ISSN 2042-2695

CENTRE *for* ECONOMIC PERFORMANCE

CEP Discussion Paper No 953

October 2009

How Does Innovation Affect Worker Well-being?

Alex Bryson, Harald Dale-Olsen and Erling Barth

THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Abstract
We explore the effects of management innovations on worker well-being using private sector linked employer-employee data for Britain. We find management innovations are associated with lower worker well-being and lower job satisfaction, an effect which becomes more pronounced when we account for the endogeneity of innovation. This is the case for three different count measures of innovation – a global measure of innovation and measures for labour innovations and capital innovations. The effects are ameliorated when workers are covered by a collective bargaining agreement.

Key-words: innovation; well-being; job satisfaction; trade unions
JEL-codes: J28; J51; J81; L23; 031

This paper was produced as part of the Centre's Labour Markets Programme. The Centre for Economic Performance is financed by the Economic and Social Research Council.

Acknowledgements
We are grateful to participants at the European Association of Labour Economists 2009 Conference in Tallinn, and seminar participants at the Paris School of Economics, the University of Lancaster and the Centre for Economic Performance at LSE for comments. We thank the Norwegian Research Council for funding (grant No. 173591/S20). This work is also part of the research activity at ESOP, University of Oslo, funded by the Norwegian Research Council. Alex Bryson thanks the sponsors of the Workplace Employment Relations Survey 2004 (Department for Business Innovation and Skills, Acas, ESRC and PSI) and the UK Data Archive for access to the WERS data.

Alex Bryson is a Visiting Research Fellow at the Centre for Economic Performance, London School of Economics and Senior Research Fellow at the National Institute of Economic and Social Research (NIESR). Harald Dale-Olsen and Erling Barth are Senior Researchers at the Institute for Social Research, Oslo, Norway.

Published by
Centre for Economic Performance
London School of Economics and Political Science
Houghton Street
London WC2A 2AE

1. Introduction

Innovation may take many forms, including process innovations in labour deployment and capital investment, and innovations in products and services, but it is commonplace to assume that firms must be innovative in order to survive and prosper. There is empirical evidence to support this claim. For example, the success of Wal-Mart in the United States is attributed, in part, to innovations in its supply chain and distribution networks (Holmes, 2008). Movement towards flexible specialisation in the Italian textiles industry allowed it to produce high value-added goods which sustained it in the face of global competition from low-cost producers (Piore and Sabel, 1982). Innovations in lean production, total quality management and 'high-involvement management practices' have been cited as the reasons for the commercial success of Japanese car manufacturers (Wood, 1989), US steel producers (Ichniowski, et al. 1997) and in manufacturing more generally (Bloom and Van Reenen, 2007). On the other hand, a failure or inability to innovate can be to the detriment of firms, especially in highly competitive markets. Thus, in a recent survey of CEO's conducted by the Economist Intelligence Unit one-third of those questioned identified 'failure to innovate' as one of the top three risks facing their companies over the next three years (EIU, 2005).

Although change is known to have adverse effects on well-being relatively little attention has been devoted to the effects of managerial innovations on worker well-being. Most of the research has concentrated on the effects of innovation on job creation and destruction. Recent firm-level evidence indicates process innovations lead to job destruction, particularly in the short-term, but that these are often compensated for by employment growth arising from product and service innovation (Harrison et al., 2008). This innovation-induced job shake-out may be met with some trepidation by incumbent workers, potentially leading to stress and anxiety. In addition innovations in work practices arising from the introduction of new work methods or processes associated with the deployment of new technologies may have positive or negative effects on worker well-being depending on whether they are job enriching or a source of labour intensification.

Few studies are able to assess the links between workplace innovations and employee well-being because they lack the necessary information. In this paper we use linked employer-employee data for British private sector workplaces to explore the effects of managerial innovations on employees' well-being. We consider innovations in products and services, and process innovations in relation to both labour organization and capital investment, exploring their effects on fourteen measures of employee subjective well-being (SWB).

Managers are rarely free to innovate at will. Innovation can be met with resistance or hostility by employees who are either fearful of change or believe it will be to their detriment. Where employees have sufficient bargaining power, they may even be able to block management attempts to innovate. Some unions were notorious for enforcing restrictive labour practices in Britain during the 1960s and 1970s leading to lower labour productivity in unionised workplaces compared with their non-union counterparts (Metcalf, 1989). This, coupled with the union wage premium, meant unions had a negative impact on profitability. However, these productivity and profitability deficits began to decline in the 1980s and had largely disappeared by the 1990s (Blanchflower and Bryson, 2009; Menezes-Filho, 1997). One possible reason for this might be differential rates of managerial innovation over that period in the union and non-union sectors. Certainly, by the beginning of the 21st Century new labour working practices were just as evident in the union sector as they were in the non-union sector and, in some cases, more widespread (Wood and Bryson, 2009). We therefore devote particular attention to the role of trade unions in mediating the effects of innovation on worker well-being.

We have three main findings. First, managerial innovations are associated with lower worker well-being and lower job satisfaction, ceteris paribus. Second, the effect becomes more pronounced when we account for the endogeneity of innovation. Third, the effect is ameliorated when workers are covered by a collective bargaining agreement.

The remainder of the paper is structured as follows. Section Two reviews the theoretical and empirical literatures linking innovation to worker well-being and the mediating role played by unionization. Section Three introduces our data. Section Four outlines the empirical strategy. Section Five reports our results and Section Six concludes.

2. Theoretical and Empirical Literature

Theory suggests innovation may have either positive or negative effects on worker well-being. Worker well-being may be adversely affected where managerial innovations are to workers' detriment (or perceived as such), where they generate uncertainty associated with future loss, and where they are introduced in a way that is perceived to be unfair. However, not all innovations will be perceived in the same fashion by workers because some are more likely to impinge on their working conditions and work arrangements than others. For example, changes to working hours or work organization may have a greater direct effect on workers than, say, the introduction of a new product or service that requires no major change to working arrangements.

Those innovations to which researchers have devoted the most attention are what are sometimes referred to as innovative working practices (IWPs) and are akin to the practices that are also sometimes described as 'new', 'high-involvement', 'high commitment' or 'high performance'. There are, broadly speaking, two schools of thought on whether IWPs are to the detriment of worker well-being. The first holds that IWPs may offer employees opportunities to improve the quality of their working lives, via devolved decision-making powers and responsibilities. Since workers often demand greater decision-making power at the workplace, more control over how they do their work, and more input into managerial decision-making (Freeman and Rogers, 1999) it seems reasonable to assume that IWPs may increase job satisfaction and well-being. Writers in this school recognise that not all workers benefit, for example because of job cuts and associated insecurity (Black et al., 2004); and not all workers prefer greater decision-making. The second school of thought is that IWPs may entail labour intensification: more is being demanded of workers in terms of their commitment and effort; and, because of market rigidities, workers have little choice but to engage with them. IWPs are often associated with high levels of work intensity and worker stress, even when they are also associated with higher work commitment (Ramsay et al., 2000) or higher job control (Gallie, 2005).

