





DOES JOB DESIGN MAKE WORKERS HAPPY?

Petri Böckerman* , Alex Bryson** , Antti Kauhanen***  and
Mari Kangasniemi**** 

ABSTRACT

Using linked employer-employee data for Finland we examine associations between job design, employee well-being and job-related stress. Three key findings stand out. First, in accordance with the theory of Karasek and Karasek and Theorell, job control and supervisory support are positively correlated with employee well-being and negatively correlated with job-related stress. Second, as predicted by theory, job demands are positively correlated with job-related stress. Third, there is no association between job demands and employee well-being and, contrary to expectations, neither job control nor supervisory support alleviate the negative relationship between job demands and job-related stress. Our results confirm the importance of job design for employee well-being.

I INTRODUCTION

In the standard labour supply model there is a marginal disutility to additional work because performing it eats into leisure time. Consequently, people are paid to work and will respond to financial incentives with greater effort at the extensive and intensive margins. Recent research on momentary well-being is consistent with this proposition: working is second only to being sick in bed when individuals are randomly dinged on their smartphone and asked how happy they are during an activity (Bryson and MacKerron, 2017). At the same time, paid work contributes to higher reported life satisfaction, even after controlling for income, and individuals report being more fulfilled when their lives include paid employment (Blanchflower and Oswald, 2011). Their life satisfaction is particularly adversely affected by bouts of unemployment. Indeed, unemployment is one of the few episodes in life that people struggle to recover from in happiness terms (Clark *et al.*, 2008).

*University of Jyväskylä (School of Business and Economics), Labour Institute for Economic Research and IZA

**University College London, NIESR and IZA

***The Research Institute of the Finnish Economy, University of Jyväskylä (School of Business and Economics)

****Labour Institute for Economic Research

These findings on the adverse and positive associations between well-being and paid employment are not necessarily contradictory. Rather they reflect the influence of paid work on different aspects of well-being: when individuals reflect back on their lives paid work contributes to satisfaction with that life but, at the margin, individuals would often rather be doing something else.

When examining the relationship between well-being and paid work one should be mindful not only of the different dimensions of well-being, but also that not all jobs are the same.¹ This literature began as far back as Adam Smith's discussion of compensating wage differentials in *The Wealth of Nations* (1776) in which he argued that workers were more likely to undertake jobs with poor working conditions where they commanded a higher wage to compensate them for those conditions. More recently a literature in psychology has revisited the issue of non-pecuniary job attributes and their influence on worker well-being. The seminal work in this field has been undertaken by Karasek (1979) and Karasek and Theorell (1990). The original model focuses on two key aspects of job design: the demands the job makes on the individual and the degree of control the employee has over aspects of their job (what Karasek termed 'job decision latitude'). Under the model job demands create job stress, thus having a negative impact on worker well-being, whereas job control has a positive direct influence on well-being, as well as being able to mitigate the adverse effects of job demands. It is the combination of low job control and high job demands that is associated with mental strain and job dissatisfaction. As we shall see in Section Two, many empirical studies confirm these propositions. Subsequent empirical studies have incorporated forms of job support (supervisory, co-worker and non-work) and find these can mitigate the effects of job demands on job stress.

We contribute to this literature in two ways. First, we seek to identify the association between job design and worker well-being taking into account worker selection into jobs that differs along the dimensions of job control, job demands and job support. We do so by conditioning on workers' labour market histories prior to entering their current job. Earlier research has shown that the wage returns to undertaking particular jobs are substantially overstated if one does not account for worker sorting along these dimensions (Böckerman *et al.*, 2013). Therefore, we consider the sensitivity of the link between job attributes and well-being to the inclusion of work histories. Second, we use rich nationally representative linked employer-employee data for Finland to see whether findings from the empirical literature hold in the Finnish setting.

The Finnish setting has broader interest for several reasons. First, Finland is known for its high take-up of high involvement management practices which are characterized by high levels of job control and job demands (Böckerman *et al.*, 2012). Second, in contrast to much of the literature which is

¹ Paid work, even if unpleasant in its own right, may allow the individual to earn the income that makes non-work periods pleasant.

conducted in Anglo-American countries with low unionization rates, Finland has high unionization. Prior research suggests that the outcomes for workers can be different in countries with high unionization (Godard, 2004). This may be the case with regard to job design, for instance, where union membership rates of around 70% in Finland imply a substantial worker say in how jobs are designed. Third, despite a potential role for worker voice in the implementation of job design, Finland has the highest sickness absence rate in the European Union (Gimeno *et al.*, 2004), raising questions about the link between job design and worker well-being. In addition to directly affecting job outcomes, unions may alter how strongly job demand, job control or job support affect job outcomes. To take one example, it may be that job support from a union representative is of higher 'quality' than job support from elsewhere if, for instance, the union has the power to challenge arbitrary employer behaviours.

We find that in accordance with the theory of Karasek (1979) and Karasek and Theorell (1990) job control and supervisory support are positively correlated with employee well-being and negatively correlated with job-related stress. As predicted, job demands are positively correlated with job-related stress. However, there is no association between job demands and employee well-being and, contrary to expectations, neither job control nor supervisory support alleviate the negative relationship between job demands and job-related stress.

II LITERATURE

Karasek's (1979) model of worker well-being as a function of job design has been labelled 'perhaps the most popular theory of the predictors of job well-being' (Wood, 2008, p. 156). It maintains that, when entered separately into a worker well-being equation in an additive fashion job demands adversely affect employee well-being, whereas job control is positively associated with well-being. Furthermore, in a multiplicative model in which job control and job demand are interacted with one another job control will mitigate the adverse effects of job demands. A large empirical literature has emerged testing these propositions. Reviews of the early empirical literature indicated substantial support for the additive model and some, though less compelling evidence, for the multiplicative model (van der Doef and Maes, 1999; de Lange *et al.*, 2003).

