Psycho-social risk factors at work and their relations to jobsatisfaction

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Abstract.
This paper looks into the relationships between job satisfaction and evidence-based risk factors in the work environment like conflicts, social support, time pressure, influence, flexibility of work schedule and predictability. Physical risk factors like noise and heavy lifts are used for sensitivity analysis only. The analysis is carried out using individual assessments of working conditions in a representative cohort of 5.000 Danish employees at two points in time, 1995 and 2000. It is the first time these data are used in an economically, analytical context.
Method: Two types of regression analysis were performed, one based on the pooled cross-sections using unconditional likelihood for estimation and one with fixed effects eliminated using conditional likelihood as estimation method. The latter is applied in order to control for fixed personal characteristics. Only individuals who change their reported level of job satisfaction from 1995 to 2000 are used in the conditional likelihood analysis. In the first type of analysis, controls were made for tenure in job, gender, marital status, education, wage and having a leading position. In the fixed-effects analysis, controls were made for tenure in job, marital status, education, wages and having a leading position. Sensitivity analysis was carried out with regard to physical work environment and the year on which the cross-section is based. Two outcomes are investigated, being highly satisfied with the job and being dissatisfied with the job.
Results: Predictability, influence and role clearness have significant impact on all levels of job satisfaction. Development, flexible working hours and social support are significant predictors for having a high level of job satisfaction only whereas working under time pressure only turned out to be a stable and significant predictor of being dissatisfied. Wages is positively and significantly correlated with the overall job satisfaction measure when fixed effects were controlled for. Gender, marital status, education, leader status and tenure were insignificant when all factors are considered.

Introduction

The fact that most companies today consider human resources to be their most important asset has lead job satisfaction to be an important indicator of future opportunities. At the same time, case studies (1-10) have evidenced, that interventions for improving the work environment are having derived positive effects on company productivity, quality as well as the motivation of the employees. Despite these facts, the ways of linking work environment to company performance and employee satisfaction are not studied to any wide extent among economists. The purpose of this paper is to investigate the relationship between work environment, and in particular psycho-social health risk factors, and job satisfaction. The results of the analysis should increase the knowledge of interactions between work environment and the well-being and satisfaction of employees, as to provide the necessary insight for human resource management to handle with these job factors.

The paper starts out reviewing methodological and theoretical issues regarding the concept job satisfaction as well as previous research within the area. After this, concurrent theories within occupational health research are presented and discussed. The analysis and its results should be applicable in both an economical and a psychological frame of reference by integrating standard economic variables alongside with evidence based psycho-social health risk factors known from work psychology.

The paper uses Danish nationwide data on individual employee assessments of the work environment (DWECS) in the years 1995 and 2000. 3,800 of the 5000 participants in DWECS in 1995 and 2000 were interviewed both in 1995 and 2000. From these, a balanced data set consisting of responses from 3427 wages earners was constructed.

Job satisfaction is a subjective measure and there are very strong arguments for the fact that individuals scale their feelings towards their job differently, though facing the same objective working conditions. Panel data are especially suitable for analysing this type of outcomes. Different methods will be able to account for bias emerging from unobserved personal characteristics, or heterogeneity. A recent study on the factors influencing the level of job satisfaction has shown that taking into account unobserved personal traits reduces the number of explanatory variables considerably (11).

Using the definition applied by Freemann (12) and others, job satisfaction is a positive emotional state resulting from the appraisal of one's job. The appraisal will obviously be influenced by the state, or mood, an individual is in. Other factors also contribute to the subjectivity and complexity of determination of job satisfaction. As pointed out both by Freemann and another economist, Hammermesh (13) expectations of ones job will heavily influence the way the job is evaluated. For this education pay an important role, but also looking at what other receives in reward for their jobs and attributes of alterative jobs. Moreover, people may select themselves into a high level of job satisfaction by investing more in their labour market relations. Thus some individuals, apart from those who are always content, always have a highly satisfying job.

The value of job satisfaction in a labour economical context is established through looking at observable consequences of job satisfaction, thus compromising the problem of measuring what people think or feel rather than what they do. Several studies in an economic context have evidenced the effects on job satisfaction on quits (14, 15). Other studies have shown the effects of job satisfaction and motivation on absenteeism (16, 17) as well as turnover (18) and counterproductive behaviour (19).

As for determinants of job satisfaction, standard economic determinants are union membership where studies have showed that the effect of union membership has changed in recent years, from having a negative influence on job satisfaction to a positive, macro-economic variables like business cycles and unemployment rates, and demographic variables like gender, age, family relations, education tenure and job sector, alongside with micro-economic standard variables like wages and working hours. This analysis will integrate these variables to a large extent.

Some argues that job satisfaction captures omitted variables in determination of labour market outcomes, whereas for this analysis, the aim is to try to uncover some of these omitted variables. A recent study by Westergaard and Kristensen (20), suggest that other job attributes have important implications for the estimates of demographic variables when more detailed job characteristic are integrated in the analysis.

As for the relation between occupational health and job satisfaction, research in occupational health relationships has confirmed the relationships between job satisfaction and work environment as far back as in the eighties, and later on, job satisfaction has been treated both as cause of occupational illness (21), and a symptom of occupational illness (22). Furthermore, there is evidence, that work environment can influence the employee's ability to stay at the work place (23), employee long-term absence from work due to illness (24, 25), productivity (1, 4, 9) as well as the general attitude towards the work place and co-workers.

Within management research which stands for most of the studies on job satisfaction, the relationships assessed have been between job satisfaction and a number of job parameters, work environment as a whole counting as one parameter (26, 14) or not measured at all.

Theory and method

The analyses in this paper should establish the impacts of individual work environments parameters in a context that takes other determinants of the well being and attitude towards the job into consideration. The results should be applicable to a representative group of employees. All the data in this analysis is based on questionnaires, meaning the method is subjective and may be influenced by the observer. The dependent variable, job satisfaction, is also subjective and consequently a methodological challenge in the analysis is to ensure that results are robust in regard to the influence from personal traits.

In this paper, the scale on which job satisfaction is measured is a global rather than a facet job satisfaction measures. Newer studies are to an increasingly degree concerned with measuring satisfaction as facets of various aspects of a job instead of using global measures but still there is a lot more freedom for analysis when using raw measures as determinants of job satisfaction. In the data available for these analyses, the wording of the question on job satisfaction is: "Are you satisfied with your job? The answers fall in 4 verbally labelled and ordered categories.

The two-factor model by Herzberg (27) was one of the earliest models on job satisfaction and motivation that gave explicit credit to the work environment. Work environment was recognized as a hygiene or maintenance factor, being able to influence employee job dissatisfaction rather than increasing job satisfaction, or at least only for a short period of time. The model was based on "critical incident interviews", in which the respondent is asked to describe events where they had felt either exceptionally good or exceptionally bad in terms of the objective situation in which the feelings occurred, the duration of the feelings and the effects on performance. The factors of the model were extracted from the interviews, and divided into categories according to the length of the feelings experienced and leveled according to their relative frequency.

As factors which could invoke long-lasting positive feelings towards the jobs, “motivators”, were achievement, influence, possibility of growth, recognition, advancement and work itself. As maintenance, or short-lasting motivators, were: wages, job security, working conditions, interpersonal relations, company policy and administration, effects from work on personal life and supervision in terms of technical support and advice.

In contrasts to maintenance factors, *motivators* lead to satisfaction because of the need for growth and sense of self-achievement, and these needs are mainly related to the intrinsic values of work, in opposition to the extrinsic values of work, like interpersonal relations and physical working conditions.

