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JEL classification: *J5, J51, J28, J82*

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1. Introduction

Empirical evidence indicates union members report lower job satisfaction than their non-member counterparts, ceteris paribus, despite unions' role in improving pay and working conditions. Considerable efforts have been made to explain this empirical regularity (see Bryson *et al.* 2010 and Green and Heywood 2010 for recent reviews). If union membership was compulsory where workers are covered by collective bargaining this might not be puzzling. However, covered employees are not compelled to join unions in Britain. So we might expect workers to sort to optimise their utility, whereupon there would be no job satisfaction differential between members and non-members. On the other hand, the 'open shop' model makes the union associated multi-attribute good largely non-excludable, creating an incentive to free-ride. This paves the way for the coexistence of members and non-members in workplaces. It is this coexistence that we aim to exploit to gain new insights into the link between unions and job satisfaction. Specifically, we argue that this coexistence may have a negative spillover on non-members' wellbeing. If so, the gap in job satisfaction between members and non-members the literature reports may be an underestimate, since it does not account for the potentially adverse causal impact of unionisation on the job satisfaction of non-members.

Recent evidence (Bryson *et al.* 2010), indicates the importance of bargaining coverage at the workplace in explaining the link between membership and satisfaction. If members' bargaining power is a rising function of union density, something much of the literature confirms, then non-members would be limiting the bargaining power of members. If so, non-members may risk being ostracised by members, which may have adverse implications on their job-related wellbeing. Several factors may entail adverse wellbeing effects on non-members. These include the exclusion of non-members from certain private goods such as legal and pension advice (Booth and Chatterji, 1995), reputational costs (Booth, 1985), and a potentially disruptive workplace environment triggered by the process of collective bargaining, among others.

This paper establishes whether there is a negative spillover wellbeing effect of unionisation on non-members. In doing so it departs from the existing literature by focusing exclusively on non-members. Our theoretical framework adapts the Social Custom Model of trade unions (Booth 1995) to non-members. We argue that non-members are identical to members other than with respect to their exposure to unionisation. Using rich linked employer-employee data we construct a counterfactual world for the non-members in the union world that is observationally equivalent but excludes unions, thereby addressing the potentially important issue of non-member selection adequately, if not perfectly. We also carry out a sensitivity

analysis of the effect of unionisation on non-member wellbeing using the method pioneered by Altonji *et al.* (2005), which has been further developed in Oster (2014).

Our analysis centres on the private sector for two main reasons. First, the public sector accounts for only 31.7% of the employees observed in our data; and 63.4% of these employees are union members. This makes it almost impossible to carry out our non-member centred analysis, which relies on constructing a counterfactual group of non-members in non-union workplaces. Secondly, it is difficult to get a clear picture of the role collective bargaining plays in setting pay in public establishments due to the presence of public sector pay review bodies in such establishments.

We find that unionisation reduces the job satisfaction of non-members in workplaces where pay is set through collective bargaining. Non-members are outside of the bargaining process. However, our findings suggest a reduction in their job satisfaction, possibly due to a strained workplace environment triggered by bargaining and voice induced complaining. Our findings have a major implication for the empirical union literature linking membership and job satisfaction. The often reported 'puzzling' empirical regularity indicates that unionisation lowers members' job satisfaction compared with non-members'. If non-members in union workplaces fare worse in job satisfaction terms vis-à-vis other workers in non-union workplaces as our findings indicate, it may mean that the job satisfaction gap between members and non-members may have been underestimated.

The rest of the paper is organised as follows. Section Two reviews the literature. Section Three extends the Social Custom Model and sets out the framework for the empirical analyses. Section four describes the data and variables used in the empirical analyses. Section Five discusses the empirical models. Section Six discusses the results before the final section concludes the paper.

2. Review of the literature

The negative association between job satisfaction and union membership is a puzzling empirical regularity. The puzzle stems from the expectation that unions should in general enhance members' job satisfaction and wellbeing. A number of influential studies have established a link between unions and a pay premium and/or lower pay inequality (see, for example, Freeman 1980, Booth 1995, Gosling and Machin 1995, Clark and Oswald 1996, Card 1996, Card *et al.* 2003, Budd and Na 2000, Metcalf *et al.* 2001, Hirsch 2004, Blanchflower and Bryson 2004). Unions have also been linked to a number of other welfare improving changes for members, which include access to employer provided training (Booth 1991, Acemoglu *et al.*

2001, Booth *et al.* 2003, Waddoups 2012), risk sharing (Malcomson 1983), health insurance and pension plans (Buchmueller *et al.* 2002), workplace and occupational health and safety (Donado and Walde 2012), family friendly policies (Budd and Mumford 2004), and curbing discrimination (Phanindra and Peled 1999). More generally, unions uphold members' interest in collective bargaining on issues such as transfers, promotions and grievances, among others, in the spirit of Freeman and Medoff (1984)'s "collective voice". Notwithstanding these well-established benefits associated with unions, which would be expected to enhance the satisfaction and wellbeing of members, existing empirical evidence points to a negative association between membership and job satisfaction.

The union literature is centred on the impact of unionisation on members. Little is known about the effect unionisation may have on non-members. However, several factors can be thought of as having negative spillover effects on non-members. *First*, the operation of union bargaining and voice may impact the wellbeing of non-members adversely even though they are outside the bargaining process. This is because the workplace environment can become strained due to voice induced complaining, especially if the process is conflict-laden. As a result, employees generally and non-members in particular may experience a lower wellbeing than might otherwise be the case. There is some evidence suggesting that non-members in union workplaces are more likely to view the climate as poor vis-à-vis comparable non-members in non-union workplaces (Bryson, 1999). *Secondly*, unionisation may entail some additional costs to the firm, which it may try to claw back through cost-offsetting practices such as tight manning levels or the loss of autonomy. Such practices may lead to increased disutility, particularly for non-members. *Third*, unions do still procure some private benefits including legal and pensions advice exclusively for their members. Such 'discrimination' by unions may trigger envy on the part of non-members, with possibly adverse wellbeing consequences. It is also possible that unions, who are keen to procure private excludable goods for members, are able to promote policies that discriminate in favour of members, perhaps with the collusion of employers, reducing the job dissatisfaction of non-members. *Fourth*, there may also be 'reputational' costs associated with being a non-member as per the Social Custom Model. The wage standardising policies of unions may also be viewed as adversely impacting the wellbeing of non-members. Abowd and Farber (1982) indicate that non-members with high earnings potential who end up in union workplaces are misallocated. Such non-members are likely to have a preference for greater wage inequality than members, thereby incurring some wellbeing cost as a result of union policies.

In theory, the effects of unionisation on non-members' wellbeing could go either way. The 'open shop' model of unionisation in Britain may mean that non-members choose to free-ride in union workplaces perhaps attracted by the benefits of unionisation. Such benefits may or may not fully compensate for the potential disutility stemming from adverse spillover effects of unionisation. Unions are unable, for the most part, to offer private excludable goods to members. Instead, they tend to provide public goods thus extending the benefits they confer on members to covered non-members as well. Donado and Walde (2012) show this to be the case with respect to health and safety provisions at work. The law also prevents employers from discriminating on grounds of union membership. These union-generated benefits might translate into higher levels of non-member wellbeing than might have been in a non-union environment. The net wellbeing effect of unionisation on non-members is therefore an empirical question. In this paper we first adapt the Social Custom Model of trade unions to provide a theoretical analysis on the wellbeing effect of unionisation on non-members. The main empirical approach involves comparing reported job satisfaction and job-related anxiety of non-members in a unionised workplace with that of their counterparts in non-union workplaces, which we model jointly using seemingly unrelated regressions (SUR). In addition, the method of matching is used to compare non-members in unionised workplaces with observationally 'similar' counterparts in non-unionised workplaces, thereby comparing 'like-for-like'. We also conduct sensitivity analysis to ascertain the robustness of our results.

3. Theoretical Model

The focus of this paper is on non-members, which necessitates adapting the Social Customs Model of trade unions (Booth 1985), SCM hereinafter. As in the SCM, reputation enters non-members' utility function; but only as a negative construct as set out in the assumptions below.

Assumption 1: There is a closed industry, wherein there are workplaces with and without trade unions; and employment is not dependent on membership since employer discrimination on the basis of membership status is illegal.

Assumption 2: As in Booth (1985), there are two job attributes that enter workers' utility functions: wage (w) and reputation (r); but with the qualifications in assumptions 3 and 4 below.

