = \delta_0 + \sum_{j=2}^4 \delta_j s_{jt} + \varepsilon_t$



(b) STOCHASTIC STATIONARY SEASONALITY  $z_t = 0.8z_{t-4} + \varepsilon_t$



(c) STOCHASTIC NON-STATIONARY SEASONALITY  $z_t = z_{t-4} + \varepsilon_t$

## Appendix 4.2 Definition of Seasonal Variables

$$z_{1t} = (1 + B + B^2 + B^3 + B^4 + B^5 + B^6 + B^7 + B^8 + B^9 + B^{10} + B^{11})x_t$$

$$z_{2t} = (1 - B + B^2 - B^3 + B^4 - B^5 + B^6 - B^7 + B^8 - B^9 + B^{10} - B^{11})x_t$$

$$z_{3t} = -(B - B^3 + B^5 - B^7 + B^9 - B^{11})x_t$$

$$z_{4t} = -(1 - B^2 + B^4 - B^6 + B^8 - B^{10})x_t$$

$$z_{5t} = -1/2(1 + B - 2B^2 + B^3 + B^4 - 2B^5 + B^6 + B^7 - 2B^8 + B^9 + B^{10} - 2B^{11})x_t$$

$$z_{6t} = \sqrt{3}/2(1 - B + B^3 + B^4 + B^6 - B^7 + B^9 - B^{10})x_t$$

$$z_{7t} = 1/2(1 - B - 2B^2 - B^3 + B^4 + 2B^5 + B^6 - B^7 - 2B^8 + B^9 + B^{10} + 2B^{11})x_t$$

$$z_{8t} = -\sqrt{3}/2(1 + B - B^3 - B^4 + B^6 + B^7 - B^9 - B^{10})x_t$$

$$z_{9t} = -1/2(\sqrt{3} - B + B^3 + \sqrt{3}B^4 + 2B^5 - \sqrt{3}B^6 + B^7 - 2B^8 - B^9 + \sqrt{3}B^{10} - 2B^{11})x_t$$

$$z_{10t} = 1/2(1 - \sqrt{3}B + 2B^2 - \sqrt{3}B^3 + B^4 - B^6 + \sqrt{3}B^7 - 2B^8 + \sqrt{3}B^9 - B^{10})x_t$$

$$z_{11t} = 1/2(\sqrt{3} + B - B^3 - \sqrt{3}B^4 - 2B^5 - \sqrt{3}B^6 - B^7 + B^9 + \sqrt{3}B^{10} + 2B^{11})x_t$$

$$z_{12t} = -1/2(1 + \sqrt{3}B + 2B^2 - \sqrt{3}B^3 + B^4 - B^6 - \sqrt{3}B^7 - 2B^8 - \sqrt{3}B^9 - B^{10})x_t$$

## **Chapter Five: Absence, Seasonality and the Business Cycle: A Disaggregated Analysis**

### **5.1 Introduction**

Following the work in the previous chapter, this chapter extends the analysis of absence through the business cycle to a series of disaggregation exercises to examine the finding that absenteeism is affected by both supply (as proxied by unemployment) and demand (as proxied by aggregate industrial production) factors. In particular, the finding that demand factors also have a long-term relationship with employee absenteeism is worthy of further exploration.

The techniques and basic model that were developed in the previous chapter will be extended in three ways:

First, the data will be disaggregated into three broad sectors (manufacturing, service and public sector workers) to examine if the long-term inverse relationship between absenteeism and unemployment and aggregate production is consistent across different kinds of industries.

Second, workers will be divided into unionised and non-unionised groups. Again the relationship between absence and business cycle factors will be explored. The empirical question I seek to answer here is to whether or not individuals who receive

the benefit of union representation are affected by business cycle factors in a different way to those who do not have union protection.

There is a weakness in these analyses. In both of the previous analyses, there is no obvious way to disaggregate either the unemployment or the production series into measures that better reflect the labour supply and demand conditions for these specific workers. It is possible to disaggregate the production data into ten industrial sectors, which allow for a better matching of workers and their absence behaviour to demand factors that affect them. However, I will continue to use aggregate unemployment.

In the previous chapter it was demonstrated that absenteeism is influenced by both supply and demand side factors. The supply side is captured using the aggregate unemployment rate and the demand side (or firm factors) is proxied by industrial production. As was mentioned in the previous chapter, the idea of absenteeism being influenced by unemployment is not new. However, the empirical modelling of demand side factors has received relatively little attention, until now. In this chapter, I aim to investigate this relationship in more depth, and hopefully add some additional substance to the findings from the previous chapter.

Again, in each of the exercises, the basic empirical model and the estimation techniques employed in the previous chapter, in particular the Hylleberg, et al (1990) and Beaulieu and Miron (1993) tests for seasonal unit roots will be employed.

## **5.2 Seasonality and Absence**

The previous chapter also demonstrated that aggregate absence exhibits a highly seasonal pattern, with absence rates tending to be highest in the winter months (in particular, January and February) and lowest in the summer months (in particular July and August). This phenomenon is investigated further in this chapter. In particular, I make use of a methodology developed by HEGY (Hylleberg, Engle, Granger and Yoo, 1990) for analysing seasonal patterns in quarterly data which was in turn modified by Beaulieu and Miron (1993) for monthly data. Both sets of authors argue that incorrectly modeling an economic time series using seasonal ‘dummy’ variation may yield spurious results. The more seasonality the data display, the more crucial the seasonal pattern be correctly modeled.

## **5.3 Absence and the Business Cycle: Three Broad Sectors**

The key aim of this chapter is to examine the robustness of the relationship between absence and the business cycle. The first step will be to conduct a broader disaggregation, looking this time at three types of workers: manufacturing sector workers, service sector workers and public sector workers. Appendix 5.1 contains means and standard deviations of the absence series for each of these groups. Plots of

these absence series and descriptions of the patterns they display can be found in Appendix 5.2.

The first step in this analysis is to consider the seasonal properties of the absence series. Since we are continuing to use the fully aggregated production and unemployment series, the empirical results from the previous chapter (both series being non-stationary, with no seasonal unit roots) suggests that if the absence series are also non-stationary, then the possibility of a long-term cointegrating relationship exists.

Table 5.1 below shows the results of the Beaulieu-Miron adaptation of the HEGY procedure, in which the monthly absence series are tested for non-seasonal and seasonal unit roots, by running the following auxiliary regression:

$$z_{13t} = \gamma_0 + \gamma_1 t + \sum_{j=2}^{12} \gamma_j s_{jt} + \sum_{k=1}^{12} \pi_k z_{kt-1} + \sum_{h=1}^H \delta_h z_{13t-h} + \varepsilon_t \quad (1)$$

In this equation,  $z_{13t} = (1-\beta^{12})x_t$  where  $\beta$  is the lag operator. Again, the deterministic trend and/or the seasonal dummies are optional and significant lags are included to whiten the residuals.



**Table 5.1 Tests for Stationarity at all Frequencies for Manufacturing, Service and Public Sector Absenteeism**

	Manufacturing			Services			Public		
	I,T	I,S	I,T,S	I,T	I,S	I,T,S	I,T	I,S	I,T,S
<b>Lags</b>	3	2,3,8,1 0,15	2,3,8,1 1,15	-	2,3,10, 11,14, 15	2,3,10, 11,14, 15	2,3,8,9 ,14,15	2,3,7,8 ,9,10, 14,15	2,3,7,8 ,9,10, 14,15
t( $\pi_1$ )	-3.27	-4.11*	-3.54*	-2.27	-2.59	-2.53	-2.27	-2.55	-2.16
t( $\pi_2$ )	-3.50*	-2.23	-2.06	-3.22*	-3.78*	-3.77*	-3.40*	-2.31	-2.30
t( $\pi_3$ )	-3.54*	-3.43*	-3.46*	-3.89*	-3.36*	-3.20*	-2.85*	-3.97*	-3.91*
t( $\pi_4$ )	0.32	0.15	0.04	0.18	0.88	0.78	-0.72	-1.22	-1.22
t( $\pi_5$ )	-3.00*	-4.72*	-4.48*	-4.31*	-3.79*	-3.77*	-2.61*	-3.21*	-3.20*
t( $\pi_6$ )	0.44	0.40	0.47	0.95	-0.06	-0.01	0.94	0.62	0.62
t( $\pi_7$ )	-4.02*	-5.22*	-4.91*	-4.99*	-4.13*	-3.96*	-3.42*	-4.09*	-3.87*
t( $\pi_8$ )	0.72	0.85	0.74	0.30	0.42	0.46	0.65	0.72	0.75
t( $\pi_9$ )	-3.77*	-4.50*	-4.21*	-3.64*	-4.24*	-4.26*	-3.69*	-3.75*	-3.70*
t( $\pi_{10}$ )	0.70	0.86	0.92	-0.15	-0.58	-0.60	-0.84	-1.00	-1.00
t( $\pi_{11}$ )	-1.96*	-3.92*	-3.87*	-1.29	-4.01*	-4.10*	-2.57*	-2.95*	-2.94*
t( $\pi_{12}$ )	0.56	1.15	1.01	-0.51	-0.15	-0.07	0.22	0.80	0.80
F( $\pi_3 \cap \pi_4$ )	6.33*	7.80*	7.65*	7.58*	6.22*	5.55	4.26*	8.51*	8.37*
F( $\pi_5 \cap \pi_6$ )	4.60*	12.03*	11.29*	9.84*	7.22*	7.16*	4.25*	5.55	5.52
F( $\pi_7 \cap \pi_8$ )	8.45*	14.54*	13.32*	12.50*	8.87*	8.22*	6.62*	8.72*	8.00*
F( $\pi_9 \cap \pi_{10}$ )	7.41*	10.20*	9.22*	6.63*	9.18*	9.29*	7.43*	7.81*	7.61*
F( $\pi_{11} \cap \pi_{12}$ )	2.09*	8.09*	7.96*	0.97	8.21*	8.55*	3.30*	4.47	4.43
F( $\pi_1 \cap \gamma_1$ )	8.47*		7.64*	2.97		3.74	3.15*		3.23
Seas+ $\pi_2 - \pi_{12}$		6.02*	5.83*		5.85*	5.81		5.56	5.35
$\gamma_1$			.06			-3.78			-0.15
Seas			4.76*			3.03*			2.53

Failure to reject  $H_0: \pi_1 = 0$  against  $H_1: \pi_1 < 0$  indicates the presence of a unit root at zero frequency (a stochastic trend). Failure to reject  $\pi_k$  for  $k = 2$  or at least one element of each of the sets  $\{3,4\}$ ,  $\{5,6\}$ ,  $\{7,8\}$ ,  $\{9,10\}$ ,  $\{11,12\}$ , which can be tested

individually with t statistics or jointly with F statistics, means a seasonal unit root is present at that frequency.

In both the service and the public sectors, the acceptance of  $\pi_1 \cap \gamma_1 = 0$  in both the I,T and I,T,S specifications suggests that the correct specification is I,S. For manufacturing we are able to reject  $\pi_1 \cap \gamma_1 = 0$  for either of the I,T or I,T,S specifications. However we are also able to reject  $\text{Seas} + \pi_2 - \pi_{12} = 0$  in the I,T,S specification, suggesting that the seasonal dummies are significant and that the I,T,S specification is appropriate. In each of these cases we are able to reject the presence of a seasonal unit root at all frequencies. For both the service and public sector, we are unable to reject the presence of a unit root at zero frequency, suggesting that these series are non-stationary. For the manufacturing series  $\pi_1 = 0$  is rejected suggesting that the manufacturing series is stationary.

The non-stationarity of the relevant absence series implies the possibility of a cointegrating relationship between absence, aggregate production and the rate of unemployment for the service and public sector series. On the other hand, the stationarity of the manufacturing absence series would suggest there cannot be a cointegrating relationship in this case. However, the results of any individual unit root test are subject to the possibility of either a Type I error (rejecting a unit root which is actually present) or a Type II error (accepting that a unit root is present, when in fact this is not the case). As such, there is a case when dealing with several similar time

series for interpreting the overall pattern of the unit root tests in order to make a consistent decision, one way or the other, as to whether the series are stationary or non-stationary. Accordingly, I will treat the manufacturing series as I treat the public and service sector series. That is, it will be modeled with the I, S specification, and as if the presence of unit root at zero frequency could not be rejected, although acknowledging that there is some ambiguity in the results of the univariate seasonal unit root tests.

### *Cointegration Tests*

Having established evidence that the disaggregated series are non-stationary and with the strong evidence from the previous chapter that both the unemployment and the production series are also non-stationary, I will now proceed to an analysis of whether the series are cointegrated using the tests developed by Johansen (1988, 1991). Given the evidence that the seasonal factors are significant, and the rejection of the presence of a unit root at all monthly frequencies for each of the series, I include seasonal dummy variables for the months January through November in each specification, although the specific parameter values will not be reported.

For systems comprising three non-stationary  $I(1)$  series, each with a deterministic seasonal component (i.e. seasonal dummy variation), the Johansen method is based on the following vector autoregression (VAR) specification:

$$z_t = \alpha + \Gamma s_t + \sum_{m=1}^M \Phi_m z_{t-m} + \varepsilon_t \quad (2)$$

Again,  $z_t = (a_t y_{t-1} u_t)$ ,  $\alpha = \{\alpha_i\}$  is a 3x1 vector of intercepts,  $\Gamma = \{\gamma_{ij}\}$  is a 3x11 matrix of coefficients and  $s_t = \{s_{jt}\}$  is a 11x1 vector of seasonal dummies,  $\Phi_m = \{\phi_{ij}^m\}$  for  $i, j = 1 \dots 3$  and  $m = 1 \dots M$  where  $M$  is the maximum lag length and  $\varepsilon_t = (\varepsilon_{1t} \varepsilon_{2t} \varepsilon_{3t})$ .

Before the cointegration tests can be conducted, it is necessary to establish the appropriate lag structure of estimations of (2) setting  $M = M_0$  against  $M = M_1$ , with  $M=M_1$  against  $M=M_2$ , etc. starting from a maximum of 8. This procedure tests if the quality of the model is improved by adding successive lags. These tests<sup>1</sup> show that the appropriate number of lags is 8 for the manufacturing sector, 4 for the service sector and 3 for public sector. This implies (2) can be reparameterised as:

$$\Delta z_t = \alpha + \Gamma s_t + \sum_{m=1}^M \Psi_m \Delta z_{t-m} + \Theta z_{t-1} + \varepsilon_t \quad (3)$$

With  $M = 8, 4$  and  $3$  for manufacturing, service, and public sector absence, respectively.  $\Psi_m = \{\psi_{ij}^m\}$  and  $\Theta = \{\theta_{ij}\}$  are 3x3 matrices of coefficients. The coefficients are defined in the Chapter 4, equation (17).

---

<sup>1</sup> While the results of these tests are important, the actual figures are not particularly interesting. They are available upon request.

The next issue that must be addressed is the number of cointegrating vectors linking the various absence series, aggregate production and the level of unemployment. This depends on whether restrictions on  $r = \text{rank}(\Theta)$  can be imposed in (3). A single cointegrating vector, for instance,  $e_t = a_t - \beta_0 - \beta_1 y_{t-1} - \beta_2 u_t$ , requires  $r = 1$ . Johansen provides two alternative tests for  $r$ , the first based on the maximal eigenvalue statistic and the second based on the trace statistic. The results of these tests can be found in Table 5.2.

