Industrial and Corporate Change, Volume 21, Number 3, pp. 587–613
doi:10.1093/icc/dtr047
Advance Access published August 9, 2011

Innovative work practices and sickness absence: what does a nationally representative employee survey tell?

Petri Böckerman*,†, Edvard Johansson and Antti Kauhanen*****

This article examines the effect of innovative work practices on the prevalence of sickness absence and accidents at work. We focus on the "bundles" of workplace innovations that consist of self-managed teams, information sharing, employer-provided training, and incentive pay. We use nationally representative individual-level data from the Finnish Quality of Work Life Survey from 2008. The findings point to the conclusion that high-performance workplace system has little impact on the overall health of employees.

JEL classification: I12, J28.

1. Introduction

Innovative work practices such as self-managed teams and incentive pay have become a regular feature of contemporary human resource management. These workplace innovations aim at more flexibility in the work organization, enhanced labor–management cooperation, greater employee involvement in decision making, and financial participation of the employees (Ichniowski *et al.*, 1996). Most studies find that innovative work practices have positive impacts on firm-level performance (e.g., Ichniowski *et al.*, 1997; Bartel, 2004; Black and Lynch, 2004).[1]

*Petri Böckerman, Labour Institute for Economic Research, Pitkänsillanranta 3A, 00530 Helsinki, Finland. e-mail: petri.bockerman@labour.fi

**Edvard Johansson, Åland University of Applied Sciences, Neptunigatan 17, AX-22111 Mariehamn, Åland, Finland. e-mail: edvard.johansson@ha.ax

***Antti Kauhanen, The Research Institute of the Finnish Economy, Lönnrotinkatu 4B, 00120 Helsinki, Finland. e-mail: antti.kauhanen@etla.fi

†Main author for correspondence.

[1]However, Cappelli and Neumark (2001) report more mixed results.

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There is a much smaller body of literature on what innovative work practices do to employees, and the findings from it are contradictory. Some authors argue that employers gain at the expense of the employees (Ramsay *et al.*, 2000; Harley, 2005), while others maintain that in the high-performance workplaces both employers and employees end up being better off (Appelbaum *et al.*, 2000; Handel and Levine, 2004).

One part of the literature on the potential drawbacks of innovative work practices on employee outcomes concerns their effects on employee health. Traditionally, these questions have been approached on a case–study basis, as representative data sets containing information on both participation in innovative work practices and employee health outcomes have been lacking (ILO, 1998). However, this line of research has expanded in a more quantitative direction recently. Askenazy (2001), and Fairris and Brenner (2001) investigate the relationship between innovative work practices and workplace injuries using establishment data originating from Osterman's (1994) survey of United States establishments. They find evidence of a positive relationship between innovative work practices and various occupational injuries. Brenner *et al.* (2004) also find a positive relationship between innovative work practices and cumulative trauma disorders in their study using United States establishment-level data. Coles *et al.* (2007) study the connection between just-in-time production and sickness absence. Askenazy and Caroli (2006, 2010) use individual-level data from a supplement of the French Labor Force Survey from 1998 to examine whether there is a relationship between innovative work practices and mental strain, occupational risks, and occupational injuries. With the help of propensity score matching methods they discover that employees who are involved in innovative work practices are significantly worse off in terms of occupational hazards than those who are not. On the other hand, Askenazy and Caroli (2010) find that information and communication technologies provide employees with a safer workplace. Finally, there are related studies that examine the effects using information on satisfaction. Green and Heywood (2008) observe that performance pay increases job satisfaction. Jones *et al.* (2009) report that satisfaction with employer-provided training reduces absenteeism and Bryson *et al.* (2009) find that management innovations lower job satisfaction.[2]

In this article, we contribute to the literature on the employee outcomes of innovative work practices by studying their effect on sickness absence and accidents at work. While the studies that focus on cumulative disorders and other specific injuries or illnesses are useful, they may not capture the whole effect of innovative work practices. There may thus be effects on other illnesses and the general well-being of employees as well that can be captured by analyzing the prevalence of sickness

[2]Cristini *et al.* (2011) report positive effects of high-performance management on the employee outcomes in Denmark. Cottini *et al.* (2009) examine the effects of high-involvement work practices on labor turnover.

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absence. Also, by focusing on sickness absence, we are able to contribute to the literature on the determinants of sickness absence in economics (e.g., Barmby *et al.,* 2004), which has not paid particular attention to the effects of innovative work practices.

We use nationally representative individual-level data from the Finnish Quality of Work Life Survey from 2008, which includes information on participation in innovative work practices as well as information on sickness absence and occupational accidents. The survey contains information on several different aspects of workplace innovations (self-managed teams, information sharing, employer-provided training, and incentive pay). We start with straightforward probit models in which we explain sickness absence and treat innovative work practices as an exogenous variable. However, innovative workplace practices are arguably not randomly assigned to firms, but may be determined jointly with sickness absence. For this reason, the preferred estimates are based on the recursive models in which innovative work practices are treated as endogenous variables. The identification strategy is based on the use of information on foreign ownership.

The Finnish case has a broader interest for at least three reasons. First, innovative work practices have gained popularity in Finland rapidly during the past 10 years. A major part of this development has been caused by the foreign-owned firms that have been among the first to adopt these practices (Tainio and Lilja, 2003). Second, Finland has the highest share of sickness absenteeism in Europe (Gimeno *et al.*, 2004a).[3] Thus, sickness absences cause a substantial reduction in actual working time. Third, most of the existing literature use data from countries with very low union membership rates. According to the arguments in the literature, the outcomes for workers of innovative workplace practices can be different in countries with high unionization (e.g., Godard, 2001, 2004; Belangér *et al.*, 2002). In particular, the high unionization rate (∼70%) together with close co-operation between employees and employers in Finland should provide an exceptionally fertile ground for the benefits of innovative work practices to emerge. For this reason, it is interesting to examine whether one is still able to find some negative effects of these practices on the employee outcomes.

The rest of the article is structured as follows. Section 2 describes the conceptual framework. Section 3 introduces the data. Section 4 contains empirical analyses. Section 5 concludes.

[3]The earlier Finnish research on sickness absence (e.g., Kivimäki *et al.*, 2000; Virtanen *et al.*, 2001; Vahtera *et al.*, 2004) have used data from very specific sectors of the labor market, like the municipal sector. It has not considered the effects of innovative work practices.