More recently regression analyses of British linked employer-employee data indicated that 'the characteristics of the job are considerably more important in influencing well-being than employee or workplace characteristics' (van Wanrooy *et al.*, 2013, p. 130) and provided strong support for Karasek's additive model using three different measures of worker well-being, namely job-related contentment, job-related enthusiasm and overall job satisfaction (van Wanrooy *et al.*, 2013, p. 129-134). These findings were broadly replicated in a subsequent comparative analysis of job satisfaction for Britain and France using linked employer-employee data (Bryson *et al.*, 2016, p. 204-205).

Payne (1979) added support to the demand and control model by arguing that various types of support at the workplace, particularly social support from supervisors and colleagues, could assist employees in dealing with high demands, thus lowering work strain and stress. Karasek and Theorell (1990, p. 68–76) subsequently incorporated support into Karasek's original model. Wood (2008, p. 156) identifies three channels by which social support may buffer the adverse effects of job demands: role clarity, helping people 'manage' their feelings better and, following Warr (2011), motivational support intended to reassure workers that their extra efforts will eventually reap rewards.

Early empirical studies found some evidence to suggest that low social support among those facing high job demands and low job control accentuated job strain (Payne and Fletcher, 1983; Landsberger *et al.*, 1992) and cardiac risk (Johnson and Hall, 1988). More recent evidence only finds partial support for the buffering role of social support. Sargent and Terry's (2000) study of university clerical workers found clear evidence that, when combined with high job control, high levels of supervisory support mitigated the adverse effects of job demands on both job satisfaction and feelings of depersonalization, whereas co-worker support and non-work support did not. Using nationally representative linked employer-employee data for Britain Wood (2008) finds that supportive management does not buffer the effects of job demands in raising job-related anxiety.

Analysts' desire to test the Karasek model has meant they have focused on the main effects of job demands, job controls and the interaction between the two, as well as the buffering role of social support. In doing so they have downplayed the independent effects of social support in isolation, and the other multiplicative effects when combining support, demands and control. This is somewhat surprising given the importance of social interactions to human beings in a range of contexts. Kahneman *et al.*'s (2004) Day Reconstruction Method study indicated that individuals prefer being with almost anybody compared to being on their own. Bryson and MacKerron (2017) find 'Talking, Chatting and Socialising' ranks seventh out of forty activities in terms of its association with momentary happiness, and that it is only when one is doing this that the underlying negative effect of working on momentary happiness is wiped out (Bryson and MacKerron, 2017, p. 16). It is possible that part of this 'social' effect at work is because being with others is a distraction from work activity, or is simply pleasurable in its own right.

However, a number of the studies discussed above also find supportive management has a *direct* effect on worker well-being. For instance Wood (2008) finds that supportive management, consultative management and informative management are all positively and significantly associated with lower job-related anxiety and higher job satisfaction. Similarly, van Wanrooy *et al.* (2013, p. 132–134) find that the main effect of their supportive management scale is positive and statistically significant in models estimating job-related contentment, job-related enthusiasm and overall job satisfaction. Bryson *et al.*

(2016, p. 204–205) also find this is the case for job satisfaction in their comparative analysis of British and French employees in the private sector.

One complication is that there is an exception to Kahneman *et al.*'s (2004) general finding that people are happier when they are with others. The exception is when they are with their boss. It seems likely that the effects of supervisory 'support' depend on the quality of the relationship between a worker and his or her supervisor. Recent evidence from Denmark finds that having an unsupportive boss leads to a large increase in the probability of voluntary quits (Cottini *et al.*, 2011). This might also explain why Sargent and Terry (2000) observe that supervisory support has no direct independent association with job satisfaction whereas the main effect of co-worker support on job satisfaction is positive and statistically significant. Using both British and U.S. data Artz *et al.* (2016) focus on boss competence and show that it is a very important determinant of employee job satisfaction.²

There are two potentially important drawbacks to the literature examining links between worker well-being and job design. The first is that the partial correlations presented in regression analyses pay little attention to non-random sorting into jobs by workers. This is a potentially important oversight since there is a substantial literature about workers and firms seeking good worker-job matches (Jovanovic, 1979). Where workers are heterogeneous in their tastes for hard work (job demands), and their desire for autonomy (job control), or where heterogeneous risk preferences mean employees place various amounts of weight on the support they will receive from their supervisor to perform a task, workers will sort into different types of job according to the utility they think they will derive from the job.³ At the same time, employers may signal their desire for certain types of worker conditional on the jobs they have available, as in the case of Lazear's (2000) model in which firms seek more productive workers through the use of incentive schemes. It seems very likely that worker sorting across firms arising from worker and employer choices, will result in non-random exposure to job demands, job controls and job support, imparting a bias to estimates of the links between job design and worker well-being if one cannot account for that sorting. *A priori* it remains unclear which way any bias may go. It depends, in part, on how efficient the labour market is in allocating workers to the jobs they would ideally like to perform. If certain types of jobs are rationed (in the sense that demand for them exceeds their supply), effects of

² The authors argue that boss competence plays an important role in workers' well-being because the quality of the decisions bosses make is a function of that competence and the quality of those decisions has a direct impact on the joint production of the worker and her supervisor which determines the worker's utility. They suggest that an expert supervisor is able to 'guide the pair to a jointly efficient outcome' (p. 6).