Still today, job attributes are often referred to as intrinsic or extrinsic factors (11). But the job factors assigned to either the intrinsic or the extrinsic values of work differ. Herzberg considered working conditions as those not including factors in the job related to any intrinsic values. Thereby, possibility of growth and influence are not included as parts of the working conditions. Both influence and possibility to learn new thing through ones job are in fact major health protecting factors, which will be discussed in the following sections.

The work environment factors to be considered in this combined analysis also have to meet some criteria in that they should have proved to be risk factors, with a negative health outcome. This holds for hazardous factors in the chemical and physical work environment which have for a long time been recognised to have serious negative effects on employee health. But due to the fact that an increasing part of the labour force is occupied within “knowledge-work” also an increasing amount of psychological work factors meet this criterion.

Three widely used concurrent theories within research in the psycho-social work environment are the Demand-Control-Balance theory, elaborated by Karasek (28), the Action-Theoretical Approach, still under development by different researchers (29) and the Effort-Reward Balance theory by Sigrist. (30).

The Demand-Control-Balance model incorporates effects from job decision latitude and psychological demands. Psychological job demands, or job strain, encompass quantitative job demands, time pressure and conflicting job demands. Workers exposed to high job strain, defined as the combination of a high degrees of these psychological demands and low control or decision latitude in meeting those demands have an increased risk of a number of somatic diseases, notably cardiovascular diseases. Later studies (31) have shown that social support from colleagues and managers can offset the negative consequences of high job strain. Job strain has been associated with diseases like musculoskeletal disorders, cancer, psychiatric illness, gastrointestinal illness, suicide, sleeping problems and diabetes (32).

The Action-Theoretical Approach strives to make an objective measurement of the work environment, in terms of interviews where an observer both observes and asks questions to understand the observations. According to this theory, the following principles should be used for the job design: choice of own work strategy, work should encompass complete action, minimizing outside events and interruptions, allowance for activeness in work, enhancing of the control and qualifications of employees and finally should work provide feedback.

The Effort-Reward imbalance model integrates the negative effects of low status control, high extrinsic or intrinsic effort, in combination with low gain. High efforts in combination with low rewards have been shown to have an impact on stress, sudden cardiac death and hypertension. The effort-reward model is based on nearly solely subjective assessment of the work environment, but the concept of fairness is increasingly being recognized as important for workers health and wellbeing. Reward can be in the form of wages, recognition and opportunities for development or career opportunities.

Factors included in these theories, which are agreed upon influence the level of stress and wellbeing of the workers, are:

1) Influence on own work and own working conditions,
2) Meaning of work in terms of coherence in work tasks and goals,
3) Being given relevant information about the work and the work place in general,
4) Practical and social support,
5) Recognition and rewards, and finally,
6) Job demands should not be too high or too low and with a clear role specification.

This not to say that other factors, like hassles or frequent interruptions, role conflicts, threats or violence i.e. are not important, but these 6 factors are generally agreed upon risk factors. Finally, new research suggests interaction effects between physical and psychosocial demands (33).

The psychosocial risk factors considered in the analyses in this paper are role conflicts, role clearness, predictability, social support, opportunity for development, and influence on planning of job routines, conflicts, teasing or violence and working under time pressure. Furthermore, odd work positions and lifting, as well as noise, are controlled for, as physical work environment factors. It was not possible in both 1995 and 2000 to retrieve data on achievement, meaning or recognition.

Demographic and economic variables are for tenure in job, gender, marital status, education, wage and having a leading position. In Herzberg studies, wages had both features of a motivator when a wages increase was given in relation to some kind of achievement, and a maintenance factor when perceived to be unfair. The disadvantage in this study is that wages cannot be assessed as a relative pay, in the terms of fair pay compared to others at the same work place.

Another factor which has been assigned different attributes through time is working hours. Long working hours can be evident both for workers having a very challenging job and workers just having to much work. This problem is related to the validity of quantitative job demands and pointed out (34) by Kristensen et al. Working hours will be analysed separately in this paper due to these adverse effects.

The overall purpose of this paper is to investigate the relationship between work environment, and in particular psycho-social health risk factors, and job satisfaction in a context that takes other determinants of the well being and attitude towards the job into consideration The analysis treats both having the highest level of jobsatisfaction and being dissatisfied with ones job in order to uncover intrinsic job attributes as well as extrinsic attributes. Furthermore, the method applied has the ability to eliminate the fixed, personal characteristics.

Data, population

Data on work environment and health in the working population were taken from the Danish work environment cohort study, DWECS, which is being collected by the Danish National Institute of Occupational Health, as a consequence of the fact that the heterogeneity of the working population makes it necessary to collect data from large samples. Its purposes are to monitor the prevalence of occupational risk factors, the prevalence and incidence of health symptoms and to be able to estimate changes of health and labor market status as possible consequences of occupational risk factors.

DWECS uses a split panel design: The 1990 panel consists of a simple random sample drawn in 1990 from the central population register and consists of people aged 18-59 years per 1st October 1990. People in this panel were interviewed again in 1995, 2000 and 2005 irrespective of participation in previous rounds. The panel is adjusted for agening and immigration, and the relative size of each panel reflects the proportion of the relevant groups of the total population – each panel represents around 1/330 of the national population.

The 1990 sample consisted of 9,653 people living in Denmark, of which 8,664 participated (90 %). The combined 1995 sample consisted of 10,702 people living in Denmark, of which 8,572 participated (80%). The combined 2000 sample consisted of 11,437 people living in Denmark, of which 8,583 participated (75%). In 1995, 65.9% of the participants were wages earners, 6.7% were enterprise owners and 27.4% were outside the working market. In 2000, these respective percentages were 65.6, 6.2 and 28.2. 3800 of the wages earners in 1995 were also participating and wages earners at the same time, in 2000. When a balanced sample is created, after deducting observations with missing values, the cohort consisted of 3427 individuals. Table 1 summarizes key demographic and economic variables:

Table 1 Summary of key demographic and economic variables in balanced panel (N=3427)

	1995	*2000*		*1995*	*2000*
Gender			Monthly Wages*		
Male	53 %	53 %	Mean	10.477 kr.	13.014 kr
Age in years			Std. deviation	4.615 kr	4.321 kr
Mean	37 years	42 years	Tenure		
Education			Mean	7.7 years	9.9 years
10 years or less	19 %	14 %	Std. deviation	7.8 years	9.1 years
High school	6 %	2 %	Being a Leader		
Vocational	45 %	46 %	Yes	8.7 %	9.6 %
3 years*	10 %	10 %	Working hours		
4 years*	14 %	18 %	Mean	36.7 hours	37.7 hours
5 years*	7 %	9 %	Std. deviation	8.0 hours	7.9 hours

** 3 years means having finished a 3 year further education. The same for 4 and 5 years*
** Monthly Wages is an after tax measure*

In 1995 average age was 37.3 years, average tenure in the job 7.7 years. In 2000, average tenure had changed to 9.9 years. 53 % was male. The variables are entered in the same form in the analysis, except for wages which is transformed to log wages.

Job Satisfaction and Work Environment variables:
The wording of the question on job satisfaction is: "Are you satisfied with your job? Possible answers are: "Yes, indeed", "To some extent", "Not so much" and "No or very seldom". The range is 1-4, where 4 refer to the highest level of job satisfaction.

All non-dichotomous ordinal variables are standardized, ranging from 0-100. Influence to plan ones own work, predictability and social support are originally 4-level-variables, flexibility of work schedule a 5-level variables and opportunities for development, job security, time pressure, role clarity and conflicts are, except for time pressure, composite variables, all recoded into dichotomous variables. See appendix 1 for a more thorough description of the questions and the scales used.