**Table 5.2 Johansen Tests for Cointegration**

<b><u>Manufacturing</u></b>			
$H_0$	$H_1$	Maximal Eigenvalue	Trace statistic
$r = 0$	$r > 0$	24.66**	33.32**
$r \leq 1$	$r > 1$	7.58	8.66
$r \leq 2$	$r > 2$	1.08	1.08
<b><u>Services</u></b>			
$H_0$	$H_1$	Maximal Eigenvalue	Trace statistic
$r = 0$	$r > 0$	37.42**	47.48**
$r \leq 1$	$r > 1$	8.95	10.07
$r \leq 2$	$r > 2$	1.12	1.12
<b><u>Public Sector</u></b>			
$H_0$	$H_1$	Maximal Eigenvalue	Trace statistic
$r = 0$	$r > 0$	51.30**	59.74**
$r \leq 1$	$r > 1$	7.91	8.44
$r \leq 2$	$r > 2$	0.53	0.53

\*\* Denotes statistical significance at 5%

Table 5.2 shows that in each of the sectors, the presence of zero cointegrating vectors ( $r = 0$ ) can be rejected at the 5% level. In addition, the hypotheses that there are multiple cointegrating vectors for these can also be rejected for each of the

sectors. The tests strongly conclude that there is a single cointegrating vector for each of these systems of equations.

Now that it has been established that there is strong evidence of a single cointegrating vector, the next step is to determine the direction and significance of the relationship between the production and unemployment series with the level of absence.

**Table 5.3 Estimated Cointegrating Relationship:  $a_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 U_t + e_t$**

**Manufacturing:**

$\beta_0 = -1.4118$	$\beta_1 = -0.64913$	$\beta_2 = -0.25604$
Likelihood Ratio Tests:	(i) $H_0: \beta_1 = 0$	$\chi^2(1) = 3.694^*$
	(ii) $H_0: \beta_2 = 0$	$\chi^2(1) = 3.272^*$

**Service Sector:**

$\beta_0 = 2.2946$	$\beta_1 = -0.41143$	$\beta_2 = -0.11862$
Likelihood Ratio Tests:	(i) $H_0: \beta_1 = 0$	$\chi^2(1) = 9.648^{**}$
	(ii) $H_0: \beta_2 = 0$	$\chi^2(1) = 4.852^{**}$

**Public Sector:**

$\beta_0 = -0.60958$	$\beta_1 = -0.55306$	$\beta_2 = -0.15232$
Likelihood Ratio Tests:	(i) $H_0: \beta_1 = 0$	$\chi^2(1) = 8.911^{**}$
	(ii) $H_0: \beta_2 = 0$	$\chi^2(1) = 3.474^*$

\*\* Denotes 5% statistical significance

\* Denotes 10% statistical significance

Table 5.3 provides strong evidence of inverse long-run relationships between absenteeism, and both aggregate production and unemployment. This finding is consistent with theoretical model and also with the empirical findings from the previous chapter. The findings for the service sector are the most robust, with both unemployment and aggregate production being negative and significant at the 5% level. In the public sector model, aggregate production is significant at the 5% level, while the effect of unemployment appears to be somewhat weaker, suggesting that demand side factors are relatively more important in influencing the attendance patterns of these kinds of workers. This could be interpreted in light of the (generally) higher levels of job security for public sector workers, *vis a vis*, workers in the private sector. Finally the coefficients for production and unemployment are not significant at 5% level tests for the manufacturing model, although both are significant at the 10% level. However, as discussed before, there is some concern about the validity of this result, given that the manufacturing absence series may be stationary. Nevertheless, the evidence presented in Table 5.3 suggests that there is a weak long-term relationship between absence and production and unemployment, although it should be viewed with this caveat in mind.

#### **5.4 Absence and the Business Cycle: Unionised and Non-unionised Workers**

Although the evidence from the analysis of three broad sectors suggests that both labour demand and labour supply factors have significant long run relationships with aggregate absenteeism, the evidence seemed to differ somewhat across broad industry

sectors. This suggests that workers in these sectors may be influenced somewhat differently by business cycle variables.

To extend this idea, the next step in this analysis will be to divide the workers into two broad categories: unionised and non-unionised workers and examine how the effects of business cycle factors on absence differ over these two types of workers. The basic hypothesis being put forward is that unionised workers should be in more secure positions, and as such, the “threat of the sack” may not exert such strong influence over attendance behaviour. Empirically, this would suggest that labour supply (unemployment) might not exert quite as strong an effect as it would on workers in less secure positions. This is the view taken by Chauhudry and Ng (1992). Allen (1984) also acknowledges this point, but also offers several alternative explanations as to why absenteeism among union members may be lower<sup>2</sup>.

Again, the CPS data will be used to construct the absence series, while the same unemployment and production series will be used in the cointegration analysis. As in the case of the broad sector models, it would be desirable to use data on unemployment and production more closely matched to the type of worker being considered. Clearly, the results would better reflect the effects of demand factors if the production series (in this case) could be divided into production from the unionised sector and production from the non-unionised sector. Unfortunately, this is not

---

<sup>2</sup> This is discussed in some depth in Chapter Two.



possible with the dataset at my disposal. In addition, it is unlikely that unemployment will affect all workers in the same way. Even in periods of severe recession, certain kinds of workers remain in high demand and one would not expect that this kind of worker would be affected in any meaningful way by changes in the level of unemployment generally. Recessions do not affect all industries, geographic regions or occupational categories in a uniform fashion. However, there is no obvious way in which the unemployment series can be broken down in a way that would better capture the actual labour market conditions that the individual worker is facing.

The CPS did not begin including questions regarding union status until January 1983, which means the data between January 1979 and December 1982 (48 months) is not useable in this analysis. Consequently, there is data for the period between January 1983 and December 1993 (132 months) for this section of the analysis. Plots of these absence series can be found in Appendix 5.3.

Following the same procedure as with the tests in the previous section, I begin by looking at the properties of the individual absence series to test for the presence of a unit root at frequency (1). In addition I test for the presence of seasonal unit roots by running the following auxiliary regression:

$$z_{13t} = \gamma_0 + \gamma_1 t + \sum_{j=2}^{12} \gamma_j s_{jt} + \sum_{k=1}^{12} \pi_k z_{kt-1} + \sum_{h=1}^H \delta_h z_{13t-h} + \varepsilon_t \quad (4)$$

In this equation,  $z_{13t} = (1-\beta^{12})x_t$  where  $\beta$  is the lag operator. Again, the deterministic trend and/or the seasonal dummies are optional and significant lags of the auxiliary regression are included to whiten the residuals.

**Table 5.4 Tests for Stationarity at all Frequencies for Union and Non-union Rates of Absenteeism**

lags	Union			Non-Union			5 % Critical values		
	I,T	I,S	I,T,S	I,T	I,S	I,T,S	I,T	I,S	I,T,S
	-	2,3,5,9, 10,14, 15	2,3,5,9, 10,14, 15	-	2,3,4,7, 8,10, 14, 15	2,3,4,7, 8,10, 14, 15			
$t(\pi_1)$	-3.03	-2.65	-2.58	-2.49	-1.73	-1.57	-3.27	-2.66	-3.21
$t(\pi_2)$	-2.95*	-3.22*	-3.20*	-2.84*	-2.39	-2.34	-1.86	-2.66	-2.66
$t(\pi_3)$	-4.33*	-2.55	-2.56	-2.24	-1.97	-1.98	-1.80	-3.11	-3.11
$t(\pi_4)$	-0.53	-1.81	-1.80	0.23	-0.08	-0.06	+/-1.86	+/-2.10	+/-2.09
$t(\pi_5)$	-4.12*	-3.38*	-3.36*	-3.41*	-2.81*	-2.80*	+/-1.86	+/-2.10	+/-2.09
$t(\pi_6)$	-0.29	-0.09	-0.11	1.42	0.53	0.53	+/-1.86	+/-2.10	+/-2.09
$t(\pi_7)$	-2.77*	-1.55	-1.57	-2.86*	-3.99*	-3.98*	+/-1.86	+/-2.10	+/-2.09
$t(\pi_8)$	1.61	2.71*	2.70*	-0.79	0.27	0.24	+/-1.86	+/-2.10	+/-2.09
$t(\pi_9)$	-3.95*	-3.50*	-3.42*	-3.75*	-3.73*	3.66*	+/-1.86	+/-2.10	+/-2.09
$t(\pi_{10})$	-1.41	-0.69	-0.70	-1.48	0.28	0.29	+/-1.86	+/-2.10	+/-2.09
$t(\pi_{11})$	-2.70*	-4.87*	-4.80*	-0.99	-2.91*	-2.90*	+/-1.86	+/-2.10	+/-2.09
$t(\pi_{12})$	0.26	0.83	0.87	0.22	-0.50	-0.51	+/-1.86	+/-2.10	+/-2.09
$F(\pi_3 \cap \pi_4)$	9.52*	4.67	4.68	2.53	1.94	1.96	2.89	5.73	5.71
$F(\pi_5 \cap \pi_6)$	8.55*	5.86*	5.76*	7.00*	4.21	4.19	2.89	5.73	5.71
$F(\pi_7 \cap \pi_8)$	5.64*	5.85*	5.87*	4.47	8.00*	7.94*	2.89	5.73	5.71
$F(\pi_9 \cap \pi_{10})$	9.24*	6.47*	6.21*	8.45*	6.95*	6.71*	2.89	5.73	5.71
$F(\pi_{11} \cap \pi_{12})$	3.66	11.88*	11.53*	6.51*	4.52	4.49	2.89	5.73	5.71
$F(\pi_1 \cap \gamma_1)$	5.29		3.61	3.10		1.54	5.83		5.53
Seas + $\pi_2$ - $\pi_{12}$		6.36*	6.16*		4.32*	3.99*		2.92	2.90

\* denotes significance at the 5% level.

A key point to note is that the new critical values of these parameters are required since the length of the sample period has changed. In line with the approach used in

the previous chapter, they are generated using a Monte-Carlo simulation of 10,000 replications of the auxiliary regression (4).

In common with the previous disaggregation analysis, the joint hypothesis of  $\pi_1 \cap \gamma_1 = 0$  is accepted in both the I,T and I,T,S specifications, while the hypothesis  $Seas \cap \pi_2 - \pi_{12} = 0$  is rejected in the I,S and I,T,S specifications. This suggests that the I,S specification best represents the data generating process.

Tests for stationarity at frequency (1) narrowly accepts the hypothesis that the unionised absence series is non-stationary. Tests for stationarity in the non-unionised series much more clearly accept the hypothesis of non-stationarity. In the tests for the remaining frequencies the hypothesis of a seasonal unit root in the non-unionised series cannot be rejected at frequency {3,4} which is cause for some concern. As before we could attribute this result to an isolated Type II error affecting one of a large number of similar tests. The analysis will proceed to examine whether there is cointegration in these two systems of equations, but the final conclusions may need to be qualified in light of the failure to reject the presence of seasonal unit roots at all frequencies for the non-unionised absence series<sup>3</sup>.

---

<sup>3</sup> Although there is some reservation about the forthcoming results due to the inability to reject the presence of seasonal unit roots at all frequencies, this is not a problem upon which we should dwell. Thus far in the analysis we have tested absence series at the aggregate and disaggregated in several ways. Only one possible seasonal unit root is found, suggesting that this is not a significant problem in the data.

Following the procedure of the previous section, having established that the absence series are I(1) the next step is to use the Johansen tests for cointegration. This first involves re-estimating (2) to determine the appropriate lag length by testing the removal of successive lags from the model until there this process removes a lag that is offers significant predictive power to the model. There are 7 and 6 significant lags for the unionised and non-unionised series, respectively<sup>4</sup>. This means that (2) can be reparameterised as in (3) with  $k = 7$  for the unionised series and  $k = 6$  for the non-unionised series.

Next, the Johansen Maximal Eigenvalue and trace statistics are calculated to determine the number of cointegrating vectors. The results are displayed below in Table 5.5

**Table 5.5 Johansen Tests for Cointegration**

<b><u>Unionised</u></b>			
$H_0$	$H_1$	Maximal eigenvalue	Trace statistic
$r = 0$	$r > 0$	29.39**	35.44**
$r \leq 1$	$r > 1$	5.93	6.04
$r \leq 2$	$r > 2$	0.11	0.11
<b><u>Non-Unionised</u></b>			
$H_0$	$H_1$	Maximal eigenvalue	Trace statistic
$r = 0$	$r > 0$	40.31**	49.52**
$r \leq 1$	$r > 1$	8.94	9.22
$r \leq 2$	$r > 2$	0.28	0.28

\*\* Denotes significance at the 5% level.

<sup>4</sup> Again, the results of these tests are available upon request.

Again, the evidence of a single cointegrating vector for both these systems of equations is compelling. Both tests robustly reject the null hypotheses of zero cointegrating vectors. The tests also reject the hypotheses of multiple cointegrating vectors in favour of the null hypotheses of a single cointegrating vector.

Having established that there is a single cointegrating vector, the next step is to determine the direction and significance of the relationships between production and unemployment series and the unionised and non-unionised absence series. These are displayed in Table 5.6

**Table 5.6 Estimated Cointegrating Relationship:  $a_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 U_t + e_t$**

**Unionised Workers:**

$\beta_0 = 2.8864$	$\beta_1 = -0.24354$	$\beta_2 = -0.06798$
Likelihood Ratio Tests:	(i) $H_0: \beta_1 = 0$	$\chi^2(1) = 3.138^*$
	(ii) $H_0: \beta_2 = 0$	$\chi^2(1) = 1.3887$

**Non-Unionised Workers:**

$\beta_0 = 4.1607$	$\beta_1 = -0.04746$	$\beta_2 = -0.09362$
Likelihood Ratio Tests:	(i) $H_0: \beta_1 = 0$	$\chi^2(1) = 0.379$
	(ii) $H_0: \beta_2 = 0$	$\chi^2(1) = 6.950^{**}$

\*\* Denotes 5% statistical significance

\* Denotes 10% statistical significance

The results of this portion of the analysis suggest that the relationship between absence and the business cycle depends very much on the kind of worker in question. Unionised workers do not seem to be influenced by unemployment (the labour supply variable). However the coefficient on the production series (the labour demand variable) is negative (as expected) and significant at the 10% level. Conversely, the non-unionised absence series is not affected by production, while the coefficient on unemployment is negative and significant at the 5% level. This suggests that “the fear of the sack” does not have any discernible effect on unionised workers. This seems plausible, given that one would think of a unionised worker having greater protection against a layoff, suggesting that they would have little reason to change their attendance patterns as a result of changing labour market conditions. However, the production series shows an inverse long-term relationship with absenteeism. This suggests that unionised workers do respond to the urgency of the firms’ demand for their services. An explanation of this may be that there is some implicit deal between unions and management whereby the union delivers the necessary labour when demand is high, but firms are more lenient with respect to attendance, when demand is slack.

The production series does not appear to have any long-term effect on the absence series for non-unionised workers. This suggests that firms’ urgency of demand for their services has no influence on the attendance patterns of non-unionised workers. There is strong evidence, however, of a long term inverse relationship between

unemployment and absenteeism, suggesting that non-unionised workers do alter their attendance patterns when the consequences of losing their job increases.

### **5.5 Absence and the Business Cycle: 10 Industrial Sectors**

Taking the analysis from the previous sections one step further, this section extends the study to examine 10 industrial sectors for which production series can be identified. The basic premise of this section is to further explore the nature of the relationship between absenteeism and aggregate production.

Again, the absence series in this analysis are derived from industrial sector codes from the (CPS). There are two principal limitations to the data in this study. First, not all workers in the original series could be included in the disaggregation exercise. Unfortunately, monthly aggregate production figures are only available for a relatively small number of industries. In fact there are no monthly measures of production in the service sector so these workers had to be removed from the sample. In addition, all public sector workers (also included in the study in the previous chapter) had to be removed. Furthermore, for several other industries where industrial production figures are available, there were simply not enough individuals in the CPS working in this particular industry to derive a reliable monthly series of absence rates. There were, however 10 industries for which it was possible to construct reasonably reliable sectoral absence series and in turn, link this information to an industry level measure of aggregate production. These are (with abbreviations

in parentheses): Machinery (MAC), Wood and Wood Products (WWP), Paper and Paper Products (PPP), Food, Beverage and Tobacco (FBT), Electrical Machinery (EM), Transport Equipment (TE), Chemicals, Rubbers and Plastics (CRP), Basic Metals (BM), Textiles, Clothing and Leather (TCL) and Electricity, Gas and Water (EGW).