³ This is a finding that crops up in a number of settings. For example, Plug *et al.* (2014) show that gays and lesbians behave in response to their perceptions regarding the incidence of prejudice by sorting themselves into occupations with more tolerant employers and co-workers – the sort of behaviour one might anticipate when workers are concerned about the amount of job support they might receive from supervisors and colleagues.

job demands, for example may prove more negative for worker well-being than in a scenario in which all workers sort into the types of jobs that best suit their preferences.

We address sorting by conditioning on workers' labour market and earnings histories in the previous 10 years, as detailed in Section Three. There are two reasons to condition on work and earnings histories. The first is that employers seek out high ability workers to work in demanding jobs – that is, those with high demands and high job autonomy. This explains why the wage premium attached to 'high involvement' jobs falls conditioning on employees' work histories (Böckerman *et al.*, 2013). If there is a correlation between ability and well-being that is not accounted for in our model, this may bias our estimates of the links between job design and worker well-being.⁴ Conditioning on work histories therefore helps to identify potential (mis)allocation of workers to jobs, giving us greater confidence that the model accurately identifies the link between worker well-being and job design for 'like' employees. The second reason is that, as the programme evaluation literature makes clear, matching on work histories helps soak up otherwise omitted variables that can bias estimates of the effect of treatments on labour market outcomes (Barnow and Smith, 2015). Thus, notwithstanding concerns about non-random worker-job sorting, it is likely that conditioning on work histories will partial out otherwise unobserved worker heterogeneity which could potentially bias our estimates.

The association between prior unemployment and subsequent worker well-being is of particular interest. Previous studies confirm that past unemployment has a scarring effect on individuals' psychological well-being, even when conditioning on current employment status (Clark *et al.*, 2001). This could reflect the inhibiting effect of a poor work history in obtaining a higher quality of job in the future. However, no studies condition on current job quality when examining the links between past unemployment and current worker well-being.

A second potential limitation to the existing literature is that few studies examine the links between job design and multiple aspects of employee well-being. Consequently, it is difficult to know whether the different associations between job design and worker well-being reflect cross-study differences in methodology, the population of interest, sampling design and data items, or whether the differences reflect genuinely different associations between job design and alternative measures of worker well-being. This would not be a concern if well-being measures were really slightly different takes on the same underlying construct but this is not the case (Bryson *et al.*, 2017). As we show in the next section, we run analyses for two key worker well-being measures that have a low inter-item correlation.

⁴ Such a correlation is plausible. There is a literature indicating that the job satisfaction of workers is negatively correlated with observable indicators of ability such as education and earnings (Clark and Oswald, 1996). If observable and unobservable indicators of ability are positively correlated this would suggest the incorporation of work histories may mitigate the bias.

III DATA AND ESTIMATION

The analyses are based on the Finnish part of the European Meadow project *Measuring the Dynamics of Organisations and Work* conducted by Statistics Finland in 2010 (Meadow Consortium, 2010; Alasoini *et al.*, 2014).⁵ The aim was to gather comprehensive information on the changes in work organization and perceived working conditions. The survey covers both Finnish private and public sector organizations excluding employers that had fewer than ten employees in 2010.

Although employer representatives and employees were interviewed our analysis is based on the employees' survey which contains information on multiple facets of employee well-being.⁶ Respondents are confined to those who have worked at least one and half years in their current employer before interview. The response rate to the employees' survey was approximately 50%.⁷

The dependent variables in the regression models describe two crucial aspects of employee well-being.⁸ The first one is a well-being measure that is constructed by summing three items of the survey. The scale has a Cronbach's alpha of 0.85. We standardize the scale to have zero mean and standard deviation of unity. The first item asks: 'In your current job, do you feel enthusiasm and joy from working?' with responses coded 'a lot', 'a fair amount', 'some', 'little' and 'not at all'. The second item captures feelings and thoughts at work using three dimensions: 'I feel strong and energetic in my job', 'I feel enthusiasm about my job' and 'I feel satisfaction when I'm immersed in my work'. The responses to these questions are given with the alternatives: 'Every day', 'A few times a week', 'Once a week', 'A few times a month', 'Once a month', 'A few times a year' and 'Never'. The third item is: 'All in all, how satisfied are you with this job?', with responses measured on a four-point Likert scale from 'Very dissatisfied' (coded 1) to 'Very satisfied' (coded 4).

The second dependent variable captures perceived work stress. According to the survey questions stress means a condition where one feels oneself tense, uneasy, anxious or distressed or he or she has difficulties sleeping as worrying interferes with sleep. The responses were given on a five-point Likert scale from 'Not at all' (coded 1) to 'Very much' coded 5).

⁵ The Meadow project covers 14 research teams in EU countries.

⁶ Sampling was such that, in the vast majority of cases, there is only one respondent per employer.

⁷ When using the survey weights calibrated by Statistics Finland, the Meadow survey is representative of Finnish workplaces employing more than 10 workers. It is not necessarily representative of employees because the sampled employees had to have a tenure of at least 18 months (Minkkinen *et al.*, 2013). We use the survey weights in our analysis.

⁸ The Meadow survey contains a number of specific questions about employee well-being in which respondents were asked to assess perceived working conditions at their workplace. These include the experience of achievement, joy of working, trust and co-operation, expertise, management and supervisory work, taking care of employees' interests, adoption of employees' ideas and initiatives, boldness to propose fresh ideas that improve work, and fostering fairness. We report the estimation results for these additional items in the working paper version.