A number of studies have looked at the impact of IWPs on job quality and find mixed evidence (Godard, 2004). Some (e.g. Barker, 1993; Godard 2001) support the pessimistic school of thought finding that some practices are associated with work overload. Others (e.g. Appelbaum et al., 2000) have found no adverse effects of some IWPs on stress levels; while Doeringer et al (2002) found that manufacturing start-ups which adopt IWPs offer jobs with relatively high pay, good training, job security and opportunities for participation. Of particular note is Wood's (2008) study since he uses the Workplace Employment Relations Survey 2004, the data used in this paper. Wood (2008) confirms Karasek's (1979) theory that worker well-being is negatively related to job demands and positively related to job control,

and that high job controls reduce the negative association between job demands and well-being.[1]

IWPs are often introduced as part of broader structural and organizational changes such as the introduction of new plant or technology, changes in management structure, or the introduction or redesign of products and services. Such innovation may also bring with it the threat of job loss, resulting in job insecurity which, in turn, is associated with negative worker affect (De Witte, 1999). Job insecurity may be engendered by innovations such as product innovations, regardless of whether they entail IWPs. For instance, they may entail shifts in productive capacity either within or across plants, leading to the closure of particular plants or production lines. Even if a worker's job is not at risk, her wellbeing may suffer from the knowledge that her work colleagues may be at risk.

It is not simply the nature of a managerial innovation that may affect worker well-being. How it is introduced can also matter. Employees' perceptions of fairness or equity are associated with SWB (Warr, 2007: 135-140). Innovations may result in perceptions of distributive (in)justice depending upon the allocations of rights and rewards accruing to workers and they may result in perceptions of procedural (in)justice depending upon the process that governed the introduction of the innovation. As Warr (2007: 137) notes unjust outcomes and procedures are themselves experienced as negative, thus directly affecting SWB, as well as influencing perceptions of environmental features that also affect SWB, such as perceptions of supervisors or the organization in general. The empirical research reviewed by Warr finds links between perceptions of unfairness at the workplace and emotional exhaustion, distress, and lower job satisfaction (op. cit.).

Trade unions may play an important role in mitigating or exacerbating the negative effects of managerial innovation on worker well-being for a number of reasons. First, unions may play a role in negotiating on behalf of their members over the nature of a workplace innovation. Worker well-being may be viewed as a public good, that is, a good affecting the well-being of everyone in such a way that one individual's partaking of the good does not preclude others from doing so. Without a union, individuals will lack the incentive to pursue public goods since, as Freeman and Medoff (1984:8–9) argue: "Without a collective organization, the incentive for the individual to take into account the effects of his or her actions on others, or to express his or her preferences, or invest time and money in changing conditions, is likely to be too small to spur action". Unions with a strong bargaining position may be able to block innovations which appear particularly detrimental to workers. Where management innovations proceed they may be significantly modified by the union such that they are more acceptable to employees than might have been the case in the absence of trade union representation.

Via their union representatives employees have the opportunity to refashion innovations to their advantage, either in response to union-oriented consultations or through the union's role as negotiator with the employer. Consultation and negotiation with union representatives gives employees a 'say' in the innovation process which can enhance worker well-being, irrespective of the final shape of the innovation, simply because workers feel they have had some meaningful involvement in the process. This can lead to heightened perceptions of procedural fairness and the sense that employees have some control over how their working environment is being reshaped.

The third way in which unions may ameliorate the negative impact of innovations on employee well-being is as a guarantor of job security to employees in the face of potentially productivity-enhancing labour reorganisation. Unions often link the acceptance of

[1] In a similar vein, Bordia et al's (2004) case study links organizational change to psychological stress through perceived loss of control. Pollard (2001) shows that workplace reorganization caused significant increases in distress and in systolic blood pressure and that uncertainty was a key factor.

innovations to job security commitments, thus increasing the credibility of managerial assurances that innovations do not come at the expense of jobs. These agreements often take the form of job security guarantees (JSG's) which seek to avoid compulsory redundancies if at all possible. JSG's are more prevalent in union than in non-union workplaces and, although job cuts are just as likely where JSG's are present, the probability of compulsory redundancy is lower. As a consequence, JSG's reduce employee perceptions of job insecurity (Bryson et al., 2009) and may thus facilitate managerial innovation.[2]

Fourth, social psychologists argue that social supports can help people cope with high demands under conditions of low control (Payne, 1979), as in the case of workers facing managerial innovations. Wood (2008: 157) argues that trade unions can be regarded as a source of social support which, under Karasek and Theorell's (1990: 75) model, helps to limit the impact of work strain on worker well-being. However, in his empirical analysis he finds union membership is not correlated with well-being or job satisfaction.

A fifth means by which unions may mediate the link between managerial innovations and worker well-being is through their efforts to secure higher wages in return for productivity-enhancing innovations. This may be seen as a form of rent-sharing on the part of unions, or the negotiation of compensatory wage differentials in return for what might be regarded as the disamenities associated with managerial innovation. If unions are particularly adept at capturing innovation-generated rents this may act as a disincentive for firms to innovate in the first place.[3] In fact, innovative practices are at least as prevalent in unionized workplaces as they are in non-unionized workplaces in Britain (Wood and Bryson, 2009). However, ceteris paribus wages are higher in innovative unionised workplaces than they are in innovative non-unionized workplaces, a finding consistent with unions extracting a wage premium in return for managerial innovations (Bryson et al., 2005). Thus, even if workers do not like innovation they may be more sanguine about it if their wages rise as a consequence.

For all these reasons it seems that unions may be able to assuage employees' worst feelings about managerial innovations, potentially contributing to the higher productivity of innovations in unionized plants compared to non-unionized plants (Bryson et al., 2005). Similarly in the manufacturing sector in the United States unions are associated with a higher rate of innovation and with higher labour productivity in the presence of innovative practices (Black and Lynch, 2004).

On the other hand, there are reasons why unionization may exacerbate negative effects of innovation on worker well-being. First, by increasing the flow of information between unions and management, unions can heighten employees' awareness of problems and short-comings with management and their innovations, thus increasing employee dissatisfaction (Freeman and Medoff, 1984:142; Gallie et al., 1998:113–4). Second, unions increase the stock of dissatisfied workers because dissatisfied workers are less likely to quit in unionized workplaces than they are in nonunionized workplaces. This is so because the union offers a voice outlet for worker dissatisfaction that is less costly than quitting (Freeman and Medoff 1994:141). In doing so, unions raise average workplace tenure, which is associated with greater dissatisfaction (Bryson and McKay 1997). Third, where management

[2] Black and Lynch (2004: footnote 5) make the point that, because worker-management agreements are rarely legally enforced unions can help overcome the incentive incompatibility problems discussed by Malcolmson (1983).

[3] Unions can lower the incentive to invest in new capital if they expropriate a portion of the rents arising from investment, thus lowering the returns to investment relative to non-union firms (Hirsch, 1992). Grout (1984) makes a similar point with respect to R&D investments. Lower profitability in union firms will also mean there is less internal capital available for reinvestment than in non-union firms. The counter-argument is that unions increase the cost of labour relative to capital thus leading to capital intensification. Empirical studies for the United States (Hirsch, 1990, 1992) and Britain (Denny and Nickell, 1991) suggest that unionised firms invest less in capital than non-union firms.

does not involve unions in the innovation process, worker discontent arising from unmet expectations and perceptions of procedural unfairness may result in lower well-being than in circumstances where the absence of a union is associated with lower worker expectations of involvement.

It is difficult establishing the causal relationship between managerial innovation and employee well-being because innovations are not randomly assigned to workplaces and their employees. First, managerial innovation is not random, and may even be a response to worker well-being, in which case our results will be plagued by reverse causation. It is even conceivable that some management innovations are introduced to combat low morale and job dissatisfaction such that innovation is endogenous with respect to well-being. For instance, managers may wish to introduce changes in response to employee ill-being or dissatisfaction with current arrangements, in which case treating innovation as exogenous will overstate any negative effects of innovation on well-being. Alternatively, managers may wish to capitalise on times when employees are 'feeling good' by introducing innovations, thus potentially minimising opposition to change. If so, this could result in an understatement of any negative effects of innovation on well-being.