A second limitation is that it is not possible to construct a monthly unemployment rate for workers in each industry. Instead, what is used here is the same aggregate unemployment rate that was used in the previous sections of this chapter. To some extent this is reasonable since once a worker becomes unemployed, he or she is no longer tied to any particular industry. Therefore an industry specific unemployment rate, even if it existed, would not necessarily be very informative.

As the disaggregated absence series use much smaller samples in their construction it is worthwhile to examine the plots of these series closely to investigate how they differ from the plots of the aggregated series. The plots of these series and a brief analysis of each can be found in Appendix 5.4

Overall the early portion of the data period displays a fairly consistent pattern of decline in the rate of absence across most industries. This tends to be followed by a period of relatively low volatility in the absence series through the mid 1980's with



cyclical patterns becoming less clear and the volatility of the series increasing through the late 1980's and early 1990's.

The most striking feature of the disaggregated plots is that they are much more volatile than their aggregated counterparts. This leads to the simple conclusion is that working with disaggregated absence series based on much smaller samples of workers than previously used leads to a rather less reliable absence time series.

The seasonal patterns tend to suggest that there are absence peaks in the winter months of the series, which are particularly pronounced from 1979-86 and rather less so thereafter. The seasonal troughs tend to be rather less pronounced. However, absence does tend to be lower in the summer months, although again this is less obvious in the later period of the sample. This may reflect the overall sampling pattern of the CPS which saw it make rather considerable reductions in the number of individuals it surveyed in each period through the late 1980s and early 1990s. This has subsequently resulted in relatively smaller samples to use in the disaggregated absence series. In addition, there was a pronounced shift in the composition of the workforce through the 1980s with an increasing proportion of workers employed in the service sector and corresponding decline in the number and proportion employed in the manufacturing sector. In essence any seasonal or cyclical patterns appear, at least visually, to be overwhelmed by the increased volatility that results from building up an "aggregate" measure from a small sample.

### *Tests for Unit roots and Seasonal Unit Roots*

In the following tables the Beaulieu-Miron adaptation of the HEGY methodology<sup>5</sup> is again used to test for the presence of Unit roots in each of the 10 absence and production series using the auxiliary regression (1). Under each data generating process<sup>6</sup> up to 15 lags of the dependent variable were tested for significance. Those that were significant at the 95% level were included in the tests for stationarity and the presence of seasonal unit roots to whiten the residuals. These tests have three principal objectives. First, it tests for the presence of a non-seasonal unit root in  $t(\pi_1)$ . Second, it tests for the presence of seasonal unit roots in  $t(\pi_2)$  and  $F(\pi_3 \cap \pi_4)$ ,  $F(\pi_5 \cap \pi_6)$ ,  $F(\pi_7 \cap \pi_8)$ ,  $F(\pi_9 \cap \pi_{10})$ ,  $F(\pi_{11} \cap \pi_{12})$ . To reject the presence of seasonal unit roots at all frequencies  $t(\pi_2)$  as well as each of the F-tests must be significant<sup>7</sup>. Finally, it also tests for the data generating process that best describes the time series through  $t(\gamma_1)$ , which tests for the significance of the trend;  $F(\pi_1 + \gamma_1)$ , which tests for the joint significance of  $t(\pi_1)$ , and the trend;  $F(\gamma_j)$  which tests for the joint significance of the seasonal dummies.; and  $F(\gamma_j \cap \pi_k)$ , which tests for the joint significance of the seasonal dummies and  $t(\pi_2)$  to  $t(\pi_{12})$ .

---

<sup>5</sup> This methodology is explained in depth in the previous chapter.

<sup>6</sup> I is Intercept alone; I,T is Intercept and Trend, I,S is Intercept and Seasonal Dummies and I,T,S is Intercept, Seasonal dummies and Trend.

<sup>7</sup> Due to the number of tables in this analysis, the statistics directed towards  $\pi_3$ - $\pi_{12}$  are omitted, these tables rely on the F-tests directed towards the joint significance of the elements {3,4}, {5,6}, {7,8}, {9,10} and {11,12}.

The tables below show these results for all three tests. The first step is to identify the DGP. The idea is to establish which DGP best explains each of the absence, and production series. Then the chosen specification will be tested (for each industry) for the presence of normal and seasonal unit roots. The DGP results will be highlighted below the tables for each series and the tests for stationarity at all frequencies will be displayed in the summary Table 5.8

**Table 5.7a Tests for Stationarity<sup>8</sup>: Machinery (MAC)**

	Absence				Production			
	I	I,T	I,S	I,T,S	I	I,T	I,S	I,T,S
lags	1,4,11, 13	1,2,13, 14	1,4,13, 14	1,2,13, 14	1,11,13	1,11,13	0	0
t( $\pi_1$ )	-1.04	-4.20*	-1.11	-4.26*	-0.41	-2.51	-0.43	-2.76
t( $\pi_2$ )	-4.79*	-5.25*	-3.48*	-4.98*	-2.21	-2.17	-3.72*	-3.80*
F( $\pi_3 \cap \pi_4$ )	6.90*	8.74*	8.19*	7.11*	2.31	2.38	12.84*	13.57*
F( $\pi_5 \cap \pi_6$ )	19.16*	16.91*	17.54*	14.52*	1.25	1.20	13.76*	14.21*
F( $\pi_7 \cap \pi_8$ )	4.57	3.28	10.54*	4.11	1.22	1.24	18.51*	18.41*
F( $\pi_9 \cap \pi_{10}$ )	27.11*	23.00*	20.56*	20.19*	8.22*	8.16*	8.08*	8.44*
F( $\pi_{11} \cap \pi_{12}$ )	4.04	6.67	10.08	8.72	0.66	0.98	25.19	25.39
t( $\gamma_1$ )	-	-3.63*	-	3.71*	-	2.48	-	2.73
F( $\pi_1 + \gamma_1$ )	-	8.81*	-	9.08*	-	3.15	-	3.83
F( $\gamma_j$ )	-	-	0.91	0.76	-	-	20.69*	21.42*
F( $\gamma_j \cap \pi_k$ )	-	-	7.18*	7.29*	-	-	168.41*	175.77*

- The absence series is I,T. The production series is I,S

<sup>8</sup> Note that in all tables containing the Beaulieu Miron tests, \* denotes that the series is significant at the 5% level.

**Table 5.7b Tests for Stationarity: Wood and Wood Products (WWP)**

	Absence				Production			
	I	I,T	I,S	I,T,S	I	I,T	I,S	I,T,S
lags	0	0	0	12	1,12,13	1,12,13	0	0
$t(\pi_1)$	-2.40	-4.24*	-2.42	-4.51*	-1.33	-2.42	-0.86	-2.24
$t(\pi_2)$	-4.56*	-4.69*	-4.55*	-4.92*	-1.08	-1.08	-4.26*	-4.30*
$F(\pi_3 \cap \pi_4)$	8.49*	9.08*	8.78*	10.64*	2.32	2.29	15.86*	16.03*
$F(\pi_5 \cap \pi_6)$	12.94*	13.85*	13.89*	15.87*	4.16*	4.27*	11.58*	11.79*
$F(\pi_7 \cap \pi_8)$	9.26*	9.94*	9.91*	12.02*	2.21	2.07	10.58*	10.50*
$F(\pi_9 \cap \pi_{10})$	15.04*	16.16*	16.46*	18.70*	1.82	1.82	26.88*	27.21*
$F(\pi_{11} \cap \pi_{12})$	16.69*	17.19*	16.07*	17.82*	0.37	0.37	13.41*	14.04*
$t(\gamma_1)$	-	-3.49*	-	-3.48*	-	2.02	-	2.10
$F(\pi_1 + \gamma_1)$	-	9.16*	-	10.23*	-	2.93	-	2.59
$F(\gamma_j)$	-	-	-1.36	1.06	-	-	40.51*	41.48*
$F(\gamma_j \cap \pi_k)$	-	-	6.43*	4.27*	-	-	91.74*	93.03*

- The absence series is I,T. The production series is I,S.

**Table 5.7c Tests for Stationarity: Paper and Paper Products (PPP)**

	Absence				Production			
	I	I,T	I,S	I,T,S	I	I,T	I,S	I,T,S
lags	0	0	7	0	1,2,12, 13	1,4,6,7	0	0
$t(\pi_1)$	-2.86*	-2.92	-2.54	-2.94	-1.67	-1.72	-1.19	-0.82
$t(\pi_2)$	-3.17*	-3.11*	-3.70*	-3.38*	-1.12	-1.07	-3.62*	-3.62*
$F(\pi_3 \cap \pi_4)$	11.00*	10.72*	10.13*	10.99*	1.17	3.19*	17.21*	17.20*
$F(\pi_5 \cap \pi_6)$	11.65*	11.39*	15.14*	13.18*	2.40	3.01*	8.54*	8.52*
$F(\pi_7 \cap \pi_8)$	12.08*	12.19*	11.41*	13.09*	2.74	1.45	8.08*	8.10*
$F(\pi_9 \cap \pi_{10})$	9.84*	9.72*	7.08*	10.80*	0.45	1.76	19.11*	19.06*
$F(\pi_{11} \cap \pi_{12})$	12.63*	13.02*	15.69*	16.74*	0.77	0.59	14.49*	14.50*
$t(\gamma_1)$	-	0.39	-	0.43	-	1.21	-	0.47
$F(\pi_1 + \gamma_1)$	-	4.43	-	4.51	-	2.49	-	0.82
$F(\gamma_j)$	-	-	1.52	1.29	-	-	22.28*	22.00*
$F(\gamma_j \cap \pi_k)$	-	-	6.44*	6.36*	-	-	31.67*	30.92*

- The absence series is I. The production series is I,S.

**Table 5.7d Tests for Stationarity: Food, Beverage and Tobacco (FBT)**

lags	Absence				Production			
	I	I,T	I,S	I,T,S	I	I,T	I,S	I,T,S
	0	0	0	0	1,2,10, 12,14	1,2,10, 12,15	0	0
$t(\pi_1)$	-3.38*	-3.32*	-3.41*	-3.35*	-1.60	0.06	-1.45	-0.93
$t(\pi_2)$	-2.65*	-2.64*	-3.02*	-3.01*	-0.84	-0.80	-3.46*	-3.46*
$F(\pi_3 \cap \pi_4)$	9.91*	9.79*	9.54*	9.42*	3.07*	1.05	21.18*	21.28*
$F(\pi_5 \cap \pi_6)$	12.13*	11.97*	12.22*	12.03*	3.26	.91	19.95	19.98
$F(\pi_7 \cap \pi_8)$	11.65*	11.44*	12.87*	12.65*	2.51	1.47	12.36	12.37
$F(\pi_9 \cap \pi_{10})$	12.83*	12.69*	12.59*	12.43*	3.72	0.25	14.46	14.50
$F(\pi_{11} \cap \pi_{12})$	11.94*	11.80*	13.42*	13.29*	3.61	0.46	6.95	7.08
$t(\gamma_1)$	-	0.48	-	0.52	-	-0.25	-	0.73
$F(\pi_1 + \gamma_1)$	-	5.80	-	5.92*	-	0.80	-	1.31
$F(\gamma_j)$	-	-	0.95	0.95	-	-	15.30	15.29
$F(\gamma_j \cap \pi_k)$	-	-	6.51*	6.40*	-	-	9.48*	9.47*

- The absence series is I. The production series is I,S.

**Table 5.7e Tests for Stationarity: Electrical Machinery (EM)**

lags	Absence				Production			
	I	I,T	I,S	I,T,S	I	I,T	I,S	I,T,S
	0	0	0	0	1,2,5,8, 12,13	1,2,3,5, 8,12,13 ,15	2,5,9, 11	2,5,9
$t(\pi_1)$	-2.58	-3.00	-2.57	-2.97	0.23	-3.42	0.59	-3.11
$t(\pi_2)$	-3.83*	-3.85*	-3.85*	-3.87*	-1.20	-0.83	-4.41*	-4.27*
$F(\pi_3 \cap \pi_4)$	14.88*	15.08*	14.59*	14.79*	2.06	2.00	6.33*	6.90*
$F(\pi_5 \cap \pi_6)$	8.16*	8.29*	8.39*	8.50*	1.21	1.64	15.98*	14.33*
$F(\pi_7 \cap \pi_8)$	10.16*	10.80*	11.15*	11.35*	1.63	1.56	2.73	4.05
$F(\pi_9 \cap \pi_{10})$	9.02*	9.11*	8.66*	8.74*	1.34	0.96	25.23*	23.64*
$F(\pi_{11} \cap \pi_{12})$	17.24*	17.43*	18.24*	18.38*	2.65	1.53	16.19*	18.55*
$t(\gamma_1)$	-	-1.52	-	-1.70	-	3.76	-	3.17
$F(\pi_1 + \gamma_1)$	-	4.52	-	4.44	-	6.00*	-	5.07
$F(\gamma_j)$	-	-	0.63	0.64	-	-	12.55*	12.25*
$F(\gamma_j \cap \pi_k)$	-	-	6.34*	6.41*	-	-	16.03*	15.72*

- The absence series is I. The production series is I,T,S.

**Table 5.7f Tests for Stationarity: Transport Equipment (TE)**

lags	Absence				Production			
	I	I,T	I,S	I,T,S	I	I,T	I,S	I,T,S
	6	1,6,13	6	6	1,6,7, 12, 13	1,12,13	1,10,12	1
$t(\pi_1)$	-3.29*	-3.39*	-3.32*	-3.26*	-1.96	-2.50	-1.65	-1.63
$t(\pi_2)$	-2.30*	-1.88*	-3.61*	-3.70*	-0.09	-0.10	-1.79	-2.40
$F(\pi_3 \cap \pi_4)$	15.82*	15.77*	16.17*	15.56*	2.24	2.12	10.18*	8.81*
$F(\pi_5 \cap \pi_6)$	7.16*	7.97*	9.08*	9.41*	0.33	0.31	7.33*	7.53*
$F(\pi_7 \cap \pi_8)$	7.41*	9.32*	9.08*	9.38*	0.54	0.45	7.72*	10.62*
$F(\pi_9 \cap \pi_{10})$	20.44*	10.49*	21.49*	20.56*	0.21	0.23	6.13*	4.79
$F(\pi_{11} \cap \pi_{12})$	14.75*	15.13*	13.93*	13.04*	1.34	1.64	9.83*	8.83*
$t(\gamma_1)$	-	-1.45	-	-1.03	-	1.85	-	1.34
$F(\pi_1 + \gamma_1)$	-	5.91*	-	6.05*	-	3.66	-	1.35
$F(\gamma_j)$	-	-	1.70	1.73	-	-	4.44*	6.20*
$F(\gamma_j \cap \pi_k)$	-	-	7.83*	7.78*	-	-	6.16*	4.43*

- The absence series is I. The production series is I,S.

**Table 5.7g Tests for Stationarity: Chemicals, Rubbers and Plastics (CRP)**

lags	Absence				Production			
	I	I,T	I,S	I,T,S	I	I,T	I,S	I,T,S
	1,13	0	0	0	1,6,7,1 2,13	1,6,7,1 2,13	1,6,8, 11	1,6,7
$t(\pi_1)$	-3.65*	-3.84*	-3.65*	-4.12*	-0.27	-2.65	0.5	-1.62
$t(\pi_2)$	-3.54*	-2.89*	-3.00*	-3.07*	-0.45	-0.42	-3.05*	-1.93
$F(\pi_3 \cap \pi_4)$	9.49*	9.64*	9.66*	9.81*	1.04	10.28*	10.28*	9.63*
$F(\pi_5 \cap \pi_6)$	13.21*	12.64*	12.80*	13.13*	0.89	4.45	4.45	4.33
$F(\pi_7 \cap \pi_8)$	16.56*	16.87*	17.26*	17.89*	2.78	3.61	3.61	2.67
$F(\pi_9 \cap \pi_{10})$	15.07*	14.14*	13.53*	13.72*	0.95	6.38	6.38	11.98
$F(\pi_{11} \cap \pi_{12})$	10.24*	12.52*	15.31*	16.49*	0.15	23.02*	23.03*	16.86*
$t(\gamma_1)$	-	-1.66	-	-1.85	-	2.65	-	1.63
$F(\pi_1 + \gamma_1)$	-	7.40*	-	8.49*	-	3.56	-	1.34
$F(\gamma_j)$	-	-	8.08*	1.43*	-	-	8.08*	7.17*
$F(\gamma_j \cap \pi_k)$	-	-	8.78*	9.06*	-	-	5.58*	4.88*

- The absence series is I. The production series I,S.

