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# JOB ANXIETY, WORK-RELATED PSYCHOLOGICAL ILLNESS AND WORKPLACE PERFORMANCE

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Keywords: job anxiety, stress, absence, labour productivity.

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Abstract
This paper uses matched employee-employer data from the British Workplace Employment Relations Survey (WERS) to examine the relationship between employee psychological health and workplace performance in 2004 and 2011. Using two measures of work-related psychological health – namely employee-reported job anxiety and manager-reported workforce stress, depression and anxiety – we find a positive relationship between psychological ill-health and absence, but not quits. The association between psychological ill-health and labour productivity is less clear, with estimates sensitive to sector, time period and the measure of psychological health. The 2004-2011 panel is further used to explore the extent to which change in psychological health is related to change in performance.

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## 1. Introduction

There is an established literature examining the relationship between working conditions and health (see Pouliakas and Theodossiou, 2013 for a survey). Workplace accidents and injuries have declined over time and contemporary analysis of work-related health should include measures of psychological health. In terms of the latter, contributions within economics have focused on identifying its work-related determinants (Robone *et al*., 2011; Cottini and Lucifora, 2013) and associated compensating wage differentials (French and Dunlap, 1998; Groot and Maassen van den Brink, 1999).

Government organisations, however, have been keen to highlight the business case for improving employee psychological health, emphasising sickness absence, turnover and presenteeism (being at work, but working at less than full capacity) as mechanisms through which it affects firm performance (see Sainsbury Centre for Mental Health, 2007). The methodology underlying this (occupational health-based) evidence relies on estimating work time 'lost' as a result of ill-health using employee perceptions and multiplying by an estimate of the value of work, typically the hourly wage, to create an aggregate monetary cost (see, Stewart *et al*., 2003 and Goetzel *et al*., 2004). Interestingly, presenteeism has been found to be a particularly important cause of lost output for employees with mental, as opposed to physical, illness (Dewa and Lin, 2000).

While this approach provides easily interpretable national estimates of the 'cost' of psychological ill-health, it has several limitations. Most importantly, it focuses on inputs rather than outputs (Pauly *et al*., 2008) and assumes the wage reflects the value of 'lost' output. It also ignores employer responses, including replacement labour, and the underlying nature of production, particularly teamwork and time-sensitivity (Nicholson *et al*., 2006).[i] Economists more typically consider productivity at the level of the workplace but, despite recognition of the potential insights from linking this to employee-reported information (for example, Brown *et al*., 2011), occupational health and safety (OHS) has not featured prominently within this literature. Indeed, there are only a handful of

exceptions internationally (Buhai *et al*., 2008; Munch-Hansen *et al*., 2009) and none focusing specifically on psychological ill-health.

By analysing data at the workplace level, this paper contributes new evidence on the relationship between employee psychological health and performance. It has several advantages in this context. First, it does not restrict the channels through which psychological health affects performance and, indeed, it is not essential to specify such channels, which may include disruption, labour turnover and spillover effects on co-workers. Second, the cost of absence is allowed to differ across workplaces, consistent with variation in the underlying production technology (Pouliakas and Theodossiou, 2013). In fact, the direct (earnings) cost of absence may be shared to varying extents with employees or the government through, for example, sickness payment schemes. There are, however, also limitations (particularly in terms of aggregation) when focusing on the workplace. Nevertheless, we argue this complementary approach has particular relevance in assessing the impact on workplace performance. In this respect it is important to note that studies typically focus on psychological ill-health rather than *work-related* psychological ill-health which is the focus here. While we acknowledge it is often difficult to isolate the cause of psychological illness (and provide full definitions of our measures below), it is the latter, through changes in work practices and procedures (Wood, 2008), that is likely to be within an employer's direct control.

To our knowledge this study is the first to explore the link between work-related psychological health and workplace performance in this way. By using matched data from the Workplace Employment Relations Survey (WERS) it contributes to the literature in several ways. First, it provides a nationally representative, comprehensive and generalisable analysis of this relationship, which is explored in the public and private sectors separately, since differences in the nature of work and incentives may give rise to variation in the incidence and impact of psychological ill-health. Second, we utilise multiple measures of psychological health, including employee assessments of job anxiety and manager-reported stress, depression and anxiety among the workforce to explore the measurement issues involved. Third, multiple measures of workplace

performance, including absence, quits and labour productivity are used to identify the channels through which psychological health may affect workplace performance. Fourth, we use data from 2004 and 2011 to explore the robustness of relationships pre- and post-recession. Since these cross-sectional estimates reflect associations rather than causal relationships, we also utilise the 2004-2011 WERS panel element to explore the relationship between changes in workforce psychological health and workplace performance, recognising that in the presence of unobserved time varying effects and/or reverse causality these too cannot be interpreted as causal relationships.

The remainder of this paper is structured as follows. Section 2 considers existing evidence relating to employee psychological health, particularly that using data from WERS. Section 3 introduces the data and methodology. Results are presented in Section 4, while Section 5 concludes.

## 2. Background

Consistent with the earlier literature, analysis of WERS was initially restricted to considering the prevalence of accidents and injuries rather than work-related *illness* (Reilly *et al*., 1995 and Nichols *et al*., 2004). Fenn and Ashby (2004) were among the first to consider the latter using the WERS 1998. This broader consideration of health also featured in later contributions by Robinson and Smallman (2006) using the same data, and Brammer and Pavelin (2006) using WERS 2004. The results of this type of analysis, focused on modelling the number of injuries or illnesses as a function of workplace characteristics, highlight the role of features such as workplace size and unionisation. However, by forming an aggregate measure of illness these studies typically ignore heterogeneity in the nature of conditions. This seems particularly inappropriate when combining physical and psychological conditions whose determinants and consequences may differ considerably.

Questions relating to job anxiety were introduced in the employee questionnaire in WERS 2004. This information has been used to examine the determinants of employee

well-being (Wood, 2008) and the relationship between job anxiety and earnings (Bryson *et al*., 2012). Consistent with the Karasek (1979) model developed in the psychology literature, Wood (2008) finds evidence of greater anxiety in more demanding jobs with lower levels of employee control (see also Michie and Williams, 2003). He also finds evidence that perceived levels of support from and consultation with management reduce anxiety levels. Bryson *et al*. (2012) focus on the influence of employee earnings on job satisfaction and job anxiety in the private sector. They find evidence of a positive relationship between earnings and job anxiety which is robust to detailed controls for the nature of work, effort and workplace characteristics. In contrast, they find no influence of co-workers' wages.

One of the few contributions to consider the implications of psychological health for worker performance is Leontaridi and Ward (2002). Using data on OECD countries from the 1997 International Social Survey Program they examine the relationship between employee psychological well-being and behaviour at work, finding a significant positive relationship between self-reported work-related stress, individual quit intentions and absence. Consistent with the wider OHS literature (Bockerman and Ilmakunnas, 2009; Cottini *et al*., 2011) their analysis is, however, focused at the level of the employee.

There are, however, a handful of studies which use workplace data to address the relationship between broader OHS and performance. For example, Buhai *et al*. (2008) examine the impact of workplace OHS on the performance of Danish manufacturing firms using representative, longitudinal, matched employee-employer data. They include indicators of various aspects of the work environment within a production framework, and use estimation methods to account for bias arising from endogeneity. While improvements to the 'internal climate' and 'repetitive and strenuous work' have a positive influence on productivity (as measured by sales adjusted for firm size), there is no influence of what is referred to as psycho-social factors (such as pressure of time or a lack of influence). In contrast, Munch-Hansen *et al*. (2009) find a strong negative association between average employee satisfaction with psychosocial working conditions

(where the latter reflects aspects such as skill discretion, workload and decision authority) and registered absence among public sector workplaces in Denmark.