Assumption 3: The wage (w) non-members receive has three components to it that include an entry-level average industry-wide pay (w_o); a union wage premium specific to the union sub-sector (ω), which is thought to be a function of union density (d) or simply $\omega = \omega(d)$

and an industry-wide pay mark-up that is a certain proportion (ρ) of the union wage premium, which reflects wage premium induced industry-wide pay hike. That is:

(1) $$w = w_o + \rho\omega(d) + u\omega(d)$$

where $0 \leq d < 1$, $0 < \rho < 1$ and $u = 1$ if union sub-sector and 0 otherwise.

Assumption 4: The reputation good (r) reflects disutility associated with violating the social custom of unions. Non-membership in a union workplace is thought to entail a disutility stemming from 'ostracisation' by members, who would regard non-members as weakening their bargaining power. In other words, free-riding is assumed to entail some sort of psychic cost, a negative reputation. The level of disutility non-members experience is thought to increase with workplace union density. This is because members may take the liberty of imposing their will on non-members as their group size increases. The negative reputation or disutility non-members in a union workplace experience can be given by an increasing convex function of the following general form:

(2) $$r = r(d),$$

where $r(0) = 0; r_d > 0; r_{dd} > 0$ and the subscripts signifying the first and second order derivatives.

Assumption 5: The negative reputation non-members experience depends on whether pay is set through collective bargaining. This is because unions' bargaining power is a function of union density, d. If so, it may not be unrealistic to imagine members feeling aggrieved by free-riding non-member co-workers. Taking this into account, whether a workplace is covered by collective bargaining can enter the reputation function multiplicatively as:

(3) $$r = b \cdot r(d)$$

where, $b = 1$ if workplace is covered by collective bargaining and 0 otherwise.

Assumption 6: Employee utility is assumed to be given by a continuous, twice differentiable and increasing convex function. Suppose the utility function of a non-member in a union workplace, U^1, is given by:

(4) $$U^1 = U(w_o + \rho\omega(d) + \omega(d) - r(d)),$$

A non-member in a non-union workplace would have neither pay premium nor reputational costs. Thus, the corresponding utility function of such a worker, U^0, would only be a function of the industry-wide average wage and any mark-up in this that may be due to union pay pressure:

$$U^0 = U(w_o + \rho\omega(d)) \tag{5}$$

Equilibrium

The 'open shop' model means that members coexist with non-members; and both types of workers are free to sort to optimise their utility. Such coexistence provides non-members the incentive to free ride, since the union associated multi-attribute good is largely non-excludable. However, free riding is not costless as there is a disutility, a psychic cost, associated with it. Non-members may choose to free ride as long as the union good at least compensates for the disutility from free riding. Members, on the other hand, would counteract freeriding, since it weakens their bargaining power. Equilibrium holds when the utility derived from the non-excludable wage premium unions procure equals the spillover disutility non-members experience from violating the social custom of unions. Assuming additive separability of U^1 and U^0, equilibrium is when:

$$\begin{aligned} & U^1 = U^0 \\ \Leftrightarrow\ & U(w_o) + U(\rho\omega(d)) + U(\omega(d)) - U(r(d)) = U(w_o) + U(\rho\omega(d)) \\ \Leftrightarrow\ & U(\omega(d)) = U(r(d)) \end{aligned} \tag{6}$$

Deviation from the equilibrium in equation (6) may represent two possible cases for non-members. *Case* 1: $U(\omega(d)) > U(r(d))$. In this case the benefit from free riding outweighs its cost, thus providing non-members the incentive to continue to free ride, which member would attempt to thwart. *Case* 2: $U(\omega(d)) < U(r(d))$. This signifies the case where the spillover disutility exceeds the union wage premium, which would mean that *either* non-members join unions to circumvent the disutility from violating the unions' social custom *or* they seek to join the non-union sub-sector.

The theoretical framework we developed suggests that non-members in unionised workplaces experience a psychic cost, a disutility, from free riding. This is the case as long as the wage premium non-members receive is no less than the disutility from violating the social custom of unions. In the empirical analysis we undertake, we expect the disutility from free riding to translate into a reduction in job satisfaction for non-members in unionised settings

with collective bargaining.[1] This is because job satisfaction as an outcome has a *comparison* or *status* element to it (see, for example, Clark *et al.* 2009 on this), which is likely to allow capturing the dynamics between members and non-members we outlined. This focus will also be in keeping with the union literature and the 'puzzling' empirical regularity we discussed earlier. As well as job satisfaction, our empirical analysis will also use job-related anxiety as an outcome. However, the way the job-related anxiety outcome has been measured in our data does not suggest a *comparison* or *status* aspect to it as the discussion in Section 4 indicates. Although, we use all available subjective wellbeing outcomes in our data for the sake of completeness, the job-related anxiety outcome may not therefore capture the dynamics between members and non-members.

4. Data and variables

4.1 Overview of the Data

The data used in this paper come from the 2004 British Workplace Employment Relations Survey (WERS2004), the most authoritative source of information on employment relations in Great Britain offering linked employer-employee data representative of all workplaces with five or more employees. The sample of workplaces surveyed was drawn randomly from the Inter-Departmental Business Register (IDBR), which is maintained by the Office for National Statistics (ONS). Workplaces were stratified by size and industry; and a random sample was selected from within a particular size-industry stratum. The sample covers both the private and public sectors; and includes all industries except those engaged in primary activities, private households with domestic staff and those workplaces with fewer than five employees. The management survey achieved a response rate of 64%. It was carried out face-to-face with the workplace manager or the senior person at the workplace with day-to-day responsibility for employment relations. The employee survey, which achieved a response rate of 61%, produced a sample of 22,451 employees from 86% of the workplaces (1,733 establishments) that took part in the management survey. Data on employees were collected through an eight-page self-completion questionnaire (Kersley *et al.* 2006).

The elimination of cases from the original sample involving: (*i*) missing values in any one of the reported wellbeing outcomes, (*ii*) missing values in any one of the employee characteristics, (*iii*) missing values in any one of the workplace characteristics and (*iv*) retaining only workplaces with at least two responding employees resulted in the retention of 17,411 employees in 1453 workplaces. Union members made up 36.6% of the original WERS2004

[1] The theory we adapted serves to predict the direction of the job satisfaction differential between members and non-members and does not come up with specific parameters to be estimated.

sample and 36.3% of the sample after the elimination of cases with missing values and a single employee observation per workplace. 69.8% of the retained 17,411 employees come from the private sector; yielding 12,150 employees in 1058 private establishments. Union members made up 24.2% of employees in the sector, whose elimination yielded the estimation sample being confined to 9213 *non-member employees* in 1034 *private establishments*.[2]

4.2 Definition of variables

4.2.1. Outcome variables

There are two types of employee wellbeing measure in WERS2004 this paper uses. The first relates to levels of satisfaction with eight different job facets. The survey asked employees to rate – on a five-point scale from 'very satisfied' to 'very dissatisfied' – "how satisfied are you with the following aspects of your job": (*i*) the sense of achievement they get from their work; (*ii*) the scope for using their own initiative; (*iii*) the amount of influence they have over their job; (*iv*) the training they receive; (*v*) the amount of pay they receive; (*vi*) their job security; (*vii*) the work itself and (*viii*) their involvement in decision making. *Secondly*, WERS2004 also monitored job-related anxiety outcomes. Employees were asked to provide responses – on a five five-point scale from 'all of the time' to 'never' – to the 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, and content?"[3]

Principal components analysis on the facets of job satisfaction identified a single factor with an eigen value above 1 (3.99) explaining 99 per cent of the variance in the eight items and with a Kaiser-Meyer-Olkin (KMO) sampling adequacy measure of 0.88. Similarly, principal components analysis on the job-related anxiety outcomes identified one factor with an eigen value above 1 (3.42) explaining 88 per cent of the variance in the six job-related anxiety measures and with a KMO sampling adequacy measure of 0.80.[4] Based on the principal components analyses, therefore, two different job-related wellbeing measures have been generated – *job*

[2] In other words, 24 workplaces had respondents who were all union members. The membership profiles of the original and subsequent sub-samples obtained here are in line with similar figures stated elsewhere in the literature.

[3] Psychologists emphasise the need for a broader definition of work-related wellbeing than just job satisfaction (Warr 1990, 1994, 1999). Job-related anxiety measures are also considered important facets of psychological wellbeing (Warr 1994, Daniels 2000). Bryson *et al.* (2012) argue that job satisfaction and job-related anxiety capture two distinct components of worker wellbeing. Haile (2012) also used the same data and outcomes.