**Table 5.7h Tests for Stationarity: Basic Metals (BM)**

	Absence				Production			
	I	I,T	I,S	I,T,S	I	I,T	I,S	I,T,S
lags	7	0	7	0	1,11,13	0	0	1,11,13
$t(\pi_1)$	-2.97*	-3.05	-2.93*	-3.06	-3.30*	-3.48*	-3.19*	-3.13*
$t(\pi_2)$	-3.69*	-3.14*	-3.74*	-3.16*	-2.41*	-2.39*	-3.97*	-3.94*
$F(\pi_3 \cap \pi_4)$	8.76*	8.52*	9.89*	9.32*	1.67	1.62	12.90*	12.70*
$F(\pi_5 \cap \pi_6)$	12.24*	11.31*	13.28*	11.77*	6.53*	6.45*	15.87*	15.70*
$F(\pi_7 \cap \pi_8)$	7.51*	9.20*	7.49*	9.22*	2.98*	2.82	13.90*	13.94*
$F(\pi_9 \cap \pi_{10})$	6.90*	9.04*	6.71*	9.02*	4.03*	4.07*	16.43*	16.21*
$F(\pi_{11} \cap \pi_{12})$	10.20*	8.40*	11.59*	9.35*	4.06*	4.57*	13.01*	12.91*
$t(\gamma_1)$	-	-1.28	-	-1.28	-	1.82	-	1.00
$F(\pi_1 + \gamma_1)$	-	5.37	-	5.39	-	7.20	-	5.59
$F(\gamma_j)$	-	-	0.98	-0.78	-	-	12.13*	12.07*
$F(\gamma_j \cap \pi_k)$	-	-	5.62*	5.39*	-	-	114.62*	107.68*

- The absence series is I. The production series is I,S.

**Table 5.7i Tests for Stationarity: Textiles, Clothing and Leather (TCL)**

	Absence				Production			
	I	I,T	I,S	I,T,S	I	I,T	I,S	I,T,S
lags	12	0	0	0	1,2,5,7, 12,13	1,2,5,7, 12,13	1,5,7	1,5,7
$t(\pi_1)$	-2.85*	-3.26	-2.99*	-3.81*	-2.89*	-3.30*	-2.75*	-2.93
$t(\pi_2)$	-3.12*	-3.62*	-4.18*	-4.25*	-0.84	-0.83	-2.73*	-2.68
$F(\pi_3 \cap \pi_4)$	5.46*	11.00*	13.40*	14.15*	0.73	0.71	8.54*	8.51*
$F(\pi_5 \cap \pi_6)$	3.78*	7.57*	10.24*	10.86*	1.74	1.72	5.20	5.10
$F(\pi_7 \cap \pi_8)$	5.53*	9.24*	13.14*	14.18*	1.89	1.80	1.88	1.91
$F(\pi_9 \cap \pi_{10})$	5.96*	8.66*	12.96*	13.60*	2.74	2.77	6.59*	6.55*
$F(\pi_{11} \cap \pi_{12})$	6.73*	10.68*	12.99*	14.83*	0.33	0.30	21.53*	20.74*
$t(\gamma_1)$	-	-1.93	-	-2.36	-	1.56	-	1.05
$F(\pi_1 + \gamma_1)$	-	5.47*	-	7.40*	-	5.43	-	4.34
$F(\gamma_j)$	-	-	3.22	3.43	-	-	5.26*	5.12*
$F(\gamma_j \cap \pi_k)$	-	-	7.45*	7.91*	-	-	8.23*	8.03*

- The absence series is I. The production series is I,S.

**Table 5.7j Tests for Stationarity: Electricity, Gas and Water (EGW)**

	Absence				Production			
	I	I,T	I,S	I,T,S	I	I,T	I,S	I,T,S
lags	2,9	0	4	0	2,11	0	1,5	1,5
$t(\pi_1)$	-2.94*	-3.56*	-2.98*	-3.46*	0.84	-1.91	0.06	-2.53
$t(\pi_2)$	-4.09*	-3.34*	-2.99*	-3.27*	-2.02*	-4.06*	-3.58	-3.48*
$F(\pi_3 \cap \pi_4)$	5.66*	13.15*	11.03*	12.89*	2.09	8.36*	16.16*	15.40*
$F(\pi_5 \cap \pi_6)$	9.46*	16.70*	14.25*	16.62*	3.45*	13.16*	14.89*	14.51*
$F(\pi_7 \cap \pi_8)$	8.97*	10.12*	8.65*	10.38*	0.28	0.20	14.83*	15.97*
$F(\pi_9 \cap \pi_{10})$	13.78*	13.29*	12.55*	13.33*	1.78	10.80*	9.90*	9.60*
$F(\pi_{11} \cap \pi_{12})$	13.82*	10.27*	11.57*	11.32*	0.89	1.25	13.52*	14.04*
$t(\gamma_1)$	-	-1.56	-	-1.44	-	2.56	-	2.73
$F(\pi_1 + \gamma_1)$	-	6.34*	-	5.99*	-	3.54	-	3.72
$F(\gamma_j)$	-	-	0.57	0.66	-	-	8.49*	8.76*
$F(\gamma_j \cap \pi_k)$	-	-	6.20*	6.58*	-	-	7.98*	8.14*

- The absence series is I. The production series is I,S.

**Table 5.7k 5% Critical Values**

	I	I,T	I,S	I,T,S
$t(\pi_1)$	-2.79	-3.29	-2.74	-3.23
$t(\pi_2)$	-1.86	-1.86	-2.71	-2.73
$F(\pi_3 \cap \pi_4)$	2.93	2.97	5.99	5.99
$F(\pi_5 \cap \pi_6)$	2.93	2.97	5.99	5.99
$F(\pi_7 \cap \pi_8)$	2.93	2.97	5.99	5.99
$F(\pi_9 \cap \pi_{10})$	2.93	2.97	5.99	5.99
$F(\pi_{11} \cap \pi_{12})$	2.93	2.97	5.99	5.99
$t(\gamma_1)$	-	+/- 3.03	-	+/- 2.94
$F(\pi_1 + \gamma_1)$	-	5.91	-	5.67
$F(\gamma_j)$	-	-	4.37	4.38
$F(\gamma_j \cap \pi_k)$	-	-	2.81	2.79

In their original papers neither Beaulieu and Miron (1993) nor HEGY (1990) introduced the possibility of the specification with just the intercept as being the most appropriate DGP. However, in several cases the tests of the ten disaggregated



absence series suggested that neither the trend or the seasonal dummy variable alternatives (I,T; I,S; I,T,S) were significant. As such, the most appropriate DGP in these cases is just the intercept. In all but two cases (Wood and Wood Products and Machinery which were I,T) the specification with the intercept alone proved to be the best DGP. This finding contrasts with the analysis of the aggregate absence series, which were best modeled with the I,S specification. However, since the graphical analysis showed there is far more random variation in the disaggregated absence series which introduces a level of volatility that tends to disguise the trend and seasonal components, this finding is not really surprising.

The DGPs for the production series, in all but one instance (Electrical Machinery, which has a significant trend and seasonal component and is therefore I,T,S), are best modeled using the I,S specification. This is consistent with the tests on aggregate production in the previous chapter.

Table 5.8 below summarizes the findings from the above tests for seasonal unit roots as well as the zero-frequency unit roots for the intercept only specification of the absence series and the I,S specification of the production series.

**Table 5.8 Summary of Results**

Industry	Absence (I)		Production (I,S)	
	Z.F. Unit root	Seasonal UR	Z.F. Unit Root	Seasonal UR
WWP	Yes	No	Yes	No
PPP	No	No	Yes	No
TCL	No	No	No	Yes
BM	No	No	No	No
CRP	No	No	Yes	No
FBT	No	No	Yes	No
TE	No	No	Yes	Yes
EM	Yes	No	Yes	Yes
MAC	Yes	No	Yes	No
EGW	No	No	Yes	No

***Stationarity***

In 7 of the 10 cases, the absence series was found to be stationary, which contrasts with the finding the aggregate absence is non-stationary in the previous chapter.

There are several points to make about this. First, there is strong reason to believe that these results from specific industries are much less reliable than the results from the aggregate series in Chapter Four and also from the more broadly disaggregated data examined in sections 5.2 and 5.3 of this chapter. Using smaller samples introduces a tremendous amount of volatility. In a sense the extra volatility masks some of the true properties of the univariate series making it appear to be marginally stationary, rather than non-stationary as is found for the aggregate series. It is important to note that the more aggregated series do not provide an overwhelming

case for non-stationarity, but with the exception of the manufacturing series (which is only stationary by a narrow margin) the series are found to have a unit root.

The approach of this chapter has been to examine the individual series and to develop a consensus as to what the broad process which best explains the data. Given that the presence of a unit root could not be rejected in the aggregate series, and the case for stationarity is ambiguous, the cointegration analysis will proceed with the assumption that the absence series are indeed non-stationary.

Again the disaggregated production series tended to be non-stationary with only textiles, clothing and leather and basic metals being found to be stationary (with textiles, clothing and leather rejecting the presence of a unit root by a very narrow margin). The evidence of unit roots in the disaggregated production series is quite compelling.

### *Seasonal Unit Roots*

None of the ten absence series displayed a seasonal unit root at any frequency. Again, this is not surprising, given that the DGP of these series is not modeled particularly well with seasonal variables. Clearly seasonal unit roots are not a concern among the absence series. In five instances (out of a possible 60) the presence of a seasonal unit root could not be rejected in for the disaggregated production series. The strongest evidence of a seasonal unit root is in the textiles,

clothing and leather production series. However, as before, with a large number of identical tests on different data, there is a reasonable expectation that some proportion of Type II errors (incorrect acceptance of the non-stationary null) for which a seasonal unit root was detected. This is how the few cases that do appear will be interpreted.

### *Cointegration*

Having established that at least some of the series contain unit roots at zero frequency, as do all of the disaggregated production series, and given that the fully aggregated counterparts of the absence series also was non-stationary, a cointegration analysis will be conducted. This, involves running the following regression:

$$z_t = \alpha + \Gamma s_t + \sum_{m=1}^M \Phi_m z_{t-m} + \varepsilon_t \quad (5)$$

As in the sections above, the first step in this analysis is to determine the appropriate lag structure to whiten the residuals. Perhaps due the much higher volatility each series tested to having the maximum number of lags (8) and as such  $M = 8$  for each of the ten series.

**Table 5.9a Johansen Tests for Cointegration<sup>9</sup>**

	BM	CRP	EGW	EM	FBT	95% crit. values
<b>Eigenvalues:</b>						
r = 0   r = 1	29.437*	25.345*	114.54*	25.13*	45.10*	20.967
r ≤ 1   r = 2	15.354*	14.296*	23.73*	18.46*	15.35*	14.069
r ≤ 2   r = 3	7.405*	3.984*	5.805*	6.80*	7.56*	3.672
<b>Trace:</b>						
r = 0   r = 1	52.195*	43.625*	144.08*	50.382*	67.918*	29.6800
r ≤ 1   r = 2	22.759*	18.280*	23.733*	25.25*	22.904*	15.4100
r ≤ 2   r = 3	7.405*	3.984*	5.805*	6.79*	7.569*	3.7620
Intercept	-12.938	-1.228	-15.264	1.794	-6.729	
Production	2.648*	-0.817	1.465	-1.659	1.660	
	(12.41)	(2.58)	(0.62)	(1.231)	(1.62)	3.84
Unemployment	0.765*	-0.398	0.755	-1.553	0.058	
	(6.70)	(1.90)	(1.32)	(2.23)	(0.02)	3.84

**Table 5.9b Johansen Tests for Cointegration**

	MAC	PPP	TCL	TE	WWP	95% crit. Values
<b>Eigenvalues:</b>						
r = 0   r = 1	41.980*	79.197*	57.004*	29.058*	30.100*	20.967
r ≤ 1   r = 2	9.331	18.170*	16.210*	14.257*	16.700*	14.069
r ≤ 2   r = 3	4.476*	8.150*	2.0015*	6.912*	15.038*	3.672
<b>Trace:</b>						
r = 0   r = 1	55.787*	103.52*	75.216	50.227	61.837	29.6800
r ≤ 1   r = 2	13.807	26.320*	18.212	21.169	31.736	15.4100
r ≤ 2   r = 3	4.476*	8.497*	2.002	6.912	15.038	3.7620
Intercept	-1.668*	-2.130	-450.78	1.506	-0.662	
Production	-0.914	-0.109	104.92*	0.366	-0.721	
	(23.68)	(0.01)	(28.18)	(0.45)	(0.13)	3.84
Unemployment	-0.517*	-1.749*	4.498*	0.312	-0.163	
	(10.34)	(4.41)	(3.885)	(3.06)	(0.622)	3.84

\* denotes significance at the 5% level

In each of the tests the null hypotheses of zero cointegrating vectors is rejected in favour of the alternative hypotheses of a single cointegrating vector. However for

<sup>9</sup> Chi-square statistics (as appropriate) are in parentheses.

several of the systems of equations the subsequent tests the presence of two and in some cases, even three cointegrating vectors cannot be rejected.

Turning to the tests for the significance of the parameters in the cointegration regressions, there is some evidence to support the theoretical model and earlier empirical results.

The machinery series (MAC) have significant negative parameter values for both production and unemployment, which is consistent with the theoretical model. The unemployment coefficient is negative and significant for the paper and paper products series (PPP), however the production coefficient is not statistically different from zero. In most of the remaining cases, neither parameter is significant. There are two exceptions: basic machinery (BM) and textiles, clothing and leather (TCL) both have positive and significant coefficients on the unemployment and the production coefficients and each case, both are statistically significant

However, it would be wrong to suggest the overall results are particularly supportive of the theoretical model or to suggest that they offer significantly more insight into the long-term relationship between absenteeism and the business cycle than has been obtained earlier from the more aggregated analysis. This is not particularly surprising, given that the ten disaggregated absence series tend to have different time series properties than the aggregated absence series, and that the results of the

cointegration analysis (i.e. the tests to determine the number of cointegrating vectors) are not particularly compelling. In only three of the ten cases (Machinery; Chemicals, Rubbers and Plastics and Electrical Machinery) did we find both unemployment and production to be correctly signed and cointegrated with the rate of absence, making it consistent with both the theoretical model and the empirical findings from the previous chapter and earlier sections of the current chapter. In one further case (Paper and Paper Products) the unemployment coefficient is negative and significant.

An important point that needs to be made is that these ten disaggregated series actually form a very small subset of the aggregate workforce that is contained in the CPS (less than 15% on average). These individuals were chosen based on the industry in which they worked being one where data on industrial production data was available. I believe this is a key point. Industries where industrial production figures are available tend to be traditional blue-collar industries. One aspect of these industries which is important to point out, is that there is a much higher likelihood of individuals working in these industries being part of a union than workers from other sectors, in particular those working in services. As found previously, absence of unionised workers tends to be more responsive to production but less responsive to unemployment, than absence of non-unionised workers.

## 5.6 Conclusions

In this chapter the relationship between employee absenteeism and business cycle factors is pursued further. The principal objective of the chapter was to build on the empirical finding from the previous chapter suggesting that labour demand factors have a significant impact on employee attendance patterns.