More recent contributions have focused on the influence of related, but more general, measures including employee perspectives and wellbeing. For example, Bartel *et al*. (2011) use data from branches of a US bank (1994-1996) to examine the relationship between employee attitudes (which include questions relating to commitment, job satisfaction and the work environment) and workplace performance. While there is evidence of a positive correlation between employee attitudes and net sales, this is not evident in fixed effects models, which the authors attribute to the existence of omitted workplace factors which determine both employee attitudes and performance. Böckerman and Ilmakunnas (2012) focus on employee job satisfaction among Finnish manufacturing plants by linking data from the European Community Household Panel to longitudinal establishment data. They find evidence of a positive relationship between job satisfaction and workplace performance in the manufacturing sector when using value added per hour worked but not sales per employee. The magnitude of these estimates is, however, sensitive to accounting for endogeneity and measurement error using an IV strategy. They conclude that there should be "more empirical studies that combine information on productivity from linked employer-employee data sources to subjective measures of employee's well-being" (page 260). By linking information on employee work-related psychological health to workplace performance in Britain, the present paper clearly contributes to this agenda.

## 3. Data and Methodology

### *Work-related Psychological Health*

WERS 2004 is a stratified random sample of 2,295 workplaces in Great Britain with more than 5 employees from Sections D-O of the 2003 Standard Industrial Classification taken from the Inter-Departmental Business Register. Of the 2,680 workplaces surveyed as part of WERS 2011, 989 are workplaces retained from the 2004 sample (the panel element) and 1,691 are new workplaces. In both years, information on workplace OHS is collected as part of the Management Questionnaire (MQ). In addition, a random sample

of up to 25 employees is asked to complete an employee questionnaire containing information about their personal characteristics and the nature of their employment. Information is provided for at least one employee at 1,733 (1,923) workplaces in 2004 (2011) and 600 workplaces contain employee responses at both points. Throughout, the analysis is weighted to correct for sampling and non-response bias at the level of the workplace, since large workplaces and those from particular industries are over-represented in the survey. This does not, however, fully correct for the potential bias arising if, within certain industries, managers (or employees) in workplaces with inferior OHS are less likely to respond. This would bias downward estimates of the prevalence of psychological ill-health, although the direction of bias on estimates of its relationship with workplace performance is less clear. We believe such biases to be small since OHS is not the focus of WERS and the response rate to employee (and employer) questions on psychological health is high (over 95%) and in line with other questions.

In terms of job anxiety the data collected varies between 2004 and 2011. In 2004 information is collected on Warr's (1990) measure of anxiety-contentment (see Wood, 2008), whereas in 2011 attention focuses on anxiety-depression. More specifically, employees are asked: *'Thinking of the past few weeks, how much of the time has your job made you feel each of the following?'*. In 2004 the 6 states are *'tense'*, *'calm'*, *'relaxed'*, *'worried'*, *'uneasy'* and *'content'* and, in 2011, they are *'tense'*, *'depressed'*, *'worried'*, *'gloomy'*, *'uneasy'* and *'miserable'*. For each state, responses are recorded on a 5 point scale from *'never'* to *'all of the time'* and are (re)coded so that higher values (1-5) reflect increased frequency. We focus on the three anxiety states ('*tense*', '*worried*' and '*uneasy*') which are common to both survey years and, following Wood (2008) and Bryson *et al*. (2012), combine these measures into a single index of job anxiety. The index is constrained to be available to employees who respond to all three items and, as such, 273 (210) individuals are dropped from our analysis in 2004 (2011). Cronbach's alpha is high at 0.85, indicating strong reliability.[ii] Table 1 presents the distribution of responses based on 22,013 (21,583) employees in 2004 (2011). The average of employee responses at the workplace ($\overline{JA}_j$) is used to measure both the intensity and prevalence of anxiety among employees. Our analysis is, however, restricted to workplaces with a

minimum of 3 employee job anxiety observations (93% of the entire sample). The workplace mean values (standard deviation) are 2.38 (0.46) and 2.13 (0.47) in 2004 and 2011 respectively, indicating a decline in average job anxiety over the period. Given changes in the economic climate, this is perhaps surprising but is consistent with recent analysis of WERS (van Wanrooy *et al*., 2013). In 2004 job anxiety is significantly higher among public than private sector workplaces, consistent with previous UK evidence which identifies a high risk of stress, depression and anxiety in professional occupations and public administration, health and education (Oxford Economics, 2007).[iii] However, the gap narrows and is no longer statistically significant in 2011.

In terms of illness, managers are asked the same question in 2004 and 2011: '*In the last 12 months, have any employees suffered from any of the following illnesses, disabilities or other physical problems that were caused or made worse by their work?*' The responses are listed as '*1) Bone, joint or muscle problems (including back problems and RSI), 2) Breathing or lung problems (including asthma), 3) Skin problems, 4) Hearing problems, 5) Stress, depression or anxiety, 6) Eye strain, 7) Heart disease/attack, or other circulatory problem, 8) Infectious disease (virus, bacteria), 9) None of these*'. A binary indicator ($S_j$), which we refer to as stress, is created to indicate a positive response to '*Stress, depression or anxiety*'. As with all measures of this type, responses are subject to recall bias. However, there is an additional complication in focusing on work-related ill-health, in that it is often difficult for the manager to correctly identify the cause (Robinson and Smallman, 2006). There may also be incentives for managers not to disclose workforce stress, leading to underreporting. Stress is reported in 14.8% of workplaces in 2004 but, consistent with the trend in job anxiety, this falls to 10.4% in 2011 (see Table 2). In both years stress is reported in substantially more public sector workplaces (32.1% compared to 8.9% in the private sector) but, given the measure relates to 'any employees', workplace size is likely to be an important confounding factor and is included as a control in the analysis which follows.[iv] Throughout we also control for physical health problems among the workforce (which includes any condition other than stress reported in response to the above question) to account for the interrelationship between physical and mental health (Stewart *et al*., 2003).

We refer to $\overline{JA}_j$ and $S_j$ as measures of employee psychological ill-health, and while they are significantly positively correlated (r=0.18), they are distinct concepts. Most obviously, $S_j$ captures a range of aspects of psychological health including elements of Warr's (1990) depression axis in addition to anxiety. While both stress and anxiety are associated with low levels of 'pleasure' in this framework, anxiety is associated with much higher levels of 'arousal'. Second, anxiety is measured as an average across employees, allowing positive and negative reports from different individuals to offset each other, whereas manager-reported stress is likely to reflect more acute cases of psychological ill-health which have come to their attention. Both measures may therefore be limited in their representativeness: job anxiety because a sample of employees is surveyed, and stress because of the focus on incidence rather than prevalence among the workforce. Third, the time frame over which these concepts are measured differs: employees are asked about anxiety over the past few weeks whereas managers report workforce stress over the last year. Fourth, an increase in job anxiety may have a positive impact on performance before reaching detrimental levels. While this may also be the case for employee-reported stress (Leontaridi and Ward, 2002) it seems less likely for manager-reported workforce stress. In all specifications we examine quartiles of the workplace job anxiety distribution as well as average levels to capture these effects.

*Workplace Performance*

Consistent with the potential channels through which psychological health could affect workplace performance, we explore intermediate measures of performance (absence and quits), as well as a final measure, labour productivity. Managers are asked a question which captures elements of both the incidence and duration of absence, namely, '*Over the last 12 months what percentage of work days was lost through employee sickness or absence at this establishment?*', and are advised to exclude authorised leave of absence, employees away on secondment or courses, or days lost through industrial action. The average workplace absence rate is stable across time at about 4.5% but is significantly higher in the public than the private sector.

In addition, managers are asked: '*In total, how many employees (full and part-time) were on the payroll at this establishment 12 months ago? And how many of these stopped working here because they left or resigned voluntarily?*' The quit rate is defined as the proportion of those on the payroll one year ago who have left voluntarily. Employers are asked to distinguish voluntary separations from dismissal, redundancy and other reasons.[v] Information on absence and quits is obtained from the Employee Profile Questionnaire which is sent to managers prior to the interview, allowing them to consult formal records and reduce measurement error. The average quit rate across workplaces is 15.7% in 2004 but falls to 10.2% in 2011; at both points it is considerably lower in the public than private sector. For ease of interpretation, we model the quit and absence rate by OLS but the results are qualitatively similar if we instead estimate tobit models which account for these variables being bounded between 0 and 100.

