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Abstract

Using nationally representative surveys of workplaces with 50 or more employees we find the adoption of High-Performance Work Systems (HPWS) in the public sector are positively correlated with workplace financial performance and the implementation of workplace organizational change. The associations are stable in 2004 and 2011, despite the intervening recession and cuts in public finance. The results are thus broadly consistent with studies finding similar positive correlations between HPWS and workplace performance in the private sector. There was little heterogeneity in effects across sectors within the public sector, with the exception of health services where the effects of HPWS on workplace change were lower.

JEL Codes: J45, M5

Keywords: high performance work systems; public sector; financial performance; organizational change

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1. Introduction

For several decades researchers have been trying to determine the effects of human resource management (HRM), and specifically high-performance work systems (HPWS), on organizational performance. Most published studies refer to private sector firms or workplaces. A few studies relate to HRM/HPWS in parts of the public sector, such as local government or schools, but (to the best of our knowledge) no study across the whole public sector. Moreover, such studies as exist focus upon a few aspects of HRM practice, for example incentive pay or team-working, rather than applying 'system' measures of HPWS. The research presented here addresses this gap through a study of HPWS and its relations to workplace performance across all types of medium-sized and large workplaces in the British public sector.[3]

Advantages of a quantitative study of the whole public sector are increased generality and increased precision. The increased sample size offered by a full sectoral study not only reduces estimated standard errors on point estimates, but also makes it more feasible to work with many control variables and to examine different functional forms. At the same time, it becomes possible to assess sub-sectoral variation in a rigorous way.

The role of contextual factors has been emphasized in recent discussions of HRM/HPWS. Studies indicate that the impact of HRM practice depends on the accompanying context (e.g., Boxall, 2013; Gould-Williams and Gatenby, 2010; Knies et al., 2018). We here adopt this concept in terms of the external demands that are imposed through public policy, foregrounding

[3] Most HRM/HPWS research in the private sector concerns large workplaces or the multiple workplaces of large firms.

those that are common to the whole sector. We also consider institutional characteristics that may affect the sector's response to these demands; again, we emphasize characteristics that are present across the sector. Major aspects of the public sector's recent and current external context are particularly clear. Financial stringency and pressures for cost reduction and workforce contraction have persisted since the early 1990s: no part of the sector has been exempt from these influences. Less obvious to the public, but familiar to those studying the sector or working in it, have been the pressures to introduce change in technology, organization, and management, revolving around certain influential ideas widely known as New Public Management (NPM). The research presented here focuses upon outcomes that are specified by the financial and change objectives that have come to dominate the sector.

Although financial stringency and NPM ideology have been continuing influences, there has also been significant variation in context over time. In the early 2000s, under the Blair-Brown government, funding was temporarily increased for some parts of the public sector with the aim of restoring staffing and service levels. This however came to an end with the economic recession of 2008 and the subsequent 'austerity' regime of the Coalition government. This article uses survey data from 2004 and 2011 and assesses whether the change in policy context over this period affected the relationships between HPWS practice and performance at workplace level.

In focusing on organizational outcomes that are of prime interest to management and principals we explicitly adopt a managerial perspective on HPWS. From that viewpoint HPWS is an effective 'technology' (Bloom et al., 2017), in the sense that it reliably assists in achieving

desired outcomes. Further, we characterize it as an 'informational' technology. This perspective is consistent with economic rationales and rational action theories in sociology. An economic or technological emphasis was present in a number of the seminal private sector studies of the 1990s (e.g. Macduffie 1995; Ichniowski et al., 1997; Becker and Huselid, 1998). The study of Collins and Smith (2006) emphasizes one informational aspect of HPWS, knowledge sharing.

We acknowledge that in recent years most research and debate concerning HPWS (especially in Europe) has adopted a social-psychological or work-motivation perspective and has been chiefly concerned with impacts on employees, whether positive or negative (Paauwe et al., 2013; Ashkanasy et al., 2016). We view this type of work (to which we have also contributed) as complementary. However, in order to interpret impacts on employees, it is useful first to form an assessment of HPWS technology in terms of the performance outcomes that managers and their principals are seeking when they adopt it. We return to this issue in the conclusion.

The structure of the article is as follows. The next section outlines the situation of the British public sector, and reviews previous empirical contributions concerning HRM and performance in the public sector. The third section reviews the HPWS concept, brings forward the management technology perspective, and connects it to public sector performance aims. There then follow three sections that set out the research plan and hypotheses, describe the study's methods, and report results. The final section summarizes the findings and offers a brief discussion.

The main new conclusions of the research are that on average higher usage of HPWS practices (at workplace level) is associated both with relatively high financial performance (as judged by

management), and with higher current implementation of a range of technical and organizational changes. These results are rather stable over the two time-periods considered.

2. The public sector context to HPWS development

Farnham and Horton (1996) emphasize a number of features of the public sector's personnel traditions. These include 'paternalism', with an emphasis on welfare provision and staff wellbeing (see also Russell, 1991, for historical examples); collectivism, with acceptance of high union density; and a conscious seeking to be 'model employers'. Familiar examples of traditional practice are open recruitment and use of selection panels; protection against the consequences of ill health through sickness pay; and strong occupational pension schemes. The sector continues to differ from the private sector in many respects. Unionization is pervasive, processes to support equal opportunities are widespread, and the proportions of female employees and of those with higher qualifications are relatively large.