[4] The Cronbach's alpha for the eight facets of job satisfaction and the six job-related anxiety measures are 0.85 and 0.86, respectively. The Cronbach's alpha values are comparable to those reported in Wood (2008) and Bryson et al. (2009).

satisfaction and *job-related anxiety*. The job satisfaction measure we use in this paper excludes pay satisfaction, even though our results do not change on including the pay satisfaction domain.[5]

Reported levels of satisfaction on the remaining seven facets with 5-point scores have then been recoded into (-2, 2) scales, where '-2' is "very dissatisfied" and '2' is "very satisfied". The resulting single summative job satisfaction outcome measure runs from (-14, 14). Similarly, the six facets of job-related anxiety measures with a 5-point score have also been rescaled into (-2, 2) scales, where '-2' is "never" and '2' is "all of the time" after reverse coding the positive affect items first. The resulting summative job-related anxiety measure runs from (-12, 12).[6] Table 1 reports descriptive statistics on the two summative outcome variables and their respective components.

Table 1: Descriptive statistics on non-members' wellbeing outcomes, including constituent domains, by workplace union status

	Non-members, all workplaces				Non-members, union workplaces				Non-members, non-union workplaces			
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Job Satisfaction												
Achievement	3.80	0.91	1.0	5.0	3.69	0.94	1.0	5.0	3.83	0.90	1.0	5.0
Initiative	3.86	0.91	1.0	5.0	3.79	0.94	1.0	5.0	3.88	0.89	1.0	5.0
Influence	3.63	0.92	1.0	5.0	3.53	0.95	1.0	5.0	3.65	0.91	1.0	5.0
Training	3.34	1.07	1.0	5.0	3.23	1.10	1.0	5.0	3.37	1.06	1.0	5.0
Job security	3.61	0.96	1.0	5.0	3.44	1.02	1.0	5.0	3.66	0.94	1.0	5.0
Work itself	3.81	0.88	1.0	5.0	3.70	0.92	1.0	5.0	3.84	0.87	1.0	5.0
Decision making	3.29	0.99	1.0	5.0	3.20	0.97	1.0	5.0	3.32	0.99	1.0	5.0
Additive job satisfaction	4.14	4.88	-14.0	14.0	3.57	4.88	-14.0	14.0	4.54	4.81	-14.0	14.0
Job-related anxiety												
Tense	3.32	0.98	1.0	5.0	3.30	0.95	1.0	5.0	3.32	0.99	1.0	5.0
Calm	2.92	1.06	1.0	5.0	2.85	1.05	1.0	5.0	2.93	1.06	1.0	5.0
Relaxed	2.68	1.10	1.0	5.0	2.59	1.09	1.0	5.0	2.70	1.10	1.0	5.0
Worried	3.62	0.99	1.0	5.0	3.62	0.97	1.0	5.0	3.63	0.99	1.0	5.0
Uneasy	3.86	1.00	1.0	5.0	3.81	0.99	1.0	5.0	3.87	1.01	1.0	5.0
Content	3.06	1.07	1.0	5.0	2.93	1.07	1.0	5.0	3.09	1.07	1.0	5.0
Additive job-related anxiety	1.44	4.68	-12.0	12.0	1.11	4.59	-12.0	12.0	1.54	4.70	-12.0	12.0
No. of non-members	9213				1992				7221			
No. of workplaces	1058				123				911			

Figure 1 depicts plots of the additive job satisfaction and job-related anxiety outcomes for non-members, which are disaggregated by workplace union status. The first panel shows a relatively higher level of satisfaction for non-members in non-union workplaces vis-à-vis their

[5] Earnings may be endogenous with respect to pay satisfaction so focusing on non-pecuniary measures of satisfaction may minimise the potential endogeneity problem stemming from our use of pay levels as control variables.

[6] The approach used here in generating the single summative scale follows that employed in Bryson et al. (2012)

counterparts in union workplaces. In contrast, the second panel exhibits a much less pronounced difference in the observed levels of job-related anxiety for the two groups.

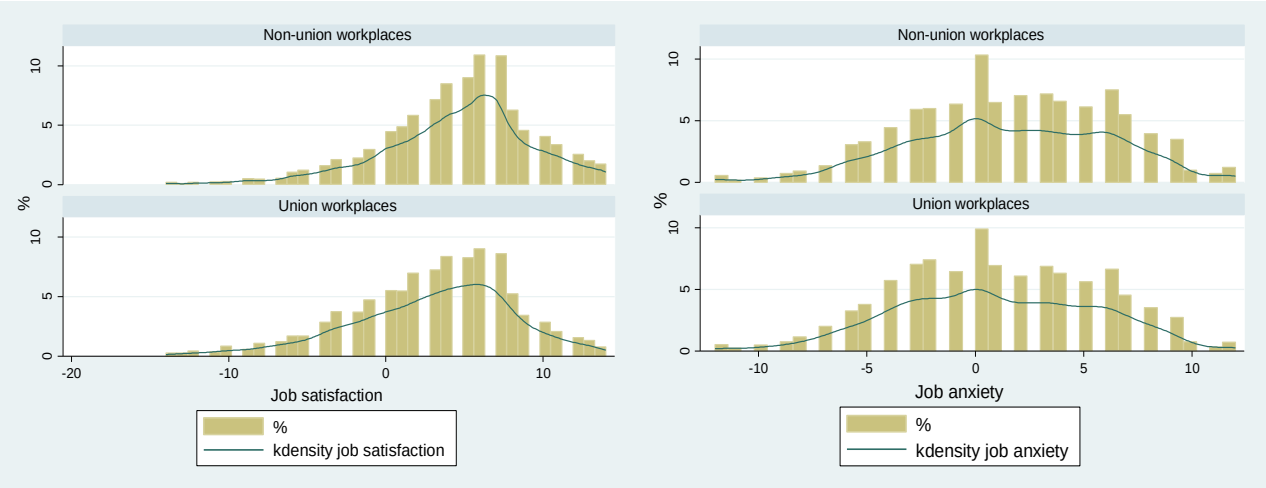

Fig. 1: Non-members' job satisfaction and job anxiety, by workplace union status

The job-related anxiety question in WERS2004 was designed to capture employees' positive and negative emotional states over a short recall period ("the past few weeks"). As such, the job anxiety outcome is more likely to be momentary in nature reflecting actual feelings (of, for example, uneasiness) experienced over a short recall period, which may not be influenced much by one's prior expectation and/or relative position or status in the workplace. In contrast, the job satisfaction outcome, with no particular reference to a time period, is likely to be more reflective in nature. Importantly, job satisfaction is also likely to be influenced by one's prior expectation (of, for example, progression in one's career) and relative status vis-à-vis co-workers, including in terms of membership status.

4.2.2. Measures of workplace union status and other control variables

Workplace union status (union present) is based on employees' response to the question "*Is there a trade union….at this workplace*?", while the *collective bargaining* status of workplaces in our data is obtained from employers' response to a series of questions on whether pay is set through collective bargaining for all the nine occupational categories monitored. A workplace would be considered as having collective bargaining coverage if the employer reported pay is set through collective bargaining, irrespective of whether the bargaining coverage is at the workplace-, organisation- or sectoral-level. A range of other employer and employee characteristics has been used, which include employee demographic and human capital characteristics, job characteristics, industry of employment as well as employer characteristics

that include geographic location and travel-to-work area unemployment and vacancy rates. Table A6 in the appendix reports descriptive statistics on all the control variables, including the key unionisation measure – union present.

5. Empirical Models

We use two alternative empirical strategies and a sensitivity analysis to determine the wellbeing effect of unionisation on non-members. The *first* approach is the Seemingly Unrelated Regression (SUR) model (Zellner, 1962), which estimates the *job satisfaction* and *job anxiety* equations jointly. As noted in the preceding section, the two outcome measures may be different in nature with regards to the reference frame employees use to make their subjective assessments. Nevertheless, the two outcomes are subjective assessments of aspects of job(s) by the same responding employee(s) that may share some commonality. Given this, using SUR, which takes into account possible correlation between the satisfaction and anxiety equations, may be appropriate.[7] The SUR set up used can be given as follows:

$$(7) \qquad wb_{ij}^{k} = \mathbf{x}_{ij}'^{k}\beta^{k} + \varepsilon_{ij}^{k}, \quad i = 1,...,N;\ j = 1,...,M, \text{ and } k = 1,2$$

where wb stands for wellbeing, representing job satisfaction and job-related anxiety as indexed by the superscript k; $\mathbf{x}$ is the vector of regressors including the workplace unionisation measures; i indexes non-members and j indexes workplaces, which are both union and non-union workplaces. The error terms in (7) are assumed to be homoscedastic, independent across individuals and have zero mean. However, the errors of the job satisfaction and job anxiety equations may be correlated for a given non-member, considering the conceptual similarity between the two outcomes noted earlier. That is, $E(\varepsilon_{ij}^{1}\varepsilon_{ij}^{2} \mid \mathbf{x}) = \sigma^{1,2} \neq 0.$ The SUR framework accounts for this using the GLS estimator, which produces Chi-squared statistics from the Breusch-Pagan test on the independence of errors from the two equations jointly estimated. Another advantage of the SUR model is that it permits conducting joint test(s) of significance on the coefficients of interest from the two equations straightforwardly.[8] As can be seen from the full regression outputs in the Appendix, the same set of regressors have been used in each of the