The other main channel through which employee psychological health may affect workplace performance is through presenteeism, or reduced labour productivity without absence. WERS does not contain information from which to measure presenteeism directly. Instead, we consider an overall measure of labour productivity which captures the influence of psychological health on performance through intermediate channels (absence, quits) and through presenteeism (which could reflect employees working below full capacity but also mechanisms such as poor relationships with co-workers and sub-optimal decision taking). We utilise both subjective and objective measures of labour productivity available in WERS as recommended by Forth and McNabb (2008).

In terms of the subjective measure, managers are asked: '*Compared with other establishments within the same industry how would you assess your workplace's labour productivity?*' Responses are ranked on a 5 point scale from (1) '*a lot below average*' to (5) '*a lot better than average*'. The measure relies on the manager's perceptions of how productivity is defined, an assessment of their own workplace productivity, identifying his/her comparator group (that is, what defines their 'own industry') and an appropriate time frame, and as such, is subject to measurement error (see Forth and McNabb, 2008). Following previous studies, we merge the lowest 2 categories given the small proportion

reporting '*a lot below average*'. Despite criticism that a concentration of workplaces report above average performance, this has not been found to affect the measure's ordinal properties (Bryson *et al*., 2005) and it has been used extensively across a range of applications (see, for example, Bryson *et al*., 2005 in the analysis of unions and Brown *et al*., 2011 in relation to employee loyalty). Perhaps surprisingly, the average response increases between 2004 and 2011 but we find no significant difference in the distribution across the response categories between the public and private sector in either year.

In 2004 a Financial Performance Questionnaire (FPQ) was completed by someone with information about the financial situation of the workplace in about half (1070) of the workplaces that completed the MQ. In 2011 this information was only collected from (545) trading sector workplaces and, for comparability, we impose this restriction on the 2004 sample, resulting in a maximum sample of 792 workplaces. Objective information on workplace performance is collected in the FPQ and, following Bryson (2013), two measures of labour productivity, measured over the past year, are examined: the log of total value of sales per employee (full-time equivalent) and the log of value added per employee (full-time equivalent).[vi] We trim the top and bottom 1% of values from both measures and estimate by OLS. It is, however, important to highlight some distinctions between the subjective and objective elements of the productivity analysis. First, the sample differs considerably between specifications because objective productivity is only available for traded workplaces who respond to the FPQ and this precludes analysis of the public sector. Second, differences in the interpretation of the subjective and objective measures arise; the former is a relative rather than absolute measure, is likely to be a broader reflection of productivity and, unlike the objective measure, is not easily quantifiable. Third, the time period to which the subjective information relates is not necessarily the last year.

In terms of subjective labour productivity, the models are estimated, separately for each survey year, as follows:

$$P_j^* = \overline{JA}_j\phi + Z_j\gamma + \varepsilon_j \qquad (1)$$

$$P_j^* = S_j\varphi + Z_j\gamma + \varepsilon_j \qquad (2)$$

where $P_j^*$ is the unobserved latent labour productivity variable related to the observed variable as follows:

$$P_j = \begin{cases} 1 & \text{if } P_j^* \le c_1 \\ 2 & \text{if } c_1 < P_j^* \le c_2 \\ 3 & \text{if } c_2 < P_j^* \le c_3 \\ 4 & \text{if } c_3 < P_j^* \end{cases}$$

and the values of the cut off points are assumed to conform to $c_1 < c_2 < c_3$. An ordered probit model is used to estimate subjective performance, where the variables within $Z_j$ include industry, log of workplace size, how long established, single establishments, region and workforce composition (occupation, female, age, temporary, full-time, ethnicity, trade union membership and disability). We also control for manager-reported organisational change, performance-related pay, the prevalence of team working and training, and the presence of an appraisal system to capture management practices which may be correlated with anxiety and performance.

*WERS 2004-2011 Panel*

Since the above analysis is based on a cross-section of workplaces at each point in time it is important to acknowledge that the estimates reflect associations rather than causal relationships. A number of issues are worth highlighting here. First, there is the potential for reverse causality, since job anxiety itself may depend on workplace performance. The direction of this effect is not clear. Employees in poorly performing workplaces may report anxiety based on their perceived job insecurity or due to pressure arising from co-worker absence/quits, enhancing the negative relationship between anxiety and performance. Conversely, workload increases associated with high demand and/or productivity gains that arise at the expense of worker health will lead to a positive relationship between anxiety and performance and bias our estimate downward. The issue

may be a particular concern for job anxiety which is measured over the 'past few weeks' whereas some indicators of performance are measured over the last year. Following Bryson (2013), we estimate augmented specifications which include the percentage of workers made redundant and the employment growth rate over the last year to condition on elements of past workplace performance that may otherwise be captured by job anxiety. The positive relationship between psychological ill-health and absence is weakened but generally remains significant, and (where it exists) the relationship between stress and labour productivity is robust to the inclusion of these additional controls (results are not reported in full but are available on request).

Second, despite the comprehensive set of workplace controls, there are potentially common unobserved influences on psychological health and performance, such as, the approach and quality of management. Despite exploration, as a consequence of the lack of a clearly valid instrumental variable (IV) which is correlated with psychological health but not workplace performance, it was not possible to use an IV procedure to examine the issue of endogeneity. Instead, we utilize the WERS 2004-2011 panel element and estimate the above models with workplace fixed effects to consider whether within workplace changes in employee psychological health are related to changes in performance. It should, however, be acknowledged that these estimates cannot be interpreted as causal in the presence of time varying unobservable factors (which may include changes in the manager and/or the sample of employees during the panel) and/or reverse causality. As noted above, the panel is a subset of the 2004 sample and, as such, our analysis focuses on measures from the MQ rather than the FPQ. The data are weighted to account for attrition on the basis of observable workplace characteristics, although further analysis suggests workplace closure by 2011 (affecting 293 workplaces) is not associated with 2004 workforce psychological health. Consistent with the trends identified from the repeated cross-section analysis, workplaces in the panel also report a decline in average job anxiety (-0.21) and slightly more workplaces move from reporting stress in 2004 to not in 2011 (11%) than vice versa (9%).

## 4. Results.

Table 3 presents the coefficients on workplace psychological health from a model of the workplace absence rate in 2004 (upper panel) and 2011 (lower panel). The three measures of psychological health, namely average job anxiety at the workplace, the quartile of job anxiety, and manager-reported stress are presented in columns (1), (2) and (3) respectively. The same results are presented for the public sector and the private sector separately in columns (4)-(6) and (7)-(9) respectively.

While relatively few workplace characteristics significantly affect the workplace absence rate, there is evidence of a positive relationship between job anxiety and absence. In 2011 for example, a one unit increase in average workplace employee job anxiety is associated with a 4.7 percentage point increase in the absence rate. Evaluated at the mean absence rate this equates to a sizeable effect (107%). A positive effect (2.7 percentage points) is also observed if manager-reported workplace stress is instead used to measure employee psychological health. This is unsurprising, since one mechanism through which managers identify stress amongst their workforce is through reported absence. In considering the sector specific results there is variability both across measures of psychological health and time, however, where such relationships are significant they are positive.

In contrast, in Table 4 we find no evidence of a relationship between job anxiety or stress and the quit rate in either year or within either sector, suggesting that this is not a mechanism through which psychological health affects workplace performance. Since anxiety is reported by current employees, it may be a better predictor of future quits than quits over the previous year. Indeed, the most anxious employees may have already left the workplace, causing the relationship between quits and anxiety to be underestimated. However, there is also no evidence of a relationship when using workplace stress (which is measured over the last year). We therefore find no evidence to support Leontaridi and Ward (2002), although their focus was on intentions rather than actual quit behaviour. The evidence also contrasts with employee level analysis by Green (2010) who finds the anxiety-contentment scale predicts individual quits over the subsequent 15 months,

although the magnitude of effects are smaller than for measures of depression-enthusiasm or job satisfaction.