In the 1980s the British public sector came under pressure with the emergence of Thatcherism, involving deregulation and termination of some state monopolies. This was followed during the 1990s by economic and cost pressures experienced internationally, as the public services in most advanced welfare economies reached a critical juncture (Esping-Anderson, 1996). The cost pressures came largely from demographic developments, notably increasing longevity and in-migration flows, and higher popular aspirations with respect to education, health, and consumption. Increasing demands for improved services were coupled (in Britain at least) with popular resistance to increased taxation. In response, British governments of both left and right persuasions have been asking the public services to 'do more with less' by operating more cost-

effectively and by embracing various types of organizational and technical innovation. What is seen as 'modern management' in the private sector has commonly been held up as the exemplar for public sector organizations to follow (Gould-Davies and Gatenby, 2010). Another tendency, common to a number of countries, has been an advance of 'marketization' of the public sector through, for instance, outsourcing, competitive tendering and privatization (see, e.g., LeGrand and Bartlett, 1993). This suite of developments has been labeled the New Public Management (NPM) (see Burke et al., 2013 for international perspectives; Bach et al., 2009 for a British review).

In Britain, political pressure for cost reduction has been intense. During the 1990s the British public sector experienced a net loss of 800,000 jobs, 300,000 of which went in the single year 1993 (Hicks et al., 2005). After a few years of recovery during the early 2000s, further large-scale cuts were initiated during the 'austerity' regime that followed the 2008 recession: current estimates suggest a cumulative reduction from 2008 of about one million jobs is in process. Such efforts have however not so far been notably effective. Official statistics show the British public sector in 2014 well behind France, Germany, and the European Union average, in terms of a conventional measure of productivity (ONS, 2017).

Against this turbulent background, the development of HRM in the public sector in the past two decades has been steady. This development can be discerned through descriptive findings in the reports of the 1998, 2004 and 2011 Workplace Employment Relations surveys (WERS) that provide nationally representative coverage of British workplaces (Cully et al., 1999; Kersley et al., 2006; Van Wanrooy et al., 2013). A summary sectoral comparison in Kersley et al. (2006:

314-6) concluded that public sector HR development had been moving progressively ahead of the private sector. For a more detailed exposition, see Bach et al. (2009: 324-9), who discern a 'performance orientation' and emulation of private sector HRM, alongside a more traditional welfare emphasis, in the public sector's HRM development across the late 1990s and early 2000s.

Research on HPWS and organizational or workplace performance in the British public sector is scanty. For healthcare organizations, Harris et al. (2007) carried out a review of HRM and performance and bewailed the lack of quantitative research on this topic.[4] Gould-Williams and Davies (2005) and Gould-Williams and Gatenby (2010) studied local government establishments, finding some positive effects of team-working on organizational performance, as indicated by managerial perceptions of service excellence, value for money, reputation and efficient use of resources. Two papers based on the survey used in this study focus on HRM use in schools: these find that the intensity with which HRM is implemented in schools is positively associated with managerial perceptions of schools' financial performance, labour productivity and quality of service, with the effects seemingly confined to state-funded schools (Bryson and Green, 2018; Bryson et al., 2018). Finally, there have been a number of studies relating to incentive pay specifically but not covering HPWS as a whole. These were probably motivated by the Makinson (2000) report that advocated increased use of incentives in public sector agencies. Burgess and Ratto (2003) review the theoretical reasons why incentive pay may not

[4] Studies for other countries are also quite rare. Exceptions include the studies by Vermeeren et al. (2014a; 2014b) for local authorities and health care organizations in the Netherlands which finds positive associations between HRM and organizational and financial performance. See also Knies et al. (2018),: the studies highlighted there tend to focus on individual attitudes and behaviour.

operate as well in the public sector as it does in the private sector, including problems measuring and attributing output, and the prevalence of multi-tasking. Burgess and Metcalfe (2000) suggest pecuniary incentives may even be counter-productive where they reduce public servants' intrinsic job satisfaction. Consistent with such predictions, Bryson et al. (2017) who find incentive pay is negatively correlated with workplace performance in the public sector. However, Prentice et al. (2007) find tentative evidence that performance pay can provide benefits in the public sector, but some of the effects have been limited by the design of schemes and 'gaming'. Subsequently, Burgess et al. (2010) show that the introduction of team-based performance pay improved task allocation in HM Customs and Excise, resulting in improved team performance. There is also a literature for the public sector concerning effects of HRM/HPWS on employee outcomes, such as attitudes, well-being or health. This however lies outside the scope of the present article.

3. HPWS and Management Technology

To frame this research, we conceptualize HPWS as a 'management technology' (Bloom et al., 2017) that helps to deliver performance outcomes through its influence on employee actions. There are several reasons why the 'managerial technology' concept is plausible and helpful. First, it is manifest that HPWS practices are chosen and progressed by managements. Second, although interpersonal choices involve bargaining and negotiation, the chosen outcomes reflect the relative power of agents (Coleman 1990: 397-420,769-84), and in this case management (and their principals) are dominant. Third, HPWS has the character of a systems-technology because the available components are well understood by management, it can be programmed in a variety

of ways, and it can be embedded long-term in an organization through formalized structures and processes or procedures.

