THE DETERMINANTS OF LATENESS:

EVIDENCE FROM BRITISH WORKERS

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ABSTRACT

Using a sample of male and female workers from the 1992 *Employment in Britain* survey we estimate a generalised grouped zero-inflated Poisson regression model of employees' self-reported lateness. Reflecting theoretical predictions from both psychology and economics, lateness is modelled as a function of incentives, the monitoring of and sanctions for lateness within the workplace, job satisfaction and attitudes to work. Various aspects of workplace incentive and disciplinary policies turn out to affect lateness, however, once these are controlled for, an important role for job satisfaction remains.

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Key words and phrases: lateness, tardiness, worker commitment, self-reported survey data, inflated and grouped count data.

1. Introduction

Labour productivity depends in part on the commitment of workers. Commitment, or the lack thereof, drives worker behaviour in ways which can impact on output and hence firm profitability. Recent research on worker behaviour has studied worker absenteeism (Barmby et al., 1995), the intensity of work effort in any hour on the job (Green, 2001) and quits (Clark, 2001). A relatively neglected aspect of worker commitment is punctuality, yet it is clear that late arrival at work imposes direct and indirect costs on the employer. As well as the direct cost of lost output and the knock-on effects of lateness in integrated production systems, late arrival can be viewed as a "withdrawal behaviour" which is a correlate of, or precursor to, shirking, absenteeism or turnover. Just as employers invest in personnel policies intended to reduce absenteeism and turnover or to elicit additional worker effort, they will find it profitable to design policies which influence employee lateness.

In this paper we provide statistical evidence from a large, representative sample of British employees, the *Employment in Britain* survey, on the determinants of late arrival at work. We address empirically two, largely distinct, characterisations of employee lateness from different theoretical literatures: economics and psychology. In economics the preferences of individuals and the incentives and constraints they face are considered to govern how individuals use their time. Lateness is therefore expected to respond to changes in employer policies which, say, better reward individual performance or punish transgressions more harshly. Equally however, as the psychology literature emphasises, manifestations of a lack of work commitment, such as lateness, may reflect negative attitudes to the workplace or job in general. Low employee morale or a lack of job satisfaction may lead to late arrival at work. There is very little previous empirical work which attempts to evaluate the relative

contributions of these two sets of potential determinants of lateness and this is the key contribution of the present study.

By estimating generalised, multivariate, count data regression models of the frequency of worker lateness we demonstrate that there is an important role for both economic and psychological factors. Lateness does respond in a predictable manner to both the incentives and sanctions in the workplace, however neglecting attitudinal variables such as job satisfaction leads to an incomplete view of the determinants of this particular aspect of worker commitment. Our work suggests that employee morale, insofar as this is measured by job satisfaction, needs to be considered by firms, alongside the usual carrots and sticks of human resource management policy, when designing policies on employee lateness.

The remainder of the paper proceeds as follows. Section 2 provides a brief overview of the existing theoretical and empirical literature, section 3 describes the data and econometric methodology, section 4 presents the results of the empirical analysis and section 5 concludes.

2. Models of Lateness

There are two largely distinct perspectives on employee lateness in the scholarly literatures of economics and psychology. Economists emphasise the preferences of, and constraints faced by, rational workers. Arriving late at work is viewed as a choice taken after weighing up the costs and benefits of alternative uses of scarce time. In contrast, researchers in industrial psychology focus on attitudes towards the workplace, particularly those relating to job satisfaction. A key objective of our multivariate regression analysis is to evaluate the empirical relevance of each of these approaches hence in this section we provide an overview of each and discuss some existing empirical results. The existing literature on lateness is

relatively sparse and so we also refer to some studies which have analysed other aspects of worker commitment such as absenteeism, quits and work intensity or effort.

The economic analysis of lateness, exemplified by Small (1982), posits a rational worker choosing a travel schedule which implies a target arrival time at work. Arriving early, relative to an exogenous work start time, imposes a cost in terms of foregone leisure and is utility-reducing. This cost will be higher where workers value leisure more. Arriving late implies two types of cost. First, earnings may be reduced if pay is docked for late arrival. Second, arriving late, like shirking in the efficiency wage model (Shapiro and Stiglitz, 1984), is likely to increase the probability of dismissal and therefore reduce the discounted flow of future earnings. The choice of travel schedule, and hence expected arrival time at work, is therefore a tradeoff between the respective costs and benefits of early and late arrival.

Factors which influence the costs and benefits of alternative expected arrival times fall into three broad groups. First, the preferences of the worker will be important. Those who value leisure more will, other things equal, prefer a later arrival time. Second, the compensation structure faced by the worker will affect schedule choice. This is potentially more complex than simply accounting for the foregone earnings which result from having pay docked for lateness. For instance, higher earnings can imply a higher demand for leisure - an income effect as in the usual model of labour supply - and this will tend to increase the attractiveness of late arrival at work. In addition, the potential motivational effects of incentive pay schemes need also to be considered: where performance-related rewards are offered this may improve all aspects of worker commitment. The third set of economic determinants of lateness relates to the implications of late arrival for job security and tenure. Both the probability of detection and the consequences of lateness will influence worker behaviour. The structure of personnel

policies including the effectiveness of monitoring within the firm and the strictness of sanctions for negative behaviour will influence the worker's decision.

It is worth noting that the effects of incentives, monitoring effectiveness and sanctions have also been discussed in the economics literature as influences on other aspects of worker commitment. In efficiency wage models (Shapiro and Stiglitz, 1984) the probability of dismissal for shirking and the level of the wage are important in securing worker effort. In models of interactions between principals (firms) and agents (workers), considerable attention is paid to designing incentive-compatible remuneration contracts under which agents will perform at a required level (Grossman and Hart, 1983). Lazear (1995), in his review of the economics of personnel, shows how incremental pay schemes can bring forth high effort levels from employees. Barmby et al. (1995) and Coles and Treble (1993) discuss how the design of personnel policies which reduce sick pay or offer bonuses for attendance may reduce absenteeism. These examples suggest that in economics a common framework may be used to analyse lateness and other aspects of worker commitment.