Table 5 presents the coefficient estimates from an ordered probit model where workplace performance is measured by subjective labour productivity. As in the previous tables, we present results for the three measures of psychological health in 2004 (upper panel) and 2011 (lower panel). There is no consistent influence of either measure of employee job anxiety on labour productivity among all workplaces. However, in 2004, manager-reported workplace stress increases the probability of reporting performance at or below the industry average, and reduces the probability of reporting superior levels of performance, consistent with an interpretation that this indicator captures more acute psychological health problems. This measure does, however, potentially suffer from common reporting bias since it is also reported by the manager.

Further examination by sector suggests that the relationship is only evident in the public sector but, even then, there is variation across time. For example, in 2004, workforce stress reduces the probability of performance superior to the industry average by 35 percentage points with a corresponding increase at the industry average, whereas in 2011 average employee job anxiety is important, a one unit increase in job anxiety reducing the probability of superior performance by 21 percentage points. Given the subjective nature of productivity, variation across sectors may, in part, reflect differences in manager perceptions or interpretations of labour productivity. However, given the difficulties involved in measuring labour productivity in the public sector more generally (Atkinson, 2005) it is difficult to propose the nature or direction of any potential bias.

Table 6 presents the results for the objective, log of sales (columns 1-3) and log of value added (columns 4-6) measures of productivity which, as noted above, are estimated on a subsample of private sector workplaces. Again, few consistent patterns merge across the specifications. In 2004 (upper panel), workplaces in the highest quartile of employee job anxiety are found to be negatively related to (log of) sales, reducing sales by approximately 34%. However, there is no evidence of a relationship between

psychological ill-health and value added, although these models are generally poorly determined, that is, relatively few of the covariates are significant. In 2011 (lower panel), there is evidence of a weak positive relationship between value added and average job anxiety, but a negative relationship with stress, perhaps reflecting that the latter captures more severe psychological ill-health. The absence of a clear relationship between psychological health and objective measures of labour productivity in the private sector is consistent with the analysis of subjective productivity although, even within this sector, direct comparisons cannot be made between Table 5 and 6 given the difference in the samples.[vii]

Table 7 presents results from fixed effects models based on the 2004-2011 WERS panel, where Panel A relates to absence, Panel B the quit rate and Panel C, subjective labour productivity.[viii] The results from specifications which pool data from 2004 and 2011 are also presented to distinguish the influence of sample composition from estimation methodology as explanations for differences in the results relative to the cross sectional analysis. The positive relationship between stress and absence identified above is evident in the pooled model, but is removed by the inclusion of fixed effects and suggests the presence of unobserved workplace characteristics that affect both stress and absence. In contrast with the cross sectional analysis, the pooled model suggests workplaces in the second but particularly the third quartile of employee job anxiety have a higher quit rate than those in the lowest quartile, but again this effect is not robust to the inclusion of fixed effects. Counterintuitively, a negative relationship between stress and the quit rate emerges in the fixed effect specification and is driven by the private sector.

Within the public sector, the negative relationship between stress and subjective productivity evident in 2004 is also evident in the pooled model and is robust to the inclusion of workplace fixed effects, suggesting it may reflect a causal relationship. In additional specifications (results not reported), we attempt to distinguish the mechanisms through which stress influences productivity in the public sector by including controls for the quit and absence rates. The negative relationship between a change in manager

reported stress and a change in labour productivity is robust to their inclusion suggesting an alternative driver such as presenteeism may be important.

## 5. Conclusion

Using matched employee-employer data for Britain, this paper contributes to the emerging economic analysis of work-related psychological health. Rather than focusing on the determinants of employee job anxiety (Wood, 2008) or work-related stress, we examine the relationship between these measures and workplace performance. In this respect the analysis provides an important comparison to existing employee-level estimates of the impact of psychological ill-health, and contributes to the existing analysis of workplace performance in Britain which has, so far, largely neglected OHS.

The relationship between psychological health and workplace performance is not straightforward and we find that the results are sensitive to which aspect of performance is considered. Consistent with the employee-level analysis of Leontaridi and Ward (2002), job anxiety, and to a greater extent work-related stress, are found to be positively correlated with absence. However, the disappearance of the relationship after the inclusion of fixed effects suggests that, rather than being causal, it is likely to reflect common unobserved workplace influences on absence and psychological health. There is no consistent evidence of a relationship between our measures of psychological ill-health and the workplace quit rate. The results with respect to labour productivity are sensitive to the choice of sector, time period and the measurement of psychological health and labour productivity, such that no clear link between psychological health and productivity is identified. Notwithstanding the measurement issues involved, the tentative evidence of a negative relationship between stress and subjective labour productivity in the public sector warrants further investigation, possibly using more direct measures of presenteeism from employers.

That our analysis provides a somewhat equivocal picture of the relationship between psychological health and workplace performance confirms that estimating the ‘cost’ of

employee psychological ill-health is perhaps more complicated than is suggested by studies which base their estimates on inputs and employee perceptions of lost output. This is unsurprising given that approach neglects the workplace, including the broader disruption to production, use of replacement labour, response of co-workers and the ability to 'catch up'. Understanding these complex factors may be facilitated by future research which focuses within workplaces where output and productivity can be more directly measured. Irrespective of the difference in methodology, our estimates are likely to be more modest (but potentially more relevant for employers) than the existing literature given our focus on work-related rather than general psychological health. It should, however, be acknowledged that in focusing on the impact on business performance we ignore the individual and social costs arising from subsequent ill-health, such as, the loss of future earnings and, cost of healthcare and welfare benefits. These may, however, be important to employers whose objectives include employee welfare or social responsibility (see Bloom *et al*., 2011). Further, and importantly, since analysis of this nature does not assess the costs of improving psychological health (Pouliakas and Theodossiou, 2013) it does not attempt to establish the optimal level of work-related psychological health. Previous evidence has, however, demonstrated a role for the employer, with job design and employee-manager relations identified as determinants of job anxiety (Wood, 2008).

Although WERS provides a unique opportunity to examine the link between alternative measures of psychological health and workplace performance in Britain, these data have a number of limitations in this context. First, the measures of psychological health are restricted to those available in a survey principally designed to examine workplace relations. Second, no direct measure of presenteeism is available from either the employee or employer and, as such, it is difficult to fully investigate the channels through which psychological health might affect labour productivity. Third, although the additional information available on objective productivity (from the FPQ) and on the same workplaces over time (via the 2004-2011 panel) provides important additional insights, in both instances the sample is relatively small and, in the latter, the period under consideration is one of substantial labour market change. While detailed and large-

scale objective measures of productivity are available in existing workplace data (such as the Annual Business Survey), future exploration of the role of OHS is conditional on being able to match this to appropriate indicators of health. The benefits of such an approach, including the potential to create longitudinal data, have been illustrated in other countries (see Böckerman and Ilmakunnas, 2012) and, as such, appear worthy of further exploration in Britain.

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Table 1. Distribution of Domains of Job Anxiety

| | 2004 | | | 2011 | | |
|---|---|---|---|---|---|---|
| | Tense | Worried | Uneasy | Tense | Worried | Uneasy |
| All of the time | 4.16 | 2.38 | 2.23 | 3.96 | 2.67 | 2.50 |
| Most of the time | 15.02 | 9.32 | 7.45 | 13.46 | 7.02 | 5.52 |
| Some of the time | 41.39 | 35.12 | 27.90 | 38.29 | 22.52 | 17.70 |
| Occasionally | 27.09 | 31.81 | 32.33 | 27.61 | 34.08 | 29.67 |
| Never | 12.35 | 21.38 | 30.09 | 16.68 | 33.71 | 44.61 |
| Mean (ranked 1-5) | 2.72 | 2.40 | 2.19 | 2.60 | 2.11 | 1.92 |
| Job Anxiety Index | | 2.43 | | | 2.21 | |

Notes to table: Employee level data are weighted and with the exception of the mean/index values, figures refer to the percentage of *employees* in each category.