Second, workers may select into or out of workplaces according to their preferences such that a non-random group of employees will be subject to managerial innovations. If this worker selection cannot be accounted for by observable characteristics entering our models, and if it is also correlated with individuals' propensity for well-being or satisfaction, it will bias our estimates of innovation's effect on well-being. For example, naturally optimistic and resilient workers may be more prepared to join workplaces which innovate. It is also plausible that employers intent on innovating seek to recruit and retain these sorts of workers. Either way, if unaccounted for this will induce an upward bias in our estimates of innovation's effects on well-being. It is also plausible that those whose wellbeing is most adversely affected by workplace innovations will quit innovating workplaces leading us to understate the negative effects of innovation on wellbeing.

Similarly, union coverage is not randomly assigned to workplaces or to workers. Indeed, there is a substantial literature which seeks to account for the endogeneity of unionisation in isolating the causal impact of unionization of job satisfaction.[4] Union organizing is often assisted by a sense of grievance on the part of workers since it can trigger greater desire for union assistance and increases the net benefits of unionizing. This can help explain the negative effects of unionization on job satisfaction found in the literature (Bryson et al., 2005). Thus efforts to assess the mediating effect of unionisation on the links between innovation and worker well-being should account for the potential endogeneity of both innovation and unionisation.

3. Data

Our data are the linked employer-employee Workplace Employment Relations Survey 2004. The survey covers all sectors of the British economy with the exception of mining and quarrying; agriculture, hunting and forestry; fishing; private households with employed persons; and extraterritorial bodies. However, we confine our analyses to private sector workplaces. Workplaces with at least 5 employees were sampled from the Inter-Departmental Business Register with a view to conducting a face-to-face interview with the manager at the workplace responsible for employment relations. The response rate was 64%. The respondent's permission was sought to distribute an eight page self-completion questionnaire

[4] For a review of this literature see Bryson et al. (2005).

to a randomly selected set of employees at the workplace or, in the case of workplaces with fewer than 26 employees, all of them. This permission was granted in 86% of cases. A further 10% of workplaces did not return any questionnaires. The overall response rate for the employee questionnaire was 61%.[5]

3.1 Well-being measures

Our data contain two sets of well-being measures. The first set is employee responses to the following question: "Thinking of the past few weeks how much of the time has your job made you feel each of the following.. tense, calm, relaxed, worried, uneasy, content?" Responses are coded on a 5-point scale: "all of the time", "most of the time", "some of the time", "occasionally", "never". These measures have their origins in Warr's (2007: 19-49) anxiety-contentment axis for measuring subjective well being (SWB). Warr distinguishes between the two ends of this axis along the two dimensions of pleasure and mental arousal. Anxiety, as measured by feeling tense, worried or uneasy, is associated with negative affect but entails a high level of arousal. Contentment, on the other hand, as measured by feeling calm, contented or relaxed, is associated with positive affect and entails low levels of arousal.[6] Principal components factor analysis[7] of the six SWB measures revealed two factors, one containing the measures of negative affect and the other containing the measures of positive affect. This confirms Wood's (2007: 159) analysis which also used WERS 2004 but for the whole economy. However, as explained by Wood (op. cit.), there are good reasons to treat the items as forming a one-dimensional scale. Thus, following Wood, we combine the six items into a single scale. Taken together these six anxiety-commitment items have a Cronbach's alpha of 0.85. Our single summative SWB score rescales the five-point scores for each measure into (-2, 2) scales where '-2' is "never" and '2' is "all of the time" having reverse-coded the negative affect items such that higher scores indicate higher positive affect. The scale thus runs from (-12, 12). Just over one-third (35%) of the sample score below zero; one-tenth (10%) score zero; and the remaining 55% have positive scores.

Our second dependent variable is job satisfaction. Job satisfaction captures the pleasure-displeasure axis in Warr's concept of subjective well-being. We use all eight facets of job satisfaction available in the data. Employees are asked: "How satisfied are you with the following aspects of your job?... achievement you get from your work; the scope for using your own initiative; the amount of influence you have over your job; the training you receive; the amount of pay you receive; your job security; the work itself; the amount of involvement you have in decision-making at this workplace?" Responses are coded along a 5-point Likert scale ranging from "very satisfied" to "very dissatisfied". Principal component analysis identifies a single factor with an eigenvalue above 1 (2.74) explaining 78% of the variance in the items. Factor loadings ranged from 0.26 (pay) to 0.80 (initiative). The Cronbach's alpha for all eight job satisfaction items is 0.85.[8] Our single summative job satisfaction score rescales the five-point scores for each measure into (-2, 2) scales where '-2' is "very dissatisfied" and '2' is "very satisfied". The scale thus runs from (-16, 16). One fifth (20%) of

[5] For more information about the survey see Kersley et al. (2006).

[6] Our data contain no information relating to Warr's other key axis for measuring SWB, namely depression-enthusiasm (depression being low affect and low arousal, while enthusiasm is high affect and high arousal). Since some of the predictors of depression-enthusiasm are known to differ from those for anxiety-contentment (Warr, 2007: 23) we cannot be sure how these other aspects of well-being may be associated with managerial innovations.

[7] We use orthogonal varimax principal components analysis with rotation.

[8] These results are similar to Wood's (2008: 160) even though his analysis relates to the whole economy.

the sample score below zero; 30% score between 0 and 4; and the remaining 50% score 5 or more.[9]

3.2 Innovation measures

It is common in the literature to characterise workplace practices as 'innovative' or 'new' when, in fact, it is unclear whether they are indeed innovations or new. We overcome that problem in this paper by focusing our attention on changes in practices in the two years prior to the survey. Our innovation variables are based on managerial responses to the following question:

"Over the past two years has management here introduced any of the changes listed on this card? PROBE: Which others? UNTIL 'None'.:

1) Introduction of performance related pay
2) Introduction or upgrading of computers
3) Introduction or upgrading of other types of new technology
4) Changes in working time arrangements
5) Changes in the organisation of work
6) Changes in work techniques or procedures
7) Introduction of initiatives to involve employees
8) Introduction of technologically new or significantly improved product or service
9) NONE None of these"

All eight innovations are positively correlated with correlations ranging between 0.19 (introduction of incentive pay and the introduction of new technology) and 0.65 (changes in work techniques and procedures and changes in work organization). Principal components analysis revealed two factors with eigenvalues above one.[10] The first factor (eigenvalue 1.90), accounting for 59% of the variance in innovation, contains the four labour-oriented innovations, namely items 4, 5, 6 and 7 above.[11] The Cronbach's alpha for these items is 0.65. The second factor (eigenvalue 1.59), accounting for 49% of the variance in innovation, contains the three capital-oriented innovations, that is, items 2, 3, and 8.[12] The introduction of performance-related pay is positively correlated with both factors, but its factor loadings are not high (0.32 and 0.18 respectively) indicating that this particular managerial innovation does not belong to either factor. This is consistent with the literature in which incentive payments are often introduced as a means of supporting labour innovations such as the introduction of employee involvement practices (Huselid, 1995). We construct three count variables, one which sums all eight innovations (NCHANGE); a second for labour innovations based on items 4, 5, 6, and 7 with a maximum value of 4 (NLABCHG), and a third for capital innovations based on items 2, 3, and 8 with a maximum value of 3 (NCAPCHG). One-quarter (25%) of workplaces had introduced no labour innovations in the previous two years; one-fifth had introduced one innovation (21%), another fifth (22%) had introduced two, a further fifth (19%) had introduced three, and 13% had introduced all four. One-fifth (20%) of workplaces had introduced none of the three capital innovations; one-

[9] The correlation between the SWB and job satisfaction scales is 0.45. If one regresses them against one another they account for 20% of the variance in the other.