Psychological theories of employee lateness focus on the idea of 'withdrawal'. It is argued that lateness is a withdrawal behaviour - a manifestation of "neglect and disrespect" (Koslowsky, 2000, p.391) - for the worker's job or employer. Other types of withdrawal include shirking, absenteeism and voluntary separation and different withdrawal behaviours may be viewed as independent of one another, as substitutes or as a progression. This latter possibility, which has received some empirical support (Rosse and Miller, 1984), conjectures that withdrawal behaviours lie on a continuum with minor loafing at one end through lateness, serious shirking and absence, all the way up to turnover at the other. As the degree of withdrawal increases, workers progress along the continuum exhibiting increasingly serious

forms of malfeasance until a separation (voluntary or involuntary) occurs. A key correlate of the worker's likelihood to withdraw from the workplace is job satisfaction. Workers who are dissatisfied with aspects of the job are those, according to the theory, who are most likely to exhibit withdrawal behaviours, including lateness.

From an empirical perspective, a number of psychological studies find a statistically significant correlation between lateness and attitudinal factors. Such investigations typically study a single employer or workplace and estimate simple correlations between lateness and other variables using relatively small samples. Koslowsky et al. (1997) provide a useful survey of this literature by undertaking a meta-analysis of 118 correlation coefficients across 30 samples from 27 independent studies. The published studies used as inputs to the meta-analysis had sample sizes ranging from 37 to 1,244 and were mainly conducted in single employers or workplaces. The meta-analyis suggests that the strongest (positive) correlation was between lateness and other types of withdrawal behaviour including absence and turnover. The next strongest correlation was a negative relationship between work attitudes - primarily job satisfaction - and lateness.

A potentially important problem with such studies is that the estimation of simple correlation coefficients between two variables of interest fails to control for the wide variety of possible determinants of lateness. If, for example, lateness is negatively related to pay which in turn is positively related to job satisfaction then an observed negative correlation between lateness and job satisfaction might simply be reflecting the influence of the omitted variable pay. Empirical work on lateness which attempts to control for this through multivariate regression techniques is rare. One strand of relevant literature is found in the analysis of transportation choice and urban traffic congestion. Here the focus is not on lateness *per se* but rather on the

scheduling of (typically commuting) trips. Implicit in a commuter's choice of transport mode and departure time is a probability of late arrival hence this literature provides some empirical evidence on the factors which influence the propensity to arrive at work after the required start time. A key explanatory variable, in addition to the explicit cost of transport mode and journey time, turns out to be the degree of flexibility in arrival time enjoyed by the employee. Abkowitz (1981), Caplice and Mahmassani (1992) and Small (1982) find that employer flexibility is a statistically significant determinant of scheduling decisions taken by urban commuters in American cities. This is consistent with the emphasis on monitoring and sanctions in the economic approach. Small (1982) and Hendrickson and Plank (1984) find, in addition, that commuters generally prefer to arrive early for work rather than late - workers would pay considerably more to avoid being one minute late compared to one minute early.

Transportation studies, in common with studies in industrial psychology, tend to be based on small samples of nationally non-representative workers. Our data allow us to control for a wide variety of potential determinants of lateness using a representative sample of the British workforce. The only similar study of which we are aware is by Leigh and Lust (1988) whose data are drawn from the United States Quality of Employment Survey and who use a Tobit regression model. They find that significant determinants of the number of days reported late within the last two weeks (sign of relationship in parentheses) include: wages (+), working too much overtime (+), experiencing commuting problems (+), work experience (-) and being a professional or managerial employee (+). In contrast to many of the psychological studies, they find no role for job satisfaction once other variables are controlled for and no link between the frequency of lateness episodes and absenteeism.

While there is no similar evidence on lateness for Britain, there is a recent empirical literature in economics on other aspects of worker commitment. Green and McIntosh (1998) analyse subjective measures of work intensity or effort and emphasise the sanction of job loss for workers who are supplying low effort. They find that the presence of trade unions is an important intervening variable which moderates the effect of the threat of job loss on effort. Clark (2001) estimates equations which explain the likelihood of workers quitting their jobs. In a panel of British workers, he finds a strong role for job satisfaction, after controlling for a large number of other variables including individual demographic characteristics, unionisation, region, industry and occupation. Barmby et al. (2001) in a multivariate count data regression model find that sick pay generosity and hence the cost of absence are significant in explaining the number of absences in a particular manufacturing firm. Our empirical evidence extends this approach to lateness and we now turn to a more detailed discussion of the data and econometric methods.

3. The Data and Econometric Model

The *Employment in Britain* study surveyed the British labour market between May and September 1992. Postcode was used to generate a nationally-representative sample of employed and self-employed people aged between 20 and 60. A total of 3855 respondents were interviewed on a wide variety of issues relating to the respondent's current employment position, employment history and to the characteristics of their employer, where appropriate. In addition, respondents were asked a set of questions designed to elicit subjective preferences and attitudes to various aspects of employment. A detailed sociological analysis of the data and further details of the sampling methodology are found in Gallie et al. (1998). The sample used here was restricted to those respondents in full-time employment who reported their earnings.

The dependent variable in our analysis refers to the number of times that the respondent reported being late in the previous month. The possible responses and sample frequencies are tabulated for the regression sample in Table 1. Around 70% of the sample reported that they had not been late at all in the previous month. Amongst those with positive lateness count, once was the modal category with rapidly declining relative frequencies for the higher (grouped) counts. Almost 2% reported being late eleven or more times which, assuming a standard five day working week, implies being late every other day, on average.

It is possible to compute a rough estimate of the average probability that a worker will be late on any given day by using the relative frequencies and the midpoints of the grouped counts. Similar calculations based on the work of other researchers provide a check on whether our raw data are comparable. Based on these 1897 workers from the *Employment in Britain* survey, we find a value of 4.4%. This is very similar to the value of 5.7% obtained by Leigh and Lust (1988) and 4.2% found by Small (1982) but is considerably smaller than the 12-16% reported by Koslowsky and Dishon-Berkovits (2001). Note however that this latter paper examines a small sample (155) of white-collar employees only, while the other studies are based on larger samples and more heterogeneous workers.