The 'technology' viewpoint contrasts with recent literature maintaining that effects of HPWS depend on a motivational impact on employees (this impact is seen as either beneficial or harmful to individuals, in competing versions – e.g., see Boxall and Macky, 2016). Our view is that HPWS obtain inputs of information from employees that are *inherently valuable* to the organization in making decisions and plans and in implementing changes. Empirically there does appear to be (often) a positive motivational impact, but this is an additional benefit that employers need not rely upon in order to justify adoption of HPWS practices.

Consistent with most of the research literature, we define HPWS as a subset of HRM that forms a cohesive suite intended to enhance (aspects of) organizational performance. We assume, in line with most recent reviews of the field, that HRM extends beyond the scope of HR departments to include the HR activities of line and general management; consequently, this also applies to HPWS.[5] When HPWS are aligned to an organization's strategic position, it is common to refer to them as SHRM (strategic HRM).

Coherence or complementarity of practices is implicit in the 'systemic' nature of HPWS. This has been expressed in the literature through emphasis on the 'bundling' of practices (e.g., Macduffie, 1995; Becker and Huselid, 2006). We refer to clusters of intercorrelated practice that have a common name (e.g., recruitment, training), as 'domains'. Several domains that are

[5] We do not further define HRM since the phrase 'human resources' has a common language meaning in contemporary English usage.

mutually supportive in relation to performance goals constitute a HPWS. Although each practice may be useful in its own right, substantial effects on performance are unlikely to be realized until the massing of connected practices reaches some threshold (Becker and Huselid, 2006). One reason for this is that a multiplicity of mutually consistent practices is a signalling device whereby management expresses values and intentions to employees; this signalling device has been designated a 'strong system' by Bowen and Ostroff (2004).

A requirement for large-sample quantitative research on HPWS is to identify domains of practice that span many organizations and are relevant to performance. The detailed elements within each domain may well vary between organizations, as they choose those practices that fit their distinctive circumstances. In the present research we have been broadly guided by Appelbaum et al. (2000) with respect to domains. Multiple practices are included within each domain, on the assumption of equifinality of practice choice (Becker and Huselid, 2006).

Because employee contribution appears relevant to the public sector's goal of achieving cost reductions and financial efficiency, we highlight a 'participation' domain that involves communication and consultation practices, and employee involvement in decision-making.[6] We also emphasize team-working, viewing this as the form of job design that has most traction in Britain, where it was developed long before the advent of HRM. Support for cost reductions and financial efficiency require trusted communication (see Coleman 1990: 175-96, for underlying theory). If a management wants to get employees compliant with or committed to

[6] This domain has also been explored in various British studies that use such concepts as 'high involvement management' or 'high commitment management' as alternatives to the HPWS concept.

new objectives, it is in accord with current 'good practice' to set up an information and discussion process and work through the difficulties with employee groups. Team-working organization contributes to the same goal by providing a structure that is readily deployed in participative exchanges. Participation and team-working are also relevant to the NPM objectives of introducing new technology, new work organization and new work practices. Progressing change requires coordinated action and a continuous effort to find solutions for practical problems of implementation; group problem-solving, drawing on the varying skills, knowledge and creativity of members, is commonly viewed as a beneficial approach, as in the 'quality circle' movement. Apart from this, team-working offers a degree of flexibility that may help perform tasks cost-effectively.

Although we regard participation and team-working as likely to be the main HPWS drivers for the public sector, we also stress that they need to be *supported* (Appelbaum et al., 2000) by other domains of practice, notably recruitment/selection, training/development, and pay/reward. These familiar elements of people management take on a new character through HPWS complementarities. For instance, organizations often support team-working by giving employees training that equips them to work cooperatively. Organizational goals can also be pursued more effectively if individuals are led to accept personal objectives consistent with those goals; this is one of the ways in which performance appraisals, a key element in the pay/reward domain, can be deployed.

We acknowledge that similar sets of practices to those we refer to above have been presented and explained through conceptual schemes that are different in emphasis from ours. Notably,

Appelbaum et al. (2000) put forward the AMO (ability-motivation-opportunity) schema. AMO has subsequently become the dominant presentational framework for HPWS research. For instance, Marin-Garcia and Tomas (2016) review 91 studies that followed this pattern, while Jiang et al. (2012) provide a meta-analysis of 116 such studies. The latter study assembles the most wide-ranging evidence to date concerning the impact of HPWS on performance outcomes, mostly from private sector studies.

4. Research plan

We analyse the HPWS-performance relation over all branches of the public sector. Our conceptual model is HPWS as embedded management practice combined with supportive personnel policies. We select outcome measures from the literature on NPM in terms of the public sector's current managerial aims, (a) financial performance and (b) implementation of workplace changes.

Our main hypothesis is that increased use of HPWS practices leads to higher workplace performance in terms of both (a) and (b) above (H1a: enhanced financial performance; H1b: increased implementation of change).

As a secondary hypothesis (H2) we propose that HPWS effects on performance will be stable across the two years we investigate (2004 and 2011), despite different economic conditions, because the leading performance priorities for the sector did not change over that time-span.

We investigate subsectoral variation in the HPWS effects, e.g. HPWS in education or health services. However we put forward no hypothesis in this regard but treat results as exploratory.