[10] The factor analysis reported in this paragraph uses STATA's factormat command which is intended for use with dummy variables. We report on the workplace-level data but results are virtually identical when run on employee-level data.

[11] The factor loadings range between 0.50 for employee involvement initiatives and 0.72 for changes in work techniques or procedures.

[12] The factor loadings range between 0.59 for the introduction of new or improved products or services and 0.73 for the upgrading or introduction of new technology.

quarter (24%) had introduced one; 29% had introduced two; and one-quarter (26%) had introduced all three. Twelve percent of workplaces had introduced performance related pay in the previous two years.

Where managers had innovated they were asked what type of involvement trade unions, joint committees and the employees affected had in "introducing and implementing this change". The pre-coded responses were: "they decided; they negotiated; they were consulted; they were informed; no involvement". Among employees who had experienced innovations in the last two years, 20% were in workplaces where there had been no employee involvement in the introduction of the innovation. Twelve per cent worked at workplaces where it had been subject to negotiation or was actually decided by employees; 56% were in workplaces where there had been consultation over innovation; and 38% were in workplaces where they had been informed about innovation. (The figures for negotiation, consultation and information sum to over 100% because in some cases workplaces took different approaches with respect to unions, joint committees and employees).

3.3 Unionization variables

We use individual-level indicators of union membership and bargaining coverage. The membership data are derived from the employee self-completion questionnaire. The coverage data are provided by the workplace manager for each single-digit occupation in the workplace. For each occupation present the manager is asked: "Which of the following statements most closely characterises the way that pay is set for [occupational group]?" The first three pre-coded answers are: "collective bargaining for more than one employer eg. industry-wide agreement"; "collective bargaining at an organization level"; "collective bargaining at this workplace".[13] We link these data to the employee through her occupation which is collected in the self-completion questionnaire. Unlike the United States, although coverage and membership are positively correlated they are far from synonymous. Two-thirds (66%) of employees were uncovered members; a further 12% were uncovered union members; 12% were covered members; and 10% were covered non-members. The correlation coefficient for membership and coverage was 0.40.

3.4 Control variables

In addition to union membership and coverage status, we control for age (9 dummies); academic qualifications (8 dummies); vocational qualifications (3 dummies); single-digit occupation (9 dummies); and dummies for disability, gender, ethnicity and having any dependent children. The dummy for male is interacted with the dependent child dummy. Our workplace-level controls are single-digit industry (11 dummies); region (10 dummies); log workplace employment size ; and dummies for low travel-to-work-area unemployment (below 1.2%) and location in an urban area.

Two dummy variables are used as instrumental variables entering innovation models, namely whether the workplace produces several different products or services, and whether the workplace had benchmarked itself against other workplaces. Three dummy variables were used as instrumental variables entering unionization models, namely being a single-establishment organization, aged at least 25 years, and facing overseas product market competition.

[13] These data were edited and cleaned by the original research team. The variables can be identified in the deposited data file as the NFSOC* dummies.

4. Empirical Approach

We analyse the effects of innovation on worker well-being using the additive scales for SWB and job satisfaction described in Section 3.1. We argue that the rescaling makes simple linear models appropriate. The relationship between the well-being of worker i employed in workplace f can be expresses by Equation 1:

$$1) \qquad W_{if} = \beta_1 Innovations_f + \beta_2 Union_{if} + \beta_3 Innovations_f x Union_{if} + \beta'_x X_{if} + \varepsilon_{if}$$

where W_{if} expresses well-being (or job satisfaction) for individual i in workplace f, $Innovations_f$ express the number of innovations introduced in workplace f (different measures), $Union_{if}$ expresses a dummy for union coverage (which varies at the worker level), while the X's express our control vector and ε_{if} represents a standard normal distributed error term. β_1 gives the effect of innovation on the well being of non-unionized workers, whereas $(\beta_1 + \beta_3)$ gives the effect of innovation on the well being of unionized workers.

The models are unweighted and so provide within-sample estimates, rather than population estimates. Individuals' probability of sample selection is not independent of one another since they are clustered within sampled workplaces. Standard errors are adjusted to account for this using clustering[14] and we use the robust estimator to tackle remaining heteroskedasticity in the error terms. Sample sizes vary a little across the well-being and job satisfaction models. For well-being the unweighted number of employee observations is 13,153 and they are clustered in 1,228 private sector workplaces (an average of nearly 11 employees per workplace).[15] For job satisfaction the unweighted number of employee observations is 12,689 and they are clustered in 1,228 workplaces. We also run Equation 1 (without the interaction term) for unionized and non-unionized employees separately.

Whilst these models provide a good approximation for the independent correlation between well-being and innovation, they make no attempt to account for the potential endogeneity of innovation or unionization with respect to worker well-being. As discussed above, this can arise for a number of reasons. First, managerial innovation is not random, and may even be a response to worker well-being, in which case our results will be plagued by reverse causation. Second, workers may select into or out of workplaces according to their preferences such that a non-random group of employees will be subject to managerial innovations. Similarly, unionization is not ascribed to workplaces and workers randomly. Indeed, union organizing is often assisted by a sense of grievance on the part of workers since it can trigger greater desire for union assistance and increases the net benefits of unionizing. This can help explain the negative effects of unionization on job satisfaction found in the literature (Bryson et al., 2005).

To account for the endogeneity of innovation, we run two-stage least squares regressions, using STATA's –ivreg2- command. In the first stage we estimate innovation with an OLS model incorporating a set of instruments which affect firms' propensity to innovate but can be reasonably excluded from the second stage equation which estimates well-being (or job satisfaction). The first instrument is *benchmarking*: those that benchmark are more likely to innovate since they seek to emulate the best practice among their peers.[16] However, there is no reason to suspect that benchmarking will have any effect on worker

[14] Thus we take into account the so-called Moulton-critique (Moulton, 1990).

[15] We lose over 1,500 observations by excluding workers with missing data on items used in the analysis. This is another reason why we decide to estimate within-sample rather than population estimates.

[16] The survey question is: "I'd now like to ask you about benchmarking By this I mean examining the way things are done at other workplaces and comparing them with this establishment. Over the past two years, has this establishment benchmarked itself against any other workplaces?"

well-being. The second instrument is *product and service diversity* at the establishment: this is likely to increase the propensity to innovate because both the opportunity and, perhaps, the necessity to innovate are greater where one has more products/services going to market. But, there is no reason to suspect a relationship between product diversity and well-being.

Initially we run these models for the whole private sector and for the union and non-union subsamples, treating union status as if it is exogenous. However, we then seek to account for the endogeneity of union status by first running STATA's –movestay- command to estimate an endogenous switching regression model.[17] The model generates Mills' ratios for the two regimes, namely union and non-union. We then incorporate the inverse of these Mills' ratios into the –ivreg2- procedure thus accounting for the endogeneity of both union status and innovation.

We use three dummy variables in the switching regression to help identify the model. The first is being a *single-site firm*: the marginal costs of a union organizing in a single-site firm are greater than for a multi-site firm, thus reducing the likelihood of collective bargaining coverage. Second, we use a dummy identifying whether the workplace faces *overseas product market competition*. Overseas competition can increase worker demand for unionization where unions help workers maintain wages relative to non-union workers in the face of more intensive competition (Bratsberg and Ragan, 2002). It may also signal high barriers to entry which can only be met by global firms which, typically, indicate rents which unions seek to share. Our third variable is a dummy identifying *workplaces aged at least twenty-five years old*: unions found it easier to organize workplaces prior to the 1980s and this differential has persisted due to the costs employers face in derecognising unions (Millward et al., 2000). We maintain that it is reasonable to exclude these three variables from the employee well-being equation. We run a range of diagnostic tests designed to see how credible these identification assumptions are. The instruments perform well. The results from the diagnostic test are reported in detail in Section 5.