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2. Conceptual framework

Innovative work practices increase employee discretion and opportunities to participate in decision making, give employees incentives to participate, and provide them with skills needed to participate (e.g., Appelbaum *et al.*, 2000). Increased discretion often follows from participating in self-managed teams, while the incentives are usually financial, and sufficient skills are achieved with employer-provided training. Such work practices transform the work of employees, especially in blue-collar occupations where discretion has traditionally been low.[4]

There are several theoretical frameworks that link work practices to health outcomes. Karasek's (1979) demands–control model postulates that jobs with high demands but low control lead to occupational stress. On the other hand, in this model, control offsets the effects of demands. Demerouti *et al.* (2001) emphasize that job demands may not lead to adverse health outcomes if health-protecting factors ("resources" in their terminology) are present. Examples of such organizational resources are job control, participation in decision making and task variety. In their model, job demands lead to exhaustion, while resources affect disengagement from work. High demands together with low resources lead to negative health outcomes. Siegrist (1996) argues that effort–reward imbalance at work leads to adverse health outcomes. If extrinsic or intrinsic factors lead to high effort that is not compensated by high rewards (in terms of money, esteem, or status control), emotional distress follows. While Karasek's model focuses only on situational factors, Siegrist's model takes personal characteristics into account through the impact of intrinsic factors on high effort. This is important, since the same personal characteristics that affect the effort–reward balance may also affect participation in innovative work practices. On the empirical side, there is ample evidence showing that both high demands and low control, and high effort and low rewards, lead to exhaustion, physical health symptoms and psychosomatic health problems (see e.g., de Jonge *et al.*, 2000 and references therein).

The impact of innovative work practices on employees has received attention recently. Two views stand out in the literature. The first view argues that innovative work practices make work more rewarding, meaningful and challenging by increasing discretion (e.g., Appelbaum *et al.*, 2000). This view predicts that employees should generally benefit from innovative work practices.[5] According to Karasek's (1979) demands–control model, increased discretion should lead to lower occupational stress. This view does not address the impact of innovative work practices on

[4]Some argue that the term "innovative" is not appropriate, since many of the work practices have been used for decades. However, the combination of these measures can be seen to reflect a new way of organizing work.

[5]See e.g., Kalmi and Kauhanen (2008) for more thorough discussion of the different views on the impact of innovative work practices on employees.

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workload directly, but, for example, in the view of Appelbaum *et al.* (2000) these practices should lead to working smarter, not harder. Thus, according to this view, innovative work practices should affect sickness absence only a little, and mostly through decreased stress.

The second view takes a more critical stance. This strand of literature argues that innovative work practices increase the workload and the pace of work, and in reality increase the control possibilities of employees only a little (Ramsay *et al.*, 2000; Harley, 2005). Berggren (1993) argues that while employee discretion may increase in other ways, they potentially lose control, especially over the pace of work. The increased pace of work, in turn, increases the likelihood of sickness absence and occupational injury. Again, according to the models discussed above, increased demands at work coupled with no change in discretion or rewards should lead to increased adverse health outcomes. Additionally, the new practices, such as self-managed teams, may substitute supervisor control with peer control, which can be more stressful for employees (Barker, 1993). Thus, according to the critical view, innovative work practices increase the incidence of sickness absence and occupational injuries by intensifying work and increasing stress.

Innovative work practices are most likely to transform the work of blue-collar employees. For this reason, it is likely that they have the largest effect on the sickness absence of blue-collar employees. In particular, the arguments about the increasing pace of work are most likely to be relevant for blue-collar employees. The case of innovative work practices and stress is more ambiguous: white-collar employees can be substantially affected by, for example, increased peer control also.

Different components of innovative work practices, such as self-managed teams, incentive pay, and training, may have a distinct and even contradictory impact on sickness absence. Incentive pay, especially in blue-collar occupations, may lead to an increased workload and pace of work. The Finnish collective agreements implicitly define different working speeds for the time rates and piece rates, but the apparent heterogeneity of workplaces makes it hard for the collective agreements to take into account all relevant aspects. Self-managed teams, on the one hand, give employees more discretion, but on the other hand they may increase stress, due to peer monitoring. Training may lead to higher competence at work, which in turn may lead to safer operations (Zacharatos *et al.*, 2005). Information sharing also potentially affects workplace safety and thus sickness absence (Zacharatos *et al.*, 2005).

Innovative work practices can affect short- and long-term sickness absence differently. If the critics are correct, and innovative work practices increase the pace of work, they may increase short-term sickness absence more than long-term sickness absence. On the other hand, if the impact comes mainly through stress, it may show up mostly in the prevalence of long-term sickness absence (e.g., Gimeno *et al.*, 2004b).

To sum up, it is *a priori* unclear whether innovative work practices affect sickness absence or not. The potential impact may vary in different employee groups or the practices may affect short- and long-term absence in different ways.

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3. Data

We use the latest wave of the Quality of Work Life Survey (QWLS) of Statistics Finland (SF) from 2008, because there has been a rapid expansion of innovative work practices in Finnish companies during the recent years. It is useful to capture this evolution. QWLS provides a representative sample of Finnish wage and salary earners (i.e., the self-employed are excluded), because the initial sample for QWLS is derived from a monthly Labor Force Survey (LFS) of SF, where a random sample of the working age population is selected for a telephone interview. The fact that QWLS is a representative sample of employees is a great advantage, because many of the earlier studies on the effects of workplace innovations have used data on a few manufacturing industries or single firms. The estimates for certain sectors and firms could be subject to substantial selection bias, if the unobserved factors that determine whether employees choose to work in the sector or firm also influence their absenteeism. Another very useful characteristic of QWLS is that the unit of observation corresponds to the "treatment" unit, because we have both the participation information and outcome measures at the individual level. This is particularly important, because the most natural level of analysis of employee outcomes such as sickness absence is the individual level. Furthermore, Ichniowski *et al.* (1996) argue that establishment and firm surveys may suffer from serious response bias, because the most successful firms with workplace innovations may be more likely to participate in the surveys. This problem does not prevail in our data.