5. Research methods – data, variables, analysis

Data

We examined two years, 2004 and 2011, with the Workplace Employment Relations Survey series (WERS). Our analysis was confined to workplaces with at least 50 employees.[7] Information was obtained through interviews with senior managers responsible for HRM. Further information on the WERS 2004 and 2011 surveys is available from the UK Data Archive and in Van Wanrooy et al. (2013).

The overall response rates for the WERS 2004 manager interview was 64 per cent. For the purposes of the present research there is management information for 490 public sector workplaces with 50-plus employees in 2004. In WERS 2011, survey response was (like most other social surveys at this time) somewhat depressed, with a management response rate of 46 per cent. However, the target sample size was increased in 2011 vis-a-vis 2004 and the proportion of public sector workplaces within the achieved sample also increased, from about 30 per cent in 2004 to 40 per cent in 2011. For the public sector subsample, there was management information from 769 workplaces.

Dependent variables

Financial performance. Management ratings of financial performance, relative to other similar workplaces, were used as the financial outcome measure. Because of the prominence of public sector budgets and costs in political and public debate, managers and professionals are likely to

[7] Official statistics of the UK and of the EU classify firms with less than 50 employees as 'small'; most such firms consist of a single workplace. We have adopted an analogous cut-off for the public sector.

be aware of financial performance. The sector has also been active in searching out comparative information. A question about the use of benchmarking (meaning exchange of performance information with other similar workplaces) showed that it was practiced by 70 per cent of the public sector workplaces in 2004, and by 74 per cent in 2011 (the corresponding proportions for the private sector were 42 per cent and 54 per cent).

The subjective nature of the financial performance ratings is properly a source of concern (Gerhart, 2013). There are two potential issues. One is the possibility that ratings are inaccurate, against a criterion of objective measurement. However, as the financial performance rating is always used as dependent variable, rating error is absorbed into the usual disturbance term of a regression model, so that estimates will remain consistent. The second potential issue is systematic bias. For instance, managers who tend to put a positive gloss on performance may also tend to exaggerate the extent of HPWS development at their workplaces, leading to an increased (spurious) correlation. We develop a check on this type of bias motivated by the 'marker variable' method of Lindell and Whitney (2001).

Organizational or workplace performance ratings have been used in a number of previous studies: see Delaney and Huselid (1996) for the USA; and for Britain, Ramsay et al. (2000); Wu et al. (2015); Bryson et al. (2018). Delaney and Huselid (1996) cited several earlier method studies in the USA showing positive correlation of the subjective measures with objective data. For the WERS 2004 data, Forth and McNabb (2008) investigated the relationship between ratings and record-based measures of performance for a subsample where the latter were available. They found positive correlations in the range 0.4 to 0.6, and judged these findings to

be somewhat reassuring. Wall et al. (2004), using other data to compare management reports with objective performance measures, also concluded that there was reasonable consistency.

Responses to the financial performance question were on a 5-point scale ranging from 'a lot below average' to 'a lot better than average', where 'average' refers to 'other similar workplaces'. The responses are assumed to be cardinal (equal interval) measures, in accordance with the customary treatment of subjective ratings by applied psychologists, and increasingly by economists (see Ferrer-i-Carbonell and Frijters, 2004). For descriptives, see Appendix Table 1.

Change at the workplace. We constructed an index of the amount of change taking place at the workplace, by counting the number reported by the manager from a list of types of change.[8] The 2004 survey question ranges over technical innovation (computers, other technical developments, technically new services), organizational change, changes in work techniques and procedures, changes in working time, changes in performance pay, changes in staff involvement, and technologically new or improved products or services. This generated a 9-point scale ranging 0-8 (reduced to 0-7 in 2011, when computers were treated as part of new technology). This measure of change is of a close-to-objective type and thereby less exposed to bias than in respect of the financial performance ratings. Its distinctness from the financial performance rating is shown by a low correlation (r_{2004}=-0.011, r_{2011}=0.004) so the two types of information can be regarded as complementary. These low correlations are reasonable, since change

[8] Others have constructed similar organizational change metrics with these data, but with a different purpose in mind (eg. Bryson et al., 2013).

projects usually involve short-term costs (equipment, training, fees) and do not have a financial payback until later.

In analysis of the change variable, we treated it as a cardinal (equal-interval) measure, permitting a linear model to be estimated; however this required an assumption that each type of change can be regarded as equal in value to any other. As an alternative, we considered each type of change in a separate (logit) analysis. The disturbance terms may be correlated across these logit models, but this does not affect the consistency of estimates in each model provided that the same set of regressors is used in all.

Explanatory variables

The chief explanatory variable was a summative index of HPWS practices. In the HRM-performance literature HPWS items have usually been aggregated into a single overall index of practices (e.g., Becker and Huselid (1998:63)), and we followed this method. We included only items that are descriptive of current practice and ignored any items that sought the manager's opinion about workplace climate, management-employee relations etc. Altogether 43 items (each item representing one practice) were used in 2004, and 44 in 2011, a larger number than in most other studies of HPWS/HRM (Ramsay et al., 2000, and Guest et al., 2003, also used large sets of items). Items were first grouped into five 'domains' (participation, team-working, training and development, recruitment/selection, and performance pay) that were tested and refined by reliability analysis prior to pooling (see Appendix Table 2). An advantage of using a large set of items/practices is that this reduces the risk of omitted variable bias. A large set of items also has

theoretical support in the signalling interpretation of Bowen and Ostroff (2004). The set used here incorporates most of the items from several previous British studies using data from the WERS series (Forth and Millward, 2004; Cox et al, 2006; Brown et al., 2008; Wood and de Menezes, 2008).