In the analysis with the highest level of jobsatisfaction as the positive outcome, all variables are coded in a way so that a negative job attribute is the lowest end of the scale, and the sign of the estimate tells the way of the correlation. Table 2 displays these values. In the analysis with job dissatisfaction as the positive outcome, job attributes which are naturally negative, like time pressure, conflicts, job insecurity and role conflicts are recoded so that the highest outcome represents the negative attribute.

Table 2 Summary of work environment variables in balanced panel (N=3427)

	1995			*2000*		
	Mean	*Standard Deviation*	*Range*	*Mean*	*Standard Deviation*	*Range*
Job Satisfaction	3.57	.66	1-4	3.69	.59	1-4
Influence	78.40	29.54	0-100	82.51	26.26	0-100
Development *	.37	.48	0/1	.22	.41	0/1
Job security *	.87	.34	0/1	.95	.23	0/1
Time pressure	45.53	34.22	0-100	32.19	31.93	0-100
Predictability	75.88	25.73	0-100	80.65	23.65	0-100
Role clearness *	.65	.48	0/1	.66	.47	0/1
Social Support	41.05	42.67	0-100	34.27	40.83	0-100
No conflicts*	.86	.35	0/1	.88	.32	0/1
Fleksible hours	44.55	47.09	0-100	49.95	47.85	0-100

* Dichotomous variables

From the table, one can see that the degree of job satisfaction has increased from 1995 to 2000. Influence, job security, predictability and the degree of flexible working hours have also increased while development, time pressure, and social support have decreased. As for job security, development, time pressure and social support, the question in 2000 is slightly different from the one in 1995 which can be the explanation of the difference. As for influence, predictability and the degree of flexible working hours the question are identical and properly a consequence of having a more established working status due to higher tenure. Any impacts from the difference in the wording of the questions will be investigated in a sensitivity analysis. Collinarity is below 0.30 for all variables except age and tenure why age is omitted from the multivariate analysis.

Statistical analyses

The specific properties of the data used in this setting, as well as in a lot of cases within sociological and, at least some parts, of health research, are that they are categorical, ordinal scaled data, characterized by that they are ordered, but with intervals which might be uneven. One example, which is central in this paper, is the measure of job satisfaction on a verbal rating scale, consisting of a discrete number of verbally described ordered categories. This type of data restricts the types of arithmetic operations that can be applied and the choice of statistical method is therefore limited.

Relatively new methods to analyse data of this type are presented by Alan Agresti in several books and articles from the eighties and up till now (35-38). Recent developments have also been undertaken by Svensson et al (39-40) but these have primary been concerned with the issue of developing scale invariant measures and methods for analyzing groups. These developments generally do not consider panel data but as the level of job satisfaction may be a result of underlying unobserved characteristics which vary among individuals, the use of panel data is important as it provides an opportunity eliminating the fixed traits or effects.

In the regression model, the fixed effects are referred to as heterogeneity and lead to biased estimates. The traditional regression model is expressed as follows:

$$Y_{ij} = \alpha + \beta_z X_{ij} + \varepsilon_{ij} \quad (1)$$

Where the *i* subscript refers to different persons and *j* refers to different measurements for person *i,* Y_{ij} is the dependent variable, α is a constant and the intercept, β_z is the vector of coefficients of the explanatory variables, X_{ij} is the values of the explanatory variables and ε_{ij} is a random error term. The model is based on the assumption that there is no correlation between the explanatory variables and the error term but as the error term captures the variation from the omitted variables which are the fixed personal traits which influences the probability of a specific outcome on the job satisfaction variable, this correlation is not zero or $\rho(X_{ij}, \varepsilon_{ij}) \neq 0$. Angrist (41) et al solves this problem in the general framework by modelling the fixed effects in a second constant which also enters the regression model:

$$Y_{ij} = \alpha + \lambda_i + \beta_z X_{ij} + \varepsilon_{ij} \quad (2)$$

The term λ_i represents the stable characteristics of an individual and for this model, $\rho(X_{ij}, \varepsilon_{ij}) = 0$. The regression can be performed as a logistic regression which solves the problem of the non-normal distributed explanatory variables, as the logistic regression relaxes the assumptions of the properties of the explanatory variables. As shown by Chamberlain (42) then using a conditional logit with a binary outcome can eliminate omitted variable bias or fixed effects in a logistic regression model. Ferrer-i-Carbonell (43) in 2000 develops an estimator to handle an ordered logit with fixed effects. In these cases the response variable is measured on a 10 point, free rating scale, meaning no words are attached to levels, and thus there was a need for developing an estimator which not rested on the assumption of ordinal comparability, or that individuals have a common opinion of satisfaction.

In this analysis, the rating scale is verbal and only measured on a 4 level scale. Thus ordinal comparability can be assumed, and to further ease the analysis, the response variable is recoded into a binary variable.

In the main analysis, two sets of logistic regressions are performed. One set for comparison purposes using the pooled cross-sections and unconditional likelihood with a regression modelling the highest level of job satisfaction as outcome as well as a regression for the outcome of the lowest level of job satisfaction. The other set have the same outcome variables but uses conditional likelihood to control for fixed effects. That the method of conditional likelihood to estimate the parameters will eliminate the fixed effects can be seen from comparing the formula for the unconditional likelihood with the formula for the conditional likelihood:

(3) $$L_U = \prod_{l=1}^{m_1} P(y_l) \prod_{l=m_1+1}^{n} [1 - p(Y_l)]$$ *(Unconditional)*

(4) $$L_C = \frac{\prod_{l=1}^{m_1} P(y_l) \prod_{l=m_1+1}^{n} [1 - p(Y_l)]}{\sum \left\{ \prod_{l=1}^{m_1} P(y_{ul}) \prod_{l=m_1+1}^{n} [1 - p(Y_{ul})] \right\}}$$ *(Conditional)*

Y_{ij} is job satisfaction, α is the intercept, λ_i represents the stable characteristics of a person, β_z is the vector of coefficients of the explanatory variables, X_{ij} is the values of the explanatory variables and ε_{ij} is the random error term

The estimation using the unconditional likelihood implies substituting equation (1) into the logistic function, then solving for parameters by maximizing (3). For the fixed effects regression, equation (2) is substituted into the logistic function which is then inserted in equation (4) where the constants are conditioned out. The actual estimation procedure for the fixed effects regression only uses the individual who changes their level of job satisfaction from 1995 to 2000 as well as gender will also be omitted from the estimation as this variable will be regarded as a constant too. The full model, when applying the variables given in table 1 and table 2, is:

(5)

$$\begin{aligned} JS_{ij} = \alpha &+ \beta_1 \text{Gender}_{ij} + \beta_2 \text{Married}_{ij} + \beta_3 \text{High school}_{ij} + \beta_4 \text{Completed vocational training}_{ij} + \\ &\beta_5 \text{Short Education}_{ij} + \beta_6 \text{Medium Education}_{ij} + \beta_7 \text{Long Education}_{ij} + \beta_8 \text{Leader}_{ij} + \\ &\beta_9 \text{Tenure}_{ij} + \beta_{10} \text{Log pay}_{ij} + \beta_{11} \text{Influence}_{ij} + \beta_{12} \text{Development}_{ij} + \beta_{13} \text{Job security}_{ij} + \\ &\beta_{14} \text{Time pressure}_{ij} + \beta_{15} \text{Predictability}_{ij} + \beta_{16} \text{Role Clearness}_{ij} + \beta_{17} \text{Social Support}_{ij} + \\ &\beta_{18} \text{No conflicts}_{ij} + \beta_{19} \text{Flexible hours}_{ij} \end{aligned}$$

The estimation method is maximum likelihood and statistical computer programs are SAS 8.2 and STATA 9.0, the logit procedure and the clogit procedure.