Like many studies of aspects of worker commitment we are using a dependent variable which is reported by the worker themselves. Such data are potentially prone to problems of mis-reporting or reporting bias. Koslowsky and Dishon-Berkovits (2001) investigate the extent of mis-reporting of lateness episodes by comparing administrative records from a large Israeli employer with employee self-reports of lateness. They find that there was some under-reporting in the self-report measures compared to the personnel records, however they

describe the inaccuracy as "mild" (p. 157) and conclude that self-report data can be used in lieu of personnel data to study lateness.

Our analysis is based on estimation of a generalisation of the Poisson regression model discussed in Moffatt and Peters (2000). Here we provide the essence of the approach; more details of the technicalities of the model and estimation procedure are contained in Appendix A.

Consider a discrete random variable Y_i representing the lateness count for individual *i*. According to the Poisson model, the probability distribution of Y_i is given by:

$$P(Y_i = y) = \frac{e^{-\lambda_i}\lambda_i^{\,y}}{y!} \qquad y = 0,1,2,\cdots,\infty \qquad (1)$$

where it is conventionally assumed that the Poisson mean depends on a vector of explanatory variables x_i according to:

$$\lambda_i = \exp(x_i'\beta)\,. \qquad (2)$$

Here β is a vector of parameters and the first element of the vector x_i is a constant, so the first element of β is an intercept.

Two features of the lateness data from the *Employment in Britain* survey require modification of the simple Poisson process presented above. The first is that we do not observe the actual lateness count for some workers since the response to the question is grouped for the higher counts. In fact, as the Appendix shows, a simple modification to the log-likelihood function can account for this. It is also possible that the grouped nature of the dependent variable may have advantages from a sampling perspective by reducing potential mis-reporting problems at

higher counts. In other words, respondents who incorrectly recall the actual number of counts might still get it in the correct 'group' at high values of the dependent variable.

The second feature of the data is common in the count data regression literature and is often called the 'excess zero' or 'zero inflation' problem. This refers to the fact that a large proportion of the respondents, and importantly, a larger proportion than a simple Poisson process would predict, report zero instances of lateness during the relevant period. Neglecting this can induce biased estimates and incorrect inferences (Winkelman, 1997, sections 3.3-3.4). To correct for this we assume that there are two types of worker. The first type will never report a strictly positive lateness count which may reflect aspects of the worker's personal characteristics, honesty or the institutional arrangements at the workplace. The second type is prone to lateness and may report a strictly positive count. However they may also report a zero if they happen not to have been late in the reporting period. Suppose that the population proportion of workers who are not prone to lateness is ω, then (1) can be rewritten as:

$$P(Y_i = y) = 1_{y=0}\,\omega + (1-\omega)\frac{e^{-\lambda_i}\lambda_i^{y}}{y!} \qquad y = 0, 1, 2, \ldots \infty \tag{3}$$

where $1_{y=0}$ is a binary indicator variable which takes the value 1 when $y = 0$ and 0 otherwise. The proportion ω can be treated as a parameter and estimated using standard maximum likelihood procedures.

A final modification of the model is to let ω vary with the observable characteristics of the respondent. Blau (1994), using the administrative records of a bank and a hospital, reports that those who were never late over an 18-month period were significantly different on a number of characteristics to those who were late at least once. This idea can be incorporated

by specifying the following model for the individual probability of not being prone to lateness:

$$\omega_i = 1 - \Phi(w_i'\gamma) \qquad (4)$$

where Φ is the standard normal cumulative distribution function. In this formulation w_i is a vector of explanatory variables (which may be the same as x_i) thought to affect the likelihood that individual i is never late. The vector γ contains parameters which are to be estimated simultaneously with β. The model based on equations (3) and (4) is known as the generalised, zero-inflated Poisson model.

In the following section we report estimates of three different specifications of a generalised, grouped, zero-inflated Poisson regression model of lateness. Specification I presents estimates of β and ω on the assumption that ω is constant across individuals. In Specification II we allow ω to vary by observation requiring that we choose which explanatory variables enter into the vectors x_i and w_i. Initially we set $w_i = x_i$, our rationale being that theory offers little guidance in determining which variables should appear in the equation determining the count and which in the equation which models proneness to being late. It is therefore an empirical matter and hence we estimate a second version of the generalised grouped zero-inflated Poisson model (Specification III) which is obtained from Specification II through a stepwise variable elimination procedure. Specifically, we start with an initial set of variables and sequentially delete those that are least significant, using a 10% significance level as a cut-off point. This test is performed using the likelihood ratio criterion comparing the equations with and without the candidate variable(s).

Table 2 contains a description of the initial set of explanatory variables in the regressions, along with some sample statistics and, for the dummy and ordinal variables, a statistical test

of their association with lateness. The variables have been divided into five broad categories which are discussed in turn below.

(i) *Worker Characteristics*. As is standard in much of labour economics, we control for age and its square, gender, education, marital status and household composition. In the discussion of lateness, household structure is likely to be important. The presence of young or school-age children is expected to cause shocks to scheduling decisions and we include the numbers of infants and school-age children in our specification in order to capture these shocks.

(ii) *Workplace Characteristics*. We control for sector (private versus public) as there may be unobservable differences in the nature of the workers who choose each of these sectors which relate to their motivation and hence propensity to be late. Industrial differences might also be expected to be important insofar as different technological processes necessitate different work-start time regimes. Lanfranchi and Treble (2002) discuss the implications of the adoption of just-in-time production processes for personnel policies related to absenteeism. The third characteristic we control for here is unionisation and we argue that this effect could work in either direction. Unionised workers might feel a higher degree of protection from management discipline practices and hence exhibit higher lateness counts. On the other hand, it has been suggested that unions can facilitate better employee-employer relations and contribute to productivity-enhancing improvements in worker commitment (Deery et al., 1999 and references therein).

(iii) *Sanctions and Monitoring*. The EIB contains a number of measures of the strictness or otherwise of the supervisory and disciplinary environment in the workplace. Particularly useful for our purposes is a question on the worker's perceptions of how long it would take

them to be dismissed for persistent lateness. This is self-reported, however it would seem that here it is the worker's perceptions which are actually important in determining his or her behaviour. Assuming dismissal takes place, an aspect of the magnitude of the sanction is the expected time to re-employment elsewhere. Thus we include the unemployment rate in the local travel-to-work area as a proxy for this effect. Two other variables are included under this heading. First, we have answers to a question on the worker's perceptions of whether punctuality is important to their supervisor. Second, we include a variable reflecting whether the worker's employer requires that he or she sign or clock in to work.