Combs et al. (2006) concluded from their meta-analysis of the HPWS-performance relationship that summative scores have been about twice as predictive of outcomes as use of separate practice variables. However, Wood and de Menezes (2011) have criticized the use of summative measures on the grounds that they obscure the operation of conceptually distinct configurations within HPWS. Arguments supporting the summative approach can be found in Becker and Huselid (2006).

To provide further coverage of management technology, we introduced a new measure, representing *target-setting intensity*; this was motivated by Bloom et al. (2017). The target-setting measure was obtained by summing the number of distinct types of targets currently being pursued by workplace management, out of a list of eleven. Descriptive statistics are shown in Appendix Table 3. Correlations between this target measure and the HPWS index were 0.30 in 2004 and 0.32 in 2011. The basic specification used the HPWS index *omitting* the target index score, while in variant analyses, the target score was added to the HPWS index to provide a *combined index*, labelled HPWS-T.

Control variables

All explanatory analyses included control variables of a standard type. Structural variables were workplace size – number of employees (four categories: 50-99, 100-1999, 200-499, 500-plus); industry groups – commercial services (mainly but not exclusively in transport and communications), public administration (includes security and emergency services), education, healthcare, and cultural community services (e.g., heritage, arts, leisure, sports); age of workplace (0-4 years, 5-9, 10-24, and 25-plus); industrial relations structure, represented by a multi-unionism dummy[9]. Compositional variables were percentages of female employees, of part-time employees, of those on fixed-term contracts, and of those in 'higher' and 'lower' occupational/skill categories with 'intermediate' as the reference category.

An additional control variable, for 2011 only, was based on the adoption of cost-cutting labour policies, such as wage freezes, wage cuts and short-time working, in response to the 2008 recession. A dummy variable was scored 1 if the workplace reported using three or more such policies, and 0 otherwise. This criterion was reached by 40 per cent of the included public sector workplaces (weighted basis).

A table of descriptive statistics for the control variables is not shown here, for reasons of space, but is available on request.

Analysis methods

The main analyses of financial performance ratings and reports of change intensity were carried out by robust regression (Berk, 1990). Computation of standard errors takes account of survey

[9] Multi-unionism provides a more sensitive measure than simple union recognition, because unions are recognized throughout most of the public sector. Variant analyses using union membership density were also carried out but led to no increase in explanatory power.

weighting and complex survey design, and generally yields somewhat conservative inferences by comparison with OLS. Separate analysis was also performed for each type of workplace change, using logit analysis, once again with a robust estimator.

Regressions were carried out using two alternative specifications in the HPWS variable: (1) linear, (2) linear-quadratic, i.e. the HPWS index score accompanied by HPWS-squared. Some previous work has found nonlinear effects particularly in relation to employee attitudinal and wellbeing variables (e.g., Godard, 2001; White and Bryson, 2013). However, we found non-linearity to be ignorable in this set of analyses, with one exception that will be noted later. Results for the linear-quadratic models are not tabulated, but the results for these, and for any other variant analyses referred to but not tabulated, are available on request.

6 Results

6.1 Preliminary assessment of bias

If managers' ratings of financial performance are biased by a 'social desirability' response tendency, then similar bias should show up in associations between the ratings and *other* reports about the workplace's management. We explored this with the 2004 data using a simplified version of the 'marker variable' method (Lindell and Whitney, 2001). Our chief marker variable was whether the workplace had a *formal strategy*; assuming that strategy is viewed as a 'superior' type of management, it would be exposed to social desirability bias, and if this also applied to financial performance ratings, the two measures would be positively associated. However, the observed association between answers to this question and financial performance

ratings was non-significant (p=0.42). Similarly we considered association of the ratings with reports of the number of aspects covered in the strategic plan, again obtaining a non-significant association (p=0.63). This also applied to the association between the financial performance ratings and whether the respondent, or any other person in the HR or personnel department, was involved in strategic planning (p=0.85).

6.2 HPWS and financial performance ratings

Table 1 summarizes estimated effects of HPWS on managers' financial performance ratings in linear regression models. There are two distinct specifications, differing in how the target setting index is treated. In model (1) target setting is omitted from the specification: with this exclusion, the estimated effect of HPWS on the outcome was positive and significant at the 1 per cent level in both years; an apparent reduction in the point estimate in 2011, from 0.045 to 0.027, was not significantly different from 2004. In model (2), the target-setting index score was amalgamated with the HPWS index to produce a new combined variable, labeled HPWS-T. The estimated effects of this enlarged variable were similar across the two years and once more significant at the 1 per cent level.

Models for 2011 included the additional control variable representing post-recessionary cost-cutting labor policies at the workplace. The estimated effect of this variable on financial ratings was negative, but not significant. A further model for 2011 (results not tabulated) included an interaction term between recessionary cost-cutting and the HPWS-T variable. The interaction

however was non-significant and the estimated effect of the HPWS-T variable was similar to that tabulated for model (2).