Results

The analysis is carried out in four steps. The first step is an unconditional logistic regression and a conditional logistic regression performed on demographic and economic variables only. The next step draws in the occupational health factors, or work environment variables, using the same data set and procedures as the in first step. The third step analyses the impact on job satisfaction from individual factors in the full regression models. As a fourth step, sensitivity analysis controlling for the potential impact from variables which have been left out of the analysis, is performed.

The population used in the conditional likelihood is only those switching between the highest level of job satisfaction and the other levels of job satisfaction seen as a whole. Table 3 shows the results of the regressions when only entering demographic and economic variables.

Table 3
Unconditional Logit and Conditional Logit with economic and demographic variables only

	Logit n=6854, Pseudo R2 =0.01				*Conditional Logit n=2180, Pseudo R2=0.02*			
	Coeffient	*Std Err*	*Z*	*P>|z|*	*Coefficient*	*Std Err*	*Z*	*P>|z|*
Male*	-.0990	.0570	-1.74	.083	-	-	-	-
Being married*	.1504	.0643	2.34	.019	.1016	.1454	.70	.484
High school*	-.1042	.1424	-.73	.465	-.3708	.3423	-1.08	.279
Vocational training*	.0153	.0761	.20	.841	.0410	.2262	.18	.856
3 years*	-.1014	.1063	-.95	.340	-.3062	.2715	-1.13	.259
4 years*	.0558	.0971	.57	.565	-.0333	.2810	-.12	.906
5 years*	.2371	.1284	1.85	.065	.2343	.3733	.63	.530
Leader*	.4858	.1066	4.56	.000	.4971	.2081	2.39	.017
Job Tenure, years	.0112	.0033	3.42	.001	.0008	.0097	.08	.937
Monthly Pay, ln kr	.2353	.0883	2.66	.008	.4112	.1778	2.31	.021

Y=1 for the answer "Yes, indeed", when asked "Are you satisfied with your job?"
* Dichotomous variables
Male omitted from the fixed effects analysis due to no within-group variance
Education entered as 5 dichotomous variables, with no education left out of the analysis
3 years means having finished a 3 year further education. The same for 4 and 5 years
Logit: Pseudo R2= 0.01
Conditional logit: Pseudo R2= 0.02

Marital status, as goes to being married, is significant only in the logit regression and the education variables all are non-significant, although having 5 years or more of further education is positively correlated with job satisfaction level with a p-value < 0.06, in the (unconditional) logit regression.

Having a leader status is positively and significantly correlated with a high level of job satisfaction in both regression models and the coefficient value has only changed marginally. The coefficient for tenure, number of years in the job is positive and significant only in the unconditional logit. Monthly pay is positively and significant correlated with job satisfaction in both the conditional logit and the unconditional logit ($p<0.05$). In the fixed effects regression, the coefficient of pay nearly doubles.

The second step in the analysis draws in the occupational health factors, or work environment variables, using the same data set as the in first step. The work environment variables entered are the variables summarized in table 2. Table 4 compares the results of the unconditional estimation and the conditional estimation.

Table 4
Unconditional Logit and Conditional Logit on full model

	Logit, n=6854				*Conditional Logit, n=2180*			
	Coef.	*Std Err*	*Z*	*P>|z|*	*Coef.*	*StdErr*	*Z*	*P>|z|*
Male*	.0499	.0631	.79	.429	-	-	-	-
Being married*	.0837	.0704	1.18	.237	.1432	.1712	.84	.403
High school*	-.2275	.1588	-1.43	.152	-.2347	.3981	-.59	.555
Vocational training*	-.0749	.0842	-.89	.374	-.1217	.2618	-.46	.642
3 years*	-.2931	.1181	-2.48	.013	-.612	.3143	- 1.95	.052
4 years*	-.0720	.1083	-.67	.506	-.2649	.3237	-.82	.413
5 years*	.0131	.1418	0.09	.927	.0373	.4265	.09	.930
Leader*	.2455	.1150	2.13	.033	.1914	.2333	.82	.412
Job Tenure, years	.0100	.0036	2.77	.006	-.0031	.0114	-.28	.783
Monthly Pay, ln kr	.0870	.1000	.87	.384	.5622	.2008	2.80	.005
Influence	.0081	.0011	7.44	.000	.0083	.0023	3.66	.000
Development	.4929	.0703	7.01	.000	.2430	.1216	2.00	.046
Job security	.3533	.0968	3.65	.000	.5431	.1781	3.05	.002
Time pressure	.0021	.0009	2.39	.017	.0010	.0016	.63	.529
Predictability	.0159	.0012	13.14	.000	.0192	.0024	7.98	.000
Role Clearness	.6050	.0601	10.06	.000	.5804	.1098	5.29	.000
Social Support	.0100	.0008	12.78	.000	.0066	.0014	4.70	.000
No conflicts	.3149	.0826	3.81	.000	.2540	.1654	1.54	.125
Fleksible hours	.0032	.0006	4.90	.000	.0040	.0013	2.96	.003

Y=1 for the answer "Yes, indeed", when asked "Are you satisfied with your job?"
* Dichotomous variables
Male omitted from the fixed effects analysis due to no within-group variance
Education entered as 5 dichotomous variables, with no education left out of the analysis
3 years means having finished a 3 year further education. The same for 4 and 5 years
Logit: Pseudo R2= 0.1397
Conditional logit: Pseudo R2= 0.1894

Marital status, as goes to being married, has turned insignificant. As for education, having a 3 years further education is the only significant variable, having a negative coefficient which nearly doubles in the fixed effects analysis. Having a leader status is positively and significantly correlated with a high level of job satisfaction in the binary logit and insignificant in the conditional logit. The coefficient for tenure, number of years in the job is positive and significant only in the unconditional logit. Monthly pay is positively and significant correlated with job satisfaction in the conditional logit only.

As for the work environment variables, all factors are positively signed and significant in the unconditional logit. Eliminating fixed effects, time pressure and conflicts turns insignificant. Also the size of the coefficient of development is halved. The coefficients of social support and predictability are altered somewhat when going from the unconditional logit to the conditional logit. The coefficient of job security doubles. Influence, role clearness and flexibility of working hour schedule are the same in the two regressions, suggesting robustness to fixed effects.

Factor changes, predicted probabilities and marginal effects:
The third step is an analysis of the impact on job satisfaction from individual factors. For this purpose, the original coefficients are expressed in odds and percentage changes in odds. Moreover, marginal effects and changes in probabilities for moving between extreme categories are calculated. These results are shown in table 5 in the next section.

The values of the odds give the increase in the odds for being in the high satisfaction category for a one point increase in the explanatory variable whereas the percent change in odds gives the percentage increase in the odds of being in the high satisfaction category for a one point increase in the explanatory variable. A one point increase in a factor has different interpretations depending on whether it is a dichotomous variable, a standardized ordinal scales variable or a continuous variable.

For the dichotomous variables, development, job security, role clearness and level of conflict, a one point increase means going from; not always having the possibility to learn new things through ones work to always having this possibility, from not having job security a year ahead to having a fixed-term appointment with more than 12 months left, from experiencing unclear responsibilities or conflicting demands in ones work to not having unclear or conflicting demands and from being exposed to unpleasant teasing, unwanted sexual attention, threats of violence, or violence at the workplace to not being involved in any of this.

For the continuous variables, the interpretation of a one point increase is straight forward and for the standardized work environment variables a 1 point increase means a 1 point increase in a 1-100 scale. This implicitly assumes some comparability of the scales and the scales are for all of them, except social support, verbal rating scales, going from “never” to “always”. Social support has the same scale originally, but is recoded with an ordering according to whether the support is from colleagues or superior, see appendix 1 for details.

