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ABSTRACT

Does Employing Older Workers Affect Workplace Performance?*

Focusing on private sector workplaces in Britain, we investigate whether the employment of older workers has implications for workplace performance. We find no significant association between changes in the proportion of older workers employed and changes in workplace performance. We find some evidence that workplace labour productivity falls where the proportion of 'middle-aged' workers falls, either due to a rise in the proportion of older or younger workers, but this association does not carry through to financial performance. Overall, the findings suggest that any reluctance on the part of employers to employ greater numbers of older workers may be misplaced.

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Introduction

The ageing population and growing labour force participation by older people means there is a shift in the age profile of those supplying their labour to employers in almost all developed economies (OECD, 2019). In the UK, for instance, there have been sharp increases in economic activity rates among those aged 55 or more over the past two decades (George et al, 2013) and much of the recent growth in employment has been in this age group (ibid.). These trends are expected to continue, with one in three working-age adults expected to be aged 50 or more by 2022. Whilst the United States has had legislation which outlaws discrimination on the basis of age since the late 1960s, most countries in Europe have been slow to tackle such prejudice. The UK government, for its part, introduced legislation to outlaw age discrimination in employment in 2010 and removed the default retirement age of 65 in 2011. In recent years, it has engaged in a series of campaigns to challenge stereotypes and to emphasise the potential business benefits to employers of employing older workers and of adopting flexible approaches to work and retirement (Department for Work and Pensions, 2007, 2017). The latest of these campaigns has set an explicit target of getting 1 million more older people into employment by 2022: the equivalent of an average employer increasing their number of older employees by 12 per cent (Business in the Community, 2017). That such campaigns should be needed reflects residual uncertainties among some employers about the net benefits of employing older workers.

In this paper we examine the relationship between the age composition of the workforce and workplace performance. More specifically, we consider whether changes in the proportion of older (and younger) workers employed at the workplace, as well as changes in age diversity, are associated with change in workplace performance. We use panel data for private sector workplaces from the nationally representative British Workplace Employment Relations Survey (WERS) to explore whether changes in the age composition of the workforce are associated with changes in workplace performance, over the period 2004 to 2011. Workplace performance is measured according to managers' subjective assessments of workplace labour productivity, quality of product or service and financial performance, as well as measures of quit rates and absence rates.

Evidence from existing studies on the relationship between age and workplace performance is mixed. These studies have been conducted in a range of settings and countries and use a range of performance measures. However, to our knowledge, our analysis is the first to explore this relationship using nationally representative data for British private sector workplaces. In general, we find no significant associations between changes in the proportion of older workers employed and changes in workplace performance. Changes in age diversity also typically show no association with change in workplace performance. This suggests that overall the age composition of private sector workplaces does not have a sizeable role to play in explaining their performance.

We find some evidence that workplace labour productivity falls where the proportion of workers aged 22-49 falls, either due to a rise in the proportion of older or younger workers. The association between a fall in the proportion of workers aged 22-49 and falling workplace labour productivity does not carry through to financial performance. One possible explanation is that workplaces benefit from older or younger workers in other ways, perhaps, for example, by reducing labour costs. However, our findings are unchanged when we additionally account for change in hourly wages, a key component of labour costs.

In the remainder of the paper, we first review the existing evidence on the association between the employment of older workers and workplace performance. We then set out the key features of the data used in the study and the approach to identifying older workers. The measures of workplace performance are described and the methods used to capture the relationship between the employment of older workers and workplace performance are described. The results of the analysis are presented and the paper concludes with a summary of key findings.

Existing evidence on older workers and workplace performance

Provided employers do not engage in direct or indirect age discrimination in hiring and firing, the laws governing equal treatment allows employers some discretion over the age composition of their workforce. The equal treatment legislation does not prescribe quotas. Consequently, the employment of older workers is largely an employer 'choice' at the margin and there are numerous cases of employers actively pursuing older job seekers (e.g. Craig, 2009). Since employers are usually assumed to be profit

maximising – at least in the market sector – we can assume that this choice is made with reference to the costs and benefits of employing older workers, as opposed to younger workers (either in their middle age or youth) or no workers at all.[i]

In a standard economic framework, it is assumed that employers combine factors of production efficiently such that they will continue to recruit older workers until their marginal productivity means it is no longer optimal to do so. If employers have optimised then the share of older workers at the workplace will be neither positively nor negatively correlated with performance outcomes. However, there are a number of reasons why we might expect the share of older workers employed at workplaces to not be optimal. First, labour market frictions such as the costs of matching workers to job slots mean that the actual number of older workers employed at a given time will not reflect what might be best for the workplace. For example, it may be that there is a shortage of older job seekers in the local labour market where the employer is recruiting. Second, employers may lack knowledge about the value of older workers and their effect on workplace performance. This lack of knowledge or information about the value of older workers may relate to the expected costs or benefits of employing older workers. It may be, for example, that some employers are unaware of the skills newer cohorts of older workers offer.

In these circumstances, where some employers have too few older workers, we would expect to see a positive correlation between the share of older workers and workplace performance. However, it may be the case that some employers will benefit more than others from having a high share of older workers. For example, where the customer-base for a particular product or service consists primarily of older people, firms may choose to serve those customers with older workers, in the belief that similarities between the seller and buyer may enhance customer satisfaction or increase sales. Alternatively, in firms which rely on employees having high-levels of firm-specific human capital it may make sense to retain a higher share of older workers who have had the time to build up that firm-specific knowledge.

There is a growing literature on the relationship between workforce demographics and organisational performance. Much of this literature has been concerned with the effects direct and indirect discrimination have in limiting the talent pool available to employers, which may adversely affect organisational performance. This concern has prompted research into the impact of increasing the

presence of under-represented groups in the workforce, including recent studies on the gender mix of corporate boards.[ii,iii] The implication is that the talent of some parts of the population is being under-utilised, such that their representation in the labour market is sub-optimal from the perspective of both firms and society.

However, most of the empirical literature on the link between the demographic characteristics of the workforce and organisational performance does not focus on discrimination. Instead it is concerned with the potential value of workforce diversity to employers, and the effects of changing workforce composition on organisational performance. The dual-focus in the literature – on employee shares and workforce diversity – is important because both may have effects on organisational performance, at least in theory.

A workplace's age composition refers to the proportion of employees in the workplace belonging to different age groups. A workplace's age diversity captures the spread of workers across the age distribution. This is sometimes captured using the standard deviation in workers' ages, or the coefficient of variance (the standard deviation divided by the mean). An alternative metric, which is the one we use in this study, is a Herfindahl index. It is related to workforce composition but combines two quantifiable measures: the number of age categories used to distinguish employees on the age dimension, and the proportion of the workforce that falls into each category.

Workplace performance may benefit from increasing the share of older workers for several reasons. If firms become increasingly reliant on firm-specific knowledge and 'corporate memory' – as might be the case where a firm is moving towards the production and sale of more specialised goods or services which are not readily available elsewhere in the market – their need for workers with considerable experience in that firm may grow. If an employer's customer base is ageing, firms may find 'matching' their staff profile to that of their customers enhances customer satisfaction or increases sales. These potential benefits are based around the conception of older workers' specific "productive assets" (Gratton et al, 2016).