5. Results

Table 1 presents OLS estimates of the association between innovation and employee well-being as measured by the additive well-being scale. Panel A presents results using the additive innovation scale. Panels B and C present identical models but replace the global innovation count measure with the additive scales for labour and capital innovations respectively. In each case four models are presented. Model (1) is run for the whole private sector and incorporates the employee's coverage status. Model (2) includes the interaction term between innovation and coverage. Models (3) and (4) are for uncovered and covered employees respectively. The pattern of results is identical in Panels A and B. Innovation is associated with lower employee well-being but, when the model is split by union coverage status, the association is only statistically significant in the case of uncovered employees. Even though the pattern seems clear, the differences between covered and the non-covered workers are significant at only at the 10 percent significance level. Panel C indicates that capital innovations are only significantly associated with lower employee well-being among uncovered employees, and only at the 10 percent significance level.

We tested the sensitivity of these results to model specification. First, we added the dummy variable for the introduction of performance-related pay in the previous two years.

[17] -movestay- implements the full information maximum likelihood method (FIML) to simultaneously estimate binary and continuous parts of the model in order to yield consistent standard errors. This approach relies on joint normality of the error terms in the binary and continuous equations (Lokshin and Sajaia, 2004). .

This was not statistically significant and it did not affect the results. Second, we replaced the coverage variable with a variable which captured covered membership. Being a covered member was associated with lower well-being than simply being covered. However, this did not affect the association between innovations and wellbeing.

Table 2 provides results for job satisfaction, using the same specifications. The negative association between innovation and job satisfaction is only significant in the case of uncovered employees and is only apparent for labour innovations (NLABCHG). The differences between effects on covered and uncovered employees are not statistically significant.

If the way in which innovation is introduced affects worker well-being one might expect this to show up in models replacing the innovation count with the nature of managerial engagement over the introduction of innovation. We tested this proposition by introducing a variable capturing the number of innovations over which employers had involved employees, either by consulting them, negotiating with them or allowing them to make the decision. In an alternative specification we counted the number of innovations over which there had been no employee involvement. These variables were not statistically significant; nor did they affect the results reported above.

Table 3 presents estimates of innovation effects on employee well-being derived from an instrumental variables approach which accounts for the potential endogeneity of innovation. Endogenising innovation, using benchmarking and product diversity as instruments, results in an increase in the innovation coefficients. This is apparent for all three innovation count measures. The innovation effect on wellbeing is underestimated when it is treated as exogenous, suggesting innovations are introduced at times when employees have positive underlying feelings about their work, or that employers who innovate recruit employees who are generally positive and well-disposed towards their work. The table confirms that this innovation effect is confined to uncovered employees. Furthermore the differences in the estimated coefficients for innovation between the covered and non-covered workers are all statistically significant.

In Table 4 we use the same approach to endogenise innovation in the job satisfaction equations. Compared with the OLS estimates in Table 2 the negative innovation coefficients are larger and, in all three cases, the innovation counts are statistically significant for uncovered employees only. However, in contrast to the results for well-being in Table 3, the differences between covered and non-covered employees are not statistically significant. The difference in the point estimates between covered and uncovered employees is very similar to that reported for well-being in Table 3 but the estimates are less precisely estimated.

We run a range of diagnostic tests designed to assess the credibility of our identification assumptions. Some of these are reported in Tables 3 and 4. First, we find that the instruments are separately and jointly statistically significant in the innovation equations. Second, using a Hansen J statistic we find that our estimates pass the over-identification test, that is to say, the instruments can reasonably be excluded from the second stage well-being and satisfaction models. Third, we use the Kleibergen-Paap Wald rk F statistic to see whether our estimates suffer from weak instruments.[18] The instruments perform very satisfactorily (the F-statistic is between 5 and 31). Finally using STATA's –endog- option we confirm the endogeneity of innovation as a regressor in both the whole private sector and uncovered employee equations.

Next we ran endogenous switching regression models to account for the fact that some unobservable employee characteristics that influence the probability of choosing union coverage could also influence the employee's well-being in their job. The three variables

[18] This test is similar to the Cragg-Donald but, unlike Cragg-Donald, it accounts for heteroskedasticity.

used to identify the model were individually and jointly statistically significant in the coverage equation. The correlation coefficients for the unobservables in the coverage and well-being equations are not statistically significant. However, the correlation coefficient for the unobservables in the coverage and job satisfaction equation are positive for both covered and uncovered employees, but only significantly different from zero for the correlation between the sector choice equation and the uncovered employee job satisfaction equation.[19] This indicates that employees who choose to work in the uncovered sector have lower job satisfaction in that sector than a randomly assigned employee by virtue of their unobservable characteristics, while those working in the covered sector do no better or worse than a random individual.

We take the inverse of the corresponding Mill's ratios for the two regimes and plug these into the –ivreg2- estimates in order to account for selection into union status while, at the same time, accounting for the endogeneity of innovation. The results are presented in Table 5. For individual well being, the lambda terms are never statistically significant. Compared with Table 3, the innovation coefficients for uncovered employees fall a little but the pattern of results is much the same: the negative impact of innovation on wellbeing is confined to uncovered employees. For job satisfaction, the lambda term for selection into the covered sector is significant for uncovered employees suggesting systematic selection of workers into the covered group. The pattern with respect to the innovation coefficient is still very similar to the one we find without accounting for selection into coverage, although the size of the coefficients drops a little.

If workers sort into or out of innovating workplaces according to their preferences it is possible this might affect our results. We therefore ran our estimates for short-tenure and longer tenured employees distinguishing between those who had been at the workplace for under two years – that is, those who had arrived in the period over which we measure innovations – and the remainder. The results remained unchanged: the effects of innovation on wellbeing and job satisfaction were confined to uncovered employees, irrespective of their workplace tenure.

6. Conclusions

Using private sector linked employer-employee data for Britain we explore the effects of management innovations on job satisfaction and an alternative measure of subjective well-being capturing employees' feelings of work-induced contentment versus stress and anxiety. We distinguish between effects among employees who are covered by collective bargaining and those who are not.

We find management innovations are associated with lower employee subjective well-being. This is the case for three different count measures of innovation – a global measure of innovation and measures for labour innovations and capital innovations. However, the effects are confined to uncovered employees. The effects become more pronounced when we account for the endogeneity of innovation, perhaps indicating that innovative employers select workers who are better able to cope with change, or that employers tend to innovate when worker well-being is high, thus making them more resilient to change. It is also possible that workers with higher well-being self select into innovative

[19] The correlation coefficient for the unobservables in the coverage equation and the job satisfaction equation for uncovered employees was 0.849 (t=53.06). The Wald test for the joint independence of the three equations has a p-value of 0.0000.

workplaces, although there is no indication of this when we split the analyses by workplace tenure.

The OLS estimates are weaker in the case of job satisfaction: only labour innovations are associated with lower employee job satisfaction. Again, the effect is confined to uncovered employees. When we endogenise innovation the effects of innovation become much stronger such that all three innovation measures are negatively and significantly related to the job satisfaction of uncovered employees. The difference in the estimated effect of innovation between covered and uncovered employees, however, is not statistically significant in the case of job satisfaction.

Workers often look to trade unions to negotiate with management over change at the workplace to ensure that any changes that do take place take account of employee interests. We find little direct evidence that negotiation, consultation or information provision in relation to innovation is associated with an amelioration of the negative effect of innovation on employee well-being. However, we do find that the negative effect of innovation on subjective well being is absent when workers are covered by a collective bargaining agreement. We cannot say, based on these results, what the exact mechanism is, but it seems quite clear that one of the things unions do is to make workplace innovations less costly to workers.

