

Choosing them to withstand them?

Working conditions and their impact on health and well-being

ÉRIC DEFEBVRE^a

*^aÉrudite, Paris-Est Créteil University, 61 avenue du Général de Gaulle, 94010 Créteil, France and Tepp FR n°3435-CNRS
Mail: eric.defebvre@univ-paris-est.fr. Phone: +33 651775786*

Preliminary draft.

Please do not quote.

Abstract: Evaluating the role of working conditions in the determination of workers' health status is obviously a crucial matter when it comes to public policies, as evidenced by the recent law in France introducing the consideration of past physical exposures into pension calculation schemes. Our goal is to determine if the possibility for workers to alter their own working conditions acts as a modulator in the relationship between work strains and physical health, mental health and well-being. To do so, we use data coming from the 2010 wave of the European Working Conditions Survey (EWCS) and resort to an instrumental variable approach to handle biases related to reverse causality and omitted variables. Our results indicate varying supplementary effects of facing detrimental working conditions and being restrained in terms of decision latitude or involvement in firms' decisions, on top of the classical effects of these indicators considered separately. Our results, much like those of the literature, demonstrate mixed and rather inconsistent effects, yet with interesting differences according to gender and the health and well-being outcome retained.

Keywords: Working conditions; Choice; Health; Instrumental variables

JEL classifications: J81; I14; C35; C36

INTRODUCTION

Evaluating the role of working conditions in the determination of workers' health status is obviously a crucial matter when it comes to public policies, as evidenced by the recent law in France introducing the consideration of past physical exposures into pension calculation schemes.

In economics and on a theoretical standpoint, the differences in wages between equally productive individuals can be explained by differences in the difficulty of work-related tasks, meaning workers with poorer working conditions are paid more than others in a perfectly competitive environment (see the Hedonic Price theory – Rosen, 1974). In this framework, seeing working conditions as a *bargaining chip* for workers to obtain better pay-out (could it be financial or not) seems very possible: one may choose to work in harsh conditions to obtain specific compensations. Empirically, the relationship between working conditions and health status received a lot of attention in the scientific community. In economics, because of the lack of data allowing for handling inherent biases such as selection on the labour market, reverse causality, omitted variables and unobserved characteristics, the role of work strains on health as a whole has been less studied. Furthermore, in this dedicated literature working conditions are considered *de facto* as constraints (not the result of a choice) in a huge majority of studies, forbidding the analysis of heterogeneous effects depending on whether the exposures are possibly the result of a choice or not.

Our goal is to determine if the possibility for workers to alter their own working conditions acts as a modulator in the relationship between work strains and physical health, mental health and well-being. To do so, we use data coming from the 2010 wave of the European Working Conditions Survey (EWCS) and resort to an instrumental variable approach to handle biases related to reverse causality and omitted variables. We extend on the literature by working on numerous, diverse working conditions indicators and by allowing many interactions between choice and strains. We also take into account the possibility of compensations at work.

The paper first presents an overview of the economic literature (Section 1), then the data (Section 2) and empirical methodology (Section 3). Finally, we present and discuss the results (Sections 4 and 5).

To the attention of the JESF discussant

As can be seen, this work is an early work in progress. A lot of work remains to be done, including major methodological enhancements.

Notably, only correlations between health and working conditions are observed at this point (only specification (1) is estimated). Because we work on cross-sectional data, we may very well face simultaneity biases (*i.e.* endogeneity). We are still to implement an instrumental variable strategy (see specification (3)).

We are also thinking about working on less aggregated indicators for both working conditions and choice indicators. This would allow for much more precision in the analysis. Yet, this would also mean that the instrumental strategy would be a lot more difficult to implement.

Those ideas are only two of many tracks of improvement. Among others, comments and suggestions about the methodology (especially instrument ideas) are very welcome!