To evaluate the empirical validity of the Karasek model we consider the association between global measures of well-being and job control, job demands and organizational support. Job control is measured in terms of employees' influence over four aspects of their job, namely the tasks they perform, the pace of work, the order in which they carry out tasks, and the distribution of tasks among workers. The answers to these questions are available on a four-point Likert scale ('not at all' (coded 4), 'some' (coded 3), 'a fair amount' (coded 2) and 'a lot' (coded 1)). We reversed the original values so that higher values mean better control and formed a standardized scale.⁹ The scale has a Cronbach's alpha of 0.68.

Job demands are evaluated based on five separate questions. The first one asks 'How often does your job involve working to tight deadlines or at very high speed?', measured as a fraction of total working time with four pre-coded responses: less than 25%, 25–50%, 51–74% and 75% or more. The second measure asks 'How often do you carry out tasks related to your main job at home?', with alternatives 'never', 'occasionally', 'frequently'.¹⁰ The third measure asks 'How often you carry out tasks related to your main job outside your actual hours of work?', with alternative responses 'every day', 'at least once a week', 'at least once a month' and 'less often than once a month/never'. The fourth measure asks 'How often are you contacted by phone or in person on work-related matters outside your usual working hours' with alternatives 'every day', 'at least once a week', 'at least once a month' and 'less often than once a month/never'. The fifth measure is based on responses to the question 'Over the past 12 months how many hours per month have you worked overtime or done extra work during an average month?'. Responses are given in terms of numbers of hours. We have capped the number of overtime hours at 40 to reduce the impact of some very large values that are not consistent with the Finnish labour law. This affects 31 observations. Using these five items on job demands we create a standardized scale. The items are quite highly correlated. The scale has a Cronbach's alpha of 0.73.

Organizational support is identified with a single question which asks: 'In case of work overload or a difficult situation, do you receive assistance from... Your supervisor or manager; Your co-workers; Your clients or cooperation partners?' Pre-coded responses are 'always', 'sometimes' and 'never'. We form three different measures for job support. Supervisor support obtains the value of 1 if a worker obtains support always from his/her supervisor or manager (otherwise 0). The variables for co-worker support and client or cooperation partner support are formed similarly.

Initially we estimate models confined to the main effects for job control, job demands and organizational support. These are followed by models including the full set of interactions for job control, job demands and organizational support. We run Ordinary Least Squares (OLS) regression models for

⁹ See the Appendix for further details on how the standardized scales are created.

¹⁰ This question has also a category 'I only work at home', but we drop these observations.

our global measures of employee well-being, because OLS makes it easy to interpret the estimated coefficients. We control for the standard determinants of employee well-being based on the empirical literature. We control for log annual income from administrative data, age, gender, educational level (6 groups), 2-digit occupation (39 groups), tenure (i.e. work experience at the current employer) and 1-digit industry (15 groups).¹¹ To extrapolate the results to the population, we use survey weights that are calibrated and provided by Statistics Finland in all estimations. To account for the fact that there are a small number of workers who are employed in the same firms, the standard errors are clustered at the firm level.

The Meadow survey data are cross-sectional and include only very limited self-reported information on labour market experience. To account for employee sorting into different types of jobs we link the Meadow data to longitudinal register data from Statistics Finland.¹² The register data are the Finnish Longitudinal Employer–Employee Data (FLEED). The FLEED is constructed from a number of registers on individuals and firms that are maintained by Statistics Finland. We link the Meadow data and the FLEED using unique personal identifiers (i.e. identification codes for individuals). The number of observations used in the models is 1563.

Using FLEED we have followed the employees that were included in the Meadow survey in 2012 over the period 2001–2011. The work history variables are the average earnings, the number of unemployment months and earnings growth during the past 10 years.¹³ The past earnings data are introduced as the log of annual earnings. Earnings include the base wage, overtime pay, bonuses and wage supplements.

IV RESULTS

Table 1 reports means and standard deviations for key data items in the analysis for the estimation sample.¹⁴ Stress is coded on a scale from 1 to 5 and employee well-being is a summary scale. Job demands, job control and job support are composed of the items discussed in Section Three. For the purpose of analysis they are converted to standardized scores with a mean of zero and standard deviation of unity. The table also shows means and standard deviations for control variables taken from the survey and the three work history variables derived from the administrative data.

¹¹ Collective labour agreements are almost always binding also for non-union members in Finland. Thus, the coverage rate of collective labour agreements is about 90%. This implies that individual union membership is not relevant in Finland. For this reason, most Finnish surveys on work life such as the one that we use in the paper do not record the union status of individual workers.

¹² For an earlier application of the same idea in the Finnish context, see Böckerman *et al.* (2013).

¹³ For those who joined the labour force after 2001, the relevant measures are calculated using the maximum number of observations over the period 2001–2011.

¹⁴ Appendix Table S3 shows the incidence of jobs with all combinations of job support, control and demands in the data.

Table 1
Summary statistics

Variable	Mean	Std. Dev.
Outcomes		
Well-being	0.00	1.00
Stress	2.32	0.98
Job control, job demands, support		
Job control	0.00	1.00
Content	2.54	0.92
Pace	2.56	0.92
Order	2.18	0.95
Distribution of work	2.90	0.96
Job demands	0.00	1.00
Tight deadlines	2.87	0.91
Having to work at home	1.66	0.72
Working outside actual hours of work	2.94	1.02
Being contacted outside usual hours of work	3.07	0.93
Average overtime hours	8.99	9.72
Supervisor support	0.41	0.49
Co-worker support	0.64	0.48
Client or cooperation partner support	0.18	0.38
Control variables		
Log annual earnings	10.48	0.36
Age	44.02	11.37
Female	0.44	0.50
Level of education		
Lower Secondary	0.13	0.34
Upper secondary	0.52	0.50
Short-cycle tertiary	0.13	0.33
Bachelor's or equivalent	0.13	0.34
Master's or equivalent	0.08	0.27
Doctoral or equivalent	0.01	0.08
Tenure	10.09	8.31
Job history		
Log real average income in the past 10 years	7.72	0.58
Unemployment during the past 10 years (years)	0.34	0.82
Average real wage growth during the last 10 years	0.16	0.33

Notes: N = 1563 for all variables in the table. For the job demands and job control scales the summary statistics for the components are also shown. The detailed questions can be found in the appendix. The reference category for education in the models is lower secondary education.