The 2008 QWLS was based on LFS respondents in March and April who were 15–64 years old with a normal weekly working time of at least 10 h. A total of 6499 individuals were selected for the QWLS sample and invited to participate in a personal face-to-face interview. Out of this sample 4392 persons, or around 68%, participated (Lehto and Sutela, 2009). There has been a general trend that the response rates of the surveys are falling in Finland and elsewhere for various reasons. It is unfortunate that QWLS data is no exception to this trend. However, QWLS has still a very high response rate (68%) for a complex and burdensome face-to-face survey. Lehto and Sutela (2009: 151–153) provide a detailed analysis of response versus non-response. Their overall assessment is that non-response does not seriously undermine the representativeness of the QWLS data.[6] The average length of the interviews was 66 min. Face-to-face interviews ensure reliable answers to almost all questions. Owing to missing information on some variables for some employees, our

[6]We have also learned from personal communication with Anna-Maija Lehto (Statistics Finland) that researchers at Statistics Finland have made experiments by calibrating weights to the QWLS 2008 to account for non-response in the survey. However, the use of weights to account for non-response proved to have only a minor effect on the estimation results. This supports the thinking that non-response is not seriously undermining the representativeness of the data.

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sample size used with the estimations is about 4300 observations. This gives us considerable statistical power. QWLS is supplemented with information from LFS and several registers maintained by SF. For example, information about the educational level of employees originates from the Register of Completed Education and Degrees.

Sickness absences are documented as the number of days absent from work because of illness during the past 12 months. (The respondents have reported them by means of categories: the number of absences lasting 1–3 days, 4–9 days and those lasting at least 10 days. For the last category, the exact number of days absent is reported.) Sickness absences are self-reported, but there is no particular reason to believe that employees gave systematically biased answers, because their identity was not revealed to their employers after the survey.[7] QWLS also contains short sickness absences that are not recorded by the Social Insurance Institution (KELA), which pays out sickness benefits to the employees affected. The reason for this is that short sickness absences do not entitle employees to the payment of sickness benefits, but they obtain normal pay from their employers. This is an important advantage of QWLS, because most of the absences are short.[8] We form an indicator for those who have been absent at least once from work due to illness during the past 12 months. This indicator constitutes our most important dependent variable. We also use an indicator for those who have been absent over 15 days. The cutoff point of >15 days is based on the distribution of the total number of days absent.[9] In particular, the cutoff point of >15 days is roughly 1.5 times the average number of days of sickness absence during the past 12 months (~9 days), according to the QLWS data. Furthermore, we examine the effects of workplace innovations on the prevalence of accidents. Accidents are defined as incidents at work which have resulted in absence from work during the past 12 months. QWLS data do not contain information about the seriousness of accidents. This is unfortunate, because Askenazy and Caroli (2010) find heterogeneous results for the impact of innovative work practices in France depending on the seriousness of the accidents.

[7]To check the external validity of the measure of sickness absence, we have compared information from QWLS to the employer survey conducted by the Confederation of Finnish Industries (2007). These two sources give a comparable picture of sickness absence in the private sector. However, it is possible that there is some bias against self-reporting absence due to mental sickness. This could be a problem especially for white-collar workers. We are not able to quantify this potential bias.

[8]Roughly half of all employees in Finland can be absent from work at least 3 days without a medical certificate, according to the collective agreements.

[9]We calculate the total number of days absent by using the midpoints of self-reported sickness absence categories.

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We capture four different aspects of innovative work practices (i.e., high-performance workplace systems, HPWS). These measures correspond to the central pieces of a high-performance workplace from the point of view of employees, as outlined in Appelbaum *et al.* (2000). In particular, Becker and Gerhart (1996) argue that the four most common components of HPWS are self-managed teams, quality circles, employer-provided training, and contingent pay. We capture all of these, except quality circles. Self-managed teams are defined as teams that select their own foremen and decide on the internal division of responsibilities. Information sharing equals one if employees are informed about the changes at work at the planning stage rather than shortly before the change or at its implementation. Training equals one if the employee has participated in employer-provided training during the past 12 months.[10] Incentive pay equals one if the person has performance-related pay and bonuses are based on the employee's own effort. The different aspects tend to be positively correlated with the highest correlation coefficient (0.12) being between performance-related pay and employer-provided training.[11]

In this article, we examine the joint effects of innovative work practices, because workplace innovations are complementary in their effects rather than substitutes (McDuffie, 1995). Therefore, we focus on the "bundles".[12] Because there is no single definition for summary measures (e.g., Blasi and Kruse, 2006; Kalmi and Kauhanen, 2008), we follow a simple strategy. "Bundles" are captured by our variable HPWS, which equals one if more than one of the aspects of workplace innovations (self-managed teams, information sharing, employer-provided training, or incentive pay) is present. This is similar to Blasi and Kruse (2006), who define "strong innovators" to be firms that utilize four or more of the eight practices they concentrate on. Also, McDuffie (1995: 204) argues that multiplicative indexes suffer from the weakness that the index equals zero if any of the components is zero. The average of an indicator for those who have been absent at least once from work due to illness during the past 12 months is slightly higher for HPWS workers (0.66) than for

[10]For comparison, the means for the variables that capture self-managed teams, information sharing and training are very close to the ones reported by Kalmi and Kauhanen (2008) from the 2003 QWLS. Bassanini *et al.* (2005) observe by using various data sources from the 1990s that roughly 50% of all Finnish employees have received some employer-provided training in 1 year. This share is higher than in most other countries in Europe.

[11]Kauhanen (2009) provides a detailed descriptive account and discussion on the distribution of innovative workplace practices among different types of workers in Finland by using the 2003 QWLS. Because these patterns have remained essentially unchanged, the discussion is not repeated here.

[12]The working paper version reports the estimation results for each separate aspect of innovative workplace practices.

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non-HPWS workers (0.64). We include a vector of control variables to all models that can be regarded as 'the usual suspects', based on the absenteeism literature (e.g., Brown and Sessions, 1996; Holmlund, 2004; Dionne and Dostie, 2007). All specifications include 14 industry indicators. The exact definitions including the means and standard deviations of the variables are documented in the Appendix Table A1.