References

Barker, J. R. (1993), 'Tightening the Iron Cage: Concertive Control in Self-Managing Teams', Administrative Science Quarterly, Vol. 38, No. 3 (September), pp. 408-437.

Black, S. E. and L. M. Lynch (2001). 'How to Compete: the Impact of Workplace Practices and Information Technology on Productivity', Review of Economics and Statistics 83 (3): 434-445.

Black, S. E., Lynch, L. M. and Krivelyova, A. (2004), 'How Workers Fare When Employers Innovate', Industrial Relations, Vol. 43, 1: 44-66.

Blanchflower, D. G. and Bryson, A. (2009), 'Trade Union Decline and the Economics of the Workplace', Chapter 3 in W. Brown, A. Bryson, J. Forth and K. Whitfield (eds.), *The Evolution of the Modern Workplace*, pp. 48-73, Cambridge University Press.

Bloom, N. and Van Reenen, J. (2007), 'Measuring and Explaining Management Practices Across Firms and Countries', The Quarterly Journal of Economics, CXXII, 1351-1408.

Bordia, P., Hunt, E., Paulsen, N., Tourish, D., DiFonzo, N. (2004), 'Uncertainty During Organizational Change: Is It All About Control?', European Journal of Work and Organizational Psychology, 13 (3), 345–365.

Bryson, A., Cappellari, L. and Lucifora, C. (2009), 'Workers' Perceptions of Job Insecurity: Do Job Security Guarantees Work?', Labour: Review of Labour Economics and Industrial Relations, Vol. 23, s1, 177-196.

Bryson, A., Cappellari, L. and Lucifora, C. (2005), 'Why So Unhappy? The Effects of Unionisation on Job Satisfaction', IZA Discussion Paper No. 1498, IZA, Bonn.

Bryson, A., Forth, J. and Kirby, S. (2005), 'High-Performance Practices, Trade Union Representation and Workplace Performance in Britain', Scottish Journal of Political Economy, 53, 3: 451-491.

Bryson, A. and McKay, S. (1997), 'What About the Workers?', in R. Jowell, J. Curtice, A. Park, L. Brook, K. Thomson and C. Bryson (eds.), *British Social Attitudes: the 14th Report*, 23-48.

Denny, K. and Nickell, S. (1991), 'Unions and Investment in the British Manufacturing Industry', British Journal of Industrial Relations, 29, 1, 113–121.

De Witte, H. (1999), 'Job Insecurity and Psychological Well-Being: Review of the Literature and Exploration of Some Unresolved Issues', European Journal of Work and Organizational Psychology, 8, 155-177.

Doeringer, P. B., Evans-Klock, C. and Terkla. D. G. (2002), *Start-up Factories—High-Performance Management, Job Quality and Regional Advantage*, Oxford University Press and W.E. Upjohn Institute for Employment Research, New York, 273.

Economist Intelligence Unit (2005), 'CEO Briefing White Paper', http://www.oracle.com/global/hk/corporate/press_050221.html

Freeman, R. B. and Rogers, J. (1999), *What Workers Want*, Cornell, Ithaca, NY.

Gallie, D. (2005), 'Work Pressure in Europe 1996-2001: Trends and Determinants', British Journal of Industrial Relations, Vol. 43, 3: 351-375.

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

Godard, J. (2001), 'The Transformation of Work and High Performance? The Implications of Alternative Work Practices for the Experience and Outcomes of Work', Industrial and Labor Relations Review, 54 (4): 776-805.

Godard, J. (2004), 'A Critical Assessment of the High-Performance Paradigm', British Journal of Industrial Relations, Vol. 42, 2: 349-378.

Green, F. (2006), *Demanding Work. The Paradox of Job Quality in the Affluent Economy*, Princeton University Press, Woodstock.

Harrison, R., Jaumandreu, J., Mairesse, J. and Peters, B. (2008), 'Does Innovation Stimulate Employment? A Firm-level Analysis Using Comparable Micro-data from Four European Countries', NBER Working Paper #14216.

Hirsch, B. T. (1990), 'Innovative Activity, Productivity Growth and Firm Performance: Are Unions a Spur or Deterrent?', in Albert N. Link and V. Kerry Smith (eds.), *Advances in Applied Microeconometrics*, JAI Press, Greenwich, Connecticut,.

Hirsch, B. T. (1992), 'Firm Investment Behaviour and Collective Bargaining Strategy', Industrial Relations, 31, 1, 95–121.

Holmes, T. (2008), 'The Diffusion of Wal-Mart and Economies of Density', NBER Working Paper #13783, Cambridge, Mass.

Huselid, M. A. (1995), 'The Impact of Human Resource Management Practices on Turnover, Productivity, and Corporate Financial Performance', Academy of Management Journal, 38, 635-672.

Ichniowski, C., Shaw, K. and Prennushi, G. (1997), 'The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines', American Economic Review, 87: 291-313.

Karasek, R. A. (1979), 'Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign', Administrative Science Quarterly, 24: 2, 285-308.

Karasek, R. and Theorell,T. (1990), *Healthy Work*, Basic Books, New York.

Lokshin, M. and Sajaia, Z. (2004), 'Maximum Likelihood Estimation of Endogenous Switching Regression Models', The Stata Journal, Vol. 4, No. 3, 282-289.

Machin, S. and Wadhwani, S. (1991), 'The Effects of Unions on Organisational Change and Employment', The Economic Journal, 101, 835–854.

Malcomson, J. (1983). 'Trade Unions and Economic Efficiency', The Economic Journal, 93, 50–65.

Menezes-Filho, N. A. (1997), 'Unions and Profitability Over the 1980s: Some Evidence on Union-firm Bargaining in the United Kingdom', The Economic Journal, 107, 651-670.

Metcalf, D. (1989), 'Water Notes Dry Up: The Impact of the Donovan Reform Proposals and Thatcherism At Work on Labour Productivity in British Manufacturing Industry', British Journal of Industrial Relations, 27, 1: 1-31.

Moulton, B. R. (1990), 'An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Units', Review of Economics and Statistics, 72, 334-338.

Nickell, S. J. and Wadhwani, S. (1991). 'Employment Determination in British Industry: Investigations Using Micro Data', Review of Economic Studies, 55, 5, 955–970.

Osterman, P. (2000), 'Work Reorganization in an Era of Restructuring: Trends in Diffusion and Effects on Employee Welfare', Industrial and Labor Relations Review, 53 (2): 179-196.

Payne, R. L. (1979), 'Demands, Supports, Constraints and Psychological Health', in C. J. Mackay and T. Cox (eds), *In Response to Stress: Occupational Aspects,* IPC Business Press, London, 85–105.

Piore, M. J. And Sabel, C. F. (1984), *The Second Industrial Divide: Possibilities for Prosperity*, Basic Books: New York.

Pollard, T. M. (2001), 'Changes in Mental Well-Being, Blood Pressure and Total Cholesterol Levels During Workplace Reorganization: the Impact of Uncertainty', Work and Stress, 15, 1: 14-28.

Rasmay, H., Scholarios, D. and Harley, B. (2000), 'Employees and High- Performance Work Systems', British Journal of Industrial Relations, 39: 501-532.

Vroman, S. B. (1990), 'The Union-Nonunion Wage Differential and Monitoring Costs', Economics Letters, 32(4): 405-409.

Warr, P. (2007), *Work, Happiness, and Unhappiness*, Mahwah: New Jersey.