Initially, the data was disaggregated into three broad industrial sectors (Manufacturing, Service and Public Sector workers) to examine the extent to which the findings from the previous chapter were robust across workers in different kinds of industries. The seasonal and cyclical factors become much more pronounced and the results indicate very strong (negative) relationships between both unemployment and aggregate production and employee absenteeism. The results are particularly strong for service sector workers, the effect on public sector workers was marginally less compelling while the results are not as pronounced for manufacturing sector workers.

Next the data was disaggregated into unionised and non-unionised workers. The results indicated that unemployment has a significant (negative) effect on absenteeism for non-unionised workers but does not appear to affect unionised workers. Conversely, aggregate production only affects unionised workers and does not significantly influence non-unionised employees. Working with series using larger numbers of individuals to derive an aggregate measure shows the pronounced



seasonal and cyclical effects, which were prominent at the aggregate, much more clearly.

Finally, the absence series was disaggregated into ten different industries, omitting a large number of respondents included in the more aggregated series, as no adequate measure of production for the industries covered was available. Greater volatility in individual absence series appears to disguise and dominate seasonal pattern that was evident in the aggregate and less specifically disaggregated series used previously. Empirical tests on the nature of the seasonality did not reveal significant evidence of the presence of seasonal unit roots. In fact, the clear cyclical and seasonal patterns evident at the aggregate level are dominated by increased volatility or “noise” in the series.

The empirical results appear to reflect this additional noise and the evidence on the individual series did not suggest consistent negative empirical relationships between unemployment and industrial production, and employee absenteeism. With the samples of individuals being used to create the aggregate absence series being quite small it appears that the increased volatility in the derived series, proved sufficient to make any relationships between unemployment, production and absence unidentifiable in most cases.

The relationship between absenteeism and the business cycle is subtle. This is due to absence being affected by a variety of other factors that have little to do with the state of the economy and that some portion of absenteeism is not malfeasance at all. There is no way in which most empirical researchers can conclusively distinguish between legitimate absence and malfeasance.

The first two broad sections of this chapter look at the relationship between absenteeism and business cycle factors across different types of workers. While there are differences between these disaggregations, the business cycle does have a significant effect on the level of absence. The final empirical exercise in this chapter was to look at ten industrial sectors to allow for a better matching of workers to actual industrial production figures, rather than continuing to use aggregate production. The expected effect was that the results would improve, given that the relationship at the aggregate level proved to be significant. Using data that related workers to the actual demand conditions for the products that they produce was expected to show much more pronounced effects. This, however, was not the case. There are two possible conclusions: First, for some reason the relationship breaks down. This seems somewhat unlikely, given that the aggregate series and the aggregate manufacturing sectors both showed that unemployment and aggregate production affect absenteeism. More likely, using much smaller samples introduces a great deal of additional “noise” to the series absence series. Over the course of the sample period there was a gradual shift from work in industrial occupations to work

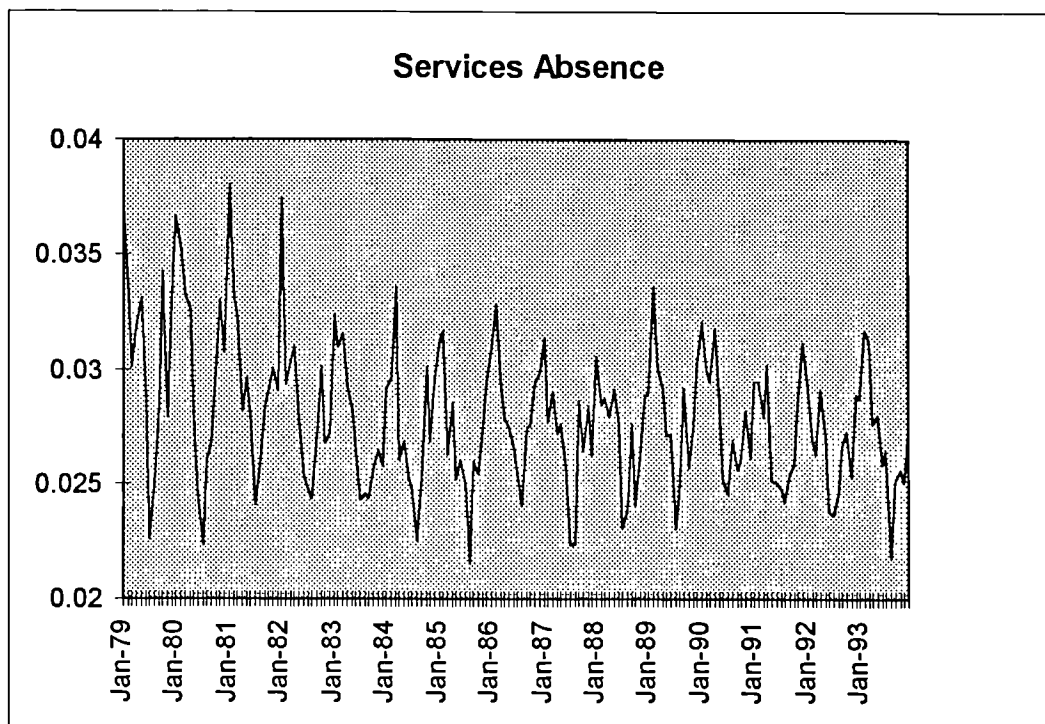
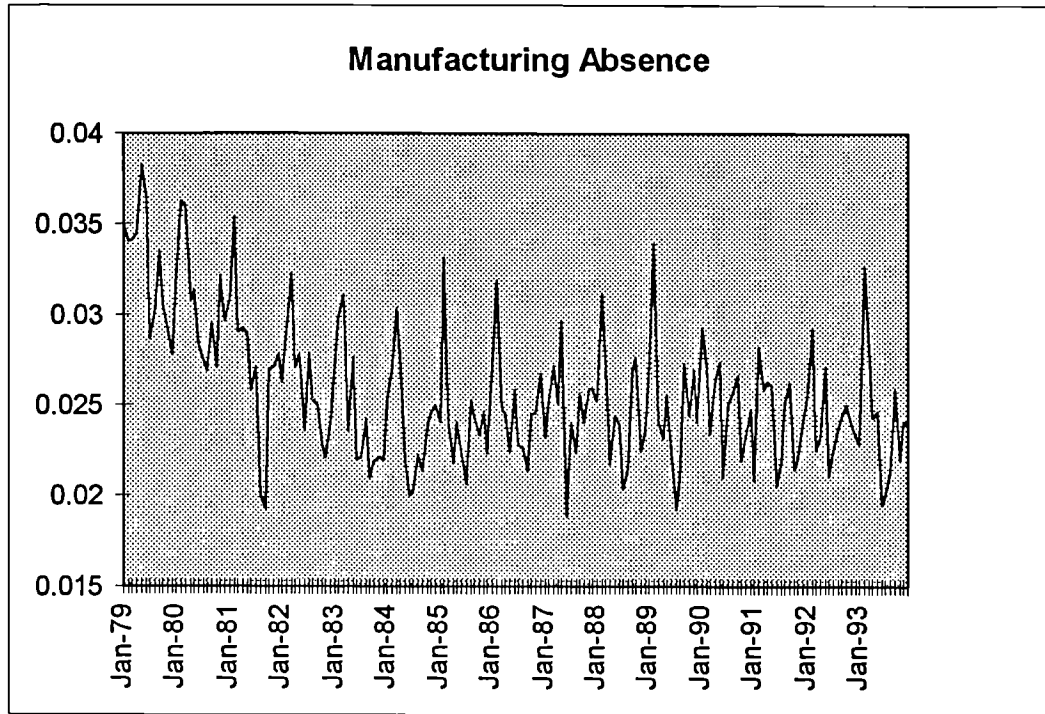
in service occupations. At the same time, the CPS gradually surveyed fewer and fewer individuals. As time goes on, the numbers of workers in most of the ten sectors falls quite dramatically, which introduces additional sample variability to the data. While I believe the relationship is still present at the finer level of disaggregation, it appears that the data is not capable of showing it. The addition of the extra noise resulting from the smaller samples in the construction of the absence series results in the subtle relationship between absence, unemployment and aggregate production becoming more difficult to identify than at the aggregate level.

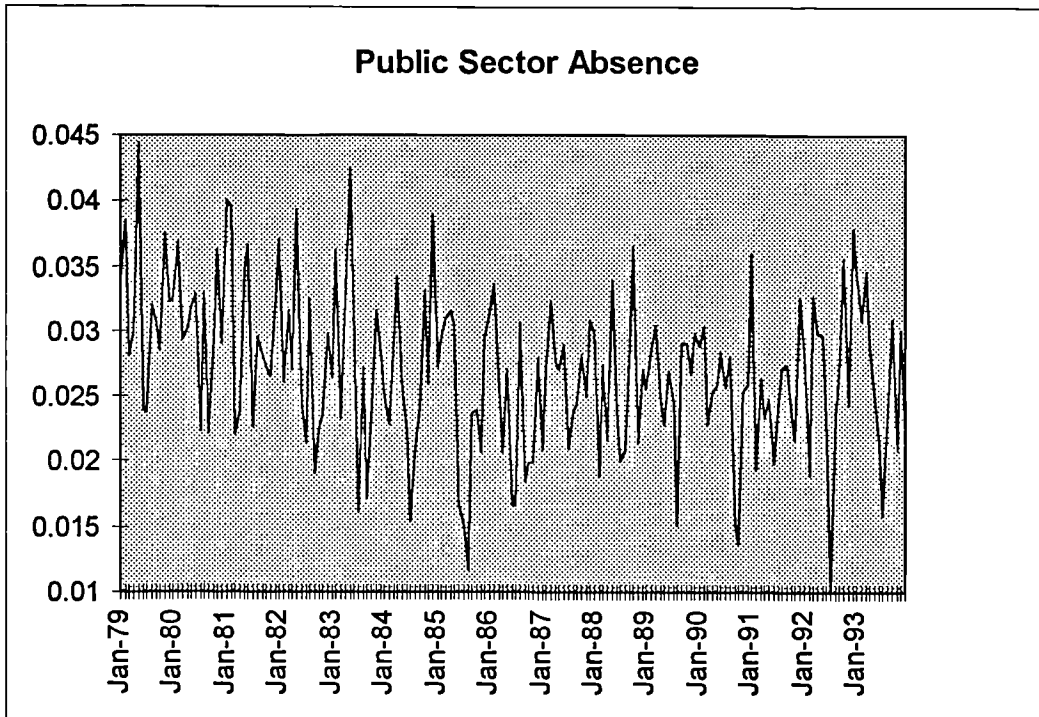
## APPENDICES

### Appendix 5.1 Means and Standard Deviations of Disaggregated Absence Series

<b>Series</b>	<b>Mean</b>	<b>Standard Deviation</b>
<b>Manufacturing Sector</b>	<b>.025741</b>	<b>.003923</b>
<b>Service Sector</b>	<b>.027985</b>	<b>.003133</b>
<b>Public Sector</b>	<b>.026984</b>	<b>.006101</b>
<b>Unionised Workers</b>	<b>.030779</b>	<b>.003614</b>
<b>Non-unionised Workers</b>	<b>.025658</b>	<b>.002587</b>
<b>Basic Machinery</b>	<b>.025512</b>	<b>.009594</b>
<b>Chemicals, Rubbers and Plastics</b>	<b>.022378</b>	<b>.007678</b>
<b>Electricity, Gas and Water</b>	<b>.021423</b>	<b>.008129</b>
<b>Electrical Machinery</b>	<b>.024679</b>	<b>.008269</b>
<b>Food, Beverage and Tobacco</b>	<b>.026716</b>	<b>.007976</b>
<b>Machinery</b>	<b>.020558</b>	<b>.007613</b>
<b>Paper and Paper Products</b>	<b>.026144</b>	<b>.008195</b>
<b>Textiles Clothing and Leather</b>	<b>.030639</b>	<b>.011019</b>
<b>Transport Equipment</b>	<b>.028515</b>	<b>.008961</b>
<b>Wood and Wood Products</b>	<b>.024409</b>	<b>.010597</b>

## Appendix 5.2 Series Plots and Descriptions: Three Broad Sectors





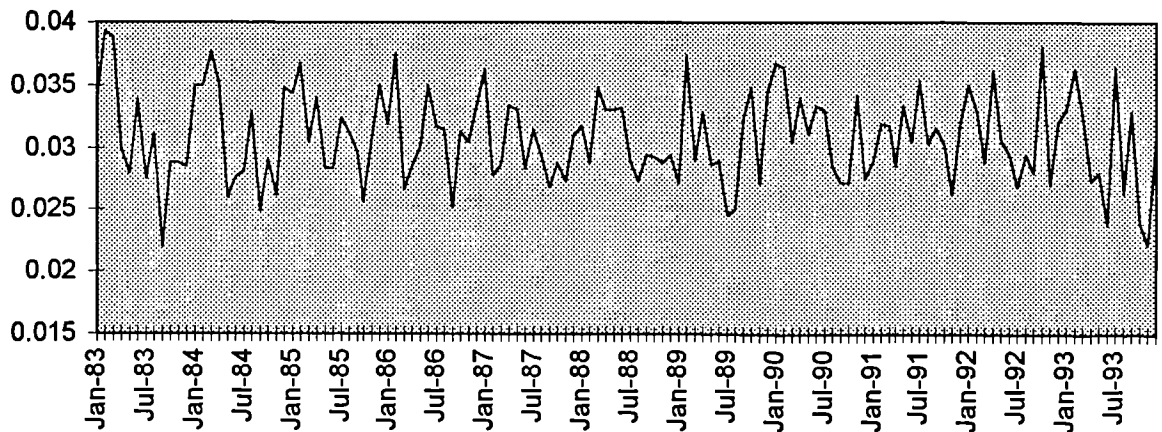
Starting with the Manufacturing Sector series, there are two striking features of this graph. First, there is a very marked downward trend in the rate of absence from 1979 through 1983. It is interesting to note that in the US this was a period of recession and it is important to note that this recession is thought to have been most severe in the manufacturing sector. Second, there is a pronounced seasonal peak in the late winter months, although the magnitude of this peak diminishes after 1989.

The Service Sector series does not experience the same marked decline through the early 80's. What is most striking about this series is the pronounced seasonal peak in the early winter as well as the seasonal trough in the early summer. This too, would seem to reflect the characteristics of the service sector, which one would expect to exhibit substantial seasonal variation in demand. It is impossible, or virtually impossible to keep inventories in service industries, implying that production cannot be smoothed across the seasonal or business cycle. This implies that labour demand in these industries will be more subject to seasonal fluctuations.

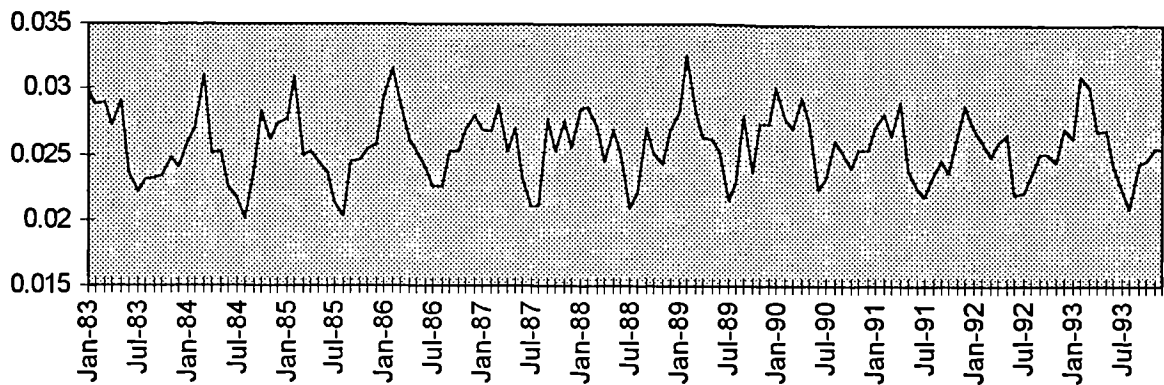
The Public Sector series displays moderate decline through the early and mid 1980's although clearly not as pronounced as the manufacturing series. It is also interesting to note that the series displays little consistent seasonal variation, which would again tend to characterize this industry rather well, since one would expect demand for basic public services to be relatively constant throughout the year.