Table 2. Work-related Workforce Health Problems

| | Percentage of workplaces | |
|---|---|---|
| | 2004 | 2011 |
| Bone, joint or muscle problems | 14.42 | 11.56 |
| Breathing or lung problems | 1.54 | 1.16 |
| Skin problems | 2.99 | 1.58 |
| Hearing problems | 0.16 | 0.21 |
| Stress, depression or anxiety | 14.75 | 10.38 |
| Eye strain | 1.87 | 1.92 |
| Heart disease/attack or other circulatory | 0.88 | 0.83 |
| Infectious disease | 1.70 | 2.17 |
| Any of the above | 25.77 | 20.31 |

Notes to table: Workplace level data are weighted. Managers can report multiple positive responses.

Table 3. Employee psychological health and work-place performance: absence rate

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| ***Panel A: 2004*** | | All | | | Public | | | Private | |
| $\overline{JA_j}$ | 1.345 | | | 2.137 | | | 2.014* | | |
| | (1.27) | | | (1.14) | | | (1.73) | | |
| $\overline{JA_j}$ Quartile 2 | | -0.446 | | | 1.063 | | | 0.094 | |
| | | (0.63) | | | (0.71) | | | (0.13) | |
| $\overline{JA_j}$ Quartile 3 | | 0.849 | | | 3.990* | | | 0.125 | |
| | | (0.97) | | | (1.75) | | | (0.15) | |
| $\overline{JA_j}$ Quartile 4 | | 1.366 | | | 4.015** | | | 2.139* | |
| | | (1.28) | | | (2.36) | | | (1.78) | |
| $S_j$ | | | 2.427*** | | | -0.713 | | | 2.398* |
| | | | (2.41) | | | (0.43) | | | (1.92) |
| Observations | 1166 | 1166 | 1603 | 303 | 303 | 349 | 784 | 784 | 1162 |
| F-test (p-value) | 2.54 (0.00) | 2.59 (0.00) | 2.53 (0.00) | 4.45 (0.00) | 4.01 (0.00) | 3.58 (0.00) | 1.79 (0.00) | 1.91 (0.00) | 2.00 (0.00) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| ***Panel B: 2011*** | | All | | | Public | | | Private | |
| $\overline{JA_j}$ | 4.652** | | | 3.670** | | | 5.270** | | |
| | (1.99) | | | (2.43) | | | (2.11) | | |
| $\overline{JA_j}$ Quartile 2 | | 0.385 | | | 0.939 | | | 0.365 | |
| | | (0.39) | | | (0.65) | | | (0.33) | |
| $\overline{JA_j}$ Quartile 3 | | 1.430 | | | 3.614* | | | 0.957 | |
| | | (1.04) | | | (1.94) | | | (0.63) | |
| $\overline{JA_j}$ Quartile 4 | | 3.146 | | | 2.979* | | | 3.739 | |
| | | (1.55) | | | (1.82) | | | (1.58) | |
| $S_j$ | | | 2.688** | | | 6.648*** | | | 0.606 |
| | | | (2.16) | | | (3.15) | | | (0.45) |
| Observations | 1258 | 1258 | 1857 | 386 | 386 | 488 | 735 | 735 | 1192 |
| F-test (p-value) | 1.49 (0.02) | 1.47 (0.02) | 1.44 (0.02) | 3.78 (0.00) | 3.48 (0.00) | 5.54 (0.00) | 1.25 (0.12) | 1.36 (0.05) | 1.51 (0.01) |

Notes to table: Data are weighted. Figures represent coefficients from an OLS model. T-statistics are reported in parenthesis where standard errors are corrected for the complex sample design. '*', '**' and '***' indicate significance at 10, 5 and 1 percent levels respectively. Models also include controls for industry, region, workforce composition (full-time, female, disabled, trade union members, non-white, temporary, age, and occupation), workplace size, when established, single establishments, organizational change, teamwork, training, performance related pay, formal appraisal and manager-reported physical health problems which are not reported here. The sample sizes for the specifications which include job anxiety are smaller than for manager-reported stress since each workplace is required to have a minimum of 3 respondents to the employee questionnaire.

Table 4. Employee psychological health and work-place performance: quit rate

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| ***Panel A: 2004*** | | All | | | Public | | | Private | |
| $\overline{JA}_j$ | 1.721 | | | -1.222 | | | 2.041 | | |
| | (0.86) | | | (0.72) | | | (0.78) | | |
| $\overline{JA}_j$ Quartile 2 | | 3.714 | | | -0.759 | | | 5.350 | |
| | | (1.35) | | | (0.57) | | | (1.48) | |
| $\overline{JA}_j$ Quartile 3 | | 2.499 | | | 0.537 | | | 2.025 | |
| | | (1.17) | | | (0.34) | | | (0.80) | |
| $\overline{JA}_j$ Quartile 4 | | 2.687 | | | -1.270 | | | 3.329 | |
| | | (1.24) | | | (0.93) | | | (1.12) | |
| $S_j$ | | | 0.186 | | | 1.074 | | | 0.492 |
| | | | (0.12) | | | (1.16) | | | (0.23) |
| Observations | 1324 | 1324 | 1823 | 346 | 346 | 400 | 882 | 882 | 1309 |
| F-test (p-value) | 6.27 (0.00) | 5.93 (0.00) | 8.84 (0.00) | 358.53 (0.00) | 299.06 (0.00) | 68.49 (0.00) | 4.88 (0.00) | 5.38 (0.00) | 8.07 (0.00) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| ***Panel B: 2011*** | | All | | | Public | | | Private | |
| $\overline{JA}_j$ | 2.605 | | | 1.661 | | | 2.929 | | |
| | (1.33) | | | (1.18) | | | (1.36) | | |
| $\overline{JA}_j$ Quartile 2 | | -0.334 | | | -0.539 | | | -0.781 | |
| | | (0.24) | | | (0.41) | | | (0.47) | |
| $\overline{JA}_j$ Quartile 3 | | 2.162 | | | 0.704 | | | 2.634 | |
| | | (1.25) | | | (0.54) | | | (1.26) | |
| $\overline{JA}_j$ Quartile 4 | | 2.080 | | | 1.268 | | | 2.512 | |
| | | (1.02) | | | (0.77) | | | (1.01) | |
| $S_j$ | | | -0.143 | | | -0.839 | | | -0.029 |
| | | | (0.10) | | | (1.05) | | | (0.01) |
| Observations | 1379 | 1379 | 2046 | 435 | 435 | 548 | 797 | 797 | 1310 |
| F-test (p-value) | 4.14 (0.00) | 4.03 (0.00) | 4.11 (0.00) | 3.73 (0.00) | 3.31 (0.00) | 6.47 (0.00) | 3.05 (0.00) | 3.01 (0.00) | 3.18 (0.00) |

Notes to table: See notes to Table 3.