[7] This also provides some efficiency gain from combining the two equations of interest.
[8] Tests on the significance of the workplace union status estimator for the job satisfaction and job anxiety equations have been carried out jointly; and results, not reported here, reject the null that the union effects are zero in the two equations estimated.

job satisfaction and job anxiety equations modelled jointly, which yields the same result as fitting the two equations separately using OLS.[9]

The *second* empirical strategy uses a matching estimator (Rosenbaum and Rubin 1983), which balances on observable characteristics of non-members, thus permitting 'like-for-like' comparison of the wellbeing of non-members in union workplaces with similar non-members in non-union workplaces. Let W^1 and W^0 represent the wellbeing outcomes of non-members in union and non-union workplaces, respectively. We define 'treatment' as non-members being in a unionised workplace (D=1) as opposed to being in a non-union workplace (D=0), which we set up based on employees' response on whether their workplace has a union. We match non-members in unionised workplaces to 'observationally similar' employees in non-unionised workplaces to obtain the *average treatment effect on the treated* (ATT). The Conditional Independence Assumption (CIA) can be invoked to generate the counterfactual wellbeing outcome of being in a non-union workplace using the method of matching as:

$$(8) \qquad E(W^0 \mid D=1, P(X)) = E(W^0 \mid D=0, P(X))$$

where *P*(.) denotes the probability of being a non-member in a union workplace estimated on a rich set of employee and employer characteristics, **x**, contained in the linked WERS2004 data.[10] Matching allows constructing the comparison group of non-members in non-union workplaces who observationally resemble non-members in union workplaces, thereby addressing adequately, if not perfectly, the potentially important issue of non-member selection. Under CIA, the average wellbeing effect of being in union workplaces on non-union workers (ATT) can be retrieved as:

$$(9) \qquad \frac{1}{N^1} \sum_{i^1 \in \{D=1\}} \left((W^1)_{i^1} - \sum_{i^0 \in \{D=0\}} \tau_{i^1 i^0} (W^0)_{i^0} \right)$$

[9] Hence, it is still possible to compare our SUR estimates with other specifications – notably those based on matching – straightforwardly.

[10] The matching estimator assumes the outcomes of interest (here wellbeing) are independent of participation status conditional on a set of observable characteristics (Heckman, Ichimura, and Todd 1998). It is thus vital that only exogenous variables that are likely to affect both 'treatment' and outcomes are used, excluding potentially endogenous ones. In view of this, the controls used for the matching equation in this paper exclude workplace size, workplace industry, whether union membership is encouraged at the workplace, level of union coverage, and individual union membership status, which are likely to be endogenous.

where $(W^1)_{i^1}$ is the wellbeing outcome of the i^1th non-member in union workplaces ($i^1 \in \{D=1\}$), $(W^0)_{i^0}$ is the wellbeing outcome of the i^0th employee in non-union workplaces ($i^0 \in \{D=0\}$), $\tau_{i^1 i^0}$ is the weight of employees from non-union workplaces with $\sum_{i^0 \in \{D=0\}} \tau_{i^1 i^0} = 1$ and N^1 is the number of non-members in union workplaces i^1. The counterfactual outcome is estimated using the weight function $\tau_{i^1 i^0}$ in the sample of employees in non-union workplaces, i^0, relative to the predicted propensity score $\widehat{P(X)}$ of each 'treated' non-member i^1. We use Gaussian kernel matching with common support, which assign larger weights to non-members from non-union workplaces that are 'close' to non-members in union workplaces on the basis of estimated propensity scores.

Finally, we conduct a sensitivity analysis to check the robustness of our results using the methodology pioneered by Altonji *et al.* (2005), which has been further developed in Oster (2014).[11] The methodology uses selection on observable characteristics as the basis for assessing potential selection on unobservables. This is achieved by comparing changes in the estimated 'treatment effect' and R-squared values between a baseline (uncontrolled) specification with only the 'treatment' variable of interest and a fully specified regression model that also controls for a range of observables to estimate a 'bounding set' or 'identified set'(Δ_S). As detailed in Oster (2014), this exercise rests on two crucial assumptions. First, there is a certain *proportional selection* (δ) capturing the relative importance of observables and unobservables in explaining the treatment. The covariance between the treatment and the observables is assumed to have the same sign as that between the treatment and the unobservables, which renders δ to be positive. This bounds the value of δ below at 0 and above at some arbitrary upper bound $\bar{\delta}$. A $\bar{\delta} = 1$ signifies equal selection in the sense of observables being equally important as unobservables. Secondly, there is a theoretical R-squared value ($R_{\max}$) obtainable from regressing the outcome of interest on the treatment and both observed and unobserved controls. A fully explained outcome would render $R_{\max} = 1$, thus giving a theoretical upper bound, whereas R-squared from the regression controlling for observables ($\tilde{R}$) can serve as a lower bound. As Oster (2014) argues, outcomes are not fully explained in many empirical settings. Given that, a 'conservative upper bound' can be instituted so that $R_{\max} = min\{\Pi\tilde{R}, 1\}$ with varying values of Π. We undertake a sensitivity analysis assuming that: (a) $\bar{\delta} = 1$ and (b) Π taking values of 1.25, 1.5, 2 and 3, which amounts to assuming unobservables explaining the variations in our outcome of interest by between 1.25 and 3 times more than that of observables. If the 'bounding set'

[11] Recent applications of the methodology include Mendolia and Walker (2014), Johnston, Schurer and Shields (2013) and Chatterji, Alegrai and Takeuchi (2011).

$\Delta_s = [\tilde{\beta}, \beta^*(\min\{\Pi\tilde{R}, 1\}, 1]$ estimated with these assumptions excludes 0, then there is sufficient ground to believe that the wellbeing effect of unionisation we estimate is unlikely to be entirely due to bias stemming from selection on unobservables.

6. Results and discussion

The main findings from the empirical analyses conducted are reported in Tables 2 and 3 below. Table 2 reports part of the SUR regression outputs, which are centred on the key control variable of 'union present', from the full non-member sample as well as the collective bargaining based sub-group analysis. In each case, three different specifications of the models have been estimated starting with the baseline specification (SUR1), which controls only for the key 'union present' binary variable and those that in addition control for employee-level characteristics (SUR2) and employee- and employer-level characteristics (SUR3). The full estimation results corresponding to each block of the results reported in Tables 2 are provided in Tables A1 to A3 in the Appendix. The tests we conducted to determine the significance of the 'union present' variable yield statistical significance at the conventional level.

As can be seen from the first block of results in Table 2, all three specifications reveal that non-members in union workplaces experience a statistically significant reduction in job satisfaction. On the other hand, the unionisation measure is not found to be statistically significant in the job-related anxiety equations. This finding indicates that the spillover effect of unionisation occurs only through its effect on non-members' job satisfaction. The bottom two panels of results in Table 2 are from sub-group analysis based on the collective bargaining status of workplaces. The findings reveal that the negative spillover effect of unionisation on job satisfaction identified is almost exclusively specific to workplaces that set pay through collective bargaining.