(iv) *Incentives*. In addition to the log of the hourly wage, we attempt to measure the impact of various aspects of incentive pay on the worker's punctuality. We therefore include dummy variables reflecting whether the individual is subject to bonus payments for the quality of their (or their workgroup's) work, whether they are on an incremental pay scheme or whether there is some other performance-related aspect to their remuneration.

(v) *Worker Attitudes*. Our main focus on worker attitudes relates to job satisfaction as has been emphasised by previous literature in both psychology and economics. The question we use asked workers to rate their overall job satisfaction on a five point Likert-type scale. In addition to job satisfaction, we also consider workers' attitudes to the statement: 'hard work is fulfilling in itself'. We argue that responses to this reflect labour-leisure preferences and are likely to influence lateness behaviour through the perceived utility of additional leisure time.

The final column of Table 2 demonstrates that there appears to be an individual association between a number of the discrete variables and the lateness variable at a significance level of 10% or lower. Particularly noticeable are the influences of time to dismissal, the importance

of lateness to the supervisor, job satisfaction and attitudes to hard work. However, due to strong association between certain of these variables themselves, and the need to control for the continuous variables, it is best to investigate the effects of these variables on lateness jointly.

4. Regression Results

Table 3 contains maximum likelihood estimates of the parameters of the count data regression models. Estimated coefficients and asymptotic t-statistics are presented for each of the three specifications discussed in the previous section. For specification I the estimates of the parameter vector β are presented. A positive coefficient in this column implies, *ceteris paribus*, that a unit increase in the relevant variable leads to a higher predicted lateness count. For each specification an estimate of the population proportion of workers who never report lateness is presented. This is contained in the row labelled 'Probability of Zero Inflation' and corresponds to the parameter ω. In specifications II and III the 'Inflation' column provides estimates of the parameter vector γ. Here a positive estimated coefficient implies that a unit increase in the relevant variable leads, *ceteris paribus*, to an increase in the probability that the worker is prone to lateness. Interpretation of the 'Count' column for specifications II and III is the same as for specification I.

In the ensuing discussion we focus primarily on specifications I and III, viewing specification II as an intermediate step, or bridge, between the two. It is clear from perusal of the asymptotic t-statistics in specification II that a large number of the variables are insignificant and, for this reason, the more parsimonious specification III, resulting from our stepwise variable deletion procedure, is preferred. Note that, based on likelihood ratio tests,

specification II fits the data better than specification I (p-value < 0.001), while the more parsimonious specification III has a similar fit to specification II (p-value = 0.79).

In specification I few of the background characteristics of the worker turn out to be statistically significant determinants of lateness. The exceptions are gender, with males predicted to have higher counts, and educational qualifications, where the least well qualified exhibit lower counts. Moving to specification III, however, demonstrates the importance of accounting for proneness to being late as well as lateness count, since a number of other individual worker characteristics become statistically significant. For example, age reduces the probability of being prone to lateness. This is similar to a finding of Leigh and Lust (1988) who use an experience variable in their regression model of lateness. They interpret the negative sign as reflecting the greater job commitment of older and more experienced workers. Interestingly, marital status (the variable Spouse) is not significant in specification I but enters both equations in specification III but with opposite signs. Thus being married increases the lateness count but is negatively related to the probability of being prone to lateness. Labour economists (e.g. Polachek and Siebert, 1993, p. 84) discuss how marriage may be related to higher productivity through selection effects and one possible interpretation of our results is that married individuals are more committed and hence less prone to lateness, however those married people who are prone to lateness will be late more often than their single counterparts because of intra-household conflicts relating to the household's allocation of time. Further evidence of the importance of intra-household allocation decisions comes from the coefficients on the variables relating to the presence of infant and school-age children in the household. Children do significantly increase the probability of being prone to lateness which seems a reasonable finding.

The background characteristics of the workplace relating to industry, sector and unionisation are all highly significant. Workers in manufacturing and the public sector exhibit less lateness. These are broad aggregations of types of employer and workplace so any explanation for these findings is necessarily speculative. It is possible however that the nature of the production process in manufacturing will imply a stricter requirement that the various parts of an integrated production process are synchronised in time. This, essentially technological, reason could explain why there is a greater culture of punctuality in manufacturing as opposed to services. We also speculate that public sector workers are more likely to have chosen their vocations for non-pecuniary reasons and will display, as a result, higher work commitment and hence less lateness.

In these data, controlling for other factors, unionised workers report significantly lower counts than non-unionised workers. The sign of the unionisation coefficient is difficult to predict *a priori*. On the one hand, unionised workers may feel protected against the sanctions which are available to employers for negative work behaviour. Green and McIntosh (1998) find evidence in support of this view in a study of worker effort levels. On the other hand, unions are often credited with acting as a communications channel between management and employees in which role they boost morale and increase worker commitment. For example, Deery *et al*. (1999) find that a positive union-management relationship is associated with higher levels of attendance in an Australian automotive manufacturer. While it is not the principal theme of our paper, our results support this latter view of the effect of unionisation on one particular aspect of worker commitment in a cross-section of the British labour force.

Monetary incentives are a key component of the economic analysis of worker commitment and our regression results provide some detail on the mechanism of how such payments affect

punctuality. The (log) hourly wage is negatively signed and significant at the 10% level in specification I. This is the opposite sign to that found by Leigh and Lust (1988) however those authors note that if pay is docked for tardiness, then a higher wage implies a higher opportunity cost of time late for work hence the wage variable is difficult to sign *a priori*. Note also that the log wage is only of marginal significance and in fact drops out of the model when we move to specification III. On the other hand, individuals who are eligible for an individual performance bonus are predicted to have lower lateness counts in both specifications I and III. We found no role in determining individual lateness behaviour for bonuses which are paid for the performance of a higher level structure such as a workgroup or plant nor was there any effect of profit sharing or performance related pay. In specification III we also found that being on an incremental pay scale increased the likelihood that a worker was prone to lateness, while at the same time reducing the lateness count. To the extent that an incremental pay scheme reflects a rising real earnings-age profile, theory (reviewed in Lazear, 1995, chapter 4) suggests that such reward schemes should induce increased worker effort, and hence by extrapolation, reduce levels of lateness. For those workers who are prone to lateness, this view is consistent with our results. However, being on such a pay scheme is also associated with a reduced probability of being prone to lateness. Further investigation of this finding would require more detailed information on the slope of the pay-experience profile, the particular point on the incremental scale currently reached by the worker and the conditions attached to salary progression. Such information is not generally available in large-scale survey data and personnel records are required for such purposes.