However, there may also be indirect benefits from the increased employment of older workers. First, in tight labour markets, firms may become increasingly concerned to maximise retention, which is aided by

delaying retirement ages. Second, increasing the percentage of older workers in the workplace may raise worker wellbeing at the workplace, something which is known to be linked to improved workplace performance (Bryson et al., 2017). This is because wellbeing follows a u-shape over the life-course, starting to rise again when individuals are in their 50s (Cheng et al., 2017).

Conversely, an increase in the percentage of older workers employed at a workplace may adversely affect workplace performance if it is reliant on employees who are physically very fit and agile, or in circumstances where older workers are slower at adopting new procedures or technologies introduced by the firm. These putative disadvantages of older workers – primarily concerned with their 'vitality assets' (Gratton et al, 2016) – tend to invoke a certain characterisation of the older worker (less agile, technophobic, or more prone to absence or illness) which, some argue, is outdated and are not necessarily linked to age per se.

The link between workforce diversity and organisational performance is also theoretically ambiguous. This is because there are potential costs as well as benefits to workforce diversity, so that any overall effect is likely to reflect the net outcome from potentially competing mechanisms.[iv] Diversity may increase production in teams where they can improve knowledge sharing, enhance decision-making, lead to increased problem-solving capacity and result in more creativity. It can also affect worker performance via wellbeing: if greater diversity is preferred – that is, workers derive greater utility from being in a more diverse workforce – this may feed through to workers' productivity and thus firm performance. However, the opposite may happen if they derive greater utility from working alongside others who are 'like them'. Greater diversity can also entail increased costs where it increases problems of co-worker communication or lowers co-operation (for instance, through lower trust relations or weaker social ties). The degree to which organisations will derive benefits from greater diversity will depend on the extent to which the skills and knowledge of older and younger workers are complementary, or if there are spillovers across different worker types, as may be the case where younger workers can learn from older workers (either informally or via formal mentoring). Lazear (1998) argues that age-related complementarities derive from the fact that younger employees tend to have greater

knowledge of new technologies while older employees have better understanding and experience of operational matters.

These considerations suggest that the performance effects of age shares and age diversity are likely to vary across workplaces according to their production technologies and worker preferences. The latter are very difficult to establish, the former less so. At one extreme, age diversity will have negative effects on firms where production is characterised by workers of similar skills performing tasks together.[v] At the other extreme, gains from diversity will be greatest where complementarities across different types of worker are high and information can be learned at low cost (Lazear, 1999).

None of the above refers directly to dynamic organisational settings in which the age composition of the workforce is changing. These changes can present their own challenges, as described in Kunze et al. (2011), who find increased age diversity can result in increased perceptions of age discrimination. In turn, this can undermine organisational affective commitment, thus reducing organisational performance. It is possible that such effects may be mitigated by appropriate equal opportunities policies which monitor and review age-related aspects of recruitment, promotion and rewards.

Table 1 summarises empirical evidence regarding the links between age, age diversity and organisational performance.[vi] All studies incorporate both age diversity measures and average age or age share measures, though their precise derivation varies across studies. In all but one study (Kunze et al., 2011) the dependent variables are confined to a measure of labour productivity (either sales, value added, total factor productivity (TFP) or scrap rates) and so can tell us nothing about the impact of age-related factors on firms' overall performance or profitability. This is an issue to the extent that older workers may be either less or more costly than younger workers, depending on their bargaining power and the importance of seniority wage setting in firms. The effects of age and age diversity on organisational performance might conceivably switch once those cost-related factors are taken into consideration.

* Table 1 about here *

It is notable how disparate the findings are, reflecting differences in samples and settings, but also perhaps the countervailing theoretical impacts that age and age dispersion are likely to have on

performance. Older average age, or a higher percentage of older workers, is not normally negatively associated with performance; it is positive and robust in Garnero et al.'s (2014) study of Belgian private sector firms and Backes-Gellner and Veen's (2013) study of German workplaces, while it has a non-linear effect in Grund and Westergaard-Nielsen (2008) and Parrotta et al., (2014). Age diversity is positively linked to productivity in Ilmakunnas and Ilmakunnas's (2011) Finnish study but is negatively linked to sales in Leonard and Levine's (2003) U.S. retail firm and in Garnero et al.'s (2014) Belgian study. Elsewhere age diversity has either no significant effect, effects that are not robust across specifications or an inverse-u shaped relationship with organisational productivity.

Some of the studies are notable for testing particular theoretical propositions. Backes-Gellner and Veen (2013) build on Lazear's (1999) framework arguing that increasing marginal costs to age diversity and decreasing marginal returns will result in an inverse-u shaped relationship between age diversity and productivity. They further argue that the optimal point in that inverse-u shape will be low in settings characterised by routine tasks but high in settings characterised by creative tasks. Their empirical evidence supports these propositions. As noted earlier, Kunze et al., (2011) outline ways in which increasing age diversity can lead to increased perceptions of age discrimination, lowering affective organisational commitment which, in turn, decreases productivity. They find support for this model in their cross-sectional data using a structural model. Furthermore, they find no direct effect of age dispersion on productivity.

Although the studies reviewed cover an array of workplaces and firms from different countries none are conducted for Britain. The analyses presented in the remainder of this paper are the first to do so. Our findings thus add to the limited range of countries explored in the extant literature, and to the limited number of studies using nationally representative data, thereby furthering our understanding of the links between the age of the workforce and workplace performance.

Data and methodology

Data

The primary data source for this analysis is the British Workplace Employment Relations Survey (WERS) (Department for Business Innovation and Skills, 2015).[vii] We make use of data from the two most recent surveys in the series which took place in 2004 and 2011. WERS is a large nationally representative survey of workplaces with five or more employees (with responses from 2,680 workplaces in 2011 and from 2,295 workplaces in 2004). It contains data from face-to-face interviews with Human Resources managers, collecting data on workplace practices and procedures (including those relating to the recruitment of older workers), workforce composition (including age distribution) and workplace performance. It has a linked survey of employees containing detail on demographic characteristics (including banded age), job traits and attitudes/perceptions of management. WERS also includes panel data tracking around 1,000 workplaces between 2004 and 2011. The survey includes workplaces which have five or more employees and covers all industries with the exception of Agriculture, Forestry and Fishing and Mining and Quarrying. It should be noted that the survey does not cover micro-employers (those with fewer than five employees) or the self-employed.[viii]

Our analysis is based on the 2004-2011 panel of private sector workplaces within WERS. These workplaces had at least five employees in 2004 and 2011 when they were surveyed and were continuously trading throughout the period. We drop the small number of cases that switched into or out of the private sector between 2004 and 2011. We observe shifts in the share of older workers for workplaces that survived and were sampled over the period 2004-2011.[ix] We establish how these within-workplace movements in the share of older employees are linked to workplace performance, taking account of other time-varying features of the workplace such as workplace size and the age-related policies and practices deployed at the workplace. We focus on the private sector because it is subject to market forces and, as such, employers in that sector are more likely to weigh the costs and benefits of employing older workers in the manner envisaged by theory.[x]

Unless otherwise stated all analyses are survey weighted using workplace-level sampling weights which adjust for the probability of sample selection and adjust for non-response biases (see van Wanrooy et al, 2013 for further details). The weighted data allow us to extrapolate the findings to the population from

which the sample was drawn, namely private sector workplaces with five or more employees that survived the period 2004-2011.