Table 5. Employee psychological health and work-place performance: subjective relative labour productivity

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| ***Panel A: 2004*** | | All | | | Public | | | Private | |
| $\overline{JA}_j$ | -0.031 | | | -0.514 | | | -0.008 | | |
| | (0.21) | | | (1.24) | | | (0.05) | | |
| $\overline{JA}_j$ Quartile 2 | | 0.301* | | | -0.255 | | | 0.251 | |
| | | (1.90) | | | (0.78) | | | (1.35) | |
| $\overline{JA}_j$ Quartile 3 | | 0.058 | | | -0.585* | | | 0.064 | |
| | | (0.36) | | | (1.69) | | | (0.35) | |
| $\overline{JA}_j$ Quartile 4 | | -0.016 | | | -0.618* | | | 0.001 | |
| | | (0.10) | | | (1.68) | | | (0.00) | |
| $S_j$ | | | -0.291*** | | | -0.885*** | | | -0.220 |
| | | | (2.51) | | | (3.66) | | | (1.56) |
| Observations | 1211 | 1211 | 1671 | 293 | 293 | 341 | 833 | 833 | 1231 |
| F-test (p-value) | 2.14 (0.00) | 2.20 (0.00) | 2.23 (0.00) | 5.83 (0.00) | 5.68 (0.00) | 6.00 (0.00) | 1.92 (0.00) | 1.87 (0.00) | 1.89 (0.00) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| ***Panel B: 2011*** | | All | | | Public | | | Private | |
| $\overline{JA}_j$ | -0.098 | | | -0.524** | | | -0.050 | | |
| | (0.84) | | | (1.97) | | | (0.36) | | |
| $\overline{JA}_j$ Quartile 2 | | -0.203 | | | 0.060 | | | -0.152 | |
| | | (1.46) | | | (0.20) | | | (0.95) | |
| $\overline{JA}_j$ Quartile 3 | | -0.223 | | | -0.293 | | | -0.128 | |
| | | (1.50) | | | (1.09) | | | (0.68) | |
| $\overline{JA}_j$ Quartile 4 | | -0.225 | | | -0.317 | | | -0.192 | |
| | | (1.56) | | | (1.05) | | | (1.05) | |
| $S_j$ | | | -0.260* | | | -0.166 | | | -0.075 |
| | | | (1.91) | | | (0.89) | | | (0.42) |
| Observations | 1310 | 1310 | 1966 | 397 | 397 | 510 | 770 | 770 | 1271 |
| F-test (p-value) | 1.85 (0.00) | 1.87 (0.00) | 2.19 (0.00) | 2.94 (0.00) | 2.91 (0.00) | 4.82 (0.00) | 1.68 (0.00) | 1.66 (0.00) | 1.92 (0.00) |

*Notes to table:* Data are weighted. T-statistics are reported in parenthesis where standard errors are corrected for the complex sample design. '*,' '**' and '***' indicate significance at 10, 5 and 1 percent levels respectively. Coefficients are from an ordered probit model. The same controls are included as in Table 3.

Table 6. Employee psychological health and work-place performance: objective labour productivity

| | *Log(sales)* | | | *Log(value-added)* | | |
|---|---|---|---|---|---|---|
| ***Panel A: 2004*** | (1) | (2) | (3) | (1) | (2) | (3) |
| | | Private | | | Private | |
| $\overline{JA}_j$ | -0.216 | | | -0.004 | | |
| | (1.04) | | | (1.05) | | |
| $\overline{JA}_j$ Quartile 2 | | -0.053 | | | -0.004 | |
| | | (0.27) | | | (1.54) | |
| $\overline{JA}_j$ Quartile 3 | | 0.176 | | | -0.002 | |
| | | (0.86) | | | (0.57) | |
| $\overline{JA}_j$ Quartile 4 | | -0.422** | | | -0.008 | |
| | | (1.97) | | | (1.50) | |
| $S_j$ | | | 0.081 | | | 0.000 |
| | | | (0.50) | | | (0.08) |
| Observations | 400 | 400 | 499 | 368 | 368 | 462 |
| F-test (p-value) | 7.23 | 9.21 | 22.16 | 1.07 | 1.53 | 2.21 |
| | (0.00) | (0.00) | (0.00) | (0.35) | (0.01) | (0.00) |
| ***Panel B: 2011*** | (1) | (2) | (3) | (1) | (2) | (3) |
| | | Private | | | Private | |
| $\overline{JA}_j$ | 0.008 | | | 0.003* | | |
| | (0.03) | | | (1.85) | | |
| $\overline{JA}_j$ Quartile 2 | | -0.330 | | | 0.001 | |
| | | (0.91) | | | (0.76) | |
| $\overline{JA}_j$ Quartile 3 | | 0.288 | | | 0.004*** | |
| | | (1.41) | | | (3.67) | |
| $\overline{JA}_j$ Quartile 4 | | -0.140 | | | 0.003 | |
| | | (0.48) | | | (1.33) | |
| $S_j$ | | | -0.266 | | | -0.003** |
| | | | (1.15) | | | (2.23) |
| Observations | 270 | 270 | 331 | 260 | 260 | 321 |
| F-test (p-value) | 9.47 | 8.30 | 7.44 | 2.03 | 2.97 | 1.96 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |

Notes to table: Data are weighted and relate to private sector workplaces only. Coefficients presented relate to OLS regressions. In 2011 the coefficients on log value added have been multiplied by 100. T-statistics are reported in parenthesis where standard errors are corrected for the complex sample design. '*,' '**' and '***' indicate significance at 10, 5 and 1 percent levels respectively. The same controls are included as in Table 3.

Table 7. Changes in employee psychological health and work-place performance: WERS 2004-2011 panel

| | All | | | | | | Public | | | | | | Private | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pooled | Fixed Effects | Pooled | Fixed Effects | Pooled | Fixed Effects | Pooled | Fixed Effects | Pooled | Fixed Effects | Pooled | Fixed Effects | Pooled | Fixed Effects | Pooled | Fixed Effects | Pooled | Fixed Effects |
| ***Panel A: Absence Rate*** | | | | | | | | | | | | | | | | | | |
| $\overline{JA_j}$ | 2.007 | -1.648 | | | | | 0.454 | 3.178 | | | | | 1.230 | -1.464 | | | | |
| | (1.59) | (1.07) | | | | | (0.32) | (0.66) | | | | | (0.80) | (1.27) | | | | |
| $\overline{JA_j}$ Quartile 2 | | | 0.433 | 0.112 | | | | | 2.160* | -3.239 | | | | | -0.501 | -0.077 | | |
| | | | (0.50) | (0.08) | | | | | (1.67) | (0.78) | | | | | (0.42) | (0.08) | | |
| $\overline{JA_j}$ Quartile 3 | | | 1.172 | -1.421 | | | | | 2.019 | -4.870 | | | | | -0.234 | -0.802 | | |
| | | | (1.05) | (0.89) | | | | | (0.86) | (1.33) | | | | | (0.19) | (0.58) | | |
| $\overline{JA_j}$ Quartile 4 | | | 1.844 | -0.532 | | | | | 0.574 | 3.350 | | | | | 1.365 | 0.239 | | |
| | | | (1.41) | (0.35) | | | | | (0.39) | (0.78) | | | | | (0.66) | (0.22) | | |
| $S_j$ | | | | | 3.149** | 2.875 | | | | | 4.555** | -0.320 | | | | | 2.660 | 1.859 |
| | | | | | (2.17) | (1.21) | | | | | (2.06) | (0.12) | | | | | (1.56) | (1.45) |
| Observations | 989 | 990 | 989 | 990 | 1354 | 1355 | 325 | 325 | 325 | 325 | 394 | 394 | 566 | 567 | 566 | 567 | 841 | 842 |
| Workplaces | | 719 | | 719 | | 870 | | 241 | | 241 | | 275 | | 426 | | 426 | | 540 |
| | **All** | | | | | | **Public** | | | | | | **Private** | | | | | |
| ***Panel B: Quit Rate*** | | | | | | | | | | | | | | | | | | |
| $\overline{JA_j}$ | 1.278 | -4.013* | | | | | -0.726 | -4.023 | | | | | 1.524 | -2.941 | | | | |
| | (0.82) | (1.91) | | | | | (0.50) | (1.43) | | | | | (0.76) | (1.04) | | | | |
| $\overline{JA_j}$ Quartile 2 | | | 3.375* | -1.148 | | | | | -1.203 | -3.826 | | | | | 3.564 | -2.074 | | |
| | | | (1.67) | (0.51) | | | | | (0.71) | (1.47) | | | | | (1.38) | (0.69) | | |
| $\overline{JA_j}$ Quartile 3 | | | 5.204*** | 0.534 | | | | | 1.014 | -1.450 | | | | | 5.640** | 0.702 | | |
| | | | (2.78) | (0.26) | | | | | (0.67) | (0.56) | | | | | (2.36) | (0.29) | | |
| $\overline{JA_j}$ Quartile 4 | | | 1.147 | -3.993* | | | | | -0.695 | -4.645 | | | | | 1.737 | -2.272 | | |
| | | | (0.66) | (1.69) | | | | | (0.45) | (1.57) | | | | | (0.76) | (0.59) | | |
| $S_j$ | | | | | -0.843 | -4.246** | | | | | 0.557 | -0.913 | | | | | -1.557 | -6.118*** |
| | | | | | (0.62) | (2.37) | | | | | (0.52) | (0.59) | | | | | (0.97) | (2.61) |
| Observations | 1109 | 1110 | 1109 | 1110 | 1521 | 1522 | 370 | 370 | 370 | 370 | 448 | 448 | 627 | 628 | 627 | 628 | 939 | 940 |
| Workplaces | | 773 | | 773 | | 912 | | 262 | | 262 | | 295 | | 456 | | 456 | | 561 |
| | **All** | | | | | | **Public** | | | | | | **Private** | | | | | |
| ***Panel C: Subjective Labour Productivity*** | | | | | | | | | | | | | | | | | | |
| $\overline{JA_j}$ | -0.137 | -0.073 | | | | | -0.164 | -0.035 | | | | | -0.152 | -0.064 | | | | |
| | (1.46) | (0.52) | | | | | (0.94) | (0.11) | | | | | (1.32) | (0.32) | | | | |
| $\overline{JA_j}$ Quartile 2 | | | 0.026 | 0.002 | | | | | -0.193 | 0.107 | | | | | 0.088 | 0.067 | | |
| | | | (0.30) | (0.02) | | | | | (1.18) | (0.40) | | | | | (0.78) | (0.49) | | |
| $\overline{JA_j}$ Quartile 3 | | | -0.142 | 0.075 | | | | | -0.248 | -0.337 | | | | | -0.117 | 0.143 | | |
| | | | (1.42) | (0.57) | | | | | (1.51) | (1.04) | | | | | (1.04) | (0.81) | | |
| $\overline{JA_j}$ Quartile 4 | | | -0.091 | -0.048 | | | | | -0.219 | -1.01 | | | | | -0.075 | -0.011 | | |
| | | | (0.79) | (0.29) | | | | | (1.08) | (0.37) | | | | | (0.54) | (0.05) | | |
| $S_j$ | | | | | -0.152* | -0.122 | | | | | -0.376*** | -0.799*** | | | | | -0.057 | 0.102 |
| | | | | | (1.90) | (1.06) | | | | | (2.85) | (3.03) | | | | | (0.55) | (0.73) |
| Observations | 1034 | 1035 | 1034 | 1035 | 1422 | 1423 | 326 | 326 | 326 | 326 | 403 | 403 | 603 | 604 | 603 | 604 | 892 | 893 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Workplaces | 742 | 742 | 893 | 246 | 246 | 287 | 444 | 444 | 554 |