As well as financial inducements, economics suggests that rational workers' behaviour will respond to the monitoring and disciplinary environment in the firm. Nationally representative survey data do not generally allow detailed investigation of this environment and it is a

strength of the *Employment in Britain* survey that workers were asked about their perceptions of the monitoring and sanctions that they face. Our regression results confirm the importance of these variables as key determinants of lateness. Unsurprisingly, workers whose supervisors viewed punctuality as important reported lower lateness counts and those required to clock or sign in were less prone to lateness. Similarly, perceptions of the time to dismissal for persistent lateness were highly significant. Relative to the baseline of dismissal between one month and one year, a longer time to dismissal is (monotonically) associated with more lateness. We should, however, note at this stage that a relatively large proportion of our sample did not report the time to dismissal. Rather than drop these observations we included a dummy variable to capture these workers. The positive sign on this variable could be interpreted in the following way: those who are insufficiently motivated to find out about their company's policies towards negative work behaviours are demonstrating low work commitment and hence are more likely to exhibit such behaviours.

The only sanctions and monitoring variable which was not a significant determinant of lateness was the local unemployment rate. This was included in the initial model on the basis that, in line with efficiency wage type models (Shapiro and Stiglitz, 1984), a larger pool of unemployed labour increases the incentives not to shirk since dismissal is more costly to the worker. In models of employee effort, Agell (1994) and Belman et al. (1992) use *subjective* measures of the likelihood of job loss as explanatory variables and find that the greater is this likelihood then the lower is the level of shirking. A potential explanation for our finding is therefore that the local unemployment rate is a poor proxy for any individual's subjective assessment of the probability of them finding themselves out of work and it is this latter measure which is important in affecting worker motivation.

To summarise the results of our discussion of the various carrots and sticks that are available to employers, it is clear that the structure of remuneration and, particularly, the supervisory and monitoring environment and the perceived punishments for transgression have a major influence on the likelihood that workers will be late and the frequency of lateness episodes. Employment policies in the workplace can, in principle, influence worker behaviour over lateness in the manner that a simple economic model might predict. One other aspect of any economic model of worker behaviour is preferences and we have argued that the strength of a worker's preferences for leisure will be important in determining lateness. Such preferences are not usually observed; our proxy is the strength of the worker's agreement with the statement that hard work is fulfilling in itself. Table 3 reveals that this variable is completely insignificant, a finding at odds with Clark and Tomlinson (2001), who use these data to analyse self-reported effort levels.

Worker attitudes are less directly controllable by employers, although employment practices and policies will impact upon them at some level. Attitudes to the job, as the psychological and economic studies discussed earlier make clear, are associated with aspects of worker behaviour and one of our key research questions is whether, controlling for other variables, attitudes relating to job satisfaction affect lateness. From specification I the answer is affirmative. Those who report being completely or very satisfied are less frequently late than those who feel neutral about their job. The dissatisfied are more likely to be late than the baseline group although this latter effect is not statistically significant. This finding is echoed in the inflation equation of specification III suggesting that job satisfaction works through affecting the probability that an individual is prone to lateness. Job satisfaction, in fact, appears in both equations in specification III although its status in the count equation is marginal. Indeed if we changed our criterion for variable elimination to 5% then job

satisfaction would drop out of the count equation (it would however remain in the other equation).

We have already discussed how smaller scale studies in individual workplaces suggest a link between job satisfaction and lateness. We believe that our finding represents an important advance insofar as we demonstrate that, even after controlling for a wide variety of other variables in a representative sample of British employees, there is a negative association between a worker's overall satisfaction with their job and their proneness to being late. The influence of job satisfaction on a variety of outcomes is increasingly being recognised and our results support the view (e.g. Clark, 1996, 2001) that the analysis of such subjective measures is a valid area of study for labour economists and industrial relations researchers. We would go further and suggest that neglecting the importance of job satisfaction yields a restrictive view of how worker behaviour is determined. The quantitative significance of this is demonstrated in Table 4 where we calculate predicted monthly lateness counts, based on the results of specification III, for a variety of worker and workplace types. We vary the sanctions ('sticks') and incentives ('carrots') faced by workers, as well as their level of job satisfaction.

Moving from a position where the individual is 'fairly satisfied or neutral' about their job to a position where they are 'completely satisfied' reduces the predicted probability that an individual is prone to lateness by around twenty percentage points (from 0.52 to 0.31) and the expected monthly lateness count from 0.98 to 0.60. This reduction in the expected count is larger than the individual effects of increased sanctions (the + Sticks type where monitoring is increased and the time to dismissal for persistent lateness falls) or increased incentives (the + Carrots type where performance bonuses and incremental pay schemes are offered). Unlike

sanctions and incentives, job satisfaction is by no means fully under the control of the employer, nevertheless our results demonstrate that changes in job satisfaction can have a quantitatively important impact on behavioural outcomes in the workplace.

5. Conclusions

Our investigation of the factors which determine the frequency of employee lateness was motivated by arguments from economics and psychology. The regression results suggest that economic variables relating to the incentives and sanctions facing workers as well as psychological or attitudinal variables relating to job satisfaction are important. The implication is that focussing on one set of explanations at the expense of the other yields an incomplete view of lateness. Such a finding contributes to a wider development in the economics literature in which self-reported, subjective, psychological measures of various phenomena appear centre stage. Examples include the analysis of happiness by Oswald (1997), job satisfaction by Clark (1996, 2001) and firm financial performance by Machin and Stewart (1990).

From the employer's perspective, our results point to a trade-off facing by those who set personnel policy. A stricter working environment, in terms of the supervision and monitoring of the worker, will secure reduced lateness, but may well create a less pleasant working environment, poorer relations between management and workers, lower job satisfaction, more lateness and potentially other withdrawal behaviours. The slope of this trade-off together with the nature of the firm's personnel and remuneration policies are the ingredients of a cost-benefit exercise which firms will undertake in order to establish the optimal way of securing a given level of lateness.