Identifying older workers

Managers participating in WERS are asked to report the number of employees in their workplace in each of the following age bands: 16-17; 18-21; 22-49; and 50 and above. This information is collected through the Employee Profile Questionnaire which is distributed to managers prior to a face-to-face interview, allowing them time to consult their records, which should improve the accuracy of the data collected.

We use the term 'older workers' to refer to employees aged 50 and over. In large part, this is a result of the nature of the WERS data. There is no consensus on what age constitutes being an 'older worker', with a range of definitions in existence (Burgmann, 2013). However, many previous UK studies have also adopted the definition of aged 50 and above (for example, Yeomans, 2011, in a review of the literature on age and employment; Canduela *et al.*, 2012, Smeaton *et al.*, 2009, among others). Many UK government statistics relating to older workers have also been produced on the basis of those aged 50 and over, although these sometimes additionally distinguish those aged 50-64 from those aged 65 and over (Department for Work and Pensions, 2015, ONS, 2015).

In identifying younger workers, we are again constrained by the data available to us and therefore in our WERS analysis we define younger workers as those aged between 16 and 21. As for older workers, there are various definitions of 'younger workers' in use, although it is fairly common for this to encompass a slightly broader age group. Labour market statistics produced by the UK's statistical office, for example, identify young people as those aged 16-24 (ONS, 2016).

We also draw comparisons with workers aged between 22 and 49 years of age (i.e. all employees who are not categorised as younger or older workers, based on the definitions above). In practice, in many studies the definitions of older and younger workers used reflect the information that is available in the data being analysed, and our study is no exception.

The analyses use two age-related measures: the share of employees in one of three age brackets (50 or more, under 22 and those aged 22-49 years) and the Herfindahl index based on the number of age

categories used to distinguish employees on the age dimension, and the proportion of the workforce that falls into each category. The Herfindahl index is calculated as follows:

$$(1-((shareold*shareold)+(shareyoung*shareyoung)+(sharemid*sharemid)))$$

where "shareold" is the share of employees in the workplace aged 50 or more, "shareyoung" is the share aged between 16 and 21, and "sharemid" is the share aged 22-49 years. The index has a minimum value of 0 if there is only one category represented within the workplace and, in the case with three categories, a maximum value 0.667 if all categories are equally represented.

In 2004 the workplace mean share of older workers employed in the panel of workplaces was 0.19. This had risen to 0.25 by 2011. The median workplace in the distribution of the change in the share of older employees witnessed an increase of 4.3 percentage points in the share of older workers at the workplace. The workplace mean for the share of young workers at the workplace fell marginally (from 0.14 to 0.11). At the median the change was zero. The top two panels of Figure 1 indicate much more dispersion in the change in older employee shares at workplaces compared to the fairly compressed dispersion of change in the share of young employees.

* Figure 1 about here *

Mean age diversity was roughly constant (0.39 in 2004 and 0.41 in 2011) but, as the bottom panel of Figure 1 indicates, there is substantial variance in the change in age diversity within workplaces over time with the distribution skewed somewhat to the right.

Both the age share measures and age diversity measure are included in the models presented in this paper, following the practice adopted in the rest of the literature reviewed above. Although the two measures are positively correlated[xi] the associations between age shares and workplace performance are robust to the exclusion of the age diversity measure.

Measuring workplace performance

The analysis makes use of a range of measures of workplace performance, namely labour productivity, the quality of goods and services produced, financial performance, and quit and absence rates. The first three measures rely on the workplace Human Resources (HR) manager's subjective assessment. The managerial respondents to the survey were asked:

> *'Compared with other workplaces in the same industry how would you assess your workplace's …*
>
> *financial performance; labour productivity; quality of service or product?'*

For each of the three questions, they chose one of five responses presented to them on a show card ranging from 'a lot better than average' to 'a lot below average'. The percentage of managers saying their workplace performance was 'a lot below average' was very small, so these responses were combined with those saying 'below average' to form a four point scale (where one represents 'below average' or 'a lot below average' and four represents 'a lot better than average'). The three subjective workplace performance measures are positively and significantly correlated such that those scoring high on one indicator tend to score high on the other two.[xii] Thus, although distinct, these three measures may relate to a single underlying workplace performance scale.[xiii] We therefore also constructed an additive scale from three performance items, summing the items then subtracting three, such that the scale ran from zero ('below average' performance on all three items) to nine (performance 'a lot better than average' on all three items).

<center>* Figure 2 about here *</center>

The unweighted distributions for the three subjective measures of performance (labour productivity, quality of output and financial performance) and the additive scale are presented in Figure 2. In the survey-weighted data, as in the unweighted data, there is substantial persistence in the performance of workplaces. Around two-fifths report no change between 2004 and 2011 relative to the industry average.[xiv] Nevertheless there is substantial movement among the remainder with around one-third reporting a deterioration in performance on all three measures and around one-quarter reporting improvement relative to the industry average. The merit of the additive scale is that there is greater

variance in performance outcomes, with only 22 per cent of the weighted sample reporting no movement over the period 2004-2011.

When investigating workplace influences on performance it is more conventional to rely on accounting measures such as sales per employee and value added per employee. They have the advantage of being measured along a cardinal scale against which one can readily quantify correlations with other workplace factors, such as the average of employee wellbeing at the workplace. Although WERS collects such measures through its Financial Performance Questionnaire (FPQ) we prefer to focus on the subjective measures of workplace performance for two main reasons. A much higher percentage of workplace managers feel able to provide an answer along the ordinal scale presented in the show card. Eighty-seven per cent are able to do so on all three subjective performance measures, whereas the number of responses to the FPQ is low (n=545, which is 20 per cent of the respondents to the management questionnaire). One reason for the high rate of non-response to the FPQ may be reticence to disclose financial data that is not already in the public domain. The second reason for relying on the subjective assessments is that earlier studies have validated the subjective performance measures, confirming that they are predictive of subsequent workplace closure, for example, and are associated with other workplace features in the way theory might predict (Forth and McNabb, 2008; Machin and Stewart, 1990, 1996).[xv]

A third potential advantage of the subjective measures is that managers are asked about performance relative to other workplaces in their industry, and therefore this should take account of any common industry shocks, which may be correlated with changing age composition.

Quit and absence rates were calculated using HR managers' responses to questions regarding labour turnover one year prior to the survey. Managers were first asked:

'In total, how many employees (full and part time) were on the payroll at this workplace 12-months ago?'

They were then asked:

'And how many of these employees stopped working here, because they … left or resigned voluntarily?'

The quit rate is simply the share of those working at the workplace 12 months ago who had left or resigned voluntarily. Absence rates were based on the following question:

'Over the last 12 months what percentage of work days was lost through employee sickness or absence at this workplace?'

Interviewers were instructed to tell managers to 'exclude authorised leave of absence, employees away on secondment or courses or days lost through industrial action'.