Only marginal effects from the pooled cross section using unconditional regression are calculated, since the fixed factors are needed in the calculation of these. Marginal effects express the change in probability of being in the high satisfaction category when a factor is increased infinitesimal around its mean and other variables are allowed to vary. This measure also provides information on the shape of curve around the means of variables.

As an addition to the marginal effects analysis, changes in the probability of being in the high satisfaction category when going from the minimum level to the maximum level of each individual variable are calculated.

Table5
Factor changes in odds, factor changes in percent, marginal effects and predicted probabilities

	Logit, n=6854		*Conditional Logit, n=2180*		*Logit, n=6854*			
	factor changes in odds	*% change in odds*	*factor changes in odds*	*% change in odds*	*dy/dx*	*Std Err*	*P>|z|*	*Δ probability when X min->max*
Male*	1.051	5.1	-	-	.0010	.0126	.429	.010
Being married*	1.087	8.7	1.154	15.4	.0168	.0143	.242	.017
High school*	.796	-20.3	.791	-20.9	-.0474	.0345	.169	-.047
Vocational training*	.928	- 7.2	.885	-11.5	-.0150	.0168	.374	-.015
3 years*	.746	-25.4	.542	-45.8	-.0614	.0258	.017	-.061
4 years*	.930	- 6.9	.767	-23.3	-.0145	.0221	.511	-.014
5 years*	1.013	1.3	1.038	3.8	.0026	.0281	.926	.003
Leader*	1.278	27.8	1.211	21.1	.0467	.0208	.025	.047
Job Tenure, years	1.010	1.0	.997	-.3	.0020	.0007	.006	.090
Monthly Pay, ln kr	1.091	9.1	1.754	75.5	.0173	.0199	.384	.083
Influence	1.008	.8	1.008	.8	.0016	.0002	.000	.177
Development	1.637	63.7	1.275	27.5	.0937	.0126	.000	.094
Job security	1.424	42.4	1.721	72.1	.0748	.0216	.001	.075
Time pressure	1.002	.2	1.001	.1	.0004	.0002	.017	.042
Predictability	1.016	1.6	1.019	1.9	.0032	.0002	.000	.356
Role Clearness	1.831	83.1	1.787	78.7	.1252	.0128	.000	.125
Social Support	1.010	1.0	1.007	.7	.0020	.0001	.000	.186
No conflicts	1.370	37.0	1.289	28.9	.0659	.0181	.000	.066
Fleksible hours	1.003	.3	1.004	.4	.0006	.0001	.000	.063

Y=1 for the answer "Yes, indeed", when asked "Are you satisfied with your job?"
* Dichotomous variables
Male omitted from the fixed effects analysis due to no within-group variance
Education entered as 5 dichotomous variables, with no education left out of the analysis
3 years means having finished a 3 year further education. The same for 4 and 5 years

When comparing the sizes of the odds in the conditional logit with the unconditional logit, influence, predictability, social support, role clearness and flexible working hours seem to have stable impacts on job satisfaction. Role clearness has the far biggest odds value, stating that for a 1 point increase in the variable, the odds of being in the category of individuals with high job satisfaction increases by 1.831. The percent increase in odds when increasing role clearness, is 78.7% which can be compared to the percent increases of the other stable variable which are less than 1 % but must related to that the scales are different.

As the impacts of these variables seems to be stable, to better compare them one can look at the increase in the probability of being in the high satisfaction category when going from the minimum value of the variable to the maximum value. Doing this, reveals that predictability has the highest impact (35%), then social support (18%), then influence (17.7%), role clearness (12%) and finally flexible working hours (6.3%).

The odds of job security have increased in the fixed effects analysis, going from 1.424 to 1.721. As the coefficient is increased in the fixed effects analysis, the predicted probabilities should be used with some caution; but the effect on job satisfaction from going from lowest level of job security, in this case from having no job security after 1 year to having a fixed term contract with more than 12 months left, raises the probability of being highly satisfied by at least 7.5 %. Another variables which is changed in the fixed effects analysis, is development. The odds go from 1.637 to 1.275 which is a quite large reduction. The associated percentage change in odds is reduced from 63.7% to 27.5%. The increase in the probability of being in the high satisfaction category when going from the minimum value of development to the maximum value is 9.4%.

Looking at the demographic and economic variables, none of the coefficient was significant in both the logit and the conditional logit regression. Job tenure, being a leader and having a 3 years further education are significant in the ordinary logit estimation while not significant in the fixed effect analysis. Monthly pay turns significant after eliminating the fixed effects. Going from the lowest level of tenure to the highest level changes the probability of being in the high satisfaction category by 9%. The same number for wages is 8.3%.

When looking at the marginal effects in table 5, comparisons of variables again have to be done with some caution; for starting out, one can examine the ratios of the dichotomous variables against each other.

Opportunities for development, job security, role clearness and conflicts are entered as dichotomous variables. Development and role clarity have about the same and the largest coefficients, 0.094/0.125 which suggests that these two factors have about the same effect on job satisfaction, at their mean which is of course a very arbitrary value for dichotomous variables of this kind. Job security (0.0748) has about the same impact on job satisfaction as conflicts (0.0659).

Comparing the ordinal variables; influence, predictability and social support (all 4-level-variables) suggests that predictability (0.0032) has twice the effect on job satisfaction as influence (0.0016), and about one third more impact on job satisfaction than social support (0.0020) which on the other hand has one and a half time the effects on job satisfaction compared to influence. Flexible working hours (0.0006), has only one fifth the impact than predictability has.

Sensitivity analysis: Left out variables

The sensitivity analysis will control for the effects of physical work environment, a year effect as well as working hours are discussed. Finally a set of regressions similar to the one just discussed except the instance of being not satisfied, is estimated. Correlation analysis with working hours was performed initially and correlation with job satisfaction was only found for the highest level of influence and predictability. Therefore, working hours is kept out of the regression analysis.

Physical work environment:

Starting out with the physical work environment, two variables are inserted in the regression showed in equation (5). One variable counts the number of physical hazards and the other one is a dichotomous variable which is positive when there is loud noise more than ¾ of the working day. See appendix 1 for details on the variables.

The results of the regressions are displayed in table 6 in appendix 2. When comparing the results from table 4 there is only a marginal change in the coefficient of influence, which decreases from 0.0083 to 0.0071. The associated decrease in odds is 0.0001.

Control for a year effect:

Controlling for a year effect is important when doing panel analysis whenever there is a risk that exogenous chocks have an impact on the level of the variables. The reason for not including year in the model is that any year effect is actually explained *in* the model by the increased level of influence, wages, job security and flexibility of working schedule. The year variable on the other hand, should be able to control for whether the decrease in development and social support is due to variation in the questions in 1995, 2000 respectively. The questions in 1995 incorporate more items and this may the cause of the decrease in these dimensions.

The results of the regressions are displayed in table 7, in appendix 2. When comparing the results from table 4 there are significant changes in regard to in the fixed effects regression as time pressure and tenure now are significant while wages turns insignificant in both regressions. The sign of the coefficient of tenure is now negative.

The impacts of job security on job satisfaction seem to decrease by introducing a year effect whereas the coefficient of development increases by nearly a 100% in the conditional logit. The coefficient of social support is also increased.

Being dissatisfied:

As discussed earlier, work environment has been recognized as a hygiene or maintenance factor, being able to influence employee job dissatisfaction rather than increasing job satisfaction. One way to test this is to perform the regressions again but this time with being dissatisfied with ones job as the positive outcome (y=1).

Job attributes which are naturally negative, like time pressure, conflicts, job insecurity and role conflicts are recoded so that the highest outcome represents the negative attribute.