Willman, P., Gomez, R. and Bryson, A. (2008), *Trading Places: Employers, Unions and the Manufacture of Voice*, CEP Discussion Paper No. 884, August.

Wood, S. (ed.) (1989), *The Transformation of Work?*, Unwin Hyman, London.

Wood, S. (2008), 'Job Characteristics, Employee Voice and Well-Being in Britain', Industrial Relations Journal, 39: 2, 153-168.

Wood, S. and Bryson, A. (2009), 'High Involvement Management', Chapter 7 in W. Brown, A. Bryson, J. Forth and K. Whitfield (eds.), *The Evolution of the Modern Workplace*, pp. 151-175, Cambridge University Press.

Table 1: OLS for correlation between innovation and well-being

	Model (1) All Workers	Model (2) All workers with interaction	Model (3) Uncovered	Model (4) Covered	Difference between covered and uncovered
	Panel A: Innovation = NCHANGE				
nchange	-0.074	-0.103	-0.098	0.003	-0.101
	(3.02)**	(3.70)**	(3.54)**	(0.06)	(1.77)
covered	-0.136	-0.622			
	(1.04)	(2.40)*			
Nchange*covered		0.120			
		(2.18)*			
Constant	3.800	3.892	4.098	2.455	
	(10.39)**	(10.63)**	(10.24)**	(2.70)**	
R-squared	0.07	0.07	0.08	0.07	
	Panel B: Innovation = NLABCHG				
nlabchg	-0.136	-0.175	-0.171	-0.016	-0.155
	(3.63)**	(4.15)**	(4.06)**	(0.20)	(1.71)
covered	-0.130	-0.491			
	(0.99)	(2.22)*			
Nlabchg*covered		0.174			
		(2.06)*			
Constant	3.768	3.824	4.042	2.485	
	(10.38)**	(10.53)**	(10.18)**	(2.76)**	
R-squared	0.07	0.07	0.08	0.07	
	Panel C: Innovation = NCAPCHG				
ncapchg	-0.066	-0.109	-0.098	0.037	-0.135
	(1.31)	(1.94)	(1.75)	(0.34)	(1.10)
covered	-0.134	-0.466			
	(1.02)	(1.85)			
Ncapchg*covered		0.179			
		(1.54)			
Constant	3.744	3.818	4.049	2.430	
	(10.22)**	(10.44)**	(10.10)**	(2.68)**	
R-squared	0.07	0.07	0.08	0.08	

Notes:

(1) Unweighted OLS of EWELLSC well-being scale. Robust estimator with clustered standard errors. T-stats in parentheses. *=significant at 95% confidence interval; **=significant at 99% confidence interval.

(2) Models (1) and (2): whole economy, N=13,153. Model (3): uncovered employees. N=10,261. Model (4): covered employees. N=2,892.

(3) All models contain the following individual-level controls: age (9 dummies); academic qualifications (8 dummies); vocational qualifications (3 dummies); single-digit occupation (9 dummies); and dummies for disability, gender, ethnicity and having any dependent children. The dummy for male is interacted with the dependent child dummy. It also contains the following workplace-level controls: single-digit industry (11 dummies); region (10 dummies); log workplace employment size; and dummies for low travel-to-work-area unemployment (below 1.2%) and location in an urban area

Table 2: OLS for correlation between innovation and job satisfaction

	Model (1) All Workers	Model (2) All workers with interaction	Model (3) Uncovered	Model (4) Covered	Difference between covered and uncovered
	Panel A: Innovation = NCHANGE				
nchange	-0.019	-0.044	-0.031	0.041	-0.072
	(0.57)	(1.21)	(0.85)	(0.58)	(0.91)
covered	-0.480	-0.904			
	(2.83)**	(2.54)*			
Nchange*covered		0.104			
		(1.38)			
Constant	5.001	5.091	5.408	2.596	
	(10.09)**	(10.26)**	(9.94)**	(2.07)*	
R-squared	0.10	0.10	0.10	0.08	
	Panel B: Innovation = NLABCHG				
nlabchg	-0.088	-0.130	-0.115	0.031	-0.146
	(1.75)	(2.38)*	(2.07)*	(0.28)	(1.18)
covered	-0.479	-0.875			
	(2.82)*	(2.89)**			
Nlabchg*covered		0.190			
		(1.59)			
Constant	5.032	5.093	5.414	2.653	
	(10.20)**	(10.36)**	(10.03)**	(2.12)*	
R-squared	0.10	0.10	0.10	0.08	
	Panel C: Innovation = NCAPCHG				
ncapchg	0.057	0.026	0.047	0.124	-0.077
	(0.84)	(0.35)	(0.63)	(0.89)	(0.49)
covered	-0.474	-0.713			
	(2.80)**	(2.14)*			
Ncapchg*covered		0.128			
		(0.86)			
Constant	4.937	4.992	5.331	2.594	
	(9.95)**	(10.04)**	(9.78)**	(2.09)*	
R-squared	0.10	0.10	0.10	0.08	

Notes:

(1) Unweighted OLS of SATSC8 job satisfaction scale. Robust estimator with clustered standard errors. T-stats in parentheses. *=significant at 95% confidence interval; **=significant at 99% confidence interval.

(2) Model (1): whole economy, N=12,689. Model (2): uncovered employees. N=9,881. Model (3): covered employees. N=2,808.

(3) See footnote to Table 1 for controls.

Table 3: Effects of innovation on well-being instrumenting for innovation

	Model (1) All workers	Model (2) Uncovered workers	Model (3) Covered workers	Difference between covered and uncovered
Panel A: Innovation = NCHANGE				
Nchange	-0.258	-0.364	0.010	-0.374
	(2.49)*	(2.89)**	(0.54)	(2.94)**
Covered	-0.151			
	(1.12)			
Hansen J p-val	*0.91*	*0.71*	*0.84*	
-endog- p-val	*0.06*	*0.02*	*0.57*	
KP Wald rk Wald F	*31.27*	*26.00*	*10.41*	
Panel B: Innovation = NLABCHG				
Nlabchg	-0.418	-0.588	0.173	-0.761
	(2.50)*	(2.92)**	(0.55)	(2.04)*
Covered	-0.131			
	(0.97)			
Hansen J p-val	*0.93*	*0.90*	*0.84*	
-endog- p-val	*0.08*	*0.03*	*0.52*	
KP Wald rk Wald F	*28.62*	*22.96*	*9.47*	
Panel C: Innovation = NCAPCHG				
Ncapchg	-0.797	-1.116	0.270	-1.386
	(2.28)*	(2.48)*	(0.53)	(2.04)*
Covered	-0.180			
	(1.23)			
Hansen J p-val	*0.65*	*0.40*	*0.83*	
-endog- p-val	*0.02*	*0.01*	*0.62*	
KP Wald rk Wald F	*12.12*	*10.07*	*9.31*	

Notes:
(1) Unweighted –ivreg2- of EWELLSC well-being scale. Robust estimator with clustered standard errors. T-stats in parentheses. *=significant at 95% confidence interval; **=significant at 99% confidence interval.
(2) Sample sizes and controls are as per Table 1.
(3) Innovation is instrumented with benchmarking and diversity in products/services.