4. Results

4.1 Baseline estimates

To make it easier to understand the estimates from probit models, they are reported as marginal effects on the probability of being absent (or experiencing an accident at work). For binary variables, these are calculated as differences in the predicted probabilities. The baseline results in Table 1 treat HPWS as an exogenous variable. We report these results for comparison, because much of the literature has reported only associations between innovative workplace practices and various outcomes (e.g., Bryson *et al.*, 2009). The results reveal that the "bundles" of workplace innovations increase sickness absence, but they are unrelated to long-term sickness absence and accidents at work.[13] According to the point estimate, those who participate in HPWS have roughly a four percentage points higher probability of reporting a positive number of absences during the past 12 months, other things being equal.[14] Given that the mean of the dependent variable is 0.65 (Appendix Table A1), this represents roughly a 6% increase in sickness absence. For comparison, the results from the same model in the Appendix Table A2 reveal that females are ~5% more likely to report a positive number of absences and it is one of the stylized facts of the literature that females have higher sickness absence rates (e.g., Holmlund, 2004; Ichino and Moretti, 2009). Regarding the control variables (Appendix Table A2), the role of adverse working conditions as a determinant of sickness absence is particularly important, which is in accordance with the results of a study on the 1997 QWLS (Böckerman and Ilmakunnas, 2008).

We estimate models separately for employees with a different socio-economic status, because the evidence shows that employees in more complex (white-collar) jobs are more likely to participate in a HPWS (e.g., Kauhanen, 2009), and because, as argued earlier, the effects of innovative work practices on sickness absence may differ between socio-economic groups. Moreover, the content of training, the functioning

[13]The linear probability models that are estimated with OLS give very similar results.

[14]The 95% confidence intervals for the effect in Table 1 (Column 1) range from 0.0096 to 0.0734. Therefore, the zero effect is almost included to the 95% confidence intervals of this point estimate.

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Table 1 The effect of innovative work practices on sickness absence and accidents

	Sickness absence positive	Sickness absence >15	Accident positive
HPWS	0.0415** (0.0163)	0.0027 (0.0115)	−0.0027 (0.0055)
N	4290	4290	4290

Notes: Marginal effects reported. The (unreported) control variables are listed in the Appendix Table A1. Table reports the results from three different specifications. The estimation results for the control variables from the first model are reported in the Appendix Table A2. Robust standard errors in parentheses: ***$P<0.01$, **$P<0.05$, *$P<0.1$.

of teams, the features of incentive plans, and the nature of information sharing may differ between the employee groups, motivating separate analyses. The average of the HPWS variable is 0.25 and 0.57 for blue-collar employees and upper white-collar employees, respectively. Firms allocate authority to employees in uncertain, more complex settings that typically involve white-collar employees, because the employees have a better idea of the correct actions to take in these settings (Prendergast, 2002). However, it is useful to note that many white-collar jobs like call centre workers are not that different from blue-collar jobs, for example, in terms of autonomy. We do not present separate estimates for accidents among upper white-collar employees, because the incidence of accidents at work is very low among them. (The average of our Accident variable is 0.016 for upper white-collar employees.)

The estimates in Table 2 (Panels A and B) reveal that the positive effects of the "bundles" of workplace innovations on sickness absence are particularly pronounced for blue-collar and lower white-collar employees. This supports the argument that innovative work practices transform especially the work of blue-collar employees and thus affect their sickness absence most. Thus, there are no influences on the outcomes for upper white-collar employees (Table 2, Panel C). We also find that long-term sickness absence and accidents at work are not affected by the "bundles."

Next, we turn to the recursive models that constitute our preferred estimates, because the most serious concern of the simple reduced-form probit estimates is that innovative work practices may be endogenous in the sense that employees, for example, working in certain types of firms are more likely to be exposed to innovative work practices. The recursive modeling is also able to take into account otherwise omitted variables. For example, workplaces with extremely competent managers may have both high employer-provided training and fewer accidents. Furthermore, a person with a known sickness may not be exposed to HPWS by his employer even if the firm uses such practices, because there may be concerns about his ability to produce efficiently. This would result in a downward bias in any effect of HPWS on absence, because the sickness absence history is not observed. Selection may also take

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Table 2 The effect of HPWS on sickness absence and accidents

	Sickness absence positive	Sickness absence >15 days	Accident positive
A: blue-collar employees			
HPWS	0.0655** (0.0321)	0.0358 (0.0263)	−0.0164 (0.0181)
N	1306	1306	1306
B: lower white-collar employees			
HPWS	0.0519** (0.0249)	0.0077 (0.0176)	0.0046 (0.0068)
N	1723	1723	1723
C: upper white-collar employees			
HPWS	0.0055 (0.0301)	−0.0163 (0.0162)	..
N	1251	1251	

Notes: Marginal effects reported. The control variables are listed in the Appendix Table A1. Robust standard errors in parentheses: ***$P<0.01$, **$P<0.05$, *$P<0.1$.

place on the employee's side. Personal motivation and need for control may explain participation in HPWS if participation is voluntary. These same traits may be linked to sickness absence.

The recursive models are formed by means of two equations that are estimated jointly. We have the binary measure of HPWS. Thus, the first equation is

$$\text{HPWS}_i = X_{1i}\beta_1 + \varepsilon_{1i} \quad (1)$$

where i indexes the individuals. In the second equation, the prevalence of sickness absence (or accidents at work) is explained by the observed binary HPWS variable and variables X_2:

$$s_i = \gamma\text{HPWS}_i + X_{2i}\beta_2 + \varepsilon_{2i} \quad (2)$$

Thus, in the first equation, we explain the binary indicator of HPWS, by the variables X_1 in a probit model. X_1 includes individual and workplace characteristics. In the second equation, a binary indicator of sickness absence (or the prevalence of accidents at work) is explained in another probit model by HPWS and the variables X_2, which includes individual and workplace characteristics. Similar modeling strategy has been used in the context of sickness absence and job satisfaction by Böckerman and Ilmakunnas (2008).

The model forms a system of probit models that has an endogenous dummy explanatory variable (HPWS). We assume that there are unobserved characteristics and, therefore, the error terms (ε_{1i} and ε_{2i}) of the probit models are correlated. The unobserved characteristics can, for example, be unobservable individual health characteristics that influence sickness absence. This constitutes one reason why the results

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from the recursive models may differ from the ones based on the reduced-form models. The system is recursive, because the current individual sickness absence does not explain workplace innovations. This is a reasonable assumption, because innovative work practices are introduced by the management and thus individual sickness absence behavior should not explain workplace innovations.[15] It is possible to estimate the model as a bivariate probit model (Greene, 2003). No exclusion restrictions are needed for the identification of the parameters, because the model is nonlinear (Wilde, 2000). However, using the exclusion restrictions improves the validity of tests of exogeneity of the endogenous dummy explanatory variable (essentially, a test of whether the correlation of the error terms of the probit models is zero) (Monfardini and Radice, 2008). Thus, we assume that the variables X_1 and X_2 are not exactly the same.