Table 2 shows the partial correlations between job control, job demands and supervisor support with well-being in columns (1) to (5) and with job-related stress in columns (6) to (10). Control, demands and support are entered alone, then together, with the final model specification also conditioning on work histories. The models account for up to 29% of the variance in employee well-being and 24% of the variance in job-related stress.

Table 2
Job control, Job demands and Supervisor support

	(1) Well-being	(2) Well-being	(3) Well-being	(4) Well-being	(5) Well-being	(6) Stress	(7) Stress	(8) Stress	(9) Stress	(10) Stress
Job control scale	0.338*** (8.071)			0.290*** (6.322)	0.288*** (6.224)	-0.118* (-2.374)			-0.131** (-2.835)	-0.130** (-2.879)
Job demands scale		0.055 (1.063)		0.032 (0.693)	0.033 (0.703)		0.405*** (8.915)		0.414*** (9.665)	0.418*** (9.940)
Supervisor support = 1			0.547*** (6.147)	0.435*** (4.952)	0.441*** (4.974)			-0.325*** (-3.761)	-0.246** (-3.055)	-0.248** (-3.081)
Age	0.002 (0.073)	-0.003 (-0.102)	0.007 (0.269)	0.008 (0.305)	0.018 (0.576)	0.076* (2.570)	0.070* (2.382)	0.072* (2.423)	0.064* (2.241)	0.034 (1.038)
Age squared/1000	0.106 (0.255)	-0.032 (0.329)	-0.009 (-0.099)	-0.116 (-0.028)	-0.880 (-0.325)	-0.880** (-2.656)	-0.775* (-2.339)	-0.811* (-2.445)	-0.721* (-2.215)	-0.413 (-1.56)
Female	0.235* (2.420)	0.230* (2.168)	0.241* (2.392)	0.267** (2.781)	0.260** (2.706)	0.191 (1.946)	0.342*** (3.894)	0.181 (1.831)	0.322*** (3.616)	0.343*** (3.836)
Upper secondary	-0.040 (-0.286)	-0.183 (-1.180)	-0.146 (-0.965)	-0.038 (-0.277)	-0.043 (-0.316)	0.177 (1.278)	0.186 (1.571)	0.207 (1.511)	0.118 (0.924)	0.113 (0.900)
Short-cycle tertiary	-0.098 (-0.563)	-0.255 (-1.345)	-0.218 (-1.239)	-0.102 (-0.626)	-0.113 (-0.698)	0.098 (0.540)	0.085 (0.532)	0.133 (0.738)	0.013 (0.079)	-0.002 (-0.010)
Bachelor's or equivalent	-0.317 (-1.642)	-0.421* (-2.081)	-0.422* (-2.254)	-0.334 (-1.866)	-0.333 (-1.836)	0.259 (1.314)	0.288 (1.684)	0.296 (1.550)	0.249 (1.464)	0.218 (1.275)
Master's or equivalent	-0.295 (-2.295)	-0.629* (-2.417)	-0.639** (-2.721)	-0.546* (-2.554)	-0.564** (-2.634)	0.194 (0.911)	0.228 (1.244)	0.237 (1.129)	0.192 (1.035)	0.184 (0.998)
Doctoral or equivalent	0.264 (0.624)	0.140 (0.350)	0.124 (0.391)	0.194 (0.506)	0.193 (0.385)	0.037 (0.139)	-0.167 (-0.468)	0.098 (0.333)	-0.186 (-0.506)	-0.204 (-0.507)
Tenure	-0.021 (-1.255)	-0.011 (-0.596)	-0.006 (-0.350)	-0.016 (-0.961)	-0.012 (-0.698)	-0.003 (-0.158)	-0.007 (-0.457)	-0.009 (-0.539)	-0.005 (-0.359)	-0.007 (-0.425)

Table 2 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Well-being	Well-being	Well-being	Well-being	Well-being	Stress	Stress	Stress	Stress	Stress
Tenure squared	0.000 (0.854)	0.000 (0.422)	0.000 (0.249)	0.000 (0.715)	0.000 (0.541)	0.000 (0.091)	0.000 (0.627)	0.000 (0.323)	0.000 (0.566)	0.000 (0.639)
Log annual earnings	0.217 (1.710)	0.298* (2.054)	0.396** (2.911)	0.258* (1.970)	0.340* (2.014)	-0.003 (-0.018)	-0.331** (-2.581)	-0.080 (-0.541)	-0.317* (-2.425)	-0.378* (-2.119)
Log average income in the past 10 years					-0.065 (-0.600)					0.106 (0.770)
Unemployment during the past 10 years					0.041 (0.981)					0.034 (0.744)
Wage growth during the past 10 years					0.047 (0.333)					-0.159 (-0.968)
Adjusted R-squared	0.248	0.151	0.218	0.289	0.290	0.095	0.204	0.108	0.240	0.242
Observations	1563	1563	1563	1563	1563	1563	1563	1563	1563	1563

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. T-statistics are in parentheses. Variables included in the regressions but not reported in the table include industry (14 categories), and occupation (38 categories).