1. Literature

1.1. Causal estimations

As emphasised by the economic literature, the study of the causal consequences of exposures to detrimental working conditions on health status is important, yet difficult (Barnay, 2016).

There is a high chance that individuals determine themselves on the labour market based on several criteria, including their own health status. The choice of a job and of its working conditions is indeed an endogenous process in regards to health status (Cottini and Lucifora, 2013), but with possibly contradictory outcomes in terms of resulting estimation biases. Individuals with the lower levels of health capital may prefer less demanding jobs in terms of work strains while more health-privileged workers may make use of this comparative advantage and choose highly-demanding (Muurinen and Le Grand, 1985), more profitable jobs (Rosen, 1974). It is also possible individuals are selected (*i.e.* by the recruiter) based on observable elements of health status. In that *scenario*, the estimations are likely to be biased downwards, as individuals with worse health conditions will be underrepresented in the sample and *vice versa*. On the other hand, it is also possible to imagine that some workers with the lower levels of health capital are also those with the lower levels of human capital, hence those with the less opportunities on the labour market. In that sense, these individuals will be left with no choice but to accept the jobs characterised by the worst working strains. This induces estimations being biased upwards, which is more of a problem. It is difficult to determine the magnitude of both these contradictory assumptions and thus the leading endogeneity bias in such a case. Yet Defebvre (2016), on French retrospective longitudinal data, shows clues that the former hypothesis of *healthy worker effect* inducing that healthier workers are preferred for more demanding jobs seem to be predominant.

Unobservable individual and time-variant characteristics, when linked to both health status and work-related outcomes, may also alter the results (Lindeboom and Kerkhofs, 2009). Elements such as health-related risky behaviours but more generally individual preferences and risk aversion behaviours are shown to determine both health and employment outcomes. For instance, workers facing more work strains and thus being better paid are in the capacity to afford more healthcare goods, hence decreasing the observed health consequences of exposures to detrimental working conditions (Fletcher *et al.*, 2011), this behaviour of course varying according to their own preferences. Generational effects, shocks or crises are also at risk to deteriorate the estimation quality. In the case of a shock affecting differently exposed and non-exposed workers in terms of work strains, the resulting heterogeneity between the two groups may be wrongly attributed to said work strains.

1.2. Working conditions and health status: a short economic literature review

The economic literature interested in the role of exposures to detrimental working conditions on health status agrees, to different degrees, on a mean negative effect of physical and psychosocial strains on different measures of health conditions. However, this average effect differs according to several individual and job characteristics.

The physical burden of work is shown to be deleterious to one's health status. On quarterly, firm level panel data, a heavy workload is found to detrimental health consequences, inducing greater absenteeism (Ose, 2005). Robone *et al.* (2011) focus on the role of the workplace, atypical work hours and job satisfaction in general and find that working conditions influence both self-assessed health and well-being, also on panel data. General job satisfaction is confirmed having a positive effect, in another study (Fischer and Sousa-Poza, 2009), on both objective and subjective health status measures. On U.S. workers and taking into account for

selection and unobserved heterogeneity, elements of work environment (weather, extreme temperatures or moisture) specifically impacts young worker's self-rated health status (Fletcher *et al.*, 2011). On the other hand, Datta Gupta and Kristensen (2008) show that, after controlling for unobserved heterogeneity, a favourable work environment and a high job security are related to better health outcomes, using longitudinal data and cross-country comparisons. Psychosocially exposed workers, for instance to situations of *Job strain* (*i.e.* exposed to high job demands and low decisional latitude – Karasek, 1979) or *Iso-strain* (*i.e.* exposed to *Job strain* and social isolation – Johnson *et al.*, 1989), face damaging effects on their mental health, as shown notably by Cottini and Lucifora (2013) on European data using instrumental variable frameworks. Taking into account for possible compensative schemes (Effort-Reward Imbalance models – Siegrist, 1996), de Jonge *et al.* (2000) find specific effects of both *Job strain* and low reward at work on worker's well-being.