Lateness is relatively under-researched in the industrial relations and economics literatures and additional insight could be gained from the analysis of employer's personnel data. Not only would this deal with potential problems of self-reporting, but would provide a much more detailed view of the micro-structure of policies relating to incentives and sanctions within the workplace. The analysis of such data, which would complement the use of large survey data sets as in the current paper, is an agenda for future research.

The precise relationship between different aspects of worker commitment and types of withdrawal is another question which needs to be addressed. The importance of lateness for firms and the wider economy will depend on whether it is a precursor to or correlate of other productivity-reducing worker behaviours such as absenteeism and shirking, or whether it is an isolated form of worker malfeasance.

Appendix A - The Econometric Model and Estimation Procedure

We begin from the standard Poisson probability model

$$P(Y_i = y) = \frac{e^{-l_i} l_i^{\,y}}{y!} \quad y = 0, \cdots, \infty \tag{A1}$$

where Y_i is a discrete random variable representing the count for individual i and

$$l_i = \exp(x_i' b). \tag{A2}$$

To account for grouping, the set of non-negative integers is partitioned into J mutually exclusive and exhaustive subsets $I_1,...,I_J$, such that each I_j is the set of consecutive integers $\{a_j, a_j+1, ..., b_j\}$, with $a_1 = 0$, $a_{j+1} = b_j + 1$ for $j = 1,2,..., J-1$, and $b_J = \infty$. The way in which the lateness question was asked results in knowledge of the set I_j to which the count belongs, but not the count itself. The probability of individual i being in group j is:

$$P(Y_i \in I_j) = \sum_{y \in I_j} P(Y_i = y) = \sum_{y \in I_j} \frac{e^{-l_i} l_i^{\,y}}{y!} \equiv P_j(x_i; b) \quad j = 1, \cdots, J. \tag{A3}$$

Let y_i be the realisation of the random variable Y_i. We define an indicator d_{ij} to take the value one if $y_i \in I_j$, and zero otherwise. Although the y's are not fully observable, the d's are, and the log-likelihood function for a sample of size n may be constructed as follows:

$$LogL(b) = \sum_{i=1}^{n} \sum_{j=1}^{J} d_{ij} \log\left[P(Y_i \in I_j)\right]. \tag{A4}$$

The final group, group J, consists of an infinite number of integers: a_J, a_{J+1}, .., ∞. The probability of the count falling in this final group should therefore be expressed as $1 - \sum_{j=1}^{J-1} P_j(x_i; b)$ in order for its evaluation to be possible.

The grouped zero-inflated Poisson model is defined as follows:

$$P(Y_i \in I_j) = 1_{j=1}\left(1 - \Phi(w_i'a)\right) + \Phi(w_i'a)P_j(x_i; b) \qquad \text{(A5)}$$

where $w_i = 1 \ \forall \ i$ and $\Phi(.)$ is the standard normal cumulative distribution function. Alternatively w_i can be defined as a vector of characteristics of individual i which are relevant to the whether the individual will ever report positive incidences of lateness at all, and α is a corresponding vector of parameters, the first of which is an intercept, The set of variables contained in w_i, the set of variables which determine whether the individual is prone to lateness, may overlap partly or completely with the set of variables in x_i, which, as previously, are assumed to determine frequency through the terms $P_j(x_i ; \beta)$ which were defined in (A3). This latter characterisation is labelled the generalised grouped zero-inflated Poisson model.

The parameter estimates can be found by optimising the log-likelihood function (A4) using an appropriate method. In the current study, a full Newton method was used and the Hessian at the solution was used to calculate the covariance matrix estimate from which standard errors are extracted. The average probability of being prone to lateness can be calculated as $\frac{1}{n}\sum_i \left[\Phi(w_i'\hat{a})\right]$, with its standard error obtained via the delta method. In the regression results we report the complement of this probability, which can be thought of as the probability of zero inflation.

Table 1 The Dependent Variable: Lateness

How often late	Frequency	Relative Frequency (%)
Never	1337	70.5
Once	250	13.2
Twice	147	7.8
3-5 times	103	5.4
6-10 times	27	1.4
More than 11 times	33	1.7

Note: The table summarises responses to a question on how often the respondent was late in the previous month.

Table 2 Explanatory Variables for the Regression Sample

Variable	Description	Frequency/Descriptive	Associated with Lateness?
Employee Characteristics			
Age	Age in years	Median: 35 Range: 20-60	-
Agesq/100	Age squared, rescaled	-	-
Male	Respondent is male	62.5%	0.529
Spouse	Respondent is living with a spouse or partner	67%	0.000
Highest Educational Qualification	High: degree or equivalent; Intermediate: A Levels or equivalent; Low: O Levels or equivalent.	High: 24.4% Intermediate: 14.9% Low: 42.7% None: 17.9%	0.051
Infants	Number of children aged less than 5 in respondent's household	Median: 0 Mean: 0.22 Range: 0-3	-
School Age Children	Number of children aged less than 17 in respondent's household	Median: 0 Mean: 0.66 Range: 0-5	-
Workplace Characteristics			
Public sector	Employer is in public sector	35.0%	0.016
Manufacturing	Employer is in manufacturing, broadly defined.	35.7%	0.494
Union	Respondent is a member of a trade union recognised in the workplace	43.5%	0.001