The results of the regressions are shown in table 8 and table 9. Table 9 displays the impact on job satisfaction from individual factors in terms of the original coefficients expressed in odds and percentage changes in odds, marginal effects and changes in probabilities for moving between extreme categories.

Table 8
Unconditional Logit and Conditional Logit modelling being dissatisfied

	Logit, n=6854				*Conditional Logit, n=2180*			
	Coefficient	*Std Err*	*Z*	*P>|z|*	*Coefficient*	*StdErr*	*Z*	*P>|z|*
Male*	-.1482	.1339	-1.11	.268	.5973	.3924	1.52	.128
Being married*	.0682	.1482	.46	.645	.0899	1.1402	.08	.937
High school*	.4571	.3026	1.51	.131	.1751	.7314	.24	.811
Vocational training*	.2655	.1812	1.46	.143	-.1257	.8879	-.14	.887
3 years*	.1893	.2634	.72	.472	-.5638	.9190	-.61	.540
4 years*	.4652	.2325	2.00	.045	-1.188	1.2554	-.95	.344
5 years*	.1411	.3249	.43	.664	.6060	.7296	.83	.406
Leader*	-.0162	.2676	-.06	.952	.0435	.0271	1.60	.109
Job Tenure, years	-.0291	.0087	-3.34	.001	-.1407	.4457	-.32	.752
Monthly Pay, ln kr	.0832	.1972	.42	.673	-.0137	.0048	-2.88	.004
Influence	-.0072	.0021	-3.47	.001	-1.017	.3342	-3.04	.002
Development	-.9977	.1993	-5.01	.000	.5381	.3478	1.55	.122
Job insecurity	.6618	.1629	4.06	.000	.0038	.0038	1.01	.310
Time pressure	.0020	.0019	1.04	.298	-.0249	.0052	-4.82	.000
Predictability	-.0220	.0022	-10.00	.000	.6907	.2803	2.46	.014
Role Conflicts	.5761	.1273	4.53	.000	-.0120	.0037	-3.29	.001
Social Support	-.0106	.0020	-5.20	.000	.1210	.2920	.41	.679
Conflicts	.4753	.1515	3.14	.002	-.0021	.0032	-.65	.514
Fleksible hours	-.0025	.0014	-1.70	.090	.5973	.3924	1.52	.128

Y=1 for the answers: “Not so much” and “No or very seldom”, when asked “Are you satisfied with your job?”
* Dichotomous variables
Male omitted from the fixed effects analysis due to no within-group variance
Education entered as 5 dichotomous variables, with no education left out of the analysis
3 years means having finished a 3 year further education. The same for 4 and 5 years

Influence, predictability, role conflict and time pressure are now the only variables which are significant in both the unconditional and the unconditional logit. Pay is significant in the fixed effects analysis only.

Table 9 shows the impact from individual factors.

Table 9 (Being dissatisfied)
Factor changes in odds, factor changes in percent, marginal effects and predicted probabilities

	Logit, n=6854		*Conditional Logit n=2180*		*Logit, n=6854*			
	factor changes in odds	*% change in odds*	*factor changes in odds*	*% change in odds*	*dy/dx*	*Std Err*	*P>|z|*	*Δ probability when X min->max*
Male*	.862	-13.8	-	-	-.0034	.0031	.271	-.003
Being married*	1.071	7.1	1.817	81.7	.0015	.0032	.639	.001
High school*	1.579	57.9	1.094	9.4	.0129	.0103	.213	.012
Vocational training*	1.304	30.4	1.191	19.1	.0062	.0042	.150	.006
3 years*	1.208	20.8	.882	-11.8	.0047	.0069	.504	.004
4 years*	1.592	59.2	.569	-43.1	.0125	.0072	.086	.012
5 years*	1.152	15.2	.305	-69.5	.0034	.0083	.682	.003
Leader*	.984	- 1.6	1.833	83.3	.0004	.0060	.951	-.000
Job Tenure, years	.971	- 2.9	1.044	4.4	-.0007	.0002	.001	-.022
Monthly Pay, ln kr	1.087	8.7	.869	- 13.1	.0019	.0045	.673	.009
Influence	.993	-.7	.986	-1.4	-.0002	.0000	.001	-.020
Development	.369	-63.1	.362	-63.8	-.0195	.0032	.000	-.019
Job insecurity	1.938	93.8	1.713	71.3	.0199	.0063	.002	.019
Time pressure	1.002	.2	1.004	.4	.0000	.0000	.298	.004
Predictability	.978	-2.2	.975	-2.5	-.0005	.0000	.000	-.104
Role conflicts	1.779	77.9	1.995	99.5	.0145	.0035	.000	.014
Social Support	.989	-1.1	.988	-1.2	-.0002	.0000	.000	-.022
Conflicts	1.608	60.9	1.129	12.9	.0130	.0049	.009	.013
Fleksible hours	.997	-.2	.998	-.2	-.0001	.0000	.089	-.005

Y=1 for the answers: "Not so much" and "No or very seldom", when asked "Are you satisfied with your job?"
* Dichotomous variables
Male omitted from the fixed effects analysis due to no within-group variance
Education entered as 5 dichotomous variables, with no education left out of the analysis
3 years means having finished a 3 year further education. The same for 4 and 5 years

The factor changes in odds, percentage change in odds, suggest that role conflict has the largest impact on job dissatisfaction. Going from no role conflicts to having a role conflict increases the odds of being dissatisfied by 1.779 in the ordinary logit and by 1.995 in the conditional logit. In terms of change in probability of being dissatisfied, it raises the probability by 1.4%.

Predictability lowers the odds of being dissatisfied by 0.978. In terms of change in probability of being dissatisfied when moving to the minimum value of the explanatory variables to the maximum values of the variables it actually lowers the probability by 10.4% which is a far stronger impact than for any of the other explanatory variables.

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Discussion

To sum up the results from the previous sections, predictability, social support, influence, role clearness and flexible working hours were significant predictors for being in the high satisfaction category, in both the analysis with and without fixed effects. The largest impacts seem to stem from predictability, then social support, influence, role clearness and flexible working hours. These variables were also robust to year effects and physical work environments effects.

The odds of job security increased in the fixed effects analysis but turned insignificant when including a year effect. About the same was evident for wages which was only significant in the fixed effects analysis, without a year effect. Whether or not this should lead to the conclusion that these factor are not stable significant predictors of having a high level of job satisfaction, will be a matter of discussing whether including a year effects is correct in an analysis with no exogenous shocks. In this paper, the main hypothesis is that the year effect should not be modelled explicit. Instead, a macro-economic indicator, like the unemployment rate, could be considered in subsequent analyses.

A variable which decreased in the fixed effects analysis was development, which was reduced significantly. Including a year effect on the other hand, increases the odds of development compared to the analysis without the year effects, and also the coefficient now seems robust to fixed effects. Thus, in conclusion, development is counted as a robust factor, having an impact comparable to that of influence.

The results of the analysis of being dissatisfied showed that the results from the previous analyses were consistent for role conflict or role clearness, predictability and influence. This point to that these factors represents both motivating and de-motivating elements. Moreover, working under time pressure turned out to be a significant predictor of being dissatisfied. The variables which did not turn out as stable significant predictors of being both highly satisfied and dissatisfied, were social support, which was only significant in the unconditional logit, and flexible working hours which was not significant in any of the regressions modelling being dissatisfied.

Conclusion

A high degree of predictability, influence and role clearness are stable and significant predictors of being highly satisfied. Experiencing a low degree of predictability, influence or role conflicts are also stable and significant predictors of being dissatisfied. Development, flexible working hours and social support turned out to be stable significant predictors for having a high level of job satisfaction only. Working under time pressure turned out to be a stable and significant predictor of being dissatisfied but did not have any impact on having a high degree of job satisfaction.