The identification assumption of the recursive structure is that foreign ownership increases the probability to adopt workplace innovations, but it does not have an influence on the prevalence of sickness absence (and accidents at work).[16] The motivation for the exclusion restriction is that previous descriptive research has documented in detail that foreign owners have introduced new managerial policies in Finland (Tainio and Lilja, 2003). However, given the extensive controls in the equations it is unlikely that foreign ownership has an independent effect on sickness absence. Thus, foreign ownership appears in the first probit model for HPWS, but it is not included in the second probit model in which sickness absence (or accidents at work) is used as a dependent variable. Otherwise, the explanatory variables X_1 and X_2 of the two probit models are the same, as listed in the Appendix Table A1.

The results in Table 3 support empirically our approach for the exclusion of foreign ownership from the second probit model. The effect of foreign ownership on the "bundles" of workplace innovations is statistically and economically significant. The "bundles" are roughly 9% more likely to appear in foreign-owned firms, other things being equal (Table 3, Column 1). This finding is in accordance with the descriptive account of the dispersion of workplace innovations to Finland in Tainio and Lilja (2003), and the econometric estimates in Kauhanen (2009), based on the 2003 QWLS. In contrast, foreign ownership is clearly unrelated to the prevalence of sickness absence and accidents at work during the past 12 months (Table 3, Columns 2 and 3). Regarding the effects on sickness absence, this confirms the pattern reported in Böckerman and Ilmakunnas (2008). Note that the results in Table 3 present only supportive evidence, because the exclusion restriction is inherently a

[15]Innovative workplace practices are arguably not introduced based on expected individual outcomes in the Finnish system of collective agreements, but based on the evaluations made at the higher organizational level.

[16]The data do not allow us to identify specific foreign ownership. However, almost all foreign ownership in Finland originates from Western Europe.

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Table 3 The effect of foreign ownership on HPWS, sickness absence and accidents

	HPWS	Sickness absence positive	Accident positive
Foreign firm	0.0888*** (0.0264)	0.0198 (0.0240)	0.0016 (0.0087)
N	4290	4290	4290

Notes: Marginal effects reported. The control variables are listed in the Appendix Table A1. Robust standard errors in parentheses: ***$P<0.01$, **$P<0.05$, *$P<0.1$.

non-testable identification assumption.[17] However, it is important to note that foreign ownership is not even marginally significant in the absence equation (Table 3, Column 2). Thus, the significance level of the marginal effect of foreign ownership in the absence equation is 0.414. The optimal rates of absence can differ between firms for various reasons (Coles *et al*., 2007). However, the argument according to which heterogeneous costs of absence across firms should imply that foreign ownership is a determinant of absence is not valid in the Finnish institutional context, because the foreign-owned firms are subject to exactly the same legislation and labor market regulations regarding sickness absence as the domestic firms.

The results from the recursive models are summarized in Table 4. We report the marginal effects for HPWS from the second probit equation for sickness absence or accidents at work.[18] (The estimates for other explanatory variables included are not reported in order to save space, but they are available upon request.) The correlations between unobservables in Table 4 range from −0.17 to 0.27. These correlations are not statistically significantly different from zero, as revealed by the likelihood-ratio tests.[19] The most important finding is that the "bundles" of workplace innovations are not statistically significant determinants of sickness absence in the recursive

[17]We have also tested the role of foreign-ownership by using a slightly alternative approach. We have first estimated a probit model for sickness absence by including the HPWS variable and the controls, but excluding the variable for foreign-owned firms. Then we have estimated other probit model for sickness absence by including the variable for foreign-owned firms and the controls, but excluding the HPWS variable. The HPWS variable is highly statistically significant in the first model, but the variable for foreign-owned firms is not even marginally significant in the second probit model.

[18]The model identifies the local average treatment effect if the effect of HPWS on sickness absence is heterogeneous and the assumptions of the bivariate probit model hold. Marginal effects have been calculated as in Wooldridge (2001: p. 477).

[19]Precise estimation of the correlations between unobservables requires large samples (see Smith and Moffatt, 1999). It is unfortunate that the sample size is relatively small in this respect. This implies that the correlations are estimated imprecisely in our context, which manifests itself as large standard errors for the correlations. Exactly the same pattern has also been observed in the earlier

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Table 4 The effect of HPWS on sickness absence and accidents from recursive models

	Sickness absence positive	Accident positive
A: all employees		
HPWS	−0.0060 (0.1967)	−0.0228 (0.0834)
N	4290	4290
ρ	0.0814 (0.8281)	0.1319 (0.7847)
B: blue-collar employees		
HPWS	0.1438 (0.2287)	−0.0570 (0.1894)
N	1306	1306
ρ	−0.1705 (0.6975)	0.1496 (0.8034)
C: lower white-collar employees		
HPWS	0.1215 (0.2507)	−0.0258 (0.0586)
N	1723	1723
ρ	−0.1353 (0.8427)	0.237 (0.7025)
D: upper white-collar employees		
HPWS	−0.1406 (0.2915)	..
N	1251	..
ρ	0.272 (0.7333)	..

Notes: Each entry of the table reports the marginal effect of HPWS from different specifications of the bivariate probit model. Only dependent variable 2 (Sickness absence positive, Accident positive) differs between the estimations. ρ refers to the correlation coefficient between unobservables in the two equations that are estimated jointly. Standard errors in parentheses, except for ρ where *P*-value from the likelihood-ratio test is reported. Standard errors for the marginal effects are calculated by bootstrapping. Statistical significance: $^{***}P<0.01$, $^{**}P<0.05$, $^{*}P<0.1$.

models (Table 4). The marginal effects of HPWS are typically larger in absolute value than in Table 2, but the standard errors are also correspondingly larger. However, the standard errors of most of the control variables are very similar in the univariate and bivariate probits. Also, the marginal effect of HPWS for all employees that constitutes the headline estimate is lower (Table 4, Panel A, Column 1) than the one from the simple probit model (Table 1, Column 1).

4.2 Robustness checks

To check the sensitivity of the baseline results, we have estimated several additional specifications. We briefly discuss these results without presenting them in tables.

applications of the estimation method (see e.g., Evans and Schwab, 1995). Thus, this outcome is clearly not a feature of our application of the estimation method only.