Throughout both job control and supervisor support are positively associated with well-being and negatively associated with stress.¹⁵ The size of the coefficients is fairly large. For example, a one standard deviation increase in job control increases well-being by about 0.3 standard deviations and reduces stress by about 0.13 standard deviations. Job demands are positively and significantly associated with stress, as predicted under Karasek's (1979) model. A one standard deviation increase in job demands increases stress by 0.4 standard deviations. Job demands are not significantly associated with well-being, although they are positively signed, perhaps reflecting the fact that some workers enjoy the challenges posed by their jobs, even when they create stress and anxiety.¹⁶ The size and significance of coefficients on control, demands and support do not vary greatly with model specification, with the exception of supervisor support where the coefficient falls but remains highly statistically significant with the introduction of job demands and controls.¹⁷

We hypothesized that the association between control, demand and support might be partly attributable to worker sorting across jobs according to their preferences and personality traits. If this is the case it is not picked up with the introduction of work history controls in models (5) and (10). These work history measures do not add to the variance accounted for in the model, they are not jointly statistically significant, and they do not have any material effect on correlations between control, demand and support and employee well-being and stress.

Table 3 incorporates interactions between job control, job demands and supervisor support to test the propositions that both job control and supervisor support should ameliorate the negative effects of job demands on employees' well-being and their positive effects on stress. Similarly to Table 2, two model specifications are presented: the first includes the basic control variables and the second adds work histories. None of the interaction effects are statistically significant, either jointly or independently, so there is no support for the mediating effects of job control and supervisor support. Encouragingly, the main effects for supervisor support and job demands reported in Table 2 are robust to the inclusion of the interaction effects. However, while the positive association between job control and employee well-being is robust, the negative coefficient for job controls in the stress equations falls in size a little and is only on the margins of statistical significance. In summary, there is no support for the mediation hypothesis.

Employees may receive job support from people other than their supervisors. To see how that support is associated with worker well-being and stress

¹⁵ If we use job satisfaction as a dependent variable instead of well-being, the results are similar.

¹⁶ We have confirmed that there is no evidence for non-linearity of the effects for job demand. Table S4 reports the relevant interaction effects and shows that they are not significant.

¹⁷ Results are similar when we exclude log annual earnings which might compensate employees for being in jobs they do not enjoy, or which cause them anxiety. This lends support to the non-existence of compensating wage differentials. These results are available on request.

Table 3
Job control, Job demands and Supervisor support with interactions

	(1) Well-being	(2) Well-being	(3) Stress	(4) Stress
Job control scale	0.272*** (4.732)	0.267*** (4.637)	-0.102 (-1.685)	-0.098 (-1.648)
Job demands scale	0.055 (0.865)	0.057 (0.898)	0.414*** (7.688)	0.418*** (7.874)
Job control scale # Job demands scale	0.057 (1.202)	0.057 (1.188)	-0.058 (-1.109)	-0.058 (-1.116)
Supervisor support = 1	0.451*** (5.044)	0.458*** (5.076)	-0.245** (-3.040)	-0.247** (-3.060)
Supervisor support = 1 # Job control scale	0.027 (0.274)	0.033 (0.336)	-0.051 (-0.646)	-0.061 (-0.804)
Supervisor support = 1 # Job demands scale	-0.023 (-0.280)	-0.025 (-0.301)	0.014 (0.183)	0.011 (0.158)
Supervisor support = 1 # Job control scale # Job demands scale	-0.086 (-1.235)	-0.092 (-1.329)	-0.010 (-0.127)	-0.002 (-0.031)
Age	0.008 (0.285)	0.019 (0.598)	0.063* (2.231)	0.034 (1.035)
Age squared/1000	-0.008 (-0.027)	-0.126 (-0.357)	-0.696* (-2.184)	-0.401 (-1.134)
Female	0.273** (2.818)	0.265** (2.734)	0.322*** (3.698)	0.343*** (3.908)
Upper secondary	-0.043 (-0.315)	-0.049 (-0.358)	0.127 (1.002)	0.121 (0.975)
Short-cycle tertiary	-0.109 (-0.660)	-0.120 (-0.736)	0.017 (0.102)	0.002 (0.010)
Bachelor's or equivalent	-0.341 (-1.880)	-0.340 (-1.849)	0.248 (1.453)	0.217 (1.259)
Master's or equivalent	-0.557** (-2.583)	-0.577** (-2.668)	0.193 (1.029)	0.185 (0.992)
Doctoral or equivalent	0.160 (0.338)	0.157 (0.329)	-0.185 (-0.465)	-0.203 (-0.521)
Tenure	-0.015 (-0.911)	-0.011 (-0.627)	-0.004 (-0.280)	-0.005 (-0.358)
Tenure squared	0.000 (0.702)	0.000 (0.507)	0.000 (0.417)	0.000 (0.507)
Log annual earnings	0.266* (2.029)	0.356* (2.103)	-0.296* (-2.253)	-0.348 (-1.958)
Log average income in the past 10 years		-0.073 (-0.669)		0.095 (0.687)
Unemployment during the past 10 years		0.042 (0.994)		0.035 (0.765)
Wage growth during the past 10 years		0.050 (0.356)		-0.165 (-0.994)
Adjusted R-squared	0.289	0.290	0.242	0.244
Observations	1563	1563	1563	1563

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. T-statistics are in parentheses. Variables included in the regressions but not reported in the table include industry (14 categories) and occupation (38 categories).