This set of analyses provides fairly strong evidence that higher intensity of HPWS implementation was associated with more positive ratings of workplace financial performance (H1a). Enlarging the HPWS variable by incorporating target setting resulted in a variable with effects on financial performance ratings that was stable across these years but not notably more powerful. By reference to standard deviation statistics shown in Appendix Table 1, it can be seen that a 10-point increase in the HPWS index (roughly the difference between the lower quartile and median of this measure) implied an 0.45/0.8=0.56 s.d.'s increase in rated financial performance in 2004 and similarly an 0.33 s.d.'s increase in 2011. Qualitatively, the HPWS or HPWS-T effect on rated financial performance dominated all control variables, none of which had statistically significant effects in this set of analyses.

[Table 1 about here]

Table 1: Estimated Effects of HPWS on financial performance ratings

2004	(1)		(2)	
	b (s.e.)	|t|	b (s.e.)	|t|
HPWS	0.045 (0.012)	3.77**	---	
HPWS-T	---		0.026 (0010)	2.67**
N, R-sq.	364, 0.120		364, 0.077	
2011	(1)		(2)	
	b (s.e.)	|t|	b (s.e.)	|t|
HPWS	0.027 (0.010)	2.64**	---	
HPWS-T	---		0.029 (0.007)	4.03**
Recession-3	-0.166 (0.118)	1.40	-0.193 (0.166)	1.66
N, R-sq	642, 0.110		642, 0.128	

Notes: Models are estimated by regression with a robust variance estimator, and include controls for workplace structural characteristics and employment composition (see text, section 5). HPWS=summative index of high performance work practices, exclusive of target setting. Some items in the index differ between 2004 and 2011. HPWS-T=HPWS plus target setting practices. Recession-3 (2011 only)=workplace has implemented three or more cost-cutting labour practices in response to recession. Significance: * 5 per cent level ** 1 per cent level.

6.3 HPWS and workplace change

Table 2 summarizes results under the two main specifications of the HPWS-index variable (excluding/including target setting) in the analysis of the effects on the number of workplace changes during the past year. The estimates of the effects of HPWS and of the expanded HPWS-T variable, were in all cases positive and significant at the 1 per cent level. The HPWS-T variable was somewhat advantageous in generating point estimates with smaller standard errors.

Variant analysis of workplace change in 2011 under model (1) but with an added quadratic term in HPWS, provided the only indication of non-linear effects within the whole set of analyses. The HPWS variable had b=0.407 with t=2.93, significant at the 1 per cent level, while HPWS-squared had b=-006 with t=-2.27, significant at the 5 per cent level. This implies that the maximum effect of HPWS was reached at around 34 practices (just below the upper quartile level of the HPWS distribution in 2011) ; beyond that the effect began to decline. However, the non-linear effect was not found when the HPWS-T variable was used.

[Table 2 about here]

Table 2: Estimated Effects of HPWS on number of workplace changes

2004	(1)		(2)	
	b (s.e.)	|t|	b (s.e.)	|t|
HPWS	0.124 (0.034)	3.70**	---	

HPWS-T	---		0.132 (0.019)	6.99**
N, R-sq.	434, 0.186		434, 0.237	
2011	(1)		(2)	
	b (s.e.)	|t|	b (s.e.)	|t|
HPWS	0.102 (0.021)	4.95**	---	
HPWS-T	---		0.101 (0.015)	6.77**
Recession-3	0.577 (0.198)	2.92 **	0.413 (0.191)	2.16*
N, R-sq	708, 0.157		708, 0.214	

Notes: The dependent variable is an index (count) of the number of types of change implemented during the past year. The range of this index is 0 to 8 in 2204 and 0 to 7 in 2011. All models are estimated by regression with a robust variance estimator and include controls for workplace structural characteristics and employment composition (see text, section 5). HPWS=summative index of high performance work practices, exclusive of target setting. Some items in the index differ between 2004 and 2011. HPWS-T=HPWS summative index plus target setting practices. Recession-3 (2011 only)=workplace has implemented three or more cost-cutting practices in response to recession. Significance: * 5 per cent level ** 1 per cent level.

Table 3 develops the analysis of workplace change by summarizing logit estimates that were produced for effects on each type of change separately. To simplify presentation, we show only the estimates for the effect of the combined HPWS-T variable (model (2)). HPWS-T was related positively and significantly (5 per cent or 1 per cent level) to each type of change in 2004, and to each type *except* performance related pay and working time arrangements, in 2011. These results indicate that the effects of HPWS-T were not dependent on just a few of the change items but extended broadly over the field of workplace change. Note that the estimates shown are average effects; conditional partial effects are not necessarily monotonically increasing in HPWS-T, since in a nonlinear model this depends also on the observed values of other variables at each selected value.

[Table 3 about here]

Table 3 Estimated effects of HPWS-T on introduction of each type of workplace change

Type of change introduced	2004		2011	
	b (s.e.)	|t|	b (s.e.)	|t|

Performance related pay	0.082 (0.036)	2.26*	0.045 (0.040)	1.13
Introduce/upgrade computers	0.104 (0.036)	2.87**	---	
Other new technology	0.074 (0.028)	2.68**	---	
Introduce new technology (including computers)	---		0.067 (0.025)	2.72**
Working time arrangements	0.111 (0.026)	4.23**	0.040 (0.021)	1.91
Organization of work	0.073 (0.028)	2.64**	0.076 (0.025)	3.07**
Work techniques or procedures	0.080 (0.029)	2.74**	0.078 (0.024)	3.30**
Employee involvement initiatives	0.091 (0.266)	3.42**	0.125 (0.022)	5.68**
Technically new or improved product or service	0.125 (0.031)	4.07**	0.098 (0.022)	4.53**

Notes: Logit models: (each row represents a separate analysis) with robust variance estimator. HPWS-T=HPWS summative index plus target setting practices (see Appendix tables 2 and 3.) Coefficients are average effects of HPWS-T on log-odds of the given change occurring during the past year. All analyses include full controls (see text, section 5). Significance: * significant at the 5% level ** significant at the 1% level.