These mean effects vary, notably according to gender. Bildt and Michélsen (2002) show on Swedish panel data that, in women, general job strain, shift work, low pride or stimulation at work and poor social support are degrading factors for mental health status. In men, only shift work and low pride are associated with poor mental health. Fletcher *et al.* (2011) find heterogeneous effects according to race, gender and age, notably with physical loads specifically affecting young women when work environment impacts older women's health more. Defebvre (2016) finds, for men and women, deleterious effects of both physical and psychosocial exposures to detrimental working conditions on the declaration of chronic diseases but with varying impacts, according to gender (women are less exposed but their health status is more impacted), strains' nature (physical or psychosocial strains) and magnitude (accounting for exposure durations and simultaneity). These results take into account selection biases as well as unobserved heterogeneity.

1.3. The role of choice

Even though the health consequences of working conditions is known to be heterogeneous according to several demographic and job-related characteristics, exposures to work strains are almost always considered *de facto* in the dedicated literature as constraints (necessarily not the result of a choice). A lot of economic studies demonstrate the importance of the gap existing between individual expectations related to employment and the actual facts of their employment situations (Bassanini and Caroli, 2015). One part of this literature focuses on the choice of work hours (*i.e.* intensive margin). Working more than one would want to but also working less than one would like is shown, on Australian panel data, to deteriorate mental health, taking into account for unobserved heterogeneity using random effects (Dockery, 2006). Bell *et al.* (2012), also on panel data but using fixed effects models, show detrimental effects of being over employed on self-assessed health status. The other part of the literature gets interests in the decision to participate or not in the labour market (*i.e.* extensive margin). Being in employment longer than wanted is potentially deleterious to health, as approximated by the literature showing positive effects of retirement on health condition (Blake and Garrouste, 2012; Coe and Zamarro, 2011; Eibich, 2015). On the other hand, being forced out of the labour market (proxied by job loss) is shown having detrimental effects, even before actual layoff (Ferrie *et al.*, 1998).

When it comes to the study of working conditions, the closest form of choice at work in the literature is embodied by the notion of decision latitude, later to be known as job control (Karasek, 1979). This concept was mostly developed in the epidemiological and psychological empirical literature, but later in economics as well. In epidemiology, Bentley *et al.* (2015) demonstrate that, while the opposite is well documented in the literature, an amelioration of job control (notably decision authority and skill discretion) is linked to a

better mental health condition, using panel data and fixed effect models. Canivet *et al.* (2013) show that job control, while often used in regards to job demands following the Job Demands-Control framework, also independently acts as a determinant of resorting to disability pensions. This impact on health status is confirmed by Smith *et al.* (2008) and shown as stable across socioeconomic statuses. In economics, a clear association between low job autonomy and a degraded mental health state is found on European data by Cottini and Lucifora (2013), using instrumental variable frameworks.

The ability to influence one's own working conditions as a modulator of the well-known role of exposures to detrimental work strains on health status is much rarer in the literature. Notably, interactions between classical working conditions indicators and choice at work indicators appear inconsistent (Schmidt and Diestel, 2011). When no specific interactional effect between decision latitude and physical workload is found on health status by Aittomäki *et al.* (2008) on Finnish data, Dalgard *et al.* (2009) find multiplicative effects of job control on the role of job demands on mental health, using Norwegian panel data. The study of de Jonge *et al.* (1999) illustrate this diversity of results, finding mixed evidence of interactions between psychological, physical, emotional demands and a weak decision latitude (embodied by a lack of autonomy).

2. Data

We use data coming from the 2010 wave of the European Working Conditions Survey (EWCS). This survey offers a very comprehensive description of the working conditions of a little less than 44,000 European workers from 34 countries (including, on top of EU27, Norway, Croatia, the former Yugoslav Republic of Macedonia, Turkey, Albania, Montenegro and Kosovo).