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First, we have experimented with different sets of control variables and estimation samples. We have estimated the models by not including the variables that describe adverse working conditions, because they are self-reported. In particular, it is possible that these variables are picking up stressful outcomes that we measure via sickness absence and accidents, at least to some degree. However, the earlier findings do not change when working conditions are not controlled for. This prevails for both single equation and recursive models.

QWLS data also contain self-reported information on how many days an employee is entitled to be absent from work without a certificate from a doctor. We have used this information as an additional control variable, but its effect on the results is very minor. We have also estimated separate specifications for those who are entitled and for those who are not entitled to take up to three days sickness absence without a medical certificate. The only significant difference to the baseline results is that the positive effect of HPWS on short-term sickness absence that was documented in Table 1 is slightly weaker for those who are not entitled to take up to 3 days sickness absence without a medical certificate.

Furthermore, we have estimated specifications by using the most detailed industry classification that is available for QWLS data. Therefore, we have included 90 different industry indicators to the models in order to more fully capture heterogeneity among industries. However, this has only a very small influence on the effect of HPWS on sickness absence and accidents at work and all the conclusions remain unchanged. In addition, we have estimated the models for the private sector firms only. The conclusions remain the same in these specifications.

We have also tested the sensitivity of the estimation results to the inclusion of the wage variable. The results are not sensitive to conditioning on wages. This pattern prevails for both the simple probit models and bivariate probit models.

Second, we have made some changes to the definitions of the variables. We have experimented with variations to the cutoff point of >15 days for long-term sickness absence. In particular, we have estimated specifications that use cutoff points from 10 days up to 20 days. This has only a very small effect on the estimation results. Thus, the baseline results are not sensitive to the cutoff point of >15 days.

We have also estimated the single equation models by using the sum of individual aspects of workplace innovations as the independent variable, because the use of a simple indicator variable describing HPWS might throw away some useful information. The findings remain the same as in the baseline results of Table 1. Also, we have used principal component analysis to summarize information about different aspects of innovative workplace practices, because there is no single definition for summary variables. The analysis was done by using Stata's factor command which is designed for use with dummy variables. Principal component analysis reveals that only one factor obtains eigenvalue that is clearly above one accounting for 31% of the variance in innovative workplace practices. The earlier results remain the same when we use this factor instead of HPWS to measure innovative workplace practices.

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Because some authors (e.g., Sesil, 2005; Wood and Bryson, 2009) maintain that performance-related pay constitutes the support for HPWS, we have constructed a HPWS variable that equals one if incentive pay and at least one other aspect of workplace innovations are present. Furthermore, we have constructed a "bundle" that includes performance-related pay and self-managed teams. In these specifications "bundles" are not significant determinants of sickness absence, not even in the single equation models. We have also constructed count variables for having at least three, and having all four HPWS practices.[20] In these specifications, the HPWS variable is not statistically significant at the 5% level and the same pattern applies for both reduced-form specifications and recursive models. These estimation results point to the heterogeneity of the effects for the definition of the "bundles." More importantly, these specifications also provide additional support to the conclusion that the connection of HPWS to sickness absence in the simple reduced-form models seems to be rather specific to the use of the HPWS variable, which equals one if more than one of the aspects of workplace innovations is present. Therefore, the overall conclusion about the non-existence of relationship between HPWS and sickness absence is supported.

Third, we have estimated the models by using the 2003 QWLS, because of the expansion of innovative work practices between 2003 and 2008. For this reason, the 2003 QWLS captures the first movers better. As argued earlier, many of these first movers were foreign-owned firms. (The share of foreign-owned firms is 9% in the 2003 QWLS versus 13% in the 2008 QWLS.) Thus, it is possible to argue that the two-step identification strategy is even more relevant for the 2003 wave. The estimation results are very similar by using the 2003 QWLS. Therefore, the simple probit model reveals that HPWS increases the prevalence of sickness absence with a similar quantitative magnitude. Even more importantly, the effect of foreign ownership on the "bundles" of workplace innovations is significant, but foreign ownership is not related to sickness absence, by a wide margin. The bivariate probit results reveal again that HPWS is not a significant determinant of sickness absence. The fact that the estimation results are similar for both the 2003 and 2008 QWLS provides indirect evidence that the Finnish institutions are important for the interpretation of the results.

Fourth, we have experimented with alternative exclusion restrictions in the bivariate models. First, we re-estimated the model without any exclusion restrictions. It is possible to identify the parameters of the recursive model without exclusion restrictions, because the model is nonlinear (Wilde, 2000). The baseline results remain the same in this case. However, it is good practice to use exclusion restrictions for the reasons discussed earlier. Second, we used multiplant status as an exclusion

[20]These bigger "bundles" of workplace innovations are relatively rare in the data. For example, 11% of all the employees are affected by more than two different aspects of innovative workplace practices.

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restriction. Larger firms (and multiplant firms) are more likely to use HPWS (e.g., Kauhanen, 2009), whereas the size of the plant (as opposed to the size of the firm) is likely to matter for sickness absence. Again, using this restriction the baseline result remains the same. However, these results apply only to the private sector firms, since the question on multiplant status pertains only to the private sector organizations.

Finally, to explore additional sources of heterogeneity in the relationship, we have estimated the models separately for males and females. The single equation results reveal that the relationship between HPWS and sickness absence is stronger for females than for males. However, the recursive models do not reveal any significant differences in the effects between males and females. Therefore, there are no effects of HPWS on sickness absence when the endogeneity of HPWS is appropriately taken into account.

5. Conclusions

Prior research has shown that the introduction of innovative work practices most likely has a beneficial effect on firm-level performance. Here, we look at the impact on employees in terms of sickness absence and accidents at work. The conceptual framework suggests that the impact of innovative work practices on sickness absence may differ between employee groups and absence measures (any absence, long-term absence, accidents at work).

In single equation models, we find that participation in a HPWS increases short-term sickness absence. This finding is consistent with some of the earlier studies that have reported positive associations between innovative workplace practices and sickness absence. However, we do not find any associations regarding longer sickness absence or accidents at work. Also, the specifications that are estimated for the subgroups of employees reveal that HPWS increases short-term sickness absence only for blue-collar and lower white-collar employees. In contrast, in the case of upper white-collar employees we discover no evidence that HPWS are related even to short-term sickness absence. However, potential worry with the single equation models is that HPWS is arguably an endogenous explanatory variable.