we replace supervisory support with support from colleagues in Table 4 and clients/business partners in Table 5. Table 4 indicates that colleague support is significantly associated with lower job-related stress, but is not associated with employee well-being. Echoing the earlier results, its interactions with job control and job demands are not significant. Client support is not statistically significant for employee well-being or stress, either in isolation or in

Table 4
Job control, Job demands and Colleague support with interactions

	(1) Well-being	(2) Well-being	(3) Well-being	(4) Stress	(5) Stress	(6) Stress
Job control scale	0.410*** (4.446)	0.376*** (4.650)	0.375*** (4.693)	-0.078 (-0.804)	-0.100 (-1.075)	-0.097 (-1.059)
Job demands scale	0.006 (0.086)	0.047 (0.678)	0.049 (0.705)	0.261*** (3.428)	0.356*** (5.030)	0.356*** (5.169)
Job control scale # Job demands scale	-0.003 (-0.043)	-0.010 (-0.173)	-0.010 (-0.173)	-0.047 (-0.621)	-0.057 (-0.826)	-0.057 (-0.844)
Colleague support = 1	0.171 (1.814)	0.086 (0.948)	0.092 (0.999)	-0.214* (-2.232)	-0.198* (-2.348)	-0.203* (-2.397)
Colleague support = 1 # Job control scale	-0.070 (-0.616)	-0.062 (-0.637)	-0.063 (-0.648)	-0.074 (-0.668)	-0.063 (-0.642)	-0.066 (-0.675)
Colleague support = 1 # Job demands scale	0.005 (0.058)	-0.037 (-0.467)	-0.038 (-0.482)	0.155 (1.796)	0.103 (1.332)	0.099 (1.298)
Colleague support = 1 # Job control scale # Job demands scale	0.016 (0.228)	0.020 (0.282)	0.017 (0.231)	0.001 (0.009)	-0.009 (-0.109)	-0.003 (-0.035)
Age		0.006 (0.211)	0.014 (0.441)		0.059* (1.998)	0.030 (0.884)
Age squared/1000		0.038 (0.126)	-0.053 (-0.146)		-0.658* (-1.985)	-0.371 (-1.007)
Female		0.239* (2.463)	0.234* (2.403)		0.330*** (3.737)	0.350*** (3.932)
Upper secondary		-0.054 (-0.393)	-0.058 (-0.424)		0.135 (1.067)	0.129 (1.036)
Short-cycle tertiary		-0.118 (-0.706)	-0.127 (-0.768)		0.044 (0.261)	0.029 (0.178)
Bachelor's or equivalent		-0.311 (-1.635)	-0.308 (-1.584)		0.238 (1.343)	0.207 (1.159)
Master's or equivalent		-0.526* (-2.280)	-0.539* (-2.326)		0.170 (0.895)	0.160 (0.845)

Table 4 (Continued)

	(1) Well-being	(2) Well-being	(3) Well-being	(4) Stress	(5) Stress	(6) Stress
Doctoral or equivalent		0.244 (0.604)	0.244 (0.598)		-0.194 (-0.564)	-0.214 (-0.632)
Tenure		-0.020 (-1.243)	-0.017 (-1.010)		-0.002 (-0.125)	-0.003 (-0.193)
Tenure squared		0.000 (0.859)	0.000 (0.709)		0.000 (0.365)	0.000 (0.442)
Log annual earnings		0.198 (1.467)	0.258 (1.458)		-0.256 (-1.883)	-0.307 (-1.680)
Log average income in the past 10 years			-0.047 (-0.397)			0.095 (0.677)
Unemployment during the past 10 years			0.033 (0.707)			0.036 (0.780)
Wage growth during the past 10 years			0.044 (0.297)			-0.156 (-0.920)
Adjusted R-squared	0.143	0.248	0.248	0.157	0.237	0.239
Observations	1563	1563	1563	1563	1563	1563

Notes: *p < 0.05; **p < 0.01; ***p < 0.001. Variables included in the regressions but not reported in the table include industry (14 categories) and occupation (38 categories).

Table 5
Job control, Job demands and Colleague support with interactions

	(1) Well-being	(2) Well-being	(3) Well-being	(4) Stress	(5) Stress	(6) Stress
Job control scale	0.352**** (6.051)	0.316**** (6.628)	0.315**** (6.613)	-0.162**** (-3.368)	-0.170**** (-4.171)	-0.171**** (-4.335)
Job demands scale	-0.000 (-0.010)	0.027 (0.498)	0.026 (0.489)	0.347**** (7.711)	0.420**** (8.947)	0.424**** (9.215)
Job control scale # Job demands scale	0.012 (0.305)	-0.007 (-0.190)	-0.009 (-0.243)	-0.075 (-1.567)	-0.078 (-1.841)	-0.076 (-1.841)
Client or business partner support = 1	0.051 (0.414)	0.001 (0.008)	0.002 (0.022)	0.097 (0.966)	0.125 (1.302)	0.127 (1.308)
Client or business partner support = 1 # Job control scale	0.094 (0.741)	0.096 (0.901)	0.092 (0.860)	0.067 (0.564)	0.060 (0.480)	0.065 (0.525)
Client or business partner support = 1 # Job demands scale	-0.028 (-0.271)	-0.056 (-0.573)	-0.053 (-0.538)	0.064 (0.806)	-0.010 (-0.129)	-0.007 (-0.095)
Client or business partner support = 1 # Job control scale # Job demands scale	-0.004 (-0.049)	0.047 (0.635)	0.047 (0.639)	0.130 (1.421)	0.079 (0.975)	0.081 (1.008)
Age		0.002 (0.063)	0.008 (0.248)		0.064* (2.217)	0.034 (1.045)
Age squared/1000		0.07 (2.468)	0.01 (2.402)		-0.74* (-2.253)	-0.44 (-1.229)
Female		0.243* (2.468)	0.238* (2.402)		0.344**** (3.959)	0.362**** (4.124)
Upper secondary		-0.061 (-0.439)	-0.064 (-0.459)		0.108 (0.893)	0.099 (0.837)
Short-cycle tertiary		-0.107 (-0.610)	-0.113 (-0.652)		0.017 (0.107)	-0.002 (-0.014)
Bachelor's or equivalent		-0.333 (-1.715)	-0.333 (-1.670)		0.219 (1.310)	0.184 (1.085)
Master's or equivalent		-0.535* (-2.340)	-0.546* (-2.371)		0.175 (0.960)	0.162 (0.893)
Doctoral or equivalent		0.257 (0.627)	0.257 (0.621)		-0.196 (-0.569)	-0.216 (-0.640)
Tenure		-0.021 (-1.317)	-0.019 (-1.115)		-0.003 (-0.195)	-0.003 (-0.223)