6.3 Industry variation in the effects of HPWS on performance

A wide study of the public sector provides the opportunity for comparisons between industry groups. These comparisons test the generality of the estimated effects; they may also be of value from a policy viewpoint. We ran models in which the HPWS or HPWS-T index variable was interacted with the industry-group control variable. Estimated interaction effects indicate whether significant inter-industry variation exists.

A difficulty with this form of analysis is that some industry sample sizes are not large, especially in year 2004. We focus on the 2011 data as sample sizes here were larger. In Table 4 we show the marginal mean effects of HPWS for each industry at selected values of the HPWS variable. These marginal means are calculated from the full model estimates, holding all variables except HPWS at their observed values. For instance, the top-left value of 3.37 in panel (a) of Table 4 is the mean perceived performance rating computed under the model for the commercial-industry group when all cases in this industry-group are given a value of 10 HPWS practices while all other variables are left at observed values. For simplicity's sake we show computations only for

the HPWS index but qualitatively similar results are obtained with HPWS-T, despite differences in the detailed numbers. The selected HPWS values shown in the table (10, 20, 35 practices) approximate the overall lower quartile, median and upper quartile values of the HPWS distribution. The percent change entries refer to percentage difference in outcomes as workplaces are moved from the median level of HPWS to the upper quartile level.

[Table 4 about here]

Table 4 Estimated marginal mean effects of HPWS index within industry-group in 2011

Group>	Commercial	Administration	Education	Health	Cultural
(a) Financial performance ratings					
(1) HPWS=10	3.37	3.20	3.42	3.01	2.58
(2) HPWS=20	3.62	3.49	3.63	3.29	3.29
(3) HPWS=35	3.99	3.92	3.94	3.72	4.36
% change (3)/(2)	+10%	+12%	+9%	+13%	+33%
(b) Number of workplace changes					
(1) HPWS=10	1.79	1.38	1.72	2.79	1.51
(2) HPWS=20	3.33	2.92	2.59	2.81	2.47
(3) HPWS=35	5.65	5.24	3.90	2.85	3.92
% change (3)/(2)	+70%	+79%	+51%	+1%	+59%

Notes: Marginal means computed from regression models including an interaction of industry-group with the HPWS summative index. Models have a robust variance estimator and include full controls. See text for explanation of the computations.

Panel (a) indicates that in 2011 there is little difference between public sector industries in the response of financial performance ratings to increases in the HPWS index. Admittedly the cultural services industry group appears to have more responsiveness than the others but with N=53 for this group there is not much practical significance here. From a policy viewpoint, the effects of 'more HPWS' are only moderate, though positive.

Panel (b) shows a more substantial response of the workplace change outcome to HPWS, and it also reveals a marked interaction involving the health-services industry group (N=200). While the model predicts workplace change increasing substantially for the other four industry groups as HPWS moves from a median to upper quartile level, almost no change is predicted for health services. At median HPWS, the amount of change under way was predicted to be roughly similar across industries, but at the upper quartile level of HPWS the health services subsector was depicted as falling behind.

7 Conclusions and discussion

The research sought to estimate the effects of HPWS on performance across medium-sized and large workplaces in the whole public sector. We focused on two performance outcomes: financial performance (as rated by managers), and the number of changes in technology and work organization that were recently taking place at the workplace. The former reflects budgetary pressures experienced throughout the sector over two decades, while the latter has relevance to the NPM policy programme that is common to many liberal-capitalist economies. Data came from national samples for two years that represented contrasting economic conditions, 2004 and 2011. To represent HPWS we used an index based on summating the number of practices across five HRM domains that have been highlighted in previous research, and we also explored inclusion of an additional domain, organizational target setting, that has previously not been considered in this literature.

7.1 Conclusions

Results provided substantial evidence that HPWS had positive effects on both rated financial performance and amount of workplace change. These findings are consistent with hypotheses 1a and 1b. Furthermore, these effects were rather stable across years, despite the difference in economic conditions between 2004 and 2011. This stability was predicted in hypothesis H2 and reflects our view of HPWS in the public sector as driven by managerial objectives that did not change. We also investigated (without any prior hypothesis) whether there was variation in the HPWS effects across subsectors of the public sector. The main finding, based on evidence from 2011, was that the effect of HPWS on workplace change was lower in the health services subsector than in others.

7.2 Discussion

The results of this research support the claim of 'universal' value for HPWS with respect to employers' performance objectives. Since little previous research has addressed the public sector, there is naturally a need for further studies; however, some replication has been provided within the present study by repeating the analysis across two years. More generally, we would underline the importance of within-study replication endeavours: multiple outcomes, and multiple measures of the explanatory and outcome variables, as well as multiple time-points with multiple samples.