### Appendix 5.3 Series Plots and Descriptions: Unionised and Non-unionised Workers

**Absence: Unionised Workers**



**Absence: Non-unionised Workers**

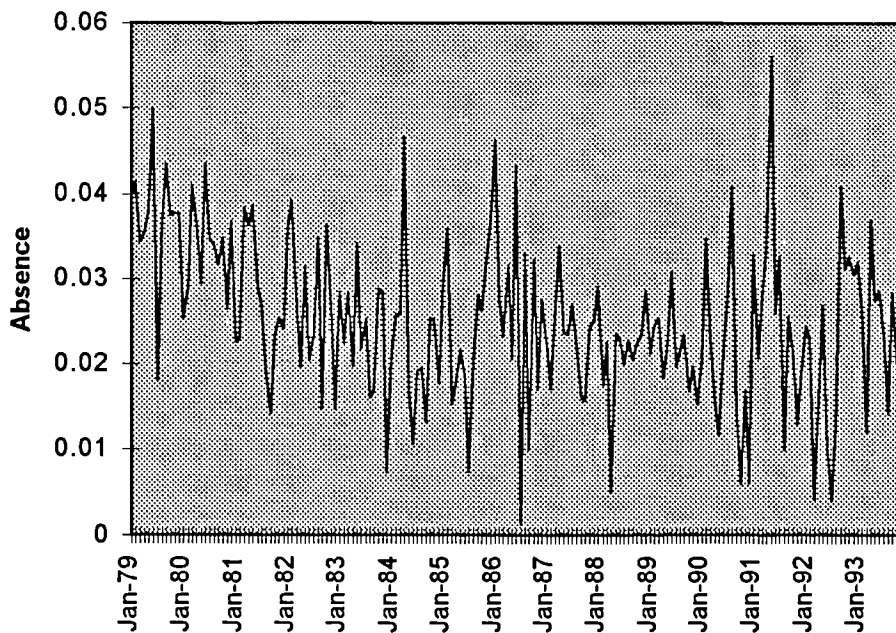


The annual absence peaks in the winter and troughs in the summer again become apparent in the time series. In addition, neither series shows any clear trend. Absence appears to remain more or less constant around a very pronounced seasonal cycle for both unionised and non-unionised workers. Overall the rate of absence is higher for unionised workers compared to those who are not.

## Appendix 5.4 Series Plots and Descriptions: Ten Industrial Sectors

The graphs below display the monthly absence series for each of the 10 disaggregated industries.

### Basic Machinery



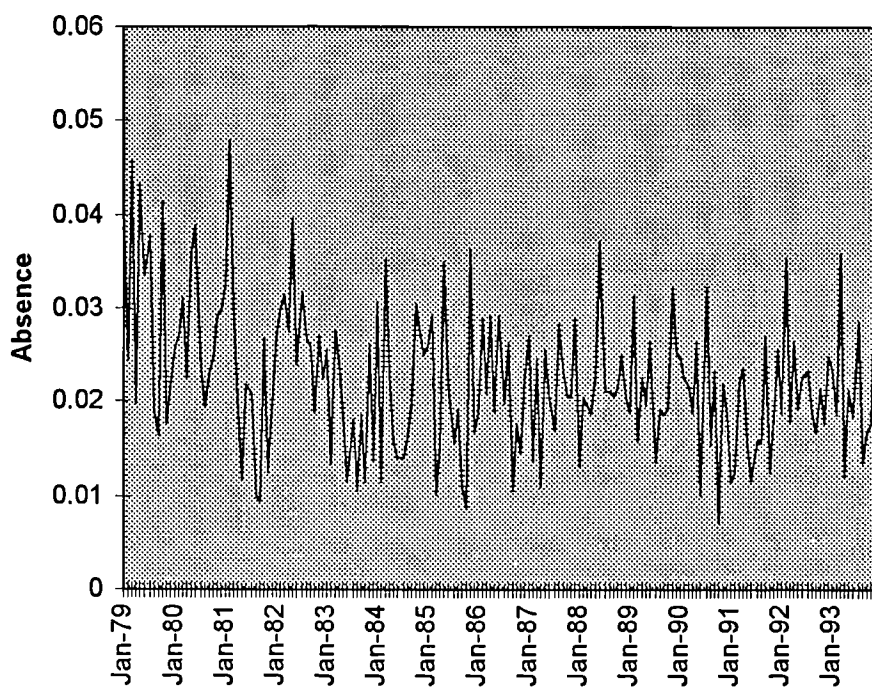
The Basic Metals series demonstrates a pronounced downward trend from January 1979 to 1984 (which is about the time that the US economy began to move into a sustained economic recovery. From 1984 to 1993 it does not show a clear cyclical trend.

The series also appears to have a consistent seasonal peak in the early months of the year from 1979 through the mid 1980's, although the seasonal effects appear to be less consistent from the mid 1980's onwards. There appears to be no consistent seasonal pattern for troughs in the monthly absence rate.

Interestingly, the period between mid 1986 and mid 1990 displays remarkably little volatility in the rate of absence. It should also be noted that this is probably the period of greatest stability in the US economy.



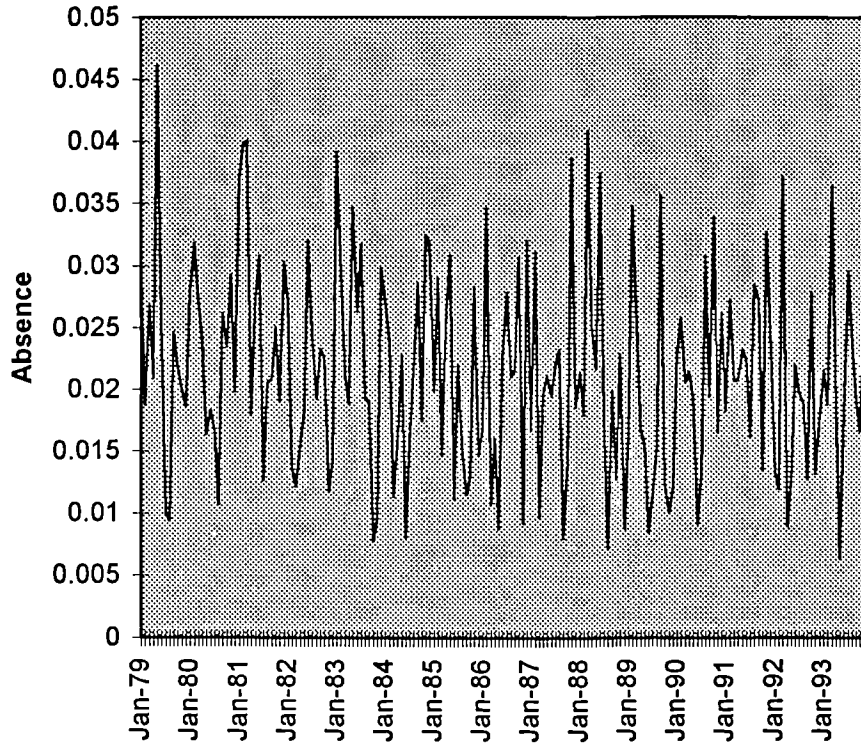
### Chemicals, Rubbers and Plastics



The Chemicals, Rubber and Plastics sector also demonstrates a downward trend from 1979 through mid 1984 before leveling off for through 1993.

Unlike the Basic Metals series, the Chemicals series does not exhibit a clear seasonal pattern at any time between 1979 and 1993.

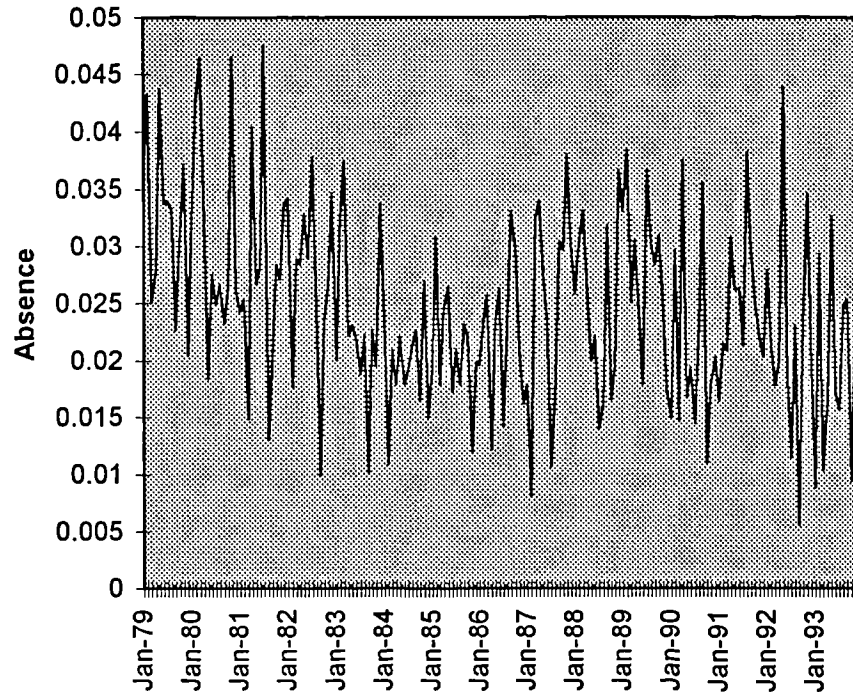
## Electricity, Gas and Water



Perhaps not surprisingly, the Electricity, Gas and Water absence series displays virtually no cyclical pattern throughout the 1979-1993 period. It is not surprising because as a provider of basic utility services, one would expect there to be limited cyclical fluctuation in the demand for these items and as such one would expect the cyclical effect of product demand on absence would be limited.

The evidence of a pronounced seasonal pattern is limited. It does appear that there are some seasonal effects from 1979-1983 with absence being lowest in the summer months. However, it does not appear to be particularly compelling.

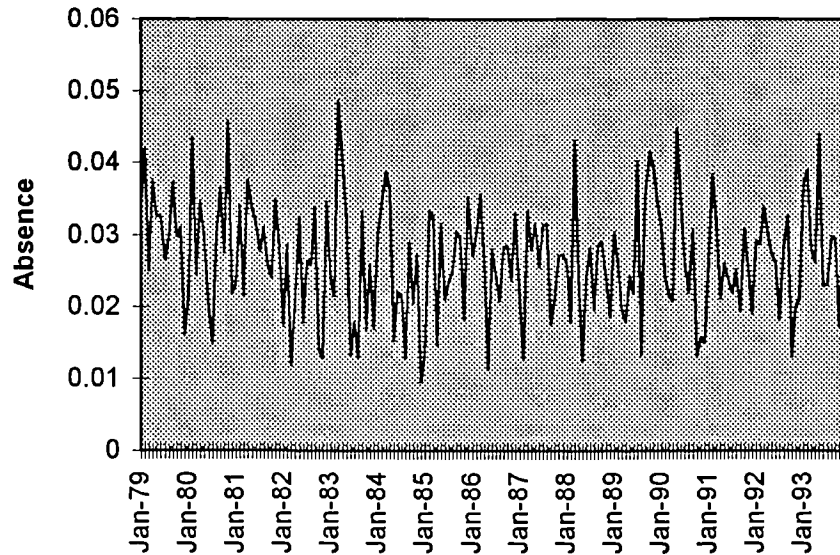
## Electrical Machinery



The Electrical Machinery absence series follows a marked downward trend for the first 5 years of the data period (1979 to 1984) at which point it enters a 3 year period of very limited fluctuation (1984-1987). Following this, it appears to go through a period of increased volatility and slight increase (1987-1989) before a mild downward trend through the early 1990's. However, the series is quite volatile through this last period.

The seasonal pattern suggests higher absence rates in the winter months from 1979-84, however the seasonal pattern becomes somewhat less clear after that. The last seven years of the series (1987-93) exhibit a great deal of volatility in the absence rate, and no clear seasonal pattern emerges.

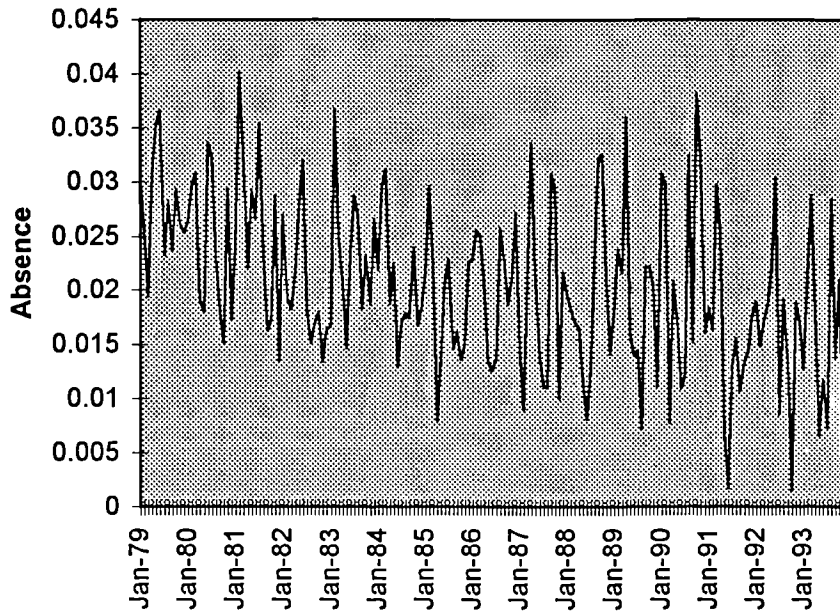
## Food, Beverage and Tobacco



The Food, Beverage and Tobacco absence series appears to follow a similar cyclical pattern as that of the Electrical Machinery series. There appears to be a downward trend through the 1979-84 period, followed by a three year period where the volatility of the absence rate declines. From 1987 onwards, there appears to be a moderate trend upwards in the rate of absence, with increased volatility.

Also similar to the Electrical Machinery series, the Food Beverage and Tobacco absence series tends to display a seasonal peak in the winter months, but after the period of low volatility in the absence rates, the seasonal patterns do not appear to re-establish themselves.

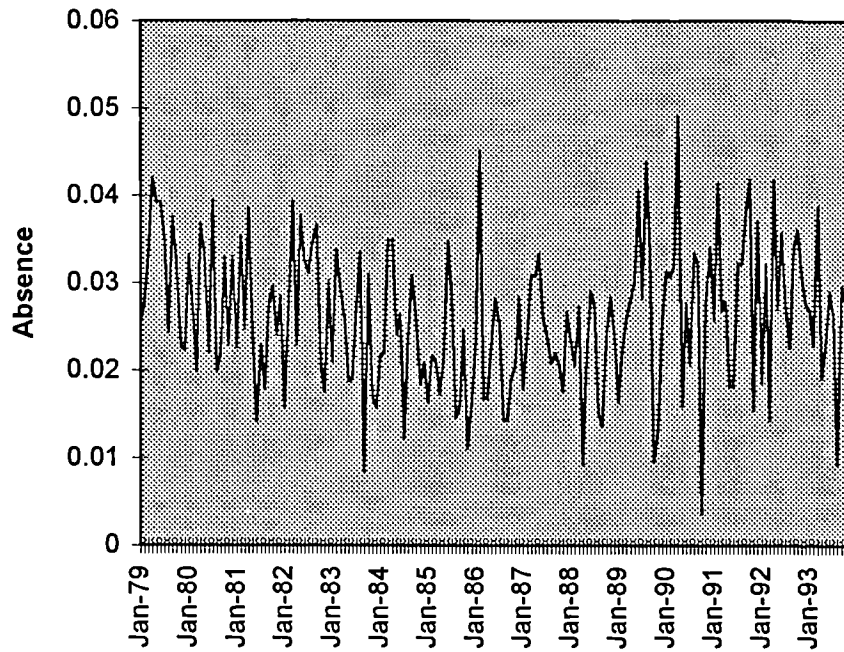
## Machinery



The absence pattern for the Machinery series has been consistently downwards throughout the time series, however, it appears that the most marked decline is in the first half of the series (1979-86). It should also be noted that although the series does continue to move downwards through the last half of the sample period (1987-1993), the series also tends to exhibit increased volatility through this period.