Table 2 continued

Incentives			
Log hourly wage	Logarithm of gross hourly earnings	Mean: 1.80 Standard Deviation: 0.53	-
Bonus1	Individual eligible for bonus payments for quality of their own work	18.8%	0.040
BonusO	Individual eligible for bonus for quality of collective work (workgroup or plant)	28.6%	0.991
Incremental Pay Scale	Respondent is on incremental pay scale	42.4%	0.246
Other Pay Incentives	Respondent is a member of a profit sharing scheme or has performance related pay.	47.8%	0.533
Sanctions and Monitoring			
Lateness Importance to Supervisor	How much importance the respondent perceives that their supervisor places on punctuality	1. Great deal: 57.3% 2. Some: 28.0% 3. Little or None: 14.7%	0.000
Clock	Respondent is required to sign in or clock on.	33.6%	0.014
Local Unemployment Rate	Unemployment rate (%) in the travel to work area.	9.4%	-
Time to dismissal for lateness	Worker's perceptions of time to dismissal for persistent lateness.	Less than 1 month: 26.7% 6 months - 1 year: 44.7% More than 1 year: 9.5% Never: 8.9% Unknown or Missing: 10.2%	0.000
Worker Attitude			
Job satisfaction	Overall satisfaction with job	1. Completely: 13.5% 2. Very: 33.2% 3. Fairly or Neutral: 44.8% 4. Dissatisfied: 8.2%	0.000
Work attitude	Agree with statement: hard work is fulfilling in itself	1. Agree strongly: 23.6% 2. Agree somewhat: 50.9% 3. Neutral: 16.2% 4. Disagree: 8.8%	0.001

Note: The final column of this table reports a p-value for the null hypothesis of no association between the relevant categorical variable and lateness. This is the standard Pearson χ^2 test.

Table 3: Regression Results

	Specification I	Specification II		Specification III	
	Count	**Inflation**	**Count**	**Inflation**	**Count**
Constant	0.8736 (1.774)*	0.2588 (0.4497)	1.080 (2.104)**	0.5315 (3.590)**	0.6481 (6.272)**
Employee Characteristics					
Age	0.0096 (0.3519)	-0.0060 (0.1958)	-0.0115 (0.4079)	-0.0141 (3.849)**	-
Agesq/100	-0.0233 (0.6368)	-0.0076 (0.1916)	0.0119 (0.3156)	-	-
Male	0.1265 (1.767)*	0.0046 (0.0549)	0.1480 (1.957)**	-	0.1351 (1.972)**
Spouse	0.0990 (1.339)	-0.3709 (4.158)**	0.1759 (2.246)**	-0.3578 (4.120)**	0.1652 (2.485)**
High Qualifications	-0.0427 (0.4991)	0.0384 (0.3690)	-0.0550 (0.6159)	-	-0.0843 (1.079)
Intermediate Qualifications	-0.0080 (0.0865)	0.0380 (0.3432)	-0.0437 (0.4467)	-	-0.0537 (0.6115)
No Qualifications	-0.3275 (2.611)**	-0.1251 (1.004)	-0.2182 (0.637)	-	-0.2940 (2.438)**
Infant	0.0615 (1.122)	0.1586 (2.153)**	0.0395 (0.6947)	0.1770 (2.563)**	-
School Age Child	0.0075 (0.1745)	0.0930 (1.795)*	-0.0210 (0.4660)	0.0798 (1.786)*	-
Workplace Characteristics					
Public sector	-0.1868 (2.162)**	-0.3046 (3.104)*	-0.0566 (0.6282)	-0.2682 (3.235)**	-
Manufacturing	-0.2555 (3.503)**	-0.0779 (0.8714)	-0.2336 (3.043)**	-	-0.2563 (3.627)**
Union	-0.2759 (3.330)**	0.419 (0.4630)	-0.2834 (3.169)**	-	-0.3681 (5.088)**
Incentives					
Log hourly wage	-0.1259 (1.759)*	0.0415 (0.4997)	-0.1158 (1.557)	-	-
Bonus1	-0.1905 (2.000)**	0.1437 (1.283)	-0.2576 (2.432)**	-	-0.2042 (2.388)**
BonusO	-0.0695 (0.8551)	-0.0310 (0.3213)	-0.0444 (0.5039)	-	-
Incremental pay scale	-0.1352 (1.833)*	0.1268 (1.446)	-0.1976 (2.514)**	0.1609 (1.950)*	-0.2286 (3.105)**
Other pay incentives	0.0776 (1.083)	-0.0463 (0.5581)	0.1043 (1.361)	-	-

Table 3 Continued

Sanctions and Monitoring					
Lateness Importance 2	0.4068 (5.517)**	0.0944 (1.090)	0.3740 (4.816)**	-	0.4121 (5.769)**
Lateness Importance 3	0.4114 (4.783)**	0.0142 (0.1338)	0.4062 (4.604)**	-	0.4335 (5.155)**
Clock	-0.1795 (2.248)**	-0.1067 (1.215)	-0.1457 (1.729)*	-0.1759 (2.294)**	-
Local Unemployment Rate	0.0002 (0.0145)	-0.0012 (0.0735)	-0.0017 (0.1110)	-	-
Dismissal for lateness:					
Less than 1 month	-0.2197 (2.477)**	0.0340 (0.3283)	-0.2417 (2.444)**	-	-0.2226 (2.536)**
More than One Year	0.4505 (4.422)**	-0.0280 (0.2221)	0.4566 (4.297)**	-	0.4409 (4.428)**
Never	0.8508 (9.702)**	-0.0201 (0.1637)	0.8596 (9.552)**	-	0.8424 (9.900)**
Unknown	0.3850 (3.046)**	-0.2799 (2.220)**	0.4738 (3.833)**	-	0.3635 (2.981)**
Worker Attitude					
Job satisfaction 1	-0.2367 (1.704)*	-0.4662 (3.663)**	-0.0166 (0.1235)	-0.5462 (4.548)**	0.0281 (0.2174)
Job satisfaction 2	-0.1563 (2.085)**	-0.1939 (2.236)**	-0.1329 (1.697)*	-0.2291 (2.722)**	-0.1217 (1.617)
Job satisfaction 4 (dissatified)	0.1436 (1.497)	0.0288 (0.2108)	0.1487 (1.461)	0.0429 (0.3242)	0.1588 (0.0972)
Work attitude 1	-0.0907 (0.9863)	-0.0366 (0.3703)	-0.0386 (0.4091)	-	-
Work attitude 3	0.0454 (0.5847)	0.0990 (0.9458)	0.0180 (0.2067)	-	-
Work attitude 4	-0.0248 (0.2456)	0.2486 (1.834)	-0.0719 (0.6616)	-	-
Probability of Zero Inflation (standard error)	0.6217 (0.0149)	0.6372 (0.0142)		0.6388 (0.0134)	
Log likelihood	-2020.52	-1973.79		-1987.42	
Observations	1897	1897		1897	

Notes:

1) For variable descriptions refer to table 2. The table entries for the explanatory variables contain the coefficient estimate with their asymptotic t-ratios in parentheses. Those tagged with * are significant between the 10% and 5% level, those with ** at the 5% level or below.