Table 2: SUR estimates of the wellbeing effect of unionisation on non-members

	SUR1		SUR2		SUR3	
	Satisfaction	Anxiety	Satisfaction	Anxiety	Satisfaction	Anxiety
	a. *All non-members*					
Union present (0/1)	-0.726***	-0.038	-0.641***	-0.034	-0.711***	-0.067
	(0.159)	(0.129)	(0.151)	(0.114)	(0.156)	(0.129)
Employee characteristics	No	No	Yes	Yes	Yes	Yes
Employer characteristics	No	No	No	No	Yes	Yes
Constant	4.613***	1.458***	3.453***	2.717***	3.898***	2.943***
	(0.101)	(0.087)	(0.435)	(0.389)	(0.486)	(0.472)
No. of non-members	9213	9213	9213	9213	9213	9213
R-squared	0.005	0.000	0.077	0.093	0.103	0.099
	b. *Non-members in workplaces without collective bargaining*					
Union present (0/1)	-0.307	0.110	-0.338	-0.055	-0.385	-0.089

	(0.237)	(0.207)	(0.225)	(0.178)	(0.217)	(0.198)
Employee characteristics	No	No	Yes	Yes	Yes	Yes
Employer characteristics	No	No	No	No	Yes	Yes
Constant	4.558***	1.427***	3.238***	2.743***	3.466***	2.804***
	(0.121)	(0.109)	(0.603)	(0.568)	(0.631)	(0.662)
No. of non-members	4951	4951	4951	4951	4951	4951
R-squared	0.001	0.000	0.080	0.109	0.105	0.114
c. *Non-members in workplaces covered by collective bargaining*						
Union present (0/1)	-1.034***	-0.161	-0.858***	-0.026	-0.861***	-0.062
	(0.216)	(0.197)	(0.210)	(0.175)	(0.224)	(0.193)
Employee characteristics	No	No	Yes	Yes	Yes	Yes
Employer characteristics	No	No	No	No	Yes	Yes
Constant	4.713***	1.514***	3.724***	2.546***	4.497***	3.099***
	(0.159)	(0.152)	(0.625)	(0.516)	(0.749)	(0.644)
No. of non-members	4262	4262	4262	4262	4262	4262
R-squared	0.011	0.000	0.080	0.084	0.111	0.093

Bootstrap standard errors from 500 replications in parentheses
*** p<0.01, ** p<0.05

Table 3 reports the matching based average treatment effect of unionisation on the wellbeing of non-members in union workplaces (ATT), which we obtained by comparing them with observationally 'similar' non-members in non-union workplaces. The Table also reports results from sub-group analysis based on the collective bargaining status of workplaces. The results are very much in line with what we reported in Table 2 in terms of at least statistical significance in that: (*a*) the negative spillover effect of unionisation on non-members' wellbeing occurs only through non-members' job satisfaction and (*b*) this effect is specific to non-members in workplaces with collective bargaining.

Table 3: Matching based estimates of the wellbeing effect of unionisation on non-members.

	Job satisfaction	Job-related anxiety
a. *All non-members*		
Union workplace (0/1)		
ATT	-0.620***	-0.008
	(0.145)	(0.126)
No. of non-members	9213	
No. of workplaces	1034	
b. *Non-members in workplaces without collective bargaining*		
Union workplace (0/1)		
ATT	-0.359	0.011
	(0.220)	(0.197)
No. of non-members	4951	
No. of workplaces	528	
c. *Non-members in workplaces covered by collective bargaining*		
Union workplace (0/1)		
ATT	-0.770***	0.035
	(0.263)	(0.227)
No. of non-members	4262	
No. of workplaces	506	

Bootstrap standard errors from 500 replications in parentheses.
*** p<0.01, ** p<0.05

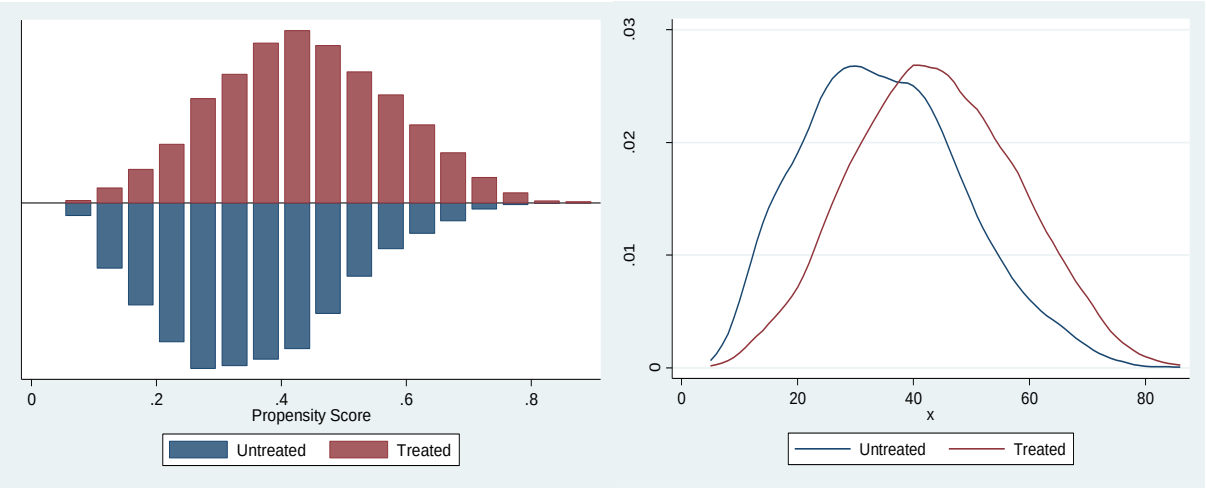

Fig. 2: Histogram and kernel graphs of propensity score for the treated and untreated.

Figure 2 depicts the distribution of propensity scores for the 'untreated' and 'treated' non-members. Both the histogram and the kernel plots show there is adequate, though not perfect, overlap between the 'untreated' and 'treated' groups. Table A4 in the Appendix reports coefficient estimates from the probit regression estimated, which generated the propensity scores controlling extensively on employer and employee characteristics thought to determine the employment of non-members in a union workplace. The propensity scores indicate a large common support, as can be seen from the covariate balance test results reported in Appendix Table A5.

Table 4 reports results from the robustness analysis we carried out based on the empirical strategy developed by Altonji *et al.* (2005) and Oster (2014). As discussed in the preceding section, the analysis centres on the movements in the estimated treatment effects and R-squared values between the baseline or '*uncontrolled*' specification (SUR1 in our case) and the fully specified or '*controlled*' model with the most observable controls (SUR3). Table 4 reports the coefficients and respective R-squared values from SUR1 and SUR3 as '*inputs from regression*'. In addition, the Table reports '*other inputs*' entries for both models, which relate to the assumptions that govern the robustness analysis. The most important results in Table 4 relate to the '*identified set estimates*' or the bounding set (Δ_s), which give estimates of the lower and upper bounds of the treatment effects.

The bounding sets we retrieved are obtained under conservative assumptions that: (a) assign equal weight for observables and unobservables in explaining the treatment effect – a very conservative assumption give that we use linked employer-employee data with extensive controls – and (b) unobservables are thought to explain the variation in observed job satisfaction

outcome by between 1.25 and 3 times more than that explained by observables. Despite these conservative assumptions, however, the *identified set estimate*s reported in Table 4, which provide the lower and upper bound estimates for the effect of unionisation on job satisfaction, suggest that we can exclude a zero effect of unionisation by a huge margin. There is thus sufficient evidence that our results are unlikely to be driven entirely by bias stemming from selection on unobservables.

Table 4: Sensitivity analysis of statistically significant effects of unionisation on job satisfaction, with alternative R_{max} values

	$R_{max}=\min(1.25\tilde{R}, 1)$	$R_{max}=\min(1.5\tilde{R}, 1)$	$R_{max}=\min(2\tilde{R}, 1)$	$R_{max}=\min(3\tilde{R}, 1)$
		a. *All non-members*		
Identified Set Estimates (Δ_S)				
Bound 1	-0.7115	-0.7115	-0.7115	-0.7115
Bound 2	-0.7076	-0.7037	-0.6958	-0.6802
Inputs from Regression:	Coeff.	R-Squared		
Uncontrolled	-0.726	0.005		
Controlled	-0.711	0.103		
Other inputs:				
Rmax	0.129	0.155	0.207	0.31
$\bar{\delta}$	1.00	1.00	1.00	1.00
		c. *Non-members in workplaces covered by collective bargaining*		
Identified Set Estimates (Δ_S)				
Bound 1	-0.861	-0.861	-0.861	-0.861
Bound 2	-0.813	-0.765	-0.669	-0.477
Inputs from Regression:	Coeff.	R-Squared		
Uncontrolled	-1.034	0.011		
Controlled	-0.861	0.111		
Other inputs:				
Rmax	0.139	0.167	0.223	0.334
$\bar{\delta}$	1.00	1.00	1.00	1.00

7. Conclusion

The paper examined the spillover effect of unionisation on non-members' wellbeing. It departed from the standard approach in the literature by focusing on the wellbeing of non-members in union and non-union private establishments. The innovative approach deployed compares the wellbeing of non-members in union workplaces with that of non-members in non-union workplaces. To this end, the paper first attempted to extend the Social Custom Model of trade unions. It then used linked employer-employee data to establish empirically the spillover effect of unionisation on non-members' wellbeing. We defined workplace union status based on employees' responses; and we used two different wellbeing measures in the form of *job satisfaction* and *job-related anxiety*.