The distribution of within-workplace changes in absence and quit rates is presented in Figure 3, together with the workplace performance additive scale (for completeness), using survey-weighted data. Mean annual absence rates among the private sector workplaces in the WERS panel rose from 3.8 to 4.5 percent of working days between 2004 and 2011 but the median within-workplace change is zero. Those at the 90th percentile of the absence change distribution experienced an increase in absence rates of eight percentage points, while those at the 10th percentile experienced a reduction of four percentage points. The mean quit rate among panel private sector workplaces fell from 17.6 per cent in 2004 to 11.6 per cent in 2011, perhaps in response to limited outside options post-recession. But the median difference was -2.3 percentage points.

Methods

We undertake multivariate analyses of the panel component of the WERS data to identify independent associations between the variables of interest. These analyses, which are also survey weighted to permit extrapolation to the population of workplaces at large, allow us to take account of the contribution of multiple factors, but it should be noted that such analyses can identify associations but not causal relationships.

The panel consists of workplaces which were observed in both 2004 and 2011. An advantage of using the panel data, rather than the two cross-sections, is that it allows us to look specifically at change within the same workplaces over time. One potential drawback is that the panel consists of a smaller sample of workplaces. While there are almost 1,000 workplaces in total in the panel sample, the sample size reduces when focusing on particular subsets of workplaces (by industry, for example). This limits our ability to look at subgroups of workplaces. The nature of the panel data also means we only observe workplaces at

two points in time, and over a period in which the economy experienced a significant downturn. It is possible that exploring change over a longer timeframe could produce different results; the availability of just two time points also limits our ability to identify the direction of any relationship with certainty.

We estimate first difference panel models which simply regress changes in our performance measures for workplace i (Δp_i) on changes in age shares (ΔS_i) - with the share aged 22-49 years omitted as the reference category - change in age diversity (ΔD_i), and other time-varying workplace-level covariates captured in the vector ΔX_i.[xvi] This vector consists of the change in: the total number of employees at the workplace; the share female; gender diversity; the share non-white; the share part-time; the share in the largest non-managerial occupational category; and the percent union membership. In addition the vector contains variables capturing change in age-related policies. These are: four dummy variables identifying the presence of an equal opportunities policy mentioning age, equal opportunities policies that do not mention age, having special recruitment procedures for older individuals, age being an important consideration in recruitment decisions; and a five point equal opportunities index identifying the degree to which the workplace monitors and reviews age-related practices in relation to hiring, pay and promotion.[xvii]

Controlling for changes in other aspects of workforce composition helps to capture the relationship between changes in performance and age-related changes, thus helping to tackle any biases in the age-performance relationship that might occur through the omission of other workforce composition changes.[xviii] Changes in union density are controlled for because these are known to affect workers' bargaining power which, in turn, can affect workplace performance.

The inclusion of changes in age-related policies and practices is motivated by the idea that effective policies can help ameliorate some of the potential adverse consequences associated with increased age diversity or a shift towards the employment of older workers. We experiment with their inclusion and exclusion to see whether their inclusion affects the coefficients on our key variables of interest, namely the age share and age diversity measures.

The baseline model (1) therefore takes the following form where beta is the coefficient for the age shares, delta is the coefficient for age diversity and the thetas are the coefficients for the control vector variables:

$$\Delta p i \;\; = \boldsymbol{\beta} \Delta \boldsymbol{S_i} + \boldsymbol{\delta} \Delta \boldsymbol{D_i} + \; \boldsymbol{\theta} \Delta \boldsymbol{X_i} \; + \epsilon \qquad\qquad (1)$$

where $\boldsymbol{\epsilon}$ is the error term.

The above models are run on data collected solely from HR managers. As such they rely solely on the management questionnaire data. However, in the majority of cases the data also contain information from sampled employees of those workplaces which we are able to link to the workplace which employs them. In these cases, we can use these data to create workplace-level means, thus enriching our analyses by taking account of time-variance in other employee traits which might, if excluded, confound the relationship we are trying to identify between changes in age shares and diversity and workplace performance. This vector of workplace mean variables constructed from employee responses is identified in equation (2) below as $\Delta \bar{E}_i$ denoting change in the workplace means. These variables are simply added to model (1) thus:

$$\Delta \boldsymbol{p_i} = \boldsymbol{\beta} \Delta \boldsymbol{S_i} + \boldsymbol{\delta} \Delta \boldsymbol{D_i} + \; \boldsymbol{\theta} \Delta \boldsymbol{X_i} \; + \boldsymbol{\gamma} \Delta \bar{\boldsymbol{E}}_i + \epsilon \qquad\qquad (2)$$

We have incorporated three such variables, namely mean hourly pay at the workplace, mean job satisfaction and mean job-related anxiety. Mean hourly pay is incorporated to account for any differential shift in labour costs which results from changes in the age composition of the workforce: comparing equation (1) with equation (2) can therefore, at least in principle, help identify whether any performance effects of age changes are amplified or nullified by changes in labour costs. The incorporation of mean worker wellbeing variables is motivated by the possibility that an older workforce may be "happier" than a younger workforce which can lead to increased workplace performance, as discussed earlier. In sensitivity checks we also controlled for change in mean workplace tenure, mean training duration and mean highest academic qualifications. None were statistically significant and they had no effect on the age-related coefficients so they were omitted from our preferred specifications.

In addition to these models with controls, we present raw correlations excluding controls for comparison purposes. We have experimented with other model specifications. These include models containing only age shares, age shares plus age diversity, and employment size. But the results were robust to these alternative specifications.

The great advantage of a panel first difference model compared to cross-sectional estimates is that the panel estimator nets out unobserved fixed differences across workplaces that might otherwise bias our estimates of the relationship between the age variables and workplace performance. It does so by focusing solely on that part of the variance within workplaces, thus ignoring variance across workplaces. Although we have incorporated a number of items capturing time-varying covariates our estimates remain vulnerable to omitted time-varying variables that are correlated with performance and age shares and age diversity. Furthermore, our estimates are unable to account for the potentially endogenous nature of change in the age composition of the workforce. However, we do test for reverse causation by regressing change in age composition between 2004 and 2011 on performance in 2004. In these tests workplace performance in 2004 is not predictive of age shares or age diversity in 2011, nor changes in age-related variables.

Finally, we supplement our first difference models with models estimating performance in 2011 as a function of baseline covariates measured in 2004. These models incorporate a rich array of 2004 covariates[xix], together with age shares in 2004 and age diversity in 2004, to see whether these are correlated with performance in 2011. Variants of these models also incorporate a lagged dependent variable.

Findings

The key associations between change in age composition, age diversity and workplace performance are summarised in Table 2. We discuss the results for each performance measure in detail below. In general, we find no significant associations between change in the proportion of older workers, or change in age diversity, and changes in workplace performance. We find some evidence that self-reported workplace labour productivity falls where the proportion of older workers rises; this is also the case where the

proportion of younger workers increases. However, this is not the case for the other measures of workplace performance considered here.