2) Baseline categories for dummy variables: female, unmarried, low qualifications, not unionised, not employed in the public or broad manufacturing sectors, time to dismissal between a month and less than a year, no pay incentives, no clocking-on, strict monitoring of late arrival, fairly satisfied or neutral about the job, agrees somewhat that hard work is fulfilling in itself.

Table 4: Predicted Probabilites and Expected Counts

Type	Pr(late)	Expected Lateness Count
Baseline	0.52	0.98
+ No Sticks	0.52	3.53
+ Sticks	0.45	0.68
+ Carrots	0.58	0.72
+ Carrots & Sticks	0.51	0.51
+ Satisfied	0.31	0.60

Notes:

The Baseline individual is 35 years old and has the characteristics defined by the excluded dummy variable categories in the equations reported in Table 3, namely: female, unmarried, low qualifications, not unionised, not employed in the public or broad manufacturing sectors, time to dismissal between a month and less than a year, no pay incentives, no clocking-on, strict monitoring of late arrival, fairly satisfied or neutral about the job, agrees somewhat that hard work is fulfilling in itself. The other types alter the Baseline type in the following manner:

+ No Sticks is where lateness is of little or no importance to the worker's supervisor and where the worker will never be dismissed for persistent lateness.

+ Sticks is where the worker is required to clock or sign in and will be dismissed within one month for persistent lateness.

+ Carrots is where the individual is on an incremental pay scheme and receives some kind of performance pay bonus.

+ Satisfied is where the individual reports being completely satisfied with his/her job.

References

Abkowitz, M. (1981). An analysis of the commuter departure time decision. *Transportation*, 10: 283-297.

Agell, S. (1994). Swedish evidence on the efficiency wage hypothesis. *Labour Economics*, 1: 129-150.

Barmby,T., Nolan, M. and Winkelman, R. (2001). Contracted workdays and absence. *Manchester School*, 69: 269-275.

Barmby, T., Orme, C. and Treble, J. (1995). Work absence histories: a panel data study. *Labour Economics*, 2: 53-65.

Belman, D., Drago, R. and Wooden, M. (1992). Workgroups, efficiency wages and work effort. *Journal of Post Keynesian Economics*, 14: 497-521.

Blau, G. (1994). Developing and testing a taxonomy of lateness behavior. *Journal of Applied Psychology*, 79: 959-970.

Caplice, C. and Mahmassani, H. (1992). Aspects of commuting behavior: preferred arrival time, use of information and switching propensity. *Transportation Research A*, 26A: 409-418.

Clark, A. (1996). Job satisfaction in Britain. *British Journal of Industrial Relations*, 34: 189-217.

Clark, A. (2001). What really matters in a job? Hedonic measurement using quit data. *Labour Economics*, 8: 223-242.

Clark, K. and M. Tomlinson (2001). The determinants of work effort: evidence from the Employment in Britain survey, Manchester University School of Economic Studies Discussion Paper 0113.

Coles, M. and J. Treble (1993). The price of worker reliability. *Economics Letters*, 41: 149-155.

Deery, S., Erwin, P. and Iverson, R. (1999). Industrial relations climate, attendance behaviour and the role of trade unions. *British Journal of Industrial Relations*, 37: 533-558.

Gallie, D. , White, M., Cheng, Y. and Tomlinson, M. (1998). *Restructuring the Employment Relationship*. Oxford: Clarendon Press.

Green, F. (2001). It's Been a Hard Day's Night: The concentration and intensification of work in late twentieth-century Britain. *British Journal Of Industrial Relations*, 39: 53-80.

Green, F. and MacIntosh, S. (1998). Union power, cost of job loss, and workers' effort. *Industrial and Labor Relations Review*, 51: 363-383.

Grossman, S. and Hart, O. (1983). An analysis of the principal-agent problem. *Econometrica*, 51: 7-45.

Hendrickson, C. and Plank, E. (1984). The Flexibility of Departure Times for Work Trips. *Transportation Research A*, 18A: 25-36.

Koslowsky, M. (2000). A new perspective on employee lateness, *Applied Psychology: An International Review*, 49: 390-407.

Koslowsky, M. and Dishon-Berkovits, M. (2001). Self-report measures of employee lateness: conceptual and methodological issues. *European Journal of Work and Organizational Psychology*, 10: 145-159.

Koslowsky, M., Sagie, P.L., Krausz, M. and Dolman Singer, A. (1997). Correlates of employee lateness: some theoretical considerations. *Journal of Applied Psychology*, 82: 79-88.

Lanfranchi, J. and Treble, J. (2002). Technology, work organisation and absence control. University of Wales, Bangor, mimeo. [http://www.bangor.ac.uk/~abs003/frenchsp2.pdf]

Lazear, E. (1995). *Personnel Economics*. Cambridge, Mass.: MIT Press.

Leigh, J.P. and Lust, J. (1988). Determinants of employee tardiness. *Work and Occupations*, 15: 78-95.

Machin, S. and Stewart, M. (1990). Unions and the financial performance of British private sector enterprises. *Journal of Applied Econometrics*, 5: 327-350.

Moffatt, P.G. and Peters, S.A. (2000). Grouped zero-inflated data models of coital frequency. *Journal of Population Economics*, 13: 205-220.

Oswald, A. (1997). Happiness and economic performance. *Economic Journal*, 107: 1815-1831.

Polachek, S. and Siebert, W. (1993). *The Economics of Earnings*, Cambridge: Cambridge University Press.

Rosse, J and Miller, H. (1984). An adaptive cycle interpretation of absence and withdrawal in Goodman, P.S. and Atkin, R.S. (eds.) *Absenteeism: New approaches to understanding, measuring and managing employee absence*. San Francisco: Jossey-Bass.

Shapiro, C. and Stiglitz, J. (1984). Equilibrium unemployment as a worker discipline device. *American Economic Review*, 74: 433-444.

Small, K.A. (1982). The scheduling of consumer activities: work trips. *American Economic Review*, 72: 467-479.

Winkelman, R. (1997), *Econometric Analysis of Count Data*, Heidelberg: Springer-Verlag.