The theoretical model developed suggests that non-members in unionised workplaces bear some level of disutility for violating the social custom of unions; regardless of the level of the wage premium unionisation may deliver. This was thought to translate into a reduction in wellbeing for non-members in unionised workplaces. The empirical results we obtained lend support to the theoretical predictions and reveal that: (*a*) there is a negative spillover effect of unionisation on non-members' job satisfaction and (*b*) the spillover effect found is specific to workplaces that set pay through collective bargaining. That the negative spillover effect is largely specific to workplaces that set pay through collective bargaining seems to point to the workplace climate of bargaining being the likely culprit behind the adverse effect of unionisation on non-members' job satisfaction found.

That the spillover wellbeing effect is confined only to non-members' job satisfaction and not to their job-related anxiety merits some discussion. Although the two wellbeing measures – job satisfaction and job-related anxiety – represent conceptually similar subjective assessments of aspects of jobs, they are not expected to capture exactly the same thing. As noted in Section Four, the job-related anxiety outcome relates to employees' experiences of positive and negative emotional states over a period of few weeks, thus being momentary in nature; while the job satisfaction outcome captures the degree of employees' satisfaction on aspects of their job without any particular reference to time, which makes it more reflective in nature. More importantly, the job satisfaction outcome includes employees' subjective assessments of aspects of their jobs such as satisfaction with 'the scope for using their own initiative' and 'the amount of influence they have over their job'. It is inevitable that such assessments rely on comparisons of one's position vis-à-vis that of co-workers'. Crucially, these are precisely aspects of one's job that unionisation is likely to affect. Considering that more than 30% of non-members in the estimation sample constitute the managerial, supervisory and professional ranks, it is not entirely surprising that unionisation, which is likely to limit their customary authority, adversely affects the job satisfaction of non-members. On the other hand, it is not apparent, conceptually at least, how unionisation may affect non-members' experiences of positive and negative emotional states over a specific period of "few weeks".

Finally, our findings may have a major implication for the empirical union literature linking membership and job satisfaction. The 'puzzling' empirical regularity that is extensively reported suggests that unionisation lowers members' job satisfaction compared with non-members'. If, however, non-members in union workplaces fare worse in job satisfaction terms vis-à-vis other workers in non-union workplaces as our findings indicate, it may mean that the job satisfaction gap between members and non-members may have been underestimated.

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Appendix: Tables of full regression outputs and descriptive statistics

Table A1: SUR estimates of the wellbeing effect of unionisation on non-members, all non-members

	SUR1		SUR2		SUR3	
	Satisfaction	Anxiety	Satisfaction	Anxiety	Satisfaction	Anxiety
Union present (0/1)	-0.726***	-0.038	-0.641***	-0.034	-0.711***	-0.067
	(0.159)	(0.129)	(0.151)	(0.114)	(0.156)	(0.129)
Age<30			-0.267	-0.215	-0.095	-0.156
			(0.153)	(0.147)	(0.153)	(0.148)
Age30-39			-0.065	0.013	0.033	0.048
			(0.148)	(0.140)	(0.150)	(0.142)
Age50+			0.728***	0.851***	0.629***	0.809***
			(0.155)	(0.158)	(0.153)	(0.158)
Female			0.442***	-0.388***	0.269**	-0.426***
			(0.130)	(0.110)	(0.129)	(0.114)
Married			0.444***	0.066	0.409***	0.050
			(0.116)	(0.114)	(0.114)	(0.114)
White			-0.037	-0.115	-0.133	-0.178
			(0.265)	(0.230)	(0.268)	(0.236)
Children <7yrs old			-0.048	-0.118	-0.111	-0.142
			(0.149)	(0.146)	(0.146)	(0.146)
Other dependents			-0.180	-0.406***	-0.275	-0.429***
			(0.157)	(0.140)	(0.154)	(0.138)
Disabled			-0.557***	-0.859***	-0.513***	-0.842***
			(0.182)	(0.170)	(0.177)	(0.169)
No academic qualification			0.882***	0.636***	0.926***	0.656***
			(0.220)	(0.200)	(0.213)	(0.202)
O-level			0.675***	0.234	0.694***	0.240
			(0.173)	(0.152)	(0.168)	(0.153)
A-level			0.312	0.140	0.394**	0.176
			(0.200)	(0.181)	(0.198)	(0.183)
Other qualification			0.395***	0.066	0.355**	0.056
			(0.152)	(0.131)	(0.149)	(0.132)
On permanent contract			0.861***	-0.339	1.047***	-0.260
			(0.199)	(0.190)	(0.199)	(0.190)
Full-time			-0.185	-0.813***	-0.184	-0.789***
			(0.181)	(0.178)	(0.180)	(0.176)
Works over 48 hours			0.310**	-1.125***	0.200	-1.175***
			(0.127)	(0.111)	(0.127)	(0.112)

Skill same as required			1.606***	0.448***	1.556***	0.424***
			(0.102)	(0.089)	(0.102)	(0.088)
Professional			-1.578***	0.080	-1.555***	0.128
			(0.232)	(0.212)	(0.228)	(0.211)
Associate professional & technical			-1.234***	0.227	-1.275***	0.198
			(0.197)	(0.188)	(0.192)	(0.186)
Admin. & secretarial			-1.787***	0.479**	-1.686***	0.526***
			(0.194)	(0.186)	(0.190)	(0.189)
Skilled trades plant & mach.			-1.947***	0.999***	-1.828***	1.036***
			(0.206)	(0.204)	(0.201)	(0.208)
Personal & customer services			-1.161***	0.534**	-1.555***	0.357
			(0.229)	(0.222)	(0.229)	(0.223)
Elementary occupations			-1.685***	0.900***	-1.680***	0.915***
			(0.251)	(0.227)	(0.246)	(0.227)
Gross weekly pay <=110			0.557**	0.778***	0.468	0.722***
			(0.252)	(0.247)	(0.245)	(0.239)
Gross weekly pay 111-180			0.210	0.223	-0.011	0.147
			(0.214)	(0.196)	(0.214)	(0.196)
Gross weekly pay 261-360			-0.279	-0.666***	-0.117	-0.595***
			(0.168)	(0.159)	(0.165)	(0.157)
Gross weekly pay 361p			0.133	-0.732***	0.522***	-0.579***
			(0.177)	(0.171)	(0.180)	(0.172)
Log workplace age					-0.168**	-0.073
					(0.068)	(0.054)
No. of employees/1000					-0.359***	-0.130
					(0.125)	(0.103)
Manufacturing					-0.071	0.009
					(0.216)	(0.171)
Construction					1.008***	0.652***
					(0.316)	(0.232)
Wholesale & retail trade					0.510**	0.349
					(0.226)	(0.188)
Hotel and restaurant					0.469	0.151
					(0.274)	(0.250)
Public & community services					0.686**	0.699***
					(0.311)	(0.257)
Education					2.029***	0.784**
					(0.482)	(0.327)
Health					2.432***	0.961***
					(0.234)	(0.230)
Urban area					-0.241	-0.321**
					(0.159)	(0.145)
Unemployment to vacancy ratio					-0.066**	-0.006
					(0.029)	(0.024)
Constant	4.613***	1.458***	3.453***	2.717***	3.898***	2.943***
	(0.101)	(0.087)	(0.435)	(0.389)	(0.486)	(0.472)
No. of non-members	9213	9213	9213	9213	9213	9213
R-squared	0.005	0.000	0.077	0.093	0.103	0.099

Bootstrap standard errors from 500 replications in parentheses
*** p<0.01, ** p<0.05

Table 2A: SUR estimates of the wellbeing effect of unionisation on non-members, workplaces without collective bargaining coverage