<center>* Table 2 about here *</center>

Table 3 to Table 8 report first difference models for each of the six dependent variables respectively namely labour productivity, quality of output, financial performance, the additive performance scale for these three items, quit rates and absence rates.[xx] Each table reports four models. Model (1) contains only the age share and age diversity models without controls. Model (2) incorporates the controls from the management respondent as per equation (1) above. Models (3) and (4) are run on the smaller sample which contains employee-level data too: Model (4) incorporates mean hourly earnings, mean job satisfaction and mean job-related anxiety taken from employee responses, as per equation (2); Model (3) is run on the same sample as model (4) but is confined to the management survey data. A comparison of the coefficients for the age-related variables in Models (2), (3) and (4) allows us to establish whether changes in those coefficients across the models are related to the introduction of the additional controls from the employee data or the reduction in the sample size which occurs when linking the employee data to the management data.

Workplace labour productivity (as measured by managers' subjective assessments) fell with an increase in the share of younger and older workers. This relationship is apparent in the raw data (Table 3, Model 1), and remains apparent when controlling for other workplace characteristics (Table 3, Model 2). Furthermore, while the inclusion of these additional controls increases the amount of variance in changes in labour productivity that the model is able to explain, these controls make no difference to the size or statistical significance of the relationship with the share of older workers. Thus, conditioning on other dimensions of workplace demographics and age-related policies and practices does not influence the size of the association.

<center>* Table 3 about here *</center>

For a subset of workplaces, it is also possible to control for information based on employee responses. In this subset of workplaces, before the inclusion of any additional controls, the relationship between

change in the share of older workers and change in labour productivity persists – the effect is actually larger, although only statistically significant at the ten per cent level (Table 3, Model 3). When we additionally control for mean hourly pay, mean job satisfaction and mean job-related anxiety, the relationship with the change in the share of older workers is unaltered (Table 3, Model 4). As mentioned previously, existing studies have not generally found older average age to be negatively associated with workplace productivity; some have found positive effects, while others have found evidence of non-linear relationships. It is important to bear in mind the different settings in which these studies have taken place (sometimes in particular industries and none for Britain). These studies have also made use of accounting measures of performance, rather than the subjective measures used in this paper.

It is not just a rise in the proportion of older workers that was associated with a fall in workplace labour productivity. Increasing the share of younger workers was also negatively associated with changes in workplace labour productivity, the effect being somewhat larger than that for the share of older employees. Taken together these findings on older and younger worker shares imply that an increase in the share of workers aged 22-49 years (the omitted reference category) is associated with increased labour productivity.

The fact that age diversity has the potential to have both positive and negative consequences for workplace performance may explain why the findings from existing empirical studies on this issue are mixed. In our analysis change in age diversity was not typically associated with changes in labour productivity, although when controlling for workplace characteristics, there was a positive and statistically significant association at a 90 per cent confidence level (Table 3 Model 2). This did not remain significant once additionally controlling for average hourly pay and wellbeing among employees at the workplace.

Results from identical analyses for workplace performance in terms of the manager's assessment of quality of output are presented in Table 4. For this measure of performance, neither changes in age shares nor changes in age diversity were significantly associated with changes in the quality of output.

* Table 4 about here *

In spite of the negative association between increases in the share of older employees and changes in labour productivity, this does not feed through to financial performance. There is no statistically significant association between the change in the share of older workers and change in financial performance (Table 5). In the smaller sample for which linked employee data are available there is weak statistical evidence to suggest an increase in younger employees does adversely affect workplace financial performance (Models 3 and 4). Age diversity is not statistically significant in any of the specifications. Few existing studies have considered the relationship between age of the workforce and financial performance, with the exception of Kunze et al., (2011), who also find no significant direct effect.

* Table 5 about here *

The additive performance scale combines the changes in the subjective measures of labour productivity, quality of output and financial performance (Table 6). Here there is weak statistical support for the proposition that an increase in the share of younger employees is associated with a reduction in the workplace performance additive scale, but otherwise the age-related variables are not statistically significant.

* Table 6 about here *

We also consider workplace performance in terms of quit rates and absence rates. Again there was little to suggest that changes in the proportion of older workers, or changes in age diversity, were associated with changes in workplace performance in terms of either measure. Although the coefficients for increases in the share of older employees are negative in the models for changes in employee quit rates they are not statistically significant (Table 7). The coefficients for increases in the share of younger employees are positive in these models but, again, they are not statistically significant. Neither are changes in age diversity.

* Table 7 about here *

There is weak statistical support for the proposition that an increase in older employees increases absence rates. There is a positive and statistically significant association at a 90 per cent confidence level both with and without controlling for workplace characteristics (Table 8, Models 1 and 2). However, this

becomes non-significant in the smaller sample which links the managerial and employee data (Models 3 and 4). No significant relationship with age diversity is evident once controlling for workplace characteristics.

Table 8 about here

Finally, we use the panel data to predict 2011 workplace performance using 2004 baseline traits. This permits us to see if age-related variables in 2004 can predict 2011 workplace performance, conditioning on a range of 2004 workplace characteristics which are more extensive than those used in the analysis presented so far in this section.[xxi] The results suggest that having a higher share of older employees in 2004 is associated with poorer financial performance and poorer performance on the additive scale in 2011, albeit only at a 90 per cent confidence level, whereas a higher share of older employees in 2004 is also linked to lower absence rates in 2011 – again only at a 90 per cent confidence level (Table 9). Having a higher share of younger employees is only statistically significantly associated with lower absence rates in 2011. Age diversity in 2004 has no association with performance outcomes in 2011.

Table 9 about here

In an additional set of models we also control for workplace performance in 2004 (Table 10). Including a lagged measure of performance aims to soak up pre-existing performance differentials at the time of the 2004 survey. The introduction of the lagged performance measures increases the variance accounted for by the models[xxii], with the exception of the labour productivity model. This is because, with the exception of labour productivity, the lagged performance measures were highly statistically significant and positive, indicating persistence in performance over the period 2004-2011 within workplaces. The effect of the lagged performance measures' introduction is to reduce the size of the older worker share coefficients in all cases, leading them to be statistically non-significant across the board. The implication is that the share of older workers tends to be higher in workplaces that already had poor performance back in 2004.[xxiii]

Table 10 about here

The share of younger employees is also not significant. Neither is age diversity in 2004, apart from in the case of quits where there is weak statistical support for the proposition that greater diversity leads to lower quit rates.

Summary and conclusions

In this paper we have used panel data for private sector workplaces from the 2004-2011 Workplace Employment Relations Survey to establish the association between changes in age shares and age diversity with six measures of changes in workplace performance. The analysis focuses on within-workplace change and controls for unobserved fixed workplace traits and a range of observed time-varying variables that might conceivably affect workforce age composition and workplace performance.

In general, there are weak or no associations between changes in age shares, changes in age diversity, and workplace performance over the period. There is some evidence that both a higher percentage of older employees, and a higher percentage of younger employees, result in a reduction in labour productivity, but this does not carry through to financial performance. One possible reason for this is that workplaces benefit from their older workers in other ways, for example, by helping to reduce labour costs, thus compensating for lower older worker productivity. This could be the case if, for example, older workers received lower wages, or could result from lower expenditure on training of older workers. However, we incorporate changes in hourly wages and training provision, two of the major components in labour costs, and this does not affect the association.