Notes to table: Sample is restricted to the 2004-2011 panel. Data are weighted. Coefficients presented relate to pooled OLS and fixed effect regressions respectively. T-statistics are reported in parenthesis where standard errors are corrected for the complex sample design. '*,' '**' and '***' indicate significance at 10, 5 and 1 percent levels respectively. The same controls are included as in Table 3 but industry and region are excluded from the fixed effects specification since they are largely time invariant. A 2011 year dummy variable is, however, now included.

## Appendix Table A.1 Descriptive Statistics

| | | 2004 | | | 2011 | | |
|---|---|---|---|---|---|---|---|
| ***Dependent variables*** | | Average | Public | Private | Average | Public | Private |
| Labour Productivity | Manager ranked response relating to workplace labour productivity in comparison to other workplaces within the same industry. Ranked from *below average* (1) to *a lot better than average* (4) | 2.494 | 2.480 | 2.502 | 2.563 | 2.519 | 2.582 |
| Absence rate | Percentage of work days lost due to sickness or absence. | 5.038 | 5.921 | 4.727 | 4.794 | 5.478 | 4.542 |
| Quit rate | Percentage of employees (measured 1 year ago) who have left voluntarily. | 13.270 | 7.129 | 15.456 | 8.535 | 4.765 | 10.358 |
| ***Workplace Characteristics*** | Dummy variable equals 1 if | | | | | | |
| Scotland | Workplace is located in Scotland; 0 otherwise | 0.048 | 0.056 | 0.044 | 0.056 | 0.062 | 0.053 |
| North | Workplace is located in the North; 0 otherwise | 0.086 | 0.097 | 0.082 | 0.079 | 0.086 | 0.079 |
| Yorkshire and Humberside | Workplace is located in Yorkshire and Humberside; 0 otherwise | 0.075 | 0.068 | 0.080 | 0.065 | 0.060 | 0.068 |
| East Midlands | Workplace is located in the East Midlands; 0 otherwise | 0.038 | 0.037 | 0.037 | 0.038 | 0.038 | 0.036 |
| East Anglia | Workplace is located in East Anglia; 0 otherwise | 0.319 | 0.292 | 0.322 | 0.326 | 0.273 | 0.347 |
| South East | Workplace is located in the South East; 0 otherwise | 0.076 | 0.063 | 0.082 | 0.084 | 0.073 | 0.090 |
| South West | Workplace is located in the South West; 0 otherwise | 0.098 | 0.073 | 0.107 | 0.077 | 0.071 | 0.079 |
| West Midlands | Workplace is located in the West Midlands; 0 otherwise | 0.112 | 0.110 | 0.116 | 0.117 | 0.136 | 0.113 |
| North West | Workplace is located in the North West; 0 otherwise | 0.051 | 0.071 | 0.046 | 0.055 | 0.090 | 0.040 |
| Wales (omitted) | Workplace is located in Wales; 0 otherwise | 0.097 | 0.132 | 0.083 | 0.103 | 0.112 | 0.096 |
| Manufacturing | Manufacturing industry; 0 otherwise | 0.135 | 0.008 | 0.195 | 0.097 | 0.004 | 0.159 |
| Electricity, water and gas | Electricity, water and gas industry; 0 otherwise | 0.020 | 0.005 | 0.027 | 0.021 | 0.000 | 0.035 |
| Construction | Construction industry; 0 otherwise | 0.049 | 0.015 | 0.067 | 0.037 | 0.015 | 0.055 |
| Wholesale and retail trade | Wholesale and retail trade; 0 otherwise | 0.140 | 0.000 | 0.198 | 0.107 | 0.001 | 0.174 |
| Hotel and restaurant industry | Hotel and restaurant industry; 0 otherwise | 0.048 | 0.003 | 0.067 | 0.062 | 0.005 | 0.097 |
| Transport and communication | Transport and communication industry; 0 otherwise | 0.063 | 0.059 | 0.069 | 0.059 | 0.061 | 0.066 |
| Financial services | Financial services industry; 0 otherwise | 0.057 | 0.000 | 0.079 | 0.018 | 0.000 | 0.026 |
| Other business services | Other business services; 0 otherwise | 0.122 | 0.015 | 0.171 | 0.133 | 0.021 | 0.194 |
| Public administration | Public administration; 0 otherwise | 0.060 | 0.226 | 0.003 | 0.089 | 0.283 | 0.002 |
| Education | Education; 0 otherwise | 0.091 | 0.261 | 0.008 | 0.128 | 0.281 | 0.022 |
| Health | Health; 0 otherwise | 0.154 | 0.340 | 0.066 | 0.160 | 0.258 | 0.093 |
| Other community services (omitted) | Other community services; 0 otherwise | 0.062 | 0.066 | 0.005 | 0.089 | 0.072 | 0.076 |
| Manager or senior official | Proportion of workforce in manager or senior official occupations. | 0.108 | 0.071 | 0.123 | 0.117 | 0.086 | 0.135 |
| Professional | Proportion of workforce in professional occupations. | 0.110 | 0.206 | 0.070 | 0.166 | 0.270 | 0.105 |
| Associate professional and technical | Proportion of workforce in associate professional and technical occupations. | 0.113 | 0.192 | 0.083 | 0.108 | 0.142 | 0.088 |
| Administrative and secretarial | Proportion of workforce in administrative and secretarial occupations. | 0.157 | 0.207 | 0.135 | 0.152 | 0.210 | 0.117 |
| Skilled trades | Proportion of workforce in skilled trades occupations. | 0.070 | 0.026 | 0.090 | 0.062 | 0.022 | 0.087 |
| Personal services | Proportion of workforce in personal service occupations. | 0.082 | 0.134 | 0.050 | 0.104 | 0.128 | 0.078 |
| Sales and customer services | Proportion of workforce in sales and customer services occupations. | 0.137 | 0.012 | 0.188 | 0.106 | 0.027 | 0.155 |
| Process, plant and machine operatives | Proportion of workforce in process, plant and machine operatives occupations. | 0.087 | 0.014 | 0.120 | 0.069 | 0.017 | 0.104 |
| Elementary (omitted) | Proportion of workforce in elementary occupations. | 0.127 | 0.110 | 0.135 | 0.117 | 0.103 | 0.130 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Temporary | Proportion of workforce on temporary or fixed period contract. | 0.062 | 0.076 | 0.052 | 0.071 | 0.069 | 0.067 |
| Full-time | Proportion of workforce working full-time. | 0.725 | 0.666 | 0.758 | 0.724 | 0.686 | 0.760 |
| Trade union member | Proportion of workforce who are trade union members. | 0.275 | 0.575 | 0.166 | 0.254 | 0.547 | 0.124 |
| Female | Proportion of workforce who are female. | 0.510 | 0.648 | 0.445 | 0.523 | 0.627 | 0.452 |
| Disabled | Proportion of workforce who are work-limited disabled. | 0.012 | 0.018 | 0.009 | 0.018 | 0.026 | 0.012 |
| Aged less than 21 | Proportion of workforce who are aged between 16-21. | 0.090 | 0.034 | 0.112 | 0.065 | 0.020 | 0.091 |