To address the causal effect of innovative workplace practices on sickness absence and accidents, we use information on foreign ownership. The identification strategy is based on the argument that foreign ownership increases the prevalence of HPWS, but it does not have an influence on sickness absence or accidents. In recursive two-equation models that take into account the endogeneity of HPWS, we do not find any evidence that HPWS affects sickness absence. This holds irrespective of the employee group considered. The non-significant effect of HPWS on the prevalence of accidents remains intact.

Thus, the single equation and two-equation models lead to different conclusions about HPWS and short-term sickness absence. However, the estimates of the HPWS

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variable in the two-equation models are not very precise, which makes it hard to really distinguish the two sets of estimates from each other. Furthermore, if the effect of HPWS on sickness absence is heterogeneous, the univariate and bivariate models estimate different parameters. However, given that the alternative exclusion restrictions lead to similar conclusions, it is unlikely that the exclusion restrictions of the bivariate models pick up some peculiar group.

Additional analyses tend to support the result that HPWS has only minor effects on sickness absence. First, the only evidence of a significant positive relationship between HPWS and absence that we find pertains to short-term absence for blue-collar and lower white-collar employees when using single equation models (Table 2, Panels A and B). However, even this relationship is sensitive to the definition of HPWS. The robustness analyses revealed that the positive relationship is found in only some implementations of the HPWS variable. Second, it is essential to stress that the quantitative magnitude of the estimated effect of HWPS on short-term sickness absence is relatively small, even in Table 1. (The estimates are somewhat larger for blue-collar and lower white-collar employees in Table 2.) As discussed earlier, the zero effect is almost included to the 95% confidence intervals of the point estimate in Column 1 of Table 1 that constitutes the headline estimate of HPWS on sickness absence from single equation models. Third, we do not find any evidence of the effect of HPWS on long-term sickness absence or the prevalence of accidents at the workplace. This pattern is identical in both single equation and two-equation models. Consequently, the bottom line is that the findings point to the conclusion that HPWS has little impact on the overall health of employees.

The overall results are therefore contrary to the ones in earlier research, which has generally reported a positive relationship between HPWS and sickness absence. However, our outcome measures are broader than the ones considered previously, which has mainly considered cumulative disorders and other specific injuries. That our results are more positive from the employee point of view when compared to the few existing studies may also be partly due to the Finnish institutions. Concerning other employee outcomes, including job satisfaction, Kalmi and Kauhanen (2008) find, using Finnish data, that HPWS have mainly positive effects for employees, whereas in other literature the findings have been much more mixed. They hypothesize that the Finnish labor market institutions may affect these results. Cooperation between employees and employers arguably supports the benefits of innovative work practices.

Acknowledgements

This study has been funded by the Finnish Work Environment Fund. The authors are grateful to Alex Bryson, Derek Jones and two anonymous referees for very useful comments. Paul A. Dillingham has kindly checked the English language. The usual disclaimer applies.

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Appendix

Table A1 Definition of variables and descriptive statistics

Variable	Mean (SD)	Definition/measurement
Dependent variables		
Sickness absence		
Sickness absence positive	0.652 (0.477)	Person has been absent at least once from work due to illness during the past 12 months = 1, otherwise = 0
Sickness absence >15 days	0.155 (0.362)	Person has been absent over 15 days from work due to illness during the past 12 months = 1, otherwise = 0
Accidents		
Accident positive	0.052 (0.223)	Person has had an accident at work which has resulted in absence from work during the past 12 months = 1, otherwise = 0
Independent variables		
Innovative work practices		
Self-managed teams	0.091 (0.288)	Person participates in teams that select their own foremen and decide on the internal division of responsibilities = 1, otherwise = 0
Information sharing	0.351 (0.477)	Employees are informed about the changes at work at the planning stage rather than shortly before the change or at the implementation = 1, otherwise = 0
Training	0.603 (0.489)	Employee has participated in training provided and paid for by the employer during the past 12 months = 1, otherwise = 0
Incentive pay	0.271 (0.445)	Person has performance-related pay and bonuses are based on employee's own effort = 1, otherwise = 0
HPWS	0.410 (0.492)	More than one of the aspects (self-managed teams, information sharing, training or incentive pay) is present = 1, otherwise = 0
Wage		
Wage (1st group)	0.083 (0.276)	Gross monthly wage (excluding overtime bonuses) ≤ 1300€ = 1, otherwise = 0 (reference)
Wage (2nd group)	0.414 (0.493)	1301€ ≤ monthly wage ≤ 2300€ = 1, otherwise = 0
Wage (3rd group)	0.310 (0.463)	2301€ ≤ monthly wage ≤ 3300€ = 1, otherwise = 0

(continued)

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Table A1 Continued

Variable	Mean (SD)	Definition/measurement
Wage (4th group)	0.095 (0.293)	3301€ ≤ monthly wage ≤ 4000€ = 1, otherwise = 0
Wage (5th group)	0.097 (0.297)	Monthly wage ≥ 4001€ = 1, otherwise = 0
Working conditions		
Harm	0.254 (0.436)	At least one adverse factor that affects work 'very much' (includes heat, cold, vibration, draught, noise, smoke, gas and fumes, humidity, inadequate air conditioning, dust, dirtiness of work environment, poor or glaring lighting, irritating or corrosive substances, restless work environment, repetitive, monotonous movements, difficult or uncomfortable working positions, time pressure and tight time schedules, heavy lifting, lack of space, mildew in buildings) = 1, otherwise = 0
Hazard	0.381 (0.486)	At least one factor is experienced as 'a distinct hazard' (includes accident risk, becoming subject to physical violence, hazards caused by chemical substances, hazard of infectious diseases, hazard of skin diseases, risk of strain injuries, risk of succumbing to mental disturbance, risk of grave work exhaustion, risk of causing serious injury to others, risk of causing serious damage to valuable equipment or product) = 1, otherwise = 0
Uncertainty	0.685 (0.465)	Work carries at least one insecurity factor (includes transfer to other duties, threat of temporary dismissal, threat of permanent dismissal, threat of unemployment, threat of becoming incapable of work, unforeseen changes, threat of increase in workload) = 1, otherwise = 0
Discrimination	0.377 (0.485)	Person has fallen subject to at least one type of unequal treatment or discrimination in current workplace (includes time of hiring, remuneration, gain of respect, career advancement opportunities, allocation of work shifts, access to training provided by employer, receiving information, access to work-related benefits, attitudes of co-workers or superiors) = 1, otherwise = 0