The significance and magnitude of the relationships between the age variables and workplace performance did not shift decisively with the inclusion of variables capturing other aspects of workplace demographics, mean wages, and mean worker wellbeing. The inclusion of such variables did, however, increase the amount of variance in performance accounted for by the models. In the models seeking to predict 2011 performance outcomes using 2004 workplace characteristics, some weak negative effects of a higher older worker share in 2004 disappeared with the inclusion of lagged 2004 performance, suggesting it was workplaces which already had poorer performance in 2004 that tended to employ a higher share of older workers.

Although other studies find some effects of age shares, average age, and age diversity on organisational performance, this is the first study for Britain. It suggests age-related workplace demographics do not play a big role in the performance of private sector workplaces in Britain. Of course, there are a number of limitations to our analyses. Results could be sensitive to the inclusion of additional time-varying control variables, such as the introduction of new technology and changes in capital intensity, and there may be non-linear effects of age diversity which we have not examined. Our subjective measures of workplace performance (though the best available) may be subject to measurement error, potentially biasing the associations with workforce age downwards. Another draw-back to our study is that the panel sample sizes are quite small making it difficult to obtain precise estimates of what appear to be relatively small effects in most instances. However, our study has the advantage of being able to call upon a broad range of performance measures and a high-quality sample. Our results suggest that employers should be open to exhortations to increase their employment of older workers.

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Table 1 Empirical Evidence on the impact of Age and Age Diversity on Organisational Performance

Study	Age Measures	Outcome	Results	Comments
Leonard and Levine (2003)	Mean age; sd of log(age)	Sales, sales growth	Postive or ns; Negative	US single retail firm, 800 stores
Ilmakunnas et al. (2004)	Mean age; sd of age	Plant TFP	Positive to 40; ns	Finland
Borsch-Supan and Weiss (2007)	Mean team age; non-linear splines	Team-level scrap rate	ns	Single plant, large car manufacturer
Grund and Westergaard-Nielsen (2008)	Mean age; sd of age	Value added per employee	Inverse-u; Inverse-u	Firm panel, OLS and fixed effects. Denmark, private sector, firms with 20+ employees
Kunze et al. (2011)	Median age; sd of age	Various, including financial performance, growth, productivity	ns; Negative via perceived discrimination - no direct effect	128 companies, Germany. Cross-section.
Ilmakunnas and Ilmakunnas (2011)	Mean age and its square; sd of age; Age dissimilarity index	Value added, TFP	ns, but sensitive to model; Positive; Positive	Finland, manufacturing and production plants with 20+ employees
Backes-Gellner and Veen (2013)	Mean age; sd of age; coefficient of variation	Productivity	Positive; Negative but positive in creative tasks and innovative companies	Panel 18,000 German workplaces
Garnero et al. (2014)	Mean age; sd of age; Age dissimilarity	Log value added per hour; Log profits (value added minus wages)	Positive; Negative; Negative	Belgian panel, 2431 medium and large private sector firms
Parrotta et al. (2014)	Mean age; Herfindahl index	Log value added	Inverse-u; Negative or ns	Danish, firm-level, firms with 10+ employees

Table 2 Change in age composition, age diversity and workplace performance: summary of results

	Labour productivity	Quality of output	Financial performance	Additive scale	Quit rate	Absence rate
Change in share aged 50+	-	ns	ns	ns	ns	(+)
Change in share aged 16-21	-	ns	ns	(-)	ns	ns
Change in age diversity	(+)	ns	ns	ns	ns	ns

Notes: This table summarises the results from the underlying regression models reported in the following tables, based on the models which control for workplace characteristics, specifically: number of employees; share female; gender diversity; share non-white; share part-time; share in largest occupational group; union density; number of age-related EO practices; EO policy mentioning age; EO policy not mentioning age; age important in recruitment; special procedures for recruiting older workers.

'-' indicates a negative association which is significant at least the five per cent level of statistical significance; parentheses indicate that the association is statistically significant at the ten per cent level; 'ns' indicates no statistically significant association.

Table 3 Change in Labour Productivity, 2004-2011

	Model 1	Model 2	Model 3	Model 4
Δ Share 50+	-0.774**	-0.796**	-2.836*	-2.817*
	(-2.25)	(-2.03)	(-1.91)	(-1.92)
Δ Share 16-21	-1.248***	-1.408***	-3.487**	-3.491**
	(-2.74)	(-3.03)	(-2.30)	(-2.30)
Δ Age diversity	0.737	0.995*	0.498	0.574
	(1.28)	(1.89)	(0.33)	(0.38)
Management controls	No	Yes	Yes	Yes
Employee Controls	No	No	No	Yes
R-sq	0.025	0.118	0.208	0.212
Observations	411	411	300	300

Notes:

a. Models estimated via first differences.
b. Controls from management survey: number of employees; share female; gender diversity; share non-white; share part-time; share in largest occupational group; union density; number of age-related EO practices; EO policy mentioning age; EO policy not mentioning age; age important in recruitment; special procedures for recruiting older workers

c. Controls from employee survey: mean hourly wage; mean job satisfaction; mean job-related anxiety

d. Significance: *** p<0.01, ** p<0.05, * p<0.10. T-statistics in parentheses.

Table 4: Change in Quality of Output, 2004-2011

	M1	M2	M3	M4
Δ Share 50+	-0.38	-0.428	-1.149	-0.994
	(-0.92)	(-1.05)	(-1.23)	(-1.08)
Δ Share 16-21	-0.252	-0.319	-0.044	-0.094
	(-0.46)	(-0.62)	(-0.05)	(-0.12)
Δ Age diversity	-0.026	0.050	0.714	0.656
	(-0.06)	(0.11)	(1.01)	(0.91)
Management controls	No	Yes	Yes	Yes
Employee Controls	No	No	No	Yes
R-sq	0.010	0.090	0.081	0.106
Observations	411	411	300	300

Notes: see Table 3.

Table 5 Change in Financial Performance, 2004-2011

	M1	M2	M3	M4
Δ Share 50+	0.006	0.186	-1.511	-1.459
	(0.01)	(0.50)	(-1.12)	(-1.09)
Δ Share 16-21	-0.182	0.079	-2.315*	-2.325*
	(-0.39)	(0.17)	(-1.88)	(-1.91)
Δ Age diversity	0.259	0.197	0.248	0.414
	(0.53)	(0.43)	(0.20)	(0.33)
Management controls	No	Yes	Yes	Yes
Employee Controls	No	No	No	Yes
R-sq	0.002	0.057	0.164	0.187
Observations	411	411	300	300

Notes: see Table 3.

Table 6 Change in Additive Performance Scale, 2004-2011

	M1	M2	M3	M4
Δ Share 50+	-1.016	-0.910	0.918	1.281
	(-1.38)	(-1.13)	(0.83)	(1.12)
Δ Share 16-21	-1.604*	-1.578*	-0.504	-0.545
	(-1.73)	(-1.72)	(-0.38)	(-0.41)
Δ Age diversity	0.827	1.094	0.572	0.220
	(0.80)	(1.18)	(0.46)	(0.17)
Management controls	No	Yes	Yes	Yes
Employee Controls	No	No	No	Yes
R-sq	0.011	0.081	0.127	0.189
Observations	411	411	241	241

Notes: see Table 3.