Table 4: Effects of innovation on job satisfaction instrumenting for innovation

	Model (1) All workers	Model (2) Uncovered workers	Model (3) Covered workers	Difference between covered and uncovered
Panel A: Innovation = NCHANGE				
Nchange	-0.328	-0.441	0.051	-0.492
	(2.23)*	(2.59)**	(0.20)	(1.60)
Covered	-0.508			
	(2.88)**			
Hansen J p-val	*0.67*	*0.47*	*0.90*	
-endog- p-val	*0.02*	*0.01*	*0.96*	
KP Wald rk Wald F	*31.03*	*26.31*	*10.34*	
Panel B: Innovation = NLABCHG				
nlabchg	-0.535	-0.723	0.086	-0.809
	(2.28)*	(2.66)**	(0.20)	(1.59)
covered	-0.480			
	(2.73)***			
Hansen J p-val	*0.80*	*0.62*	*0.90*	
-endog- p-val	*0.04*	*0.01*	*0.89*	
KP Wald rk Wald F	*28.21*	*22.74*	*9.71*	
Panel C: Innovation = NCAPCHG				
ncapchg	-0.989	-1.309	0.141	-1.450
	(2.01)*	(2.22)*	(0.20)	(1.58)
covered	0.551			
	(2.90)**			
Hansen J p-val	*0.48*	*0.28*	*0.90*	
-endog- p-val	*0.01*	*0.01*	*0.97*	
KP Wald rk Wald F	*23.52*	*20.68*	*4.87*	

Notes:
(1) Unweighted –ivreg2- of EWELLSC well-being scale. Robust estimator with clustered standard errors. T-stats in parentheses. z=significant at 10% level, *=significant at 95% confidence interval; **=significant at 99% confidence interval.
(2) Controls and sample sizes are as per Table 2. Innovation is instrumented with benchmarking and diversity in products/services.

Table 5: Effects of innovation on well-being and job satisfaction instrumenting for innovation and coverage

	Well being		Job satisfaction	
	Uncovered employees	Covered employees	Uncovered employees	Covered employees
Panel A:Innovation = NCHANGE				
nchange	-0.347 (2.72)**	0.117 (0.64)	-0.362 (2.14)*	0.098 (0.38)
Lambdau	-0.589 (0.60)	0.092 (0.07)	-3.026 (2.00)*	1.201 (0.49)
Lambdanu	-0.143 (1.72)	0.103 (0.58)	0.060 (0.40)	0.467 (1.41)
Hansen J p-val	*0.73*	*0.84*	*0.48*	*0.89*
-endog- p-val	*0.03*	*0.49*	*0.02*	*0.80*
KP Wald rk Wald F	*24.82*	*10.20*	*24.98*	*10.18*
Panel B: Innovation = NLABCHG				
nlabchg	-0.560 (2.97)**	0.205 (0.64)	-0.595 (2.21)*	0.167 (0.38)
Lambdau	0.053 (0.07)	0.104 (0.08)	-2.677 (1.77)	1.240 (0.51)
Lambdanu	0.069 (0.97)	0.112 (0.63)	0.098 (0.67)	0.481 (1.48)
Hansen J p-val	*0.92*	*0.85*	*0.62*	*0.89*
-endog- p-val	*0.04*	*0.46*	*0.04*	*0.74*
KP Wald rk Wald F	*21.59*	*9.13*	*21.21*	*9.37*
Panel C: Innovation = NCAPCHG				
ncapchg	-1.068 (2.33)*	0.316 (0.63)	-1.061 (1.84)	0.268 (0.39)
Lambdau	-0.532 (0.61)	0.012 (0.01)	-3.595 (2.20)*	1.063 (0.42)
Lambdanu	-0.009 (0.10)	0.086 (0.47)	-0.020 (0.11)	0.437 (1.23)
Hansen J p-val	*0.40*	*0.84*	*0.29*	*0.89*
-endog- p-val	*0.01*	*0.36*	*0.02*	*0.80*
KP Wald rk Wald F	*9.46*	*5.19*	*9.75*	*5.03*

Notes:
(1) Unweighted –ivreg2- of EWELLSC well-being scale and STASC8 job satisfaction scale. Separate models for covered and uncovered employees incorporating lambda selection terms for covered (LAMBDAU) and uncovered (LAMBDANU) sectors obtained from the endogenous switching regression models. Innovation is instrumented with benchmarking and diversity in products/services. Coverage is instrumented with age of establishment, single establishment and facing overseas market competition.
(2) Robust estimator with clustered standard errors. z-stats in parentheses. *=significant at 95% confidence interval; **=significant at 99% confidence interval.
(3) Sample sizes and controls are as per previous tables.

CENTRE FOR ECONOMIC PERFORMANCE
Recent Discussion Papers

952	Nathan Foley-Fisher Bernardo Guimaraes	US Real Interest Rates and Default Risk in Emerging Economies
951	Yann Algan Christian Dustmann Albrecht Glitz Alan Manning	The Economic Situation of First- and Second-Generation Immigrants in France, Germany and the United Kingdom
950	Jérôme Adda Francesca Cornaglia	The Effect of Bans and Taxes on Passive Smoking
949	Nicholas Oulton	How to Measure Living Standards and Productivity
948	Alex Bryson Bernd Frick Rob Simmons	The Returns to Scarce Talent: Footedness and Player Remuneration in European Soccer
947	Jonathan Wadsworth	Did the National Minimum Wage Affect UK Wages?
946	David Marsden	The Paradox of Performance Related Pay Systems: 'Why Do We Keep Adopting Them in the Face of Evidence that they Fail to Motivate?'
945	David Marsden Almudena Cañibano	Participation in Organisations: Economic Approaches
944	Andreas Georgiadis Alan Manning	One Nation Under a Groove? Identity and Multiculturalism in Britain
943	Andreas Georgiadis Alan Manning	Theory of Values
942	Kristian Behrens Giordano Mion Yasusada Murata Jens Südekum	Trade, Wages and Productivity
941	David Marsden Richard Belfield	Institutions and the Management of Human Resources: Incentive Pay Systems in France and Great Britain
940	Elhanan Helpman Oleg Itskhoki Stephen Redding	Inequality and Unemployment in a Global Economy

939	Norman Ireland Robin A. Naylor Jeremy Smith Shqiponja Telhaj	Educational Returns, Ability Composition and Cohort Effects: Theory and Evidence for Cohorts of Early-Career UK Graduates
938	Guy Mayraz Jürgen Schupp Gert Wagner	Life Satisfaction and Relative Income: Perceptions and Evidence
937	Nicholas Bloom Raffaella Sadun John Van Reenen	The Organization of Firms Across Countries
936	Jean-Baptiste Michau	Unemployment Insurance and Cultural Transmission: Theory and Application to European Unemployment
935	João M. C. Santos-Silva Silvana Tenreyro	Trading Partners and Trading Volumes: Implementing the Helpman-Melitz-Rubinstein Model Empirically
934	Christian Morrisson Fabrice Murtin	The Century of Education
933	João M. C. Santos-Silva Silvana Tenreyro	Further Simulation Evidence on the Performance of the Poisson Pseudo-Maximum Likelihood Estimator
932	João M. C. Santos-Silva Silvana Tenreyro	On the Existence of the Maximum Likelihood Estimates for Poisson Regressioin
931	Richard Freeman John Van Reenen	What If Congress Doubled R&D Spending on the Physical Sciences?
930	Hector Calvo-Pardo Caroline Freund Emanuel Ornelas	The ASEAN Free Trade Agreement: Impact on Trade Flows and External Trade Barriers
929	Dan Anderberg Arnaud Chevalier Jonathan Wadsworth	Anatomy of a Health Scare: Education, Income and the MMR Controversy in the UK
928	Christos Genakos Mario Pagliero	Risk Taking and Performance in Multistage Tournaments: Evidence from Weightlifting Competitions
927	Nick Bloom Luis Garicano Raffaella Sadun John Van Reenen	The Distinct Effects of Information Technology and Communication Technology on Firm Organization

The Centre for Economic Performance Publications Unit
Tel 020 7955 7284 Fax 020 7955 7595 Email info@cep.lse.ac.uk
Web site http://cep.lse.ac.uk