	SUR1		SUR2		SUR3	
	Satisfaction	Anxiety	Satisfaction	Anxiety	Satisfaction	Anxiety
Union present (0/1)	-0.307	0.110	-0.338	-0.055	-0.385	-0.089
	(0.237)	(0.207)	(0.225)	(0.178)	(0.217)	(0.198)
Age<30			-0.140	-0.080	0.027	-0.019
			(0.202)	(0.185)	(0.198)	(0.184)
Age30-39			0.068	-0.048	0.183	-0.004
			(0.205)	(0.192)	(0.207)	(0.194)
Age50+			0.777***	0.874***	0.705***	0.857***
			(0.222)	(0.230)	(0.217)	(0.230)
Female			0.334	-0.567***	0.193	-0.584***
			(0.173)	(0.148)	(0.175)	(0.151)
Married			0.343**	-0.123	0.314**	-0.133
			(0.150)	(0.147)	(0.149)	(0.149)
White			-0.241	0.121	-0.366	0.053
			(0.394)	(0.347)	(0.381)	(0.351)
Children <7yrs old			0.005	0.015	-0.024	0.000
			(0.199)	(0.185)	(0.195)	(0.184)
Other dependents			-0.097	-0.316	-0.131	-0.326
			(0.206)	(0.191)	(0.201)	(0.191)
Disabled			-0.363	-0.466**	-0.248	-0.421
			(0.251)	(0.219)	(0.244)	(0.217)
No academic qualification			1.321***	1.169***	1.382***	1.187***
			(0.273)	(0.289)	(0.273)	(0.293)
O-level			1.014***	0.183	1.015***	0.176
			(0.240)	(0.214)	(0.238)	(0.217)
A-level			0.565**	0.320	0.634**	0.348
			(0.255)	(0.264)	(0.253)	(0.266)
Other qualification			0.662***	0.177	0.605***	0.162
			(0.215)	(0.185)	(0.214)	(0.184)
On permanent contract			1.250***	-0.040	1.382***	0.027
			(0.258)	(0.258)	(0.252)	(0.257)
Full-time			-0.468	-1.042***	-0.467	-1.015***
			(0.244)	(0.227)	(0.240)	(0.227)
Works over 48 hours			0.306	-1.398***	0.237	-1.425***
			(0.174)	(0.153)	(0.172)	(0.151)
Skill same as required			1.560***	0.405***	1.500***	0.378***
			(0.150)	(0.130)	(0.150)	(0.130)
Professional			-1.725***	0.022	-1.549***	0.090

			(0.367)	(0.282)	(0.368)	(0.279)
Associate professional & technical			-1.356***	-0.018	-1.340***	-0.016
			(0.260)	(0.247)	(0.253)	(0.250)
Admin. & secretarial			-1.815***	0.241	-1.662***	0.290
			(0.278)	(0.269)	(0.266)	(0.265)
Skilled trades plant & mach.			-1.791***	0.804***	-1.700***	0.841***
			(0.275)	(0.265)	(0.268)	(0.272)
Personal & customer services			-1.030***	0.371	-1.420***	0.225
			(0.319)	(0.283)	(0.319)	(0.284)
Elementary occupations			-1.872***	0.622**	-1.884***	0.659**
			(0.311)	(0.286)	(0.302)	(0.291)
Gross weekly pay <=110			0.623	0.744**	0.502	0.717**
			(0.368)	(0.331)	(0.355)	(0.326)
Gross weekly pay 111-180			0.016	0.144	-0.210	0.099
			(0.273)	(0.267)	(0.280)	(0.269)
Gross weekly pay 261-360			-0.301	-0.716***	-0.119	-0.644***
			(0.246)	(0.225)	(0.242)	(0.224)
Gross weekly pay 361p			0.240	-0.735***	0.686***	-0.580**
			(0.248)	(0.237)	(0.248)	(0.240)
Log workplace age					-0.114	-0.066
					(0.080)	(0.074)
No. of employees/1000					-0.849***	-0.294
					(0.304)	(0.258)
Manufacturing					-0.051	-0.014
					(0.283)	(0.234)
Construction					0.854**	0.668**
					(0.332)	(0.280)
Wholesale & retail trade					0.711**	0.407
					(0.279)	(0.230)
Hotel and restaurant					0.796**	0.027
					(0.321)	(0.340)
Public & community services					0.853	0.646
					(0.442)	(0.333)
Education					1.437	0.866
					(0.798)	(0.523)
Health					2.326***	0.776***
					(0.322)	(0.299)
Urban area					-0.328	-0.201
					(0.210)	(0.196)
Unemployment to vacancy ratio					-0.036	0.008
					(0.040)	(0.034)
Constant	4.558***	1.427***	3.238***	2.743***	3.466***	2.804***
	(0.121)	(0.109)	(0.603)	(0.568)	(0.631)	(0.662)
No. of non-members	4951	4951	4951	4951	4951	4951
R-squared	0.001	0.000	0.080	0.109	0.105	0.114

Bootstrap standard errors from 500 replications in parentheses
*** p<0.01, ** p<0.05

Table 3A: SUR estimates of the wellbeing effect of unionisation on non-members, workplaces with collective bargaining coverage

	SUR1		SUR2		SUR3	
	Satisfaction	Anxiety	Satisfaction	Anxiety	Satisfaction	Anxiety
Union present (0/1)	-1.034***	-0.161	-0.858***	-0.026	-0.861***	-0.062
	(0.216)	(0.197)	(0.210)	(0.175)	(0.224)	(0.193)
Age<30			-0.380	-0.349	-0.192	-0.277
			(0.251)	(0.225)	(0.241)	(0.223)
Age30-39			-0.213	0.093	-0.107	0.134
			(0.225)	(0.214)	(0.224)	(0.214)
Age50+			0.618***	0.809***	0.511**	0.750***
			(0.219)	(0.228)	(0.218)	(0.230)
Female			0.571***	-0.185	0.358	-0.238
			(0.193)	(0.165)	(0.188)	(0.172)
Married			0.537***	0.288	0.479***	0.262
			(0.174)	(0.169)	(0.169)	(0.169)
White			0.102	-0.271	0.046	-0.331
			(0.363)	(0.309)	(0.387)	(0.313)
Children <7yrs old			-0.146	-0.298	-0.223	-0.336
			(0.205)	(0.196)	(0.199)	(0.195)
Other dependents			-0.240	-0.419	-0.386	-0.453**
			(0.249)	(0.228)	(0.242)	(0.226)
Disabled			-0.754***	-1.252***	-0.785***	-1.279***
			(0.258)	(0.241)	(0.253)	(0.241)
No academic qualification			0.385	0.001	0.380	0.003
			(0.318)	(0.299)	(0.305)	(0.299)
O-level			0.278	0.286	0.324	0.304
			(0.265)	(0.233)	(0.253)	(0.234)
A-level			0.007	-0.048	0.120	-0.008
			(0.311)	(0.261)	(0.305)	(0.268)
Other qualification			0.127	-0.036	0.118	-0.044
			(0.229)	(0.205)	(0.224)	(0.206)
On permanent contract			0.478	-0.665**	0.728**	-0.559**
			(0.312)	(0.283)	(0.303)	(0.283)
Full-time			0.120	-0.586**	0.133	-0.588**
			(0.279)	(0.274)	(0.267)	(0.268)
Works over 48 hours			0.279	-0.821***	0.138	-0.896***
			(0.176)	(0.156)	(0.174)	(0.155)
Skill same as required			1.641***	0.483***	1.599***	0.463***
			(0.149)	(0.143)	(0.145)	(0.143)
Professional			-1.417***	0.102	-1.599***	0.095
			(0.308)	(0.307)	(0.313)	(0.316)

Associate professional & technical			-1.112***	0.477	-1.221***	0.368
			(0.306)	(0.280)	(0.302)	(0.280)
Admin. & secretarial			-1.738***	0.736***	-1.729***	0.739***
			(0.297)	(0.262)	(0.292)	(0.265)
Skilled trades plant & mach.			-2.051***	1.211***	-1.948***	1.212***
			(0.304)	(0.294)	(0.304)	(0.290)
Personal & customer services			-1.277***	0.747**	-1.632***	0.530
			(0.343)	(0.296)	(0.334)	(0.306)
Elementary occupations			-1.397***	1.262***	-1.405***	1.218***
			(0.370)	(0.349)	(0.359)	(0.340)
Gross weekly pay <=110			0.499	0.843**	0.448	0.762**
			(0.345)	(0.376)	(0.336)	(0.361)
Gross weekly pay 111-180			0.432	0.301	0.215	0.184
			(0.310)	(0.302)	(0.305)	(0.291)
Gross weekly pay 261-360			-0.189	-0.564**	-0.012	-0.482**
			(0.237)	(0.227)	(0.242)	(0.232)
Gross weekly pay 361p			0.109	-0.675***	0.461	-0.516**
			(0.263)	(0.252)	(0.254)	(0.251)
Log workplace age					-0.236**	-0.095
					(0.103)	(0.085)
No. of employees/1000					-0.325***	-0.114
					(0.120)	(0.116)
Manufacturing					-0.173	0.031
					(0.343)	(0.261)
Construction					1.038	0.629
					(0.537)	(0.441)
Wholesale & retail trade					0.173	0.227
					(0.350)	(0.294)
Hotel and restaurant					0.085	0.256
					(0.467)	(0.361)
Public & community services					0.424	0.742**
					(0.449)	(0.336)
Education					2.313***	0.817
					(0.496)	(0.439)
Health					2.467***	1.207***
					(0.384)	(0.346)
Urban area					-0.131	-0.500**
					(0.247)	(0.203)
Unemployment to vacancy ratio					-0.097**	-0.022
					(0.046)	(0.040)
Constant	4.713***	1.514***	3.724***	2.546***	4.497***	3.099***
	(0.159)	(0.152)	(0.625)	(0.516)	(0.749)	(0.644)
No. of non-members	4262	4262	4262	4262	4262	4262
R-squared	0.011	0.000	0.080	0.084	0.111	0.093