Table 7 Change in Quit Rate, 2004-2011

	M1	M2	M3	M4
Δ Share 50+	-11.684	-7.573	-8.859	-9.623
	(-1.32)	(-0.87)	(-1.17)	(-1.23)
Δ Share 16-21	21.456	20.537	13.191	13.691
	(1.20)	(1.16)	(0.91)	(1.01)
Δ Age diversity	5.003	3.958	18.254	16.471
	(0.56)	(0.41)	(1.54)	(1.42)
Management controls	No	Yes	Yes	Yes
Employee Controls	No	No	No	Yes
R-sq	0.037	0.134	0.157	0.193
Observations	479	479	275	275

Notes: see Table 3.

Table 8 Change in Absence Rate, 2004-2011

	M1	M2	M3	M4
Δ Share 50+	1.016*	1.027*	0.889	0.997
	(1.80)	(1.77)	(1.43)	(1.45)
Δ Share 16-21	-0.181	-0.164	-0.662	-0.548
	(-0.28)	(-0.27)	(-0.81)	(-0.66)
Δ Age diversity	-0.978*	-0.844	-0.843	-0.831
	(-1.67)	(-1.38)	(-0.95)	(-0.93)
Management controls	No	Yes	Yes	Yes
Employee Controls	No	No	No	Yes
R-sq	0.034	0.071	0.150	0.190
Observations	393	393	229	229

Notes: see Table 3.

Table 9 Performance Outcomes in 2011 (no lagged dependent variable)

	Labour Prod.	Quality	Fin. Perf.	Additive Perf. Scale	Quits	Absence
2004 Share 50+	-0.500	-0.291	-0.721*	-1.512*	-6.594	-2.385*
	(-1.32)	(-0.70)	(-1.91)	(-1.82)	(-0.500)	(-1.71)
2004 Share 16-21	-0.040	-0.232	0.327	0.056	1.671	-2.452*
	(-0.11)	(-0.54)	(0.82)	(0.06)	(0.14)	(-1.78)
2004 Age diversity	0.259	0.138	0.000	0.397	-16.661	1.993
	(0.62)	(0.33)	(0.00)	(0.40)	(-1.44)	(1.28)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.197	0.219	0.168	0.19	0.324	0.191
Observations	459	459	459	459	435	402

Notes:

a. Ordinary Least Squares estimates for 2011 outcomes.
b. 2004 baseline controls: number of employees; share female; gender diversity; share non-white; share part-time; share in largest occupational group; union density; number of age-related EO practices; EO policy mentioning age; EO policy not mentioning age; age important in recruitment; special procedures for recruiting older workers; single-establishment organisation; industry; region; age of establishment.
c. Significance: *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table 10 Performance Outcomes in 2011 (with lagged dependent variable)

	Labour Prod.	Quality	Fin. Perf.	Additive Scale	Quits	Absence
Share 50+	-0.458	-0.180	-0.552	-1.002	-4.608	-2.160
	(-1.19)	(-0.44)	(-1.54)	(-1.22)	(-0.35)	(-1.51)
Share 16-21	0.012	-0.238	0.421	0.379	1.030	-2.008
	(0.03)	(-0.58)	(1.04)	(0.41)	(0.09)	(-1.37)
Age diversity	0.248	0.171	-0.011	0.375	-19.178*	1.972
	(0.59)	(0.41)	(-0.03)	(0,38)	(-1.68)	(1.26)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.201	0.261	0.22	0.252	0.345	0.265
Observations	459	459	459	459	417	339

Notes: see Table 9.

Figure 1 Within-Workplace Changes in Age Shares and Age Diversity (weighted), 2004-2011, Panel Survey, Private Sector
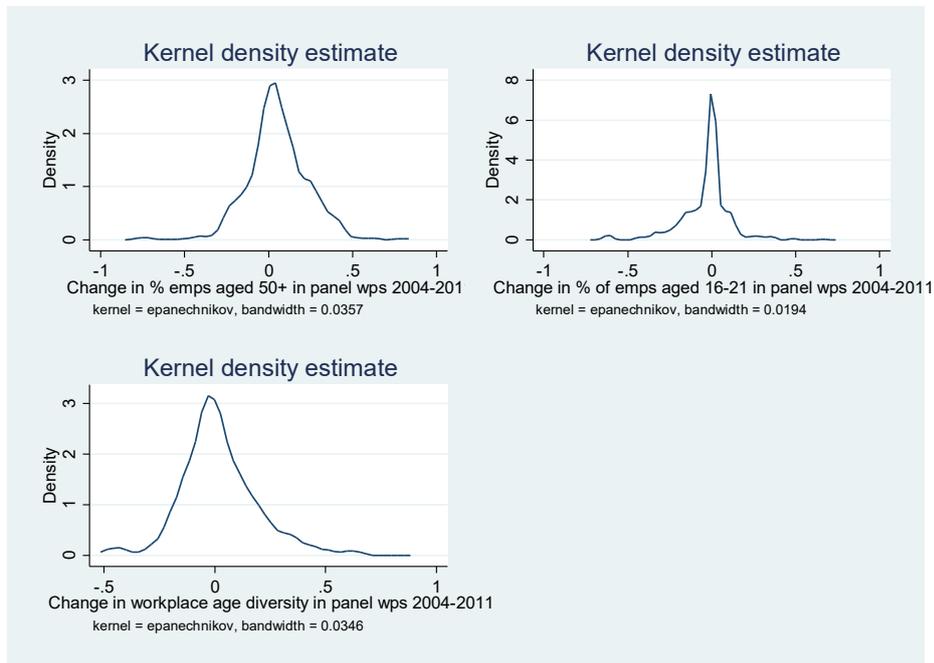
Source: Workplace Employment Relations Survey

Figure 2 Within-Workplace Changes in Workplace Performance (unweighted number of workplaces), 2004-2011, Panel Survey, Private Sector
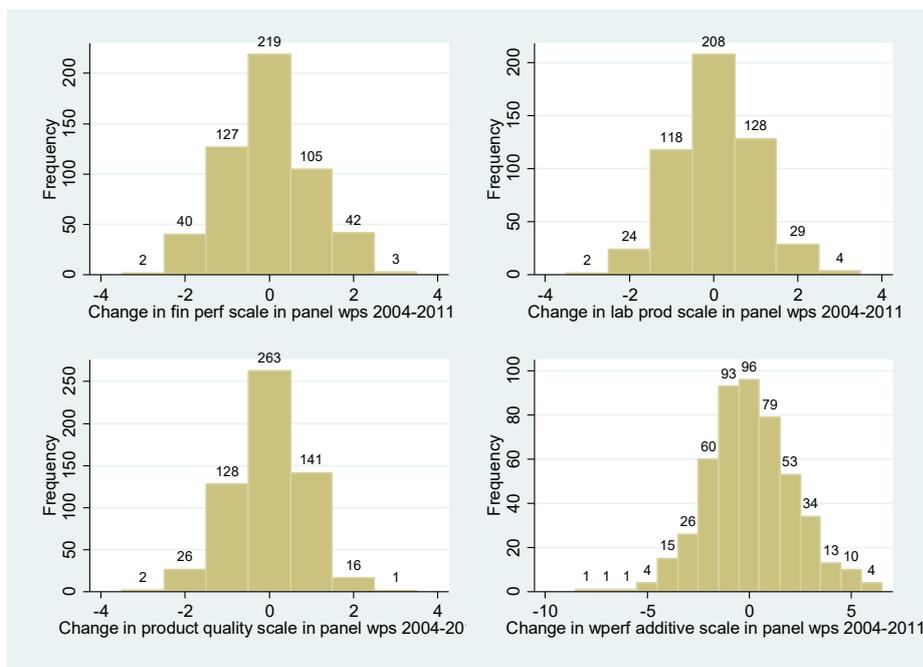
Source: Workplace Employment Relations Survey