Including a year effect caused both job security and wages to become insignificant in the fixed effects analysis but the overall conclusion is that the year effect should be left out of this analysis. All variables were robust when including physical work environments effects.

None of the demographic and economic variable; gender, marital status, education, leader status or tenure in the job were significant when eliminating the fixed effects from the models.

Appendix 1 List of work environment variables

If questions are to identical in 1995 and 2000, both questions are reported.
If the variable is dichotomous, the outcome (x=1) is indicated.

Physical work environment (sum):
Are you exposed to noise as high that you must raise voice to be able to speak with others ¾ or more of the work day?
Does your work entail that You 3/4 or more of the working hours:
Work with your back heavily bended forward with no support for hands or arms?
Work with your body twisted or bended in the same way several times an hour?
Work with your hands lifted to shoulder height or higher?
Work with your neck heavily bended forward?
Work with your hand twisted or your wrist heavily bended?
Work with your squat or kneel when you work?
1995: How often shall you by own force lift burdens above hour 30 kg? (More than once an hour)
2000: What does the thing normally weigh that you carry? (More than 29 kilos)

Influence (4 levels):
Can you plan your own work? (Never, usually not, usually, always)

Development (2 levels):
1995: Is it possible for you to learn new things and qualify yourself through your work? (Always)
2000: Is it possible for you to learn new things through your work? (Yes, indeed)

Job security (2 levels):
1995: How certain are you that you can keep your job the next 12 month? (Certain or pretty sure)
2000: Is your present job a fixed-term appointment? (With more than 12 months left)

Time pressure (2 levels - High degree or always)
1995: Does your work demand that you work under time pressure in order to get certain pieces of work done?
2000: Is it necessary to work very fast?

Predictability (4 levels):
Are you informed about decisions that concern your work place? (Never, usually not, usually, always)

Role clearness, demands (2 levels):
How right or wrong are these statements concerning your role at work?
It is clear what my responsibility is. (Absolutely right, sometimes right)
I experience conflicting demands in my work. (Absolutely right, sometimes right)

Social support (4 levels - No support, always support from colleagues but not always from superiors, always support from superiors but not always from colleagues, always support from colleagues and superiors)
1995: Do you receive help and encouragement from your superior/colleagues?
2000: How often do you receive help and support from superior or colleagues?

Conflicts, teasing, unwanted sexual attention, threats or violence (2 levels):
1995: Are you exposed to any form of unpleasant teasing, unwanted sexual attention, threats of violence, or violence at your workplace? (Not reporting any incidents constitutes a “no”)
2000: Have you been exposed to unpleasant teasing, unwanted sexual attention, threats of violence, or physical violence at your workplace within the last 12 months? (Not reporting any incidents constitutes a “no”)

Flexibility of work schedule (5 levels):
Can you from day to day vary your daily working schedule, without giving further notice? (No, up to: 15 minutes, 30 minutes, 60 minutes or more than 1 hour).

Appendix 2

Table6
Ordinary Logit and Conditional Logit (Fixed effects) including physical work environment.

	Logit, n=6854				*Conditional Logit, n=2180*			
	Coefficient	*Std Err*	*Z*	*P>|z|*	*Coefficient*	*StdErr*	*Z*	*P>|z|*
Male*	.0567	.0634	.90	.371	-	-	-	-
Being married*	.0766	.0706	1.08	.278	.1157	.1736	0.67	.505
High school*	-.2766	.1593	- 1.74	.083	-.3227	.4051	-0.80	.426
Vocational training*	-.1153	.0848	- 1.36	.174	-.1920	.2650	-0.73	.467
3 years*	-.3570	.1189	- 3.00	.003	-.6858	.3184	-2.15	.031
4 years*	-.1422	.1091	- 1.30	.192	-.362	.3287	-1.10	.270
5 years*	-.0857	.1429	-.60	.548	-.0449	.4318	-0.10	.917
Leader*	.2113	.1154	1.83	.067	.2231	.2347	0.95	.342
Job Tenure, years	.0106	.0036	2.93	.003	-.0017	.0116	-0.15	.883
Monthly Pay, ln kr	.0959	.1007	.95	.340	.5913	.2067	2.86	.004
Influence	.0075	.0011	6.83	.000	.0071	.0023	3.02	.003
Development	.4925	.0705	6.99	.000	.2727	.1239	2.20	.028
Job Security	.3373	.0973	3.47	.001	.5522	.1811	3.05	.002
Time Pressure	.0017	.0009	1.86	.063	.0005	.0016	0.30	.764
Predictability	.0155	.0012	12.76	.000	.0192	.0024	7.85	.000
Role Clearness	.5915	.0604	9.79	.000	.5723	.1110	5.15	.000
Social Support	.0100	.0008	12.87	.000	.0067	.0014	4.64	.000
No conflicts	.3000	.0830	3.61	.000	.2583	.1669	1.55	.122
Fleksible hours	.0029	.0006	4.46	.000	.0037	.0014	2.71	.007
Noise	.3624	.0917	3.95	.000	.6506	.1974	3.30	.001
Physical Hazards	-.1678	.0358	-4.68	.000	-.2349	.0767	-3.07	.002

Y=1 for the answer "Yes, indeed", when asked "Are you satisfied with your job?"
* Dichotomous variables
Male omitted from the fixed effects analysis due to no within-group variance
Education entered as 5 dichotomous variables, with no education left out of the analysis
3 years means having finished a 3 year further education. The same for 4 and 5 years

Table 7
Ordinary Logit and Conditional Logit (Fixed effects) including a year dummy.

	Logit, n=6854				*Conditional Logit, n=2180*			
	Coefficient	*Std Err*	*Z*	*P>|z|*	*Coefficient*	*StdErr*	*Z*	*P>|z|*
Year*	.1147	.0124	9.25	.000	.1487	.01746	8.51	.000
Male*	.0658	.0635	1.04	.300	-	-	-	-
Being married*	.0721	.0709	1.02	.310	.0332	.1767	.19	.851
High school*	-.1888	.1599	-1.18	.238	-.3020	.4137	-0.73	.465
Vocational training*	-.0851	.0848	-1.00	.316	-.2689	.2675	-1.01	.315
3 years*	-.3141	.1188	-2.64	.008	-.8540	.3246	-2.63	.009
4 years*	-.1023	.1091	-0.94	.349	-.7028	.3396	-2.07	.038
5 years*	-.0229	.1430	-0.16	.873	-.3172	.4479	-0.71	.479
Leader*	.3008	.1162	2.59	.010	.2680	.2459	1.09	.276
Job Tenure, years	.0083	.0036	2.28	.023	-.0264	.0125	-2.1	.035
Monthly Pay, ln kr	.0302	.1010	0.30	.765	.2795	.2132	1.31	.190
Influence	.0079	.0011	7.18	.000	.0077	.0024	3.25	.001
Development	.6218	.0722	8.61	.000	.5078	.1318	3.85	.000
Job security	.2750	.0981	2.80	.005	.2855	.1878	1.52	.128
Time pressure	.0037	.0009	4.07	.000	.0041	.0017	2.38	.017
Predictability	.0149	.0012	12.23	.000	.0175	.0025	7.07	.000
Role Clearness	.6061	.0606	10.01	.000	.5802	.1143	5.08	.000
Social Support	.0103	.0008	13.15	.000	.0070	.0015	4.74	.000
No conflicts	.2901	.0833	3.48	.000	.1487	.1728	0.86	.390
Fleksible hours	.0031	.0007	4.77	.000	.0031	.0014	2.18	.029

Y=1 for the answer "Yes, indeed", when asked "Are you satisfied with your job?"
* Dichotomous variables
Male omitted from the fixed effects analysis due to no within-group variance
Education entered as 5 dichotomous variables, with no education left out of the analysis
3 years means having finished a 3 year further education. The same for 4 and 5 years

References

1. Bunn, W., Likely, D., Slavin, T., Paralkar, S., 'Health, safety and productivity in a manufacturing environment', Journal of occ. And env. Medicine, 2001 (43), pp 47-55.