Additionally, across the main analyses we tested alternative models, with nonlinear (linear and quadratic) models alongside the familiar linear regression form. The efficacy of the linear model here is of some importance, since it is another respect in which the public sector results accord

with previous HPWS research in medium-sized and large workplaces or firms of the private sector. It is however imprudent to assume that the linear model will always suffice.

Omitted variables remain a paramount methods problem in HPWS research. Where data are available, measures of HPWS practice that are inclusive of many detailed practices are likely to reduce the scope for omitted variable bias. Results obtained with the target-setting index variable suggests that this is a powerful influence on performance outcomes (and is quite strongly correlated with the HPWS index), so it would be desirable to include it in future HPWS research. There may well be other relevant management technology variables that could be brought into analyses.

From a policy viewpoint, the study provides some confirmation of the value of HPWS to employers. In addition, this whole-sector study has illustrated the potential value of within-sector comparisons. Specifically, it highlights a disconnection of workplace change from HPWS in the health services subsector. This suggests the likely value of case research in health services to investigate how HPWS is developed and applied and how technical and organizational change is handled.

We acknowledge that this article covers only part of a social benefit evaluation of HPWS in the public sector. Another part concerns effects on employees, and this is treated in a separate article (White and Bryson, forthcoming). However, a main conclusion of that article is that HPWS had no discernible effect (whether positive or negative) on public sector employee motivation or

well-being. We can therefore reasonably assert that the positive effects on workplace performance reported here require no modification to account for effects on employees.

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Appendix Tables

Appendix Table 1: Dependent Variables – descriptive statistics (unweighted)

	2004				2011			
	range	mean	s.d.	N	range	mean	s.d.	N
financial (ratings on 5-point scale)	1-5	3.53	0.80	414	1-5	3.60	0.81	693
workplace change (number of types)	0-8	4.48	2.03	490	0-7	3.45	1.81	769

Notes: Base is public sector workplaces with at least 50 employees, in 2004 N=490, in 2011 N=769. For types of workplace change, see Table 3 in the text.

Appendix Table 2: Items Used in Construction of HPWS Measures

Domain name	Contents – Year 2004
Participation KR20=0.78	Meeting time; briefing time; subjects discussed in meetings (organization, production, staffing, finance, planning, pay); consultative committee set up; attitude surveys used; changes made with employee involvement.
Team working KR20=0.67	Proportion in teams; task rotation within teams; teams have inter-dependence, responsibility, autonomy,; team chooses their leader; quality circles used.
Development KR20=0.68	'Investor in People' standard achieved ; development included in firm strategy; proportion given off-job training; proportion given cross-job training; variety of training courses used; induction courses used; team training; training discussed in briefing groups; appraisal for non-managers.
Selection KR20=0.52	selection criteria: qualifications, skills, references, motivation, experience; use personality tests; use skill tests.
Incentives KR20=0.68	bonus for individual, group/team, workplace, organization performance; profit-sharing for non-managers; merit-based or performance pay; appraisals that affect pay differentials; incentives that affect pay differentials.
	Contents – Year 2011
Participation KR20=0.69	Meetings are regular; meeting frequency; staff time in meetings; briefing frequency; staff time in briefings; subjects discussed in meetings (staffing, finance, investment); consultative committee; attitude surveys.
Team working KR20=0.57	Proportion in teams; training for team-working; teams have inter-dependence, responsibility, autonomy; quality circles used.
Development KR20=0.60	'Investor in People' standard achieved ; development included in firm strategy; proportion given workplace training; proportion given off-job training; proportion given cross-job training; variety of training courses used; induction courses used; appraisal for managers; appraisal for all non-managers; employee development is part of workplace strategy; vacancies filled internally if possible.
Selection KR20=0.62	selection criteria: qualifications, skills, references, motivation, experience; use personality tests for manager jobs; use personality tests for non-manager jobs; use skill tests for manager jobs; use skill tests for non-manager jobs.
Incentives KR20=0.81	bonus for individual, group/team, workplace, organization performance; profit-sharing for non-managers; merit-based or performance pay; appraisals that affect pay differentials; incentives that affect pay differentials.

Notes: KR20 is the Kuder Richardson reliability measure for dichotomous item scales, computed over whole sample. Underlined items are quantitative banded variables reduced to dichotomies by splitting at the median. 'Investor in People' is an externally awarded standard for people development.

Appendix Table 3 – Target setting

	2004				2011			
	range	mean	s.d.	N	range	mean	s.d.	N
Target setting index (number of types)	0-11	4.58	3.00	490	0-11	4.92	3.05	769
Target types (dummy variables):								
Product/service volume		0.49	0.50			0.44	0.50	
Costs		0.59	0.49			0.56	0.50	
Profitability/return on investment		0.20	0.40			0.23	0.42	
Unit labour cost		0.29	0.46			0.27	0.45	
Productivity		0.39	0.49			0.45	0.50	
Quality		0.61	0.48			0.65	0.48	
Labour turnover		0.32	0.47			0.31	0.46	
Absenteeism		0.63	0.48			0.73	0.44	
Training		0.42	0.49			0.45	0.50	
Employee satisfaction		0.27	0.45			0.36	0.48	
Customer satisfaction		0.36	0.48			0.46	0.50	

Notes: KR20 reliability for the 11 binary items was 0.80 in 2004 and 0.81 in 2011. N for all binary items was 490 in 2004 and 769 in 2011.