| Aged over 50 | Proportion of workforce who are aged over 50. | 0.211 | 0.257 | 0.188 | 0.258 | 0.306 | 0.226 |
| Non-white | Proportion of workforce who are from a non-white ethnic group. | 0.080 | 0.076 | 0.082 | 0.088 | 0.093 | 0.085 |
| ***Workplace Characteristics*** | Dummy variable equals 1 if | | | | | | |
| Payment by results | Any employee at the establishment receives payment by results; 0 otherwise | 0.316 | 0.139 | 0.396 | 0.264 | 0.095 | 0.377 |
| Merit pay | Any employees at the establishment receives merit pay; 0 otherwise | 0.245 | 0.211 | 0.259 | 0.260 | 0.221 | 0.286 |
| Appraisal | Manager reports that there is a formal appraisal system at the workplace; 0 otherwise | 0.862 | 0.947 | 0.826 | 0.883 | 0.962 | 0.834 |
| Teamwork 100% | 100% of the largest occupational group work in teams; 0 otherwise | 0.390 | 0.489 | 0.357 | 0.448 | 0.513 | 0.398 |
| Teamwork 80-100% | 80-100% of the largest occupational group work in teams; 0 otherwise | 0.223 | 0.286 | 0.195 | 0.231 | 0.294 | 0.198 |
| Teamwork 0-80% (omitted) | 0-80% of the largest occupational group work in teams; 0 otherwise | 0.387 | 0.225 | 0.538 | 0.321 | 0.193 | 0.404 |
| Train 100% | 100% of the largest occupational group have been given training; 0 otherwise | 0.302 | 0.375 | 0.271 | 0.364 | 0.429 | 0.335 |
| Train 80-100% | 80-100% of the largest occupational group have been given training; 0 otherwise | 0.135 | 0.200 | 0.108 | 0.144 | 0.175 | 0.120 |
| Train 60-80% | 60-80% of the largest occupational group have been given training; 0 otherwise | 0.105 | 0.133 | 0.094 | 0.102 | 0.140 | 0.083 |
| Train 0-60% (omitted) | 0-60% of the largest occupational group have been given training; 0 otherwise | 0.458 | 0.292 | 0.527 | 0.390 | 0.256 | 0.462 |
| Physical health problem | Manager reports any work-related physical health problem among workforce; 0 otherwise | 0.384 | 0.526 | 0.332 | 0.342 | 0.468 | 0.279 |
| Single establishment | Workplace is a single independent establishment not belonging to another body; 0 otherwise | 0.227 | 0.076 | 0.276 | 0.257 | 0.118 | 0.312 |
| Log workplace size | Log of the total number of employees in workplace. | 4.457 | 5.100 | 4.192 | 4.415 | 5.150 | 4.014 |
| Index of organization change | Number of changes to the workplace introduced by management over the last 2 years. | 3.212 | 3.766 | 3.017 | 2.703 | 3.237 | 2.706 |
| Established | Number of years for which the organization has been established | 43.032 | 59.016 | 34.108 | 41.475 | 54.737 | 31.697 |
| Employment growth | Percentage change in employment over the last year | 5.797 | 7.278 | 5.395 | 2.279 | -0.256 | 3.488 |
| Redund | Percentage of employees (in employment last year) that have been made redundant. | 1.553 | 0.464 | 2.018 | 1.790 | 1.205 | 2.015 |
| ***Psychological Health*** | | | | | | | |
| $\overline{JA}_j$ | Average JA index across all employees in the employee sample at workplace *j*. | 2.437 | 2.538 | 2.400 | 2.228 | 2.323 | 2.175 |
| Work-related stress ( $S_j$ ) | Dummy variable equals 1 if manager reports stress, depression or anxiety among the workforce which is caused or made worse by work; 0 otherwise | 0.371 | 0.589 | 0.289 | 0.351 | 0.564 | 0.236 |
| ***Financial Performance*** | | | | | | | |
| Log (sales) | Logarithm of the value of sales per full-time equivalent | 4.154 | 3.462 | 4.473 | - | - | 11.223 |
| Log (value-added) | Logarithm of value-added per full-time equivalent | 9.538 | 9.535 | 9.540 | - | - | 21.196 |

Notes to table: Data are unweighted. Average formed over all workplaces in sample where the information is available.

[i] Pauly *et al*. (2008) instead ask managers in the US to evaluate the cost of absenteeism and presenteeism.

[ii] A measure of average employee anxiety-contentment available in 2004 produces similar cross sectional results to job anxiety, although the relationship with absence is consistently positive and significant and there is evidence of a negative relationship with subjective productivity in the public sector. In 2011, the results are robust to using an index of anxiety-depression.

[iii] Workplaces are classified as public, private or voluntary sector, and we focus on the differences between the first two groups. As a result the sector-specific analysis does not utilise information on the 409 voluntary sector workplaces.

[iv] Managers are also asked, '*How many employees have been absent owing to these problems over the last 12 months?'* This information cannot, however, be directly related to workforce stress unless this is the only work-related illness reported (which applies to about 25% of workplaces that report workforce stress). It is therefore not utilised here. Within these workplaces the average proportion of employees absent is 9%.

[v] Voluntary separations form the vast majority of all separations and we are confident that managers are able to distinguish these from dismissal and redundancy. However, we perform sensitivity analysis which defines the quit rate to include 'other reasons' in addition to voluntary separations since this may include retirement due to ill-health. The results are not sensitive to this.

[vi] Measures are adjusted when not reported for a full calendar year. Value added is measured as total sales minus total purchases and, following Bryson (2013), we add a constant in each year to ensure the distribution lies above zero.

[vii] Among the subsample of private sector workplaces where objective information is available there is no relationship between psychological health and subjective productivity in 2004 but there is evidence of a negative relationship between stress (but not job anxiety) and subjective productivity in 2011.

[viii] As such, we treat labour productivity as cardinal rather than ordinal. The sign and significance of the pooled results are, however, unchanged when estimated by ordered probit rather than OLS.