As far as working conditions are concerned, the survey provides information about the five most important areas of exposure: physical strains, environmental exposures, psychosocial strains, general job demands and organizational strains. Each one of these areas is subject to several questions. Physical health status can be approached by self-assessed health (five modalities), mental health by an indicator for depression and anxiety (two modalities) and well-being by several indicators (feeling cheerful, calm/relaxed, active/vigorous, fresh/rested, feeling like life is filled with interesting things). As for the choice variables, it is possible to reconstruct three main indicators: the possibility to make time arrangements, the possibility to decide how to organize the work and the degree of involvement in the firm's decisions.

In our study, for comparability purposes, we are working on a group of 18 developed countries (including Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, Hungary, the Netherlands, Austria, Poland, Portugal, Finland, Sweden, the UK and Norway). Thus, we are working on more than 25,000 individuals (13,000 men and 12,000 women).

3. Empirical strategy

3.1. Variables

Our dependent variables are covering health status through three dimensions. General/physical health status is covered by the classical indicator for self-assessed health from the European Mini module (*How is your health in general? Would you say it is... Very good, Good, Fair, Bad, Very bad*). We dichotomise this indicator, with on one side *Very good* and *Good* and on the other one *Fair, Bad* and *Very bad*. Mental health is covered by a single

question with a binary answer which does not allow us to split depression and anxiety up (*Over the last 12 months, did you suffer from depression or anxiety? Yes, No*). Finally, our well-being indicator is built using a 2010-wave exclusive question: *Please indicate for each of the five statements which is the closest to how you have been feeling over the last two weeks*. The items are *I have felt cheerful and in good spirits, I have felt calm and relaxed, I have felt active and vigorous, I woke up feeling fresh and rested and My daily life has been filled with things that interest me*. The six answer items to each of these statements go from *All the time* to *At no time*. We aggregate these indicators into one, binary outcome for general well-being.

We assess working conditions through five composite indicators in order to make the most use of what is offered by the data. We use an indicator for physical strains (painful positions, lifting/moving people, heavy loads, standing and repetitive movements), environmental exposures (vibrations, noises, high temperature, low temperature, fumes, vapours, chemicals, passive tobacco consumption and infectious materials), psychosocial strains related to feelings (contact with the public, angry clients, colleagues support, conflict with own values, emotionally involved and the necessity to hide feelings at work), general job demands (solving unforeseen problems, monotonous tasks, complex tasks and having to learning new things) and organisational strains (repetitive tasks, high speed work, tight deadlines, negative interruptions, quality standards, quality self-assessment). As is, most of these composite aggregated indicators can be used either as scores or binary variables. For more convenience we choose the latter option.

To assess the possibility for workers to have the choice in their job, we use three composite indicators. The first one represents the capacity for workers to have time arrangements at work (choosing working time and possibility to take breaks when needed). The second one assesses the capacity to alter work organization (choosing order of tasks, the method of work or the pace of work). Finally, the last indicator focuses on how workers are involved in the firm's decisions (being consulted before new targets are set, involved in improving work organization and having a say in choosing work partners). These three indicators are also made binary.

3.2. Method

Our objective is to test whether the possibility for a worker to influence his/her workplace does act as a modulator in the impact of work strains (job demands) on health status. To do so, we estimate in a first step three different models according to the outcome chosen (physical health, mental health or well-being), and we stratify our estimations by gender (as described by Devaux *et al.* in 2008 and Shmueli in 2003, men and women do not have the same declarative patterns when it comes to health and labour market outcomes). The estimation method relies on simple binary logistic models:

$$y_{i,k} = \alpha + \beta \text{Contr}_i + \gamma \text{WC}_{i,j} + \theta \text{Choice}_{i,h} + \phi \text{WC}_{i,j} \times \text{Choice}_{i,h} + \mu_i \quad (1)$$