Figure 3 Within-Workplace Changes in Additive Workplace Performance, Absence Rates and Quit Rates (weighted), 2004-2011, Panel Survey, Private Sector
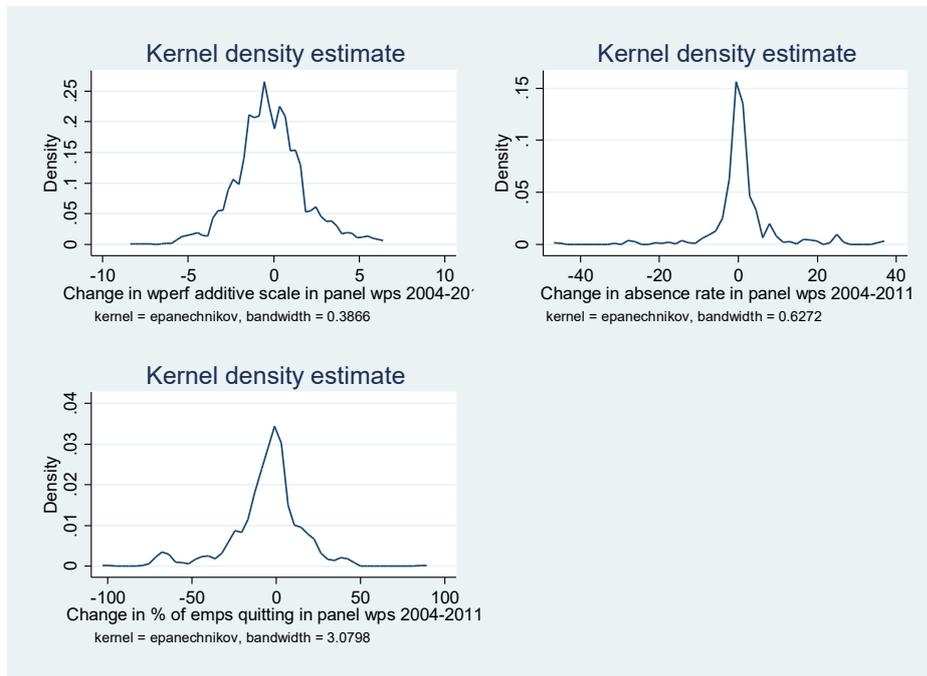
Source: Workplace Employment Relations Survey

Endnotes

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[i] It is sometimes stated that rising labour market participation by older people restricts employment opportunities for younger people. However, there is little evidence to support this argument. While at a firm level an employer may weigh up the costs and benefits of employing older or younger workers, the number of jobs in the economy as a whole is not fixed (what economists term the 'lump of labour fallacy').

[ii] For example, see Bertrand et al., (2014) for an examination of the effects of female quotas for corporate board membership in Norway.

[iii] One of the earliest examples of employers recognising the adverse effects of discrimination on their performance is Goff et al.'s (2002) account of the way in which black players were assimilated into professional baseball and basketball in the United States.

[iv] For an excellent review of this literature and its empirical counterpart see Ilmakunnas and Ilmakunnas (2011). Our brief comments draw, in part, on their review.

[v] Referred to in the literature as O-ring production functions (Kremer, 1993).

[vi] The table does not contain all empirical studies ever conducted. Instead studies are chosen based on the quality of the data, the robustness of estimation methods used and one's ability to extrapolate from the results more broadly.

[vii] For further information on WERS, see the website here: http://www.wers2011.info/

[viii] Note that WERS covers workplaces in Britain, and not the whole of the UK (i.e. it does not include Northern Ireland).

[ix] We are able to observe whether workplaces surveyed in 2004 had closed by 2011. We ran models predicting the likelihood of closure with 2004 workplace co-variates including age shares and age diversity. Age diversity in 2004 was not predictive of closure by 2011. Nor was the proportion of older workers in the workplace relative to the proportion of workers aged 22-49. However, a higher

proportion of older workers in 2004 was associated with a higher closure probability by 2011, relative to having a higher share of young workers (aged below 22 years). The share of older workers relative to workers aged 22-49 was not a significant predictor of closure. Thus, although the age profile of employees in 2004 resulted in a non-random subset of workplaces surviving throughout the period 2004-2011 this appears unrelated to the negative association between growth in the share of older workers relative to workers aged 22-49 and declining labour productivity in surviving workplaces.

[x] That said, it is arguable that public sector organisations are facing increasing pressures to deliver services efficiently to tight budgets and, as such, will be in a similar to position to workplaces in the private sector. This is an issue that could be tackled in future research.

[xi] In our estimation sample the Herfindahl index and the share of older workers has a correlation coefficient of 0.46 in 2004 and 0.49 in 2011. Both are statistically significant at the one per cent level.

[xii] Similarly those scoring low on one indicator tend to score low on the other two indicators. The correlation coefficients in the weighted data are: financial performance and labour productivity 0.44; financial performance and quality 0.25; labour productivity and quality 0.33. They are all statistically significant at the one per cent level.

[xiii] This is confirmed by a high scale reliability coefficient, or alpha, for the three performance items of 0.79.

[xiv] In the case of financial performance the percentage is 45 per cent, for labour productivity it is 40 per cent and for quality of output it is 43 per cent.

[xv] In our estimation sample those reporting poorer financial performance in 2004 were more likely to have closed by 2011.

[xvi] In a two-period model such as ours first difference and workplace fixed effects models are identical.

[xvii] The five practices are: monitors recruitment or selection; reviews recruitment or selection procedures; monitors promotions; reviews promotion procedures; reviews relative pay levels.

[xviii] Of course, it is possible that there are changes in other aspects of workforce composition that we do not control for here (such as changes in the proportion of non-UK nationals, for example).

[xix] These are: single digit industry; region; workplace size; single-establishment firm; age of establishment; share female; gender diversity; share non-white; share part-time; share in largest non-managerial occupational group; union density; and the five age-related policy and practice variables referred to above.

[xx] Throughout only the coefficients for the age-related variables are presented. Full models are available on request.

[xxi] The controls are: number of employees; share female; gender diversity; share non-white; share part-time; share in largest occupational group; union density; number of age-related EO practices; EO policy mentioning age; EO policy not mentioning age; age important in recruitment; special procedures for recruiting older workers; single-establishment organisation; industry; region; age of establishment.

[xxii] As indicated by a comparison of the r-squared in Table 9 and Table 10.

[xxiii] We can only speculate as to why this might be the case. One possibility is that workplaces that face a particularly difficult competitive environment are more likely to experiment with employment practices before others do so, in part out of concern for their own survival. This is the 'worst-first' hypothesis discussed by Goff et al., (2002) in the context of employing black professional sports players.