Table 5 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)
	Well-being	Well-being	Well-being	Stress	Stress	Stress
Tenure squared		0.000 (0.940)	0.000 (0.813)		0.000 (0.449)	0.000 (0.501)
Log annual earnings		0.208 (1.541)	0.265 (1.458)		-0.236 (-1.858)	-0.262 (-1.456)
Log average income in the past 10 years			-0.048 (-0.400)			0.071 (0.488)
Unemployment during the past 10 years			0.025 (0.547)			0.043 (0.956)
Wage growth during the past 10 years			0.024 (0.163)			-0.179 (-1.040)
Adjusted R-squared	0.137	0.248	0.247	0.151	0.232	0.234
Observations	1563	1563	1563	1563	1563	1563

Notes: *p < 0.05; **p < 0.01; ***p < 0.001. Variables included in the regressions but not reported in the table include industry (14 categories) and occupation (38 categories).

combination with job demands and controls. It appears that who is giving the support therefore matters, with supervisors playing a central role in employees' well-being and stress, while colleagues can help alleviate stress.¹⁸

V CONCLUSIONS

It is well-established in the psychology, labour economics and HRM literatures that job design is strongly correlated with worker well-being. The literature has tended to focus on those aspects of job design featuring in Karasek's (1979) and Karasek and Theorell's (1990) models, notably job control, job demands and organizational support. The empirical literature tends to find strong support for an additive model in which job controls tend to be positively correlated with employee well-being, whereas job demands are negatively correlated with employee well-being. More recently the literature has examined the proposition in the work of Karasek and Theorell (1990) and Payne (1979) that organizational supports may mediate the association between job demands and employee well-being. This literature finds mixed support for the proposition. However, much less attention has been paid to the direct relationship between organizational support (irrespective of its mediating role) and the literature has paid very little attention to non-random selection of workers into jobs. We address both of these issues using linked employer-employee data for Finland.

In accordance with the theory job control and supervisory support are positively correlated with employee well-being and negatively correlated with job-related stress, whereas job demands are positively correlated with job-related stress. However, there is no association between job demands and employee well-being and, contrary to expectations, neither job control nor supervisory support alleviate the negative relationship between job demands and job-related stress. The direct effects of organizational support have, arguably, been underplayed in the literature, perhaps because most of that empirical literature is motivated by the Karasek (1979) and Karasek and Theorell (1990) models which focus primarily on job controls and demands, elaborating on the role of support primarily as a mediating factor. Our findings suggest the direct, independent role of organizational support is deserving of much greater attention. We also find that omitting job support does not have any material effect on the size of the correlations between worker well-being, on the one hand, and demand and control on the other.

The effects of organizational support are most pronounced in relation to supervisor support, are still apparent in most cases with respect to co-worker support, but are absent with respect to the support of clients and business partners. Future research is required to establish the mechanisms underpinning these different results.

¹⁸ If all three support variables are incorporated in the model at the same time the ranking remains intact.

Our results are relatively insensitive to the configuration of variables used to construct the items.¹⁹ Furthermore, the results are not sensitive to the incorporation of work histories data, suggesting worker selection into jobs of different types is not biasing the relationships described above. Our findings differ somewhat from those in the literature in two respects. First, we find that neither job control nor job support mediate the relationship between job demands and job-related stress. Second, although job demands are associated with greater job-related stress, they are not associated with lower employee well-being. One reason for these differences could be that ours is the first paper to present results for a country (Finland) where unionization rates are high – considerably higher than in the Anglo-US countries which feature heavily in the empirical literature. It may be that the influence of unions on the nature of job design, and the nature of social support at work, could affect the associations between worker well-being and job design. Second, our measures of job control, job demands and job support differ from other studies. However, the definition of these concepts tends to differ across most studies and, in any case, our survey measures are fairly complete compared to those featuring in other studies.

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¹⁹ Some of these sensitivity checks are reported in Appendix Tables S4 and S5. Others are available from the authors on request.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

- Table S1.** Job control, Job demands, Job support, and Labor market history.
- Table S2.** Job control, Job demands and Support with additional control variables.
- Table S3.** Prevalence of different combinations of Job control, Job demands and Support.
- Table S4.** Job control, Job demands and Supervisor support as dichotomous variables.
- Table S5.** Three types of support simultaneously.
- Table S6.** Different measures of Job demands.
- Table S7.** Job control, Job demands and Supervisor support (Table 2) without log annual earnings as a control variable.

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