where $y_{i,k}$ is a vector of binary health outcomes for individual i with k being either a physical, mental or well-being indicator. Contr_i is a vector of control variables including age (30-44, 45-59, 60-74 and 75 or more), education (primary, secondary or tertiary), ethnicity (one or more parent born abroad), being a supervisor at work (having at least five workers under supervision), possible compensations for exposures to detrimental working conditions (being compensated for detrimental working conditions, overtime or Sunday work) and country dummy variables. $\text{WC}_{i,j}$ is a vector of five working conditions dimensions taking value 1 if individual i is exposed or 0 otherwise, with j indicating the specific strain considered: physical strains, environmental exposures, psychosocial strains, general job

demands and organizational strains. Choice indicators are also introduced (variable $Choice_{i,h}$) and take value 1 when i does not have the considered possibility and 0 otherwise, h representing either the possibility to make time arrangements, the possibility to decide how to organize the work or being involved in the firm's decisions. $WC_{i,j} \times Choice_{i,h}$ represents a cross variable between work strains and choice indicators, taking value 1 if individual i is exposed to said work strain and does not have said possibility to influence his/her job, taking value 0 otherwise. The objective of this cross variable is to give evidence of the possible modulator role of choice in the exposure to work strains. μ_i denotes the error term. Considering this model is run for all three health status outcomes, two genders, five working conditions indicators and three choice indicators, this induces 90 different specifications are tested to assess all possible interactions between working conditions and choice variables.

However, as health status and working conditions are observed simultaneously, the validity of this model is questionable because of the resulting endogeneity biases. First, there is a reverse causality between our outcomes (health status) and variables of interest (working conditions) because of the simultaneity between the two indicators. It is also necessary to control for the fact that choosing of a job is unlikely a random experience (due to heterogeneity of individual preferences, risk aversion attitudes, working conditions and health status among the population) as well as unobserved heterogeneity. Formally, we are estimating two models, where both error terms (μ_i and ε_i) are jointly correlated:

$$\begin{cases} y_{i,k} = \alpha + \beta Contr_i + \gamma WC_{i,j} + \theta Choice_{i,h} + \phi WC_{i,j} \times Choice_{i,h} + \mu_i \\ WC_{i,j} = \alpha' + \beta' Contr_i + \varepsilon_i \end{cases} \quad (2)$$

In theory it is possible to estimate such a model without resorting to identifying variables (exclusion condition). However it is generally preferred to base estimates on the exclusion criterion and use identifying variables. So in a second step, we include an instrumental variable in order to identify the causal effect of detrimental working conditions on health and well-being. We thus estimate, using bivariate probit models estimated in maximum likelihood (Lollivier, 2006), the following model:

$$\begin{cases} y_{i,k} = \alpha + \beta Contr_i + \gamma WC_{i,j} + \theta Choice_{i,h} + \phi WC_{i,j} \times Choice_{i,h} + \mu_i \\ WC_{i,j} = \alpha' + \beta' Contr_i + \delta Ident_i + \varepsilon_i \end{cases} \quad (3)$$

where $Ident_i$ is an instrument representing variations across countries in terms of workplace health and safety regulation (*i.e.* an indicator representing the degree of involvement of the law about workplace health and safety at a state level). This instrument is bound to be correlated with our working conditions indicators while at the same time being exogenous of individual health conditions (Cottini and Lucifora, 2013). This model supposedly allows for a correct identification and unbiased estimations. We assume that the error terms follow a bivariate normal distribution:

$$\begin{bmatrix} \varepsilon_i \\ \mu_i \end{bmatrix} \sim N \left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix} \right]$$

4. Results

4.1. Descriptive statistics

Table 1 presents a sample description for all our variables of interest. It appears that 22% of our sample declares a poor level of self-assessed health status, 10% being depressed and/or anxious and 9% having a poor level of well-being. At work, being exposed to detrimental

working conditions is far from uncommon. 30% of workers face harsh physical strains, 21% detrimental environmental exposures, respectively 34% and 19% for psychosocial risk factors and general high job demands and 22% of them face strains related to work organisation. Among these workers, 26% of them cannot make time arrangements, 16% cannot decide of how to organise their work and 22% are not involved in the firm's decisions.