2. Cooper, C., Liukkonen, P., Cartwright, S., Stress prevention in the workplace. Assessing the costs and benefits to organizations. European Foundation for the Improvement of Living and Working Conditions, Dublin, 1996.

3. Court, S., Work and enterprise panel of enquiry: links between the quality of working life and productivity, HSE, London, 2003.

4. Ahonen, G. Labour Protection and Economics, The Swedish School of Economics, Svenska Handelshögskolan, Helsingfors, 1983.

5. Hendrick, H., 'Determining the cost-benefits of ergonomics projects and factors that lead to their succes' Applied ergonomics, 34 (2003), pp. 419-427.

6. Kuusela, J., Bjurström, L., Rouhesmaa, H., Working environment and productiviy in industry', Economics of the working environment, Ministry of social Affairs and Health, Tampere, 1997.

7. Pelletier, K., A review and analysis of the health and financial outcome studies of comprehensive health promotion and disease prevention at the work site', American Journal of Health promotion, 1997. Updates: July/August 1999, November/December 2001.

8. Seely, P., Marklin, R., 'Business case for implementing two ergonomic interventions at anelectric power utility', Applied ergonomics, 34 (2003), pp. 429-439.

9. Serxner, S., Gold, D., Anderson, D., Williams, D., 'The impact of a worksite health promotion pogramme on short-term disability usage', Journal of occupational and environmental medicine, 43 (2001), pp. 25-29.

10. Eurostat publication 2004. Evaluation of Directive 89/654, 89/655, 89/656, 907269 & 90/270.

11. D'Addio, A. C., Eriksson, T., Frijters, P. "An analysis of the determinants of job satisfaction when individuals' baseline satisfaction levels may differ. CAM. Copenhagen University, Working paper

12. Freeman, RB "Job Satisfaction As An Economic Variable," American Economic Review, 1978, v68(2), 135-141

13. Hamermesh, Daniel S. "The Changing Distribution Of Job Satisfaction," Journal of Human Resources, 2001, v36(1,Winter), 1-30.

14. Kristensen, N, Westergaard, N. Job satisfaction and quits. What job characteristics matters most? Working paper, Aarhus School of business.

15. Akerlof, G.A. "Job Switching and Job Satisfaction in the U.S. Labor Market," Brookings Papers on Economic Activity, 1988:2, with Andrew Rose and Janet Yellen.

16. Keller RT. 1983. Predicting absenteeism from prior absenteeism, attitudinal factors and nonattitudinal factors. Journal of Applied psychology 68: 536-540.

17. Tharenou P., 1993. A test of reciprocal causality for abseentism. Journal of Organizational Behaviour 14: 169-190.

18. Blank N, Diderichsen, F. Short-term and long-term sick-leave in Sweden: relationships with social circumstances, working conditions and gender. Scand J Soc Med. 1995;23:265-272.

19. Gottfredson GD, Holland JL. 1990. A longitudinal test of the influence of congruence : job satisfaction, competency utilization, and counterproductive behaviour. Journal of Counseling Psychology 37: 389-398.

20. Kristensen, N, Westergaard, N. Determinants of satisfaction. The importance of detailed job characteristics. EU 2005.

21. Borritz M, Bultmann U, Rugulies R, Christensen KB, Villadsen E, Kristensen TS., Psychosocial work characteristics as predictors for burnout: findings from 3-year follow up of the PUMA Study. JOccupEnvironMed.2005Oct;47(10):1015-25.

22. Borritz et al. Burnout as a predictor of self-reported sickness absence among human service workers. *Occup Environ Med.*2006; 63: 98-106.

23. Lund, T., Villadsen, E., Who retires early and why? Determinants of early retirement pension among Danish employees 57-62 years. Eur J agening (2005) 2: 275-280.

24. Benavides FG, Benach J, Moncada S. Working conditions and sickness absence: a complex relation. J Epidemiol Community Health 2001; 55: 368.

25. Hemmingway H, Shipley MJ, Stanfeld SA, Marmot MG. Sickness absence from back pain, psychosocial work characteristics and employment grade among office workers. Scand J Work Environ Health 1997; 23 (2): 121-129.

26. Oshagbemi T. Overall job satisfaction: how good are single vs multiple item-measures? Journal of Managerial Psychology 1999; 14: 388-403.

27. Herzberg, F., Mausner, B., & Snyderman, B (1959). The motivation to work.
(2nd ed.). New York: John Wiley.

28. (9) Karasek R. and Theorell T., Healthy Work, Stress, Productivity and the Reconstruction of Working Life, Basic Books, 1990, (1992 paper) 384 p.

29. Frese, M. & Zanf, D. (1994) Action as the core of work psychology: A german approach. Handbook of Industrial & organizational psychology, 2 edn. Vool 4, p. 271-340.

30. Siegrist J (1996). Adverse health effects of high effort - low reward conditions at work. Journal of Occupational Health Psychology, 1, 27-43.

31. Johnson, J. V., Hall, E. M. 1988. Job strain, work place social support and cardiovascular disease: A cross-sectional study of a random sample of the Swedish working population. American Journal of public Health, 78, 1336-1342.

32. Kristensen, T. S. Job Stress and Cardiovascular Disease: A Theoretic Critical Review. Journal of Occupational Health Psychology. 1996, Vol. 1, No. 3, 246-260.

33. Devereux JJ, Vlachonikolis IG, Buckle PW. Epidemiological study to investigate potential interaction between physical and psychosocial factors at work may increase the risk of symptoms of musculoskeletal disorder of the neck and upper limp. Occup Environ Med. 2002; 59:269-277.

34. Kristensen, T S., Bjorner, J. B. Christensen, K. B., Borg, W. The distinction between work pace and working hours in the measurement of quantitative demands at work. Work and stress, October 2004, vol. 18, no. 4, 305-322.

35. Agresti, A.. Analysis of ordinal categorical data. John Wiley & Sons. 1984.

36. Agresti, A. Tutorial on modelling ordered categorical response data. Psychological bulletin, 1989, vol. 105, no. 290-301.

37. Agresti, A.. Modelling ordered categorical variables: recent advances and future challenges. Statistics in medicine. Vol. 18, issue 17-18. 1999. pp. 2191-2207.

38. Agresti, A.. Categorical Data Analysis. 2002 Second edition. (Wiley, 2002)

39. Svensson, E. (1998). Application of a rank-invariant method to evaluate reliability of ordered categorical assessments. Journal of Epidemiology and Biostatistics, 3, 403-409.

40. Svensson, E. (1998) Ordered invariant measures for individual and group changes in ordered categorical variables. Statistics in medicine. Vol. 17, pp. 2923-2936.

(41). Angrist. JD, Krueger, AB. Empirical strategies in labor Economics. Handbook of Labor Economics, volume 3A, 1999.

(42) Chamberlain, G. Analysis of covariance with qualitative data. The review of economic Studies, Vol. 47, no. 1, Econometrics Issue. Jan 1980. pp. 225-238.

(43) Ferrer-i-Carbonell, A., Frijters, P. How important is methodology for the estimates of the determinants of happiness. Tinbergen Institute Discussion paper. 2002.