(continued)

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Table A1 Continued

Variable	Mean (SD)	Definition/measurement
Heavy physically	0.041 (0.198)	Current tasks physically 'very demanding' = 1, otherwise = 0
Working time		
Temporary	0.121 (0.326)	Fixed-term employment relationship = 1, otherwise = 0
Part-timer	0.106 (0.307)	Part-time work = 1, otherwise = 0
Human capital variables		
Female	0.544 (0.498)	1 = female, 0 = male
Age (years)		
≤24	0.080 (0.272)	Age ≤24 years = 1, otherwise = 0
25–34	0.212 (0.409)	Age 25–34 years = 1, otherwise = 0
35–44	0.255 (0.436)	Age 35–44 years = 1, otherwise = 0 (reference)
45–54	0.269 (0.444)	Age 45–54 years = 1, otherwise = 0
55–64	0.184 (0.388)	Age 55–64 years = 1, otherwise = 0
Married	0.731 (0.444)	Married = 1, otherwise = 0
Children	0.840 (1.136)	The number of children under 18 years living at home
Comprehensive	0.141 (0.348)	Comprehensive education = 1, otherwise = 0 (reference)
Secondary education	0.445 (0.497)	Upper secondary or vocational education = 1, otherwise = 0
Polytechnic education	0.291 (0.454)	Polytechnic or lower university degree = 1, otherwise = 0
University education	0.123 (0.328)	Higher university degree = 1, otherwise = 0
Humanities	0.070 (0.255)	Field of education is humanities or teachers' education = 1, otherwise = 0
Business	0.172 (0.378)	Field of education is business, law or social science = 1, otherwise = 0
Technical	0.275 (0.446)	Field of education is technical, natural science or computer science = 1, otherwise = 0
Healthcare	0.132 (0.490)	Field of education is health care, social work, etc. = 1, otherwise = 0
Blue-collar employee	0.304 (0.460)	Blue-collar employee (hourly waged worker who is most likely low-skilled, without a post-secondary education; includes non-managerial, non-supervisory workers from agriculture, manufacturing and services) = 1, otherwise = 0 (reference)

(continued)

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Table A1 Continued

Variable	Mean (SD)	Definition/measurement
Lower white-collar employee	0.402 (0.490)	Salaried lower white-collar employee (clerical employee) = 1, otherwise = 0
Upper white-collar employee	0.292 (0.455)	Salaried upper white-collar employee (supervisor or manager) = 1, otherwise = 0
Work history (years)		
Tenure 0–2	0.335 (0.472)	Number of years at the current firm 0–2 years, otherwise 0 (reference)
Tenure 3–12	0.341 (0.474)	Number of years at the current firm 3–12 years, otherwise 0
Tenure 13–27	0.235 (0.424)	Number of years at the current firm 13–27 years, otherwise 0
Tenure >27	0.089 (0.285)	Number of years at the current firm over 27 years, otherwise 0
Self-assessed health		
Working capacity	8.500 (1.385)	Self-assessment of working capacity. The variable is scaled from 0 (total inability to work) to 10 (top condition)
Employer characteristics		
Public sector	0.346 (0.476)	Employer is state or municipality = 1, otherwise = 0
Foreign firm	0.130 (0.335)	Employer is private, foreign-owned enterprise = 1, otherwise = 0
Plant size <10	0.237 (0.425)	Size of plant under 10 employees = 1, otherwise = 0 (reference)
Plant size 10–49	0.398 (0.490)	Size of plant 10–49 employees = 1, otherwise = 0
Plant size 50–249	0.228 (0.420)	Size of plant 50–249 employees = 1, otherwise = 0
Plant size 250–999	0.096 (0.294)	Size of plant 250–999 employees = 1, otherwise = 0
Plant size >1000	0.041 (0.199)	Size of plant over 1000 employees = 1, otherwise = 0
Indicators for industries and regions		
Industries		14 dummies based on Standard Industry Classification
Regions		6 dummies based on the classification of NUTS2 regions by SF

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Table A2 The estimates for the controls

	Sickness absence positive
HPWS	0.0415** (0.0163)
Wage (2nd group)	0.0510 (0.0333)
Wage (3rd group)	0.0276 (0.0373)
Wage (4th group)	0.0136 (0.0444)
Wage (5th group)	−0.0187 (0.0497)
Harm	0.0467** (0.0188)
Hazard	0.0423** (0.0172)
Uncertainty	0.0249 (0.0171)
Discrimination	0.0360** (0.0161)
Heavy physically	0.0762** (0.0367)
Temporary	−0.0768*** (0.0276)
Part-timer	−0.0458 (0.0304)
Female	0.0532*** (0.0198)
Age (years)	
≤24	0.0315 (0.0348)
25–34	0.0544** (0.0235)
45–54	−0.1570*** (0.0233)
55–64	−0.2420*** (0.0291)
Married	0.0351* (0.0183)
Children	−0.0093 (0.0078)
Secondary education	−0.0308 (0.0268)
Polytechnic education	−0.0752** (0.0354)
University education	−0.0758* (0.0455)
Humanities	0.0511 (0.0370)
Business	0.0040 (0.0279)
Technical	0.0288 (0.0240)
Healthcare	0.0345 (0.0320)
Lower white-collar employee	0.0213 (0.0233)
Upper white-collar employee	0.0440 (0.0280)
Tenure 3–12 years	0.0228 (0.0202)
Tenure 13–27 years	−0.0130 (0.0247)
Tenure >27 years	0.0353 (0.0326)
Working capacity	−0.0583*** (0.0064)
Public sector	0.0249 (0.0250)
Foreign firm	0.0162 (0.0241)
Plant size 10–49	0.0609*** (0.0193)
Plant size 50–249	0.0891*** (0.0215)
Plant size 250–999	0.1340*** (0.0262)
Plant size >1000	0.0948*** (0.0364)
N	4290

Notes: The table reports the marginal effects for all included explanatory variables (excluding the indicators for industries and regions) from the first model of Table 1. Robust standard errors in parentheses: ***$P<0.01$, **$P<0.05$, *$P<0.1$.

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