Bootstrap standard errors from 500 replications in parentheses
*** p<0.01, ** p<0.05

Table A4: Probability of being non-member in union workplaces

	Union workplace
Age<30	-0.243***
	(0.042)
Age30-39	-0.109***
	(0.041)
Age50+	-0.019
	(0.043)
Female	0.068**
	(0.034)
Married	0.094***
	(0.032)
White	-0.110
	(0.061)
Children <7yrs old	0.024
	(0.040)
Other dependents	0.057
	(0.042)
Disabled	-0.012
	(0.046)
No academic qualification	-0.242***
	(0.056)
O-level	-0.169***
	(0.046)
A-level	-0.043
	(0.055)
Other qualification	-0.128***
	(0.041)
On permanent contract	-0.178***
	(0.054)
Full-time	-0.062
	(0.050)
Works over 48 hours	-0.024
	(0.032)
Skill same as required	-0.117***
	(0.028)
Professional	0.066
	(0.060)
Associate professional & technical	0.052
	(0.052)
Admin. & secretarial	0.005
	(0.053)
Skilled trades plant & mach.	0.269***
	(0.055)
Personal & customer services	0.273***

	(0.057)
Elementary occupations	0.242***
	(0.062)
Gross weekly pay <=110	-0.193***
	(0.067)
Gross weekly pay 111-180	0.013
	(0.056)
Gross weekly pay 261-360	0.035
	(0.045)
Gross weekly pay 361p	0.119**
	(0.047)
Log workplace age	0.102***
	(0.013)
Sole establishment	-0.543***
	(0.032)
Urban area	-0.267***
	(0.037)
Unemployment to vacancy ratio	-0.011
	(0.009)
North east	0.304***
	(0.101)
North west	-0.110
	(0.084)
Yorkshire & the Humber	0.372***
	(0.091)
East midlands	0.080
	(0.092)
West midlands	-0.163
	(0.089)
East of England	-0.069
	(0.089)
London	-0.348***
	(0.108)
South East	-0.312***
	(0.085)
South West	0.004
	(0.088)
Scotland	-0.159
	(0.092)
Constant	0.219
	(0.144)
Log likelihood	-5712.456
LR Chi2(41)	845.84
No. of employees	9,213

*** p<0.01, ** p<0.05

The probit equation uses sampling weights.

Table A5: Results from overall covariate imbalance test.

Sample	Pseudo R2	LR chi2	p>chi2	MeanBias	MedBias

Union workplace					
Raw	0.069	845.84	0.000	6.9	3.9
Matched	0.003	31.08	0.870	1.7	1.3

Table A6: Descriptive statistics on non-members, by workplace union status

	Non-members, full sample				Non-members, union workplaces				Non-members, non-union workplaces			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Workplace union characteristics												
Union workplace (employee response based)	0.216	0.412	0	1	1.000	0.000	1	1	0.000	0.000	0	0
Workplace with collective bargaining cover	0.463	0.499	0	1	0.683	0.465	0	1	0.402	0.490	0	1
Employee characteristics												
Age<30	0.293	0.455	0	1	0.253	0.435	0	1	0.305	0.460	0	1
Age30-39	0.264	0.441	0	1	0.267	0.442	0	1	0.263	0.441	0	1
Age50+	0.216	0.412	0	1	0.222	0.416	0	1	0.214	0.410	0	1
Female	0.498	0.500	0	1	0.441	0.497	0	1	0.514	0.500	0	1
Married	0.643	0.479	0	1	0.688	0.463	0	1	0.630	0.483	0	1
White	0.944	0.230	0	1	0.948	0.221	0	1	0.943	0.232	0	1
Children <7yrs old	0.186	0.389	0	1	0.190	0.392	0	1	0.185	0.388	0	1
Other dependents	0.124	0.330	0	1	0.114	0.318	0	1	0.127	0.333	0	1
Disabled	0.100	0.301	0	1	0.106	0.308	0	1	0.099	0.298	0	1
No academic qualification	0.151	0.358	0	1	0.128	0.334	0	1	0.158	0.364	0	1
O-level	0.243	0.429	0	1	0.223	0.417	0	1	0.249	0.432	0	1
A-level	0.099	0.299	0	1	0.109	0.312	0	1	0.096	0.295	0	1
Other qualification	0.322	0.467	0	1	0.314	0.464	0	1	0.324	0.468	0	1
On permanent contract	0.923	0.267	0	1	0.936	0.245	0	1	0.919	0.273	0	1
Full-time	0.793	0.405	0	1	0.847	0.360	0	1	0.777	0.416	0	1
Works over 48 hours	0.486	0.500	0	1	0.527	0.499	0	1	0.475	0.499	0	1
Skill same as required	0.418	0.493	0	1	0.374	0.484	0	1	0.431	0.495	0	1
Managers & senior officials	0.153	0.360	0	1	0.183	0.387	0	1	0.144	0.351	0	1
Professional	0.085	0.280	0	1	0.101	0.301	0	1	0.081	0.273	0	1
Associate professional & Technical	0.146	0.353	0	1	0.138	0.345	0	1	0.148	0.356	0	1
Admin. & secretarial	0.193	0.394	0	1	0.181	0.385	0	1	0.196	0.397	0	1
Skilled trades plant & mach.	0.146	0.353	0	1	0.178	0.383	0	1	0.138	0.344	0	1
Personal & customer services	0.164	0.371	0	1	0.126	0.331	0	1	0.175	0.380	0	1
Elementary occupations	0.113	0.316	0	1	0.093	0.291	0	1	0.118	0.322	0	1
Gross weekly pay <=110	0.115	0.319	0	1	0.067	0.251	0	1	0.128	0.334	0	1
Gross weekly pay 111-180	0.103	0.304	0	1	0.071	0.257	0	1	0.112	0.316	0	1
Gross weekly pay 261-360	0.200	0.400	0	1	0.222	0.416	0	1	0.195	0.396	0	1
Gross weekly pay 361p	0.389	0.488	0	1	0.464	0.499	0	1	0.368	0.482	0	1
Workplace characteristics												
Log workplace age	3.072	1.072	0	6.802	3.323	1.161	0	5.858	3.003	1.035	0	6.802
Sole establishment	0.301	0.459	0	1	0.175	0.380	0	1	0.336	0.472	0	1

No. of employees/1000	0.261	0.574	.005	7.74	0.612	0.953	.005	7.74	0.164	0.355	.005	7.74
Manufacturing	0.193	0.395	0	1	0.335	0.472	0	1	0.154	0.361	0	1
Construction	0.069	0.254	0	1	0.039	0.194	0	1	0.078	0.267	0	1
Wholesale & retail trade	0.160	0.366	0	1	0.121	0.327	0	1	0.170	0.376	0	1
Hotel and restaurant	0.095	0.293	0	1	0.110	0.314	0	1	0.090	0.287	0	1
Public & community services	0.083	0.275	0	1	0.099	0.299	0	1	0.078	0.269	0	1
Education	0.032	0.175	0	1	0.075	0.263	0	1	0.020	0.140	0	1
Health	0.101	0.302	0	1	0.037	0.189	0	1	0.119	0.324	0	1
Urban area	0.819	0.385	0	1	0.776	0.417	0	1	0.831	0.374	0	1
Unemployment to vacancy ratio	3.385	2.422	0	9	3.184	2.185	.8	9	3.440	2.481	0	9
No. of non-members	9213				1992				7221			
No. of workplaces	1034				123				911			

Highlight

Spillover Effects of Unionisation on Non-members' Well-being

- The paper examines whether unionisation has a spillover effect on non-members' wellbeing.
- It compares wellbeing outcomes of non-members in union and non-union workplaces.
- We adapt the Social Custom Model of trade unions and conduct empirical analyses using rich linked employer-employee data on private establishments.
- The paper deploys alternative empirical approaches and a sensitivity analysis.
- The findings reveal that unionisation has a negative spillover wellbeing effect on non-members' job satisfaction.
- Results from sub-group analysis suggest the adverse wellbeing effect is specific to establishments covered by collective bargaining.

Key words: *Trade union; spillover effect; well-being; linked employer-employee data; Britain*.
JEL classification: *J5, J51, J28, J82*