The seasonal pattern suggests that there is an absence peak in the autumn, while there is no obvious patterns to the troughs in the rate of absence.

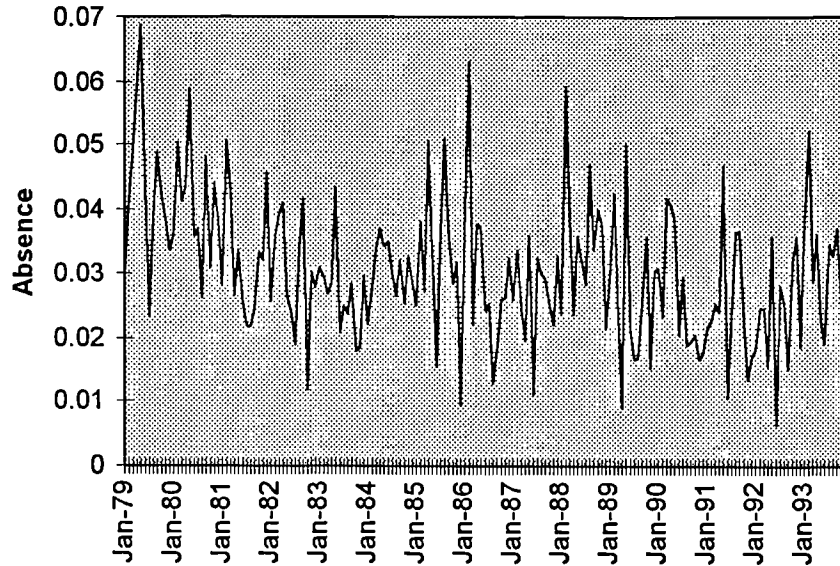
## Paper and Paper Products



The Paper and Paper Products series follows a slight downward trend from 1979-85, after which it goes into a period where it increases marginally and then falls off again from 1991-1993. The series becomes increasingly volatile after 1986.

This series shows a rather pronounced seasonal peak in the late winter and early spring months (March and April). It also demonstrates a consistent seasonal trough in the summer months, July and August in particular.

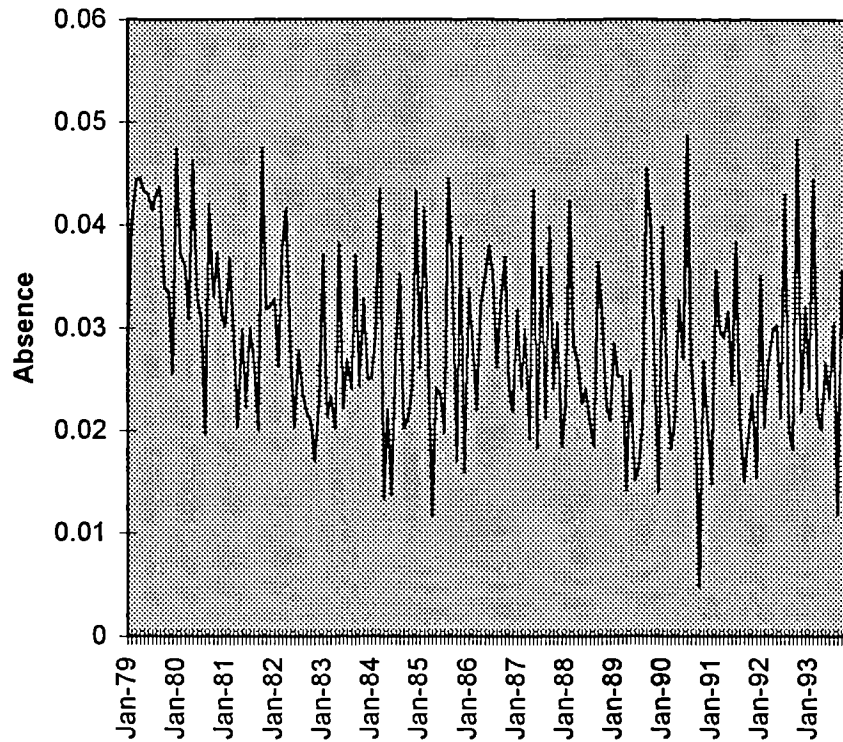
### Textiles, Clothing and Leather



The Textiles, Clothing and Leather absence series experiences declines in the early portion of the sample period (1979-84). Following this, the series exhibits no clear cyclical pattern until 1988, when it experiences a period of more moderate decline. The volatility of the series remains relatively constant throughout.

The series tends to peak in the winter months in the early periods of the sample, although the pattern becomes somewhat less pronounced after 1986. The series tends to trough during the summer months, again the pattern becomes less pronounced after 1986.

## Transport Equipment

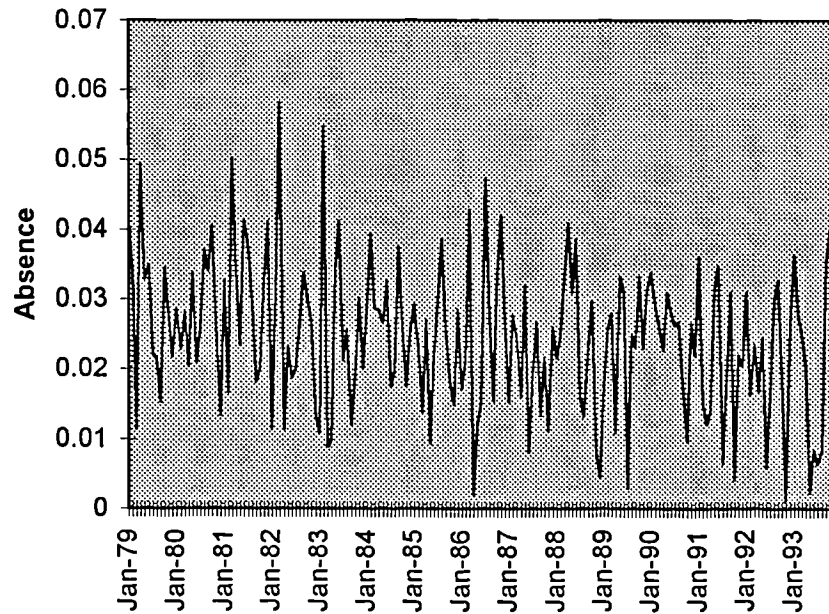


Unlike the other series (with the exception of Electricity, Gas and Water), absence in the Transport Equipment industry does not tend to follow much of a cyclical trend. There is a period of moderate decline very early in the sample period, although after 1982 it is difficult to pick up a clear trend. After 1989 the series displays increased volatility.

Like most of the other series, Transport Equipment does display a pronounced seasonal peak in the winter months early in the sample period (up to 1985), although after this, the pattern becomes less perceptible. There is no compelling evidence of a seasonal trough at any time in the sample period.



## Wood and Wood Products



The Wood and Wood products series displays moderate decline throughout the sample period. It tends to become less volatile later in the sample period, which is quite different than most of the other series.

The seasonal peaks in the late winter or early spring are prominent in both the early part of the sample period and the late. However 1986-90 does not display a prominent seasonal peak. The seasonal trough follows a similar pattern with the summer months displaying lower rates of absence in the early part of the sample period (before 1984) and the later part of the sample period (after 1988) although the middle portion does not exhibit a noticeable seasonal pattern.

## **Chapter Six: Conclusions**

Employee absenteeism has received a lot of attention from academics, in particular psychologists, as well as the popular media. The psychological work, in my opinion, can be characterised as being full of good ideas, but often lacking the empirical rigour to make the results particularly convincing. The over-riding aim of this thesis was to examine two of these ideas which seem well-suited to economic analysis and attempt to apply new and better techniques in the analysis of absenteeism.

In Chapter Two, perhaps the most important review published on absenteeism (Steers and Rhodes, 1978) is used to provide a framework to consider the vast literature on absence. It is interesting to note that the literature on absenteeism is rich in empirical studies, while considered examinations of the theory driving absenteeism and methodological advances in the statistical analysis of absenteeism are in short supply.

Most psychological studies of absenteeism are interested in using it as a proxy for 'withdrawal': the process by which individuals gradually detach themselves from their current employment. Withdrawal occurs as a result of an individual's dissatisfaction with their work situation and this dissatisfaction is thought by many (see Porter and Steers, 1973) to be the result of the job failing to meet the expectations that the individual has for it. This leads to dissatisfaction resulting in withdrawal which manifests itself first as lateness, then as absenteeism and finally as resignation.

Economists, as one might imagine, view absenteeism rather differently. Conventional labour supply theory suggests individuals have a desired number of hours they wish to supply to the labour market. If firms were indifferent to the number of hours supplied, then there would be limited potential for absenteeism. Individuals would simply work the number of hours they want. However, workers are often complements in production and firms have fixed costs associated with employment (such as training). As such firms set a fixed number of hours that workers are expected to work. If the number of hours demanded by the firm is greater than the number of hours the individual wishes to supply, the potential for absence arises.

In a system where workers have most or all of their wages replaced when they go absent, the incentive for absence is even greater. In essence absenteeism provides the individual with all the benefits in terms of leisure or household production, and they also get most or all of their wages. When thinking about absence this way, it strikes me as surprising absence isn't a much more widespread phenomenon.

Allen (1981) provides a formal model of absenteeism using the labour supply framework described above. He argues that it is the threat of discipline for taking malfeasant absence that bounds absenteeism. This discipline can take the form of lower pay raises, denial of promotion or in more extreme cases, the sack. This has become, more or less, the standard economic model of the individual decision to take absence.

While economists have lagged somewhat behind the psychologists in terms of examining the supply side aspects of absence, they have led the way in consideration of the demand side of this phenomenon. I think this generally results from psychologists believing there is little variation in firms' demand for reliable labour. All firms want perfect attendance all the time. Theoretical papers by Weiss (1985) and Coles and Treble (1993, 1996) demonstrate that this may not necessarily be the case and suggest that the nature or production technology may have important implications for the demand for reliable labour. Coles and Treble point out that if reliability is an attribute that firms desire, then they should be willing to pay a premium for it. In firms where there is a high degree of worker complementarity, reliability will be a more desirable attribute than in firms where complementarity is lower.

Barmby and Treble (1989) make a very important point when they argue that examining absence as strictly a supply side phenomenon introduces an identification problem. Their crucial point is that a failure to recognise demand side factors when modelling individual absence, results in the relationship being unestimable. However, empirical studies have been somewhat slow to capture this, since the data necessary to side-step this identification problem is not readily available.

The empirical work in this thesis examines two areas of the literature which strike me as being well-suited to economic analysis. The first is the relationship between absence and turnover. The principal aim of this literature is to test the withdrawal

hypothesis. Despite an enormous volume of empirical work, the overall conclusions are quite unsatisfying. This is largely because the studies tend to be poorly structured and fail to design adequate experiments to test the phenomenon they purport to examine. Those that do provide a reasonable structure to the problem often lack sufficient data to draw meaningful conclusions. In this thesis a formal model to show why one would expect absence to increase leading up to turnover is derived and a methodology that can adequately test this model devised. The data used are sufficiently large and detailed to allow for a comprehensive analysis of the relationship between absence and turnover.

The findings are quite striking. A clear pattern of increased absence leading up to the date of quit is observed. Perhaps more interestingly, a large increase in absence is observed 18 months prior to the individual leaving the firm before falling then rising in the period immediately preceding the quit date. This seems at odds with the withdrawal literature, which suggests a progression, rather than an oscillation.

The data are disaggregated into 'staff' (junior) and 'managerial' (senior) workers and a similar analysis is conducted. The patterns that emerge are intriguing. Staff workers tend to take more absence throughout the sample period, although the largest differential in absence between leavers and stayers is in the six month period beginning 18 months prior to quit. I attribute this increase in absence a year and a half prior to resignation to on-the-job search and job commitment. Managerial workers follow a very different pattern. Although they do tend to take more absence

in the two months leading up to quit than their staying counterparts, through the remainder of the sample period, they actually tend to take less absence than their staying counterparts. This finding does not seem to provide much support for the withdrawal hypothesis. Overall, the results suggest the relationship is considerably more complex than described in the literature.

The next two chapters of the thesis are dedicated to examining aggregate absence through the business cycle, which is typically modelled using aggregate unemployment. Although not nearly as extensive as the literature on absence and turnover, there have been a number of empirical studies examining this relationship. The pervasive view has been that there is an inverse relationship between absence and the business cycle. This is interpreted as evidence that in times of high unemployment workers are less inclined to be malfessant since the cost of doing so (getting caught and being sacked) increase as it becomes more difficult to transit out of unemployment back into a job.

Chapter Four builds on this literature in three significant ways. First, the problem of identification is fundamental. I argue that the time at which individuals are most likely to fear losing their jobs and as such take less absence, is likely to coincide with the time when firms are the most indifferent to the reliability of their workforce. I argue that if hiring and firing labour is expensive, firms will hoard labour in periods of low product demand. At the same time, if monitoring workers is costly then, at the margin, firms will be less concerned about absence in periods of low demand. This

argument becomes stronger if workers wages are not fully replaced (or if they are subsidised by government or insurance) when workers are absent. Failure to account for these demand factors means that absence is not properly identified. Second, a formal theoretical model is developed to show how the behaviour of individuals and firms might change through the business cycle. Finally, more up to date time series econometrics techniques are applied to the data, with particular attention paid to accounting for the pronounced seasonal pattern that the data display, in particular, techniques developed by Hylleberg, Engle, Granger and Yoo (1990), Beaulieu and Miron (1993) and Johansen (1988,1991) are employed.

The results are quite compelling and demonstrate that there is a long-term inverse relationship between absence, and both supply (unemployment) and demand (industrial production) side business cycle factors. This suggests that future studies of this relationship need to incorporate proxies for demand side factors to adequately identify the business cycle effects.

The inclusion of demand side factors in the modelling of absence through the business cycle is sufficiently novel that it is investigated further in Chapter Five. In this chapter the aggregate absence series is disaggregated in three ways to determine if empirical relationships found in Chapter four hold up for different kinds of workers. The first step is to examine manufacturing, service and public sector workers separately. The findings remain quite robust at this level of disaggregation. The next step is to separate unionised and non-unionised workers. The findings suggest that

unionised workers are not significantly effected by supply side factors (unemployment) but are significantly effected by demand side factors (industrial production). Conversely, non-unionised workers are effected by supply side factors, but not strongly influenced from the demand side. A key weakness with these disaggregations is that it is impossible to attribute a production series to adequately capture the demand conditions the individual might face. The final exercise in this chapter attempts to reconcile this by examining ten industrial sectors for which a production series can be linked to the absence series that reflects industry specific demand conditions. The findings are somewhat disappointing, with many of the relationships found at the aggregate level, not being apparent at a finer level of disaggregation. The simple reason for this appears to be that the samples of individuals used to form the absence series are often very small. The extra noise this introduces makes the subtle relationship between absence, unemployment and industrial production difficult to capture.

Overall, there are two key areas in which this thesis makes a significant contribution. First, it takes the applied psychology seriously and attempts to apply economic reasoning to a number of ideas which are well developed in the absenteeism literature, although very little has been said by economists. Second, it offers a number of methodological advances in terms of the statistical analysis of absenteeism. My overall impression from having examined a number of these studies is that the empirical work has been quite weak. My aim was to try to tackle some of the more interesting, yet poorly treated problems with better methodology and data than had



been used to date. While the work has not always completely succeeded, I do believe that some important advances have been made and hopefully in the future other researchers will employ some variants of the methods developed herein.

## References

Abeyasinghe, T (1994) 'Deterministic Seasonal Models and Spurious Regressions' *Journal of Econometrics*, 61, 259-272.

Allen, S.G. (1981a) 'An Empirical Model of Work Attendance' *Review of Economics and Statistics*, 63, pp 77-87.

Allen, S.G. (1981b) 'Compensation, Safety and Absenteeism: Evidence from the Paper Industry' *Industrial and Labour Relations Review*, 34, 207-218.

Allen, S.G. (1984) 'Trade Unions, Absenteeism and Exit Voice' *Industrial and Labour Relations Review*, 37, 331-345.

Anderton, et al (1980) '*Statistical Methods for Comparative Studies*' Wiley, New York.

Audas, R., T. Barmby, and J. Treble (1996) 'Absenteeism in an Internal Labour Market' mimeo.

Audas, R., T. Barmby, and J. Treble (1999) 'Absenteeism and Tournaments' mimeo.

Barmby T.A., M.G. Ercolani and J.G. Treble (1997) "A Monthly Sickness Series for Britain, 1971-1984", Institute for Labour Research Working Papers, No. 97/14.

Barmby T.A., M.G. Ercolani and J.G. Treble (1998a) "Using the Labour Force Surveys to Construct an Absence Rate Series for Britain, 1984-1997 (Revised)." Institute for Labour Research Working Papers, No. 99/27.

Barmby T.A., M.G. Ercolani and J.G. Treble (1998b) "Creating a Unified Sickness Absence Series for Britain, 1971-1997", Institute for Labour Research Working Papers, No. 99/30.

Barmby T.A., M.G. Ercolani and J.G. Treble (1999) "Sickness absence in Britain: new quarterly and annual series from the GHS and LFS", *Labour Market Trends*, August 1999, p. 405-415.

Barmby, T.A., C.D. Orme and J.G. Treble (1991) 'Worker Absenteeism: An Analysis using Microdata' *Economic Journal*, 101, 214-229.

Barmby, T.A., C.D. Orme and J.G. Treble (1995) 'Work Absence Histories: A Panel Data Study' *Labour Economics*, 2, 53-66.

Barmby, T.A., J.G. Sessions and J.G. Treble (1994) 'Absenteeism, Efficiency Wages and Shirking' *Scandinavian Journal of Economics*, 96, 561-566.

Barmby, T.A. and G. Stephan (1998) 'Absence and Firm Size' mimeo, University of Newcastle-upon-Tyne.

Barmby, T.A. and J.G. Treble (1989) 'A Note on Absenteeism' *British Journal of Industrial Relations*, 27, 155-158.

Barmby, T.A. and J.G. Treble (1991) 'Betriebliche Fehlzeiten und Arbeitsverträge' *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung*, 24, 595-604.

Beaulieu, J.J. and J.A Miron (1993) 'Seasonal Unit Roots in Aggregate US Data' *Journal of Econometrics*, 55, 305-328.

Becker, G.S. (1965) 'A Theory of the Allocation of Time' *Economic Journal*, 75, 493-517.

Beehr, T.A. and N. Gupta (1978) 'A note on the structure of employee withdrawal' *Organizational and Human Performance*, 21, 73-79.

Behrend, H. and S. Pocock (1976) 'Absence and the Individual: A Six Year Study in One Organisation' *International Labour Review* 114, 311-327.

Ben-Horim, M. and H. Levy (1984) '*Statistics: Decisions and Applications in Business and Economics*' second edition, Random House, USA.

Borjas, G (1979) 'Job Satisfaction, Wages and Unions' *Journal of Human Resources*, 14, 21-44.

Brown, S. (1995) '*Absenteeism, on-the-job Search and Quit Behaviour*' unpublished Ph.D. chapter, 200-229.

Brown, S. and J.G. Sessions (1996) 'The Economics of Absence: Theory and Evidence' *Journal of Economic Surveys*, 10, 23-53.

Brown, S., F. Fahkfhk and J.G. Sessions (1999) 'Absenteeism and Employee Sharing an Empirical Analysis Based on French Panel Data 1981-91' *Industrial and Labour Relations Review*, 52, 234-251.

Burdett, K. (1978) "A Theory of Employee job Search and Quit Rates" *American Economic Review*, 68, 212-220.

Buzzard, R.B. and W.J. Shaw (1952) 'An Analysis of Absence Under a Scheme of Paid Sick Leave' *British Journal of Industrial Medicine*, 9, 282-295.

Chadwick-Jones, J.K., C.A. Brown and N. Nicholson (1982) '*Social Psychology of Absenteeism*' Praeger, New York.

Chaudhury, M. and I. Ng (1992) 'Absenteeism Predictors: Least Squares, Rank Regression and Model Selection Results' *Canadian Journal of Economics*, 615-635.

Clegg, C (1982) 'Psychology of Lateness, Absence and Turnover: A Methodological Critique and Empirical Study' *Journal of Applied Psychology*, 68, 88-101.

Coles, M.G. and J.G. Treble (1993) 'The Price of Worker Reliability' *Economics Letters*, 41, 149-155.

Coles, M.G. and J.G. Treble (1996) 'Calculating the Price of Worker Reliability' *Labour Economics*, 3, 169-188.

Confederation of British Industry (1994) '*Managing Absence – In Sickness and In Health*', Centre-File, Quality Business Solutions.

Deardorff, A.V. and F.P. Stafford (1976) 'Compensation of Co-operating Factors' *Econometrica*, 44, 671-684.

Denerley, R.A. (1952) 'Some Effects of Paid Sick Leave on Sickness Absence' *British Journal of Industrial Medicine*, 9, 275-281.

Devine, T. and N. Kiefer (1991) '*Empirical Labor Economics: The Search Approach*,' Oxford University Press, New York.

Diamond, P.A (1981) 'Mobility Costs, Frictional Unemployment and Efficiency' *Journal of Political Economy*, 89, 798-812.

Doeringer, P.B. and M.J. Piore (1971) '*Internal Labour Markets and Manpower Analysis*' Heath, Lexington, MA, USA.

Doherty, N.A. (1979) 'National Insurance and Absence from Work' *Economic Journal*, 89, 50-65.

Edwards, P. and H. Scullion (1984) 'Absenteeism and the Control of Work' *Sociological Review*, 32, 547-72.

Ehrenberg, R.G. (1970) 'Absenteeism and the Overtime Decision' *American Economic Review*, 60, 352-357.

Enders, W. (1995) '*Applied Econometric Time Series*' Wiley, New York.

Farrell, D and J.C. Peterson (1984) 'Commitment, Absenteeism and Turnover of New employees: a Longitudinal study', *Human Relations*, 37, 681-692

Farrell, D and C.L. Stamm (1988) 'Meta Analysis of the Correlates of Employee Absence' *Human Relations*, 41, 211-227.

Ferris, G.R. and K.M. Rowland (1987). 'Tenure as a Moderator of the Absence – Intent to Leave Decision' *Human Relations*, 40, 255-266.

Fichman, M. (1984) 'A Theoretical Approach to Understanding Absenteeism' in '*Absenteeism*', P.S. Goodman and R.S. Aitken (eds.), Jossey-Bass Inc. San Francisco.

Freeman, R.B. (1976) 'Individual Mobility and Union Voice in the Labour Market' *American Economic Review*, 66, 361-368.

- Freeman, R.B. (1978) 'Job Satisfaction as an Economic Variable' *American Economic Review*, 68, 135-141.
- Gupta, N and G.D. Jenkins (1980) 'The Structure of Withdrawal: Relationships among Estrangement, Tardiness, Absenteeism and Turnover' National Technical Information Service, Springfield VA.
- Gupta, N. and G.D. Jenkins (1982) 'Absenteeism and Turnover: Is there a Progression?' *Journal of Management Studies*, 19, 395-412.
- Hammer, T.H., J.C. Landau and R.N. Stern (1981) 'Absenteeism When Workers have a Voice: The Case of Employee Ownership' *Journal of Applied Psychology*, 66, 561-573.
- Hamper, B. (1991) '*Rivthead: Tales from the Assembly Line*' Warner Books, USA.
- Heckman, J. (1981). 'The incidental parameters problem and the problem of initial conditions in estimating a discrete time – discrete data stochastic process', in C. Manski and McFadden (eds) '*Structural Analysis of Discrete Data with Econometric Applications*', MIT Press, Cambridge, pp.114-78.
- Hill, J.M.M. and E.L. Trist (1953) 'A Consideration of Industrial Accidents as Means of Withdrawal from the Workplace' *Human Relations*, 6, p. 357-380.
- Hirschman, A.O. (1970) '*Exit, Voice and Loyalty*' Harvard University Press, Cambridge, MA.
- Hylleberg, S, R.F. Engle, C.W.J. Granger and B.S. Yoo (1990) 'Seasonal Integration and Cointegration' *Journal of Econometrics*, 44, 215-238.

Ivancevich, J.M. (1985) 'Predicting Absenteeism from Prior Absence and Work Attitudes' *Academy of Management Journal*, 28, 219-228.

Jacobson, S.L. (1989) 'The Effects of Pay Incentives on Teacher Absenteeism' *Journal of Human Resources*, 24, 280-286.

Johansen, S. (1988) 'Statistical Analysis of Cointegration Vectors' *Journal of Economic Dynamics and Control*, 12, 231-254.

Johansen, S. (1991) 'Estimation and Hypothesis Testing if Cointegration Vectors in Gaussian Vector Autoregression Models' *Econometrica*, 59, 1551-1580.

Jovanovic, B. (1979) 'Job Matching and the Theory of Turnover' *Journal of Political Economy*, 87, 972-990.

Kaivanto, K. (1997) 'An Alternative Model of Pro-Cyclical Absenteeism' *Economics Letters*, 54, 29-34.

Kalecki, M. (1943) 'The Political Aspects of Full Employment' Lecture to the Marshall Society.

Killingsworth, M.R. (1983) '*Labour Supply*' Cambridge University Press, UK.

Lazear, E (1995) '*Personnel Economics*', MIT Press, USA.

Leigh, J.P. (1981) 'The Effects of Union Membership on Absence from Work Due to Illness' *Journal of Labour Research*, 2, 349-361.



Leigh, J.P. (1983a) 'Sex Differences in Absenteeism' *Industrial Relations*, 22, 349-361.

Leigh, J.P. (1983b) 'Direct and Indirect Effects of Education on Health' *Social Sciences and Medicine*, 17, 227-234.

Leigh, J.P. (1985a) 'Correlates of Absence from Work Due to Illness' *Human Relations*, 39, 81-100.

Leigh, J.P. (1985b) 'The Effects of Unemployment and the Business Cycle on Absenteeism' *Journal of Economics and Business*, 37, 159-170.

Lyons, T.F. (1972) 'Turnover and Absenteeism: A Review of Relationships and Shared Correlates' *Personnel Psychology*, 25, 271-281

Markham, S.E. (1985) 'An Investigation of the Relationship Between Unemployment and the Absentee: a Multi Level Approach' *Academy of Management Journal*, 28, 229-234.

Milgrom and Roberts (1992) '*Economics, Organisation and Management*' Prentice-Hall International, UK.

Miron, J.A. (1990) 'The Economics of Seasonal Cycles' NBER Working paper 3522.

Mitra, A, G.D Jenkins Jr. and N. Gupta (1992) 'A Meta-Analytic Review of the Relationship Between Absence and Turnover' *Journal of Applied Psychology*, 77, pp. 879-889.

Mobley, W.H. (1977) 'Intermediate Linkages in the Relationship Between Job Satisfaction and Employee Turnover' *Journal of Applied Psychology*, 62, 237-240.

Mobley, W.H. (1982) 'Some Unanswered Questions in Turnover and Withdrawal Research' *Academy of Management Review*, 7, 111-116.

Muchinsky, P.M. (1977) 'Employee Absenteeism: A Review of the Literature' *Journal of Vocational Behaviour*, 10, 316-340.

Oldham, G.R., C.T. Kulik, M.L. Ambrose, L.P. Stepina, and J.F. Brand (1986) 'Relations Between Job Facet Comparisons and Employee Reactions' *Organizational Behaviour and Human Decision Processes*, 38, 28-47.

Orme, C.D. (1997) 'The initial conditions model and two-step estimation in discrete panel data models', University of Manchester, mimeo.

Paringer, L. (1983) 'Women and Absence: Health or Economics?' *American Economic Review*, 73, 123-127.

Peel, M.J. and N. Wilson (1991) 'The Impact on Absenteeism and Quits of Profit Sharing and Other Forms of Employee Participation' *Industrial and Labour Relations Review*, 43, 454-468.

Pissarides, C.A. and J. Wadsworth (1994) 'On-the-Job Search: Some Empirical Evidence from Britain' *European Economic Review*, 38, 385-401.

Porter, L.W. and S.M. Steers (1973) 'Organisational, Work and Personal Factors in Employee Turnover and Absenteeism' *Psychological Bulletin*, 80, pp 151-176.

Price, J.L. (1977) *The Study of Turnover* Ames: Iowa State University Press.

Rosen, S. (1986) 'The Theory of Equalizing Differences' in '*The Handbook of Labour Economics, Volume 1*' by O.C. Ashenfelter and R. Layard, pp. 641-692.

Rosse, J.G. (1988) 'Relations among Lateness, Absence and Turnover: Is There a Progression of Withdrawal?' *Human Relations*, 41, pp. 517-531.

Salop, S.C. (1979) 'A Model of the Natural Rate of Unemployment' *American Economic Review*, 69, 117-125.

Sapsford, D. and P. Turnbull (1994) 'Strikes and Industrial Conflict in Britain's Docks: Balloons or Icebergs?' *Oxford Bulletin of Economics and Statistics*, 56, 249-265.

Shapiro C. and J.E. Stiglitz (1984) 'Equilibrium Unemployment as a Worker Discipline Device' *American Economic Review*, 74, 433-444.

Steers, R.M. and S.R. Rhodes (1978) 'Major Influences on Employee Attendance: a Process Model' *Journal of Applied Psychology*, 63, 391-407.

Steers, R.M. and S.R. Rhodes (1984) 'Knowledge and Speculation about Absenteeism' in '*Absenteeism*', P.S. Goodman and R.S. Aitken (eds.), Jossey-Bass Inc. San Francisco.

Steers, R.M. and R. Mowday (1981) 'Employee Turnover and Post-decision Accommodation Processes' *Research in Organisational Behaviour*, 3, 391-407.

Stumph, S.A and P.K. Dawley (1981) 'Predicting Voluntary and Involuntary Turnover using Absenteeism and Performance Indices' *Academy of Management Journal*, 24, 148-63.

Treble, J.G. (1990) 'An Essay on Absenteeism' University of Hull, Labour Economics Unit Working Paper Number 90/5.

Turnbull, P. and D. Sapsford (1992) 'A Sea of Discontent: The Tides of Organised and 'Unorganised' Conflict on the Docks' *Sociology*, 26, 291-309.

Vernon, H.M. and T. Bedford (1928) 'A Study of Absenteeism in a Group of Ten Collieries, London Medical Research Council, Industrial Fatigue Research Board No. 51.

Vernon, H.M., T. Bedford and C.G. Warner (1931) 'Two Studies of Absenteeism in Coal Mines' London Medical Research Council, Industrial Health Research Board No. 62.

Waters, L.K. and D. Roach (1979) 'Job Satisfaction, Behavioral Intention and Absenteeism as Predictors of Turnover' *Personnel Psychology*, 32, 393-397.

Weiss, A. (1985) 'Absenteeism and Wages' *Economics Letters*, 19, 277-279.

Youngblood, S.A. (1984) 'Work, Non-Work and Withdrawal' *Journal of Applied Psychology*, 49, 106-117.