Table 1: General sample description

Variable	Mean	Std. error	Min	Max	N
Health status					
<i>Poor self-assessed health</i>	.22	.41	0	1	5601
<i>Depression or anxiety</i>	.10	.30	0	1	2646
<i>Poor well-being</i>	.09	.29	0	1	2390
Working conditions					
<i>Physical exposure</i>	.30	.46	0	1	7850
<i>Environmental exposure</i>	.21	.40	0	1	5263
<i>Psychosocial exposure</i>	.34	.47	0	1	8503
<i>Job demands exposure</i>	.19	.39	0	1	4719
<i>Organisational exposure</i>	.22	.41	0	1	5348
Choice					
<i>No time arrangement</i>	.26	.44	0	1	6736
<i>No choice in work organisation</i>	.16	.37	0	1	4182
<i>Not involved in decisions</i>	.22	.41	0	1	4518
Demography					
<i>Men</i>	.50	.50	0	1	13025
<i>Women</i>	.50	.50	0	1	12990
Education					
<i>Primary</i>	.20	.40	0	1	5201
<i>Secondary</i>	.42	.49	0	1	10930
<i>Tertiary</i>	.32	.47	0	1	8304
Age					
<i>30-44</i>	.39	.49	0	1	10051
<i>45-59</i>	.36	.48	0	1	9278
<i>60-74</i>	.07	.25	0	1	1709
<i>75+</i>	.01	.06	0	1	78
<i>Foreigner</i>	.16	.37	0	1	4191
At work					
<i>Supervisor</i>	.08	.26	0	1	1960
<i>Compensated for hard work</i>	.42	.49	0	1	8694

Interpretation: ***: difference significant at the 1% level, **: difference significant at the 5% level, *: difference significant at the 10% level. The proportion of individuals declaring a poor self-assessed health status in the general sample is 22%.

Source: European Working Conditions Survey (EWCS), wave 2010.

Overall, the exposure to detrimental working conditions is heavily correlated with worse health conditions. When exposures to physical and environmental strains particularly affect the declaration of a poor self-assessed health status (resp. -12 percentage points (pp) and -10pp) and well-being (resp. -5pp and -4pp), psychosocial risk factors, a high job demands and strong organisation strains are more correlated with depression and anxiety (resp. -8pp, -4pp and -5pp). What is interesting is that choice indicators also seem relevant in terms of health status. Having the possibility to take breaks or to alter the hours of work is correlated with all three outcomes (-3pp, -1pp and -3pp resp. for general health status, mental health and well-being) but being involved in decisions seem much more important (resp. -8pp for self-assessed health and -6pp for well-being). Apparently, not being able to decide how to organise the work is less relevant, and even is positively correlated with the absence of depression and anxiety (resp. -4pp, +2pp and -3pp for all three indicators). This unexpected result might be explained by strains related to higher levels of responsibility involved by the possibility to manage one's own work.

Table 2: Differences in health status, according to individual characteristics

Variable	Poor self-assessed health			Depression or anxiety			Poor well-being		
	Mean (treated)	Mean (contr.)	Diff.	Mean (treated)	Mean (contr.)	Diff.	Mean (treated)	Mean (contr.)	Diff.
Working conditions									
<i>Physical exposure</i>	.30	.18	-.12***	.13	.09	-.04***	.13	.08	-.05***
<i>Environmental exposure</i>	.30	.19	-.10***	.12	.10	-.02***	.12	.09	-.04***
<i>Psychosocial exposure</i>	.24	.20	-.04***	.16	.07	-.08***	.11	.08	-.03***
<i>Job demands exposure</i>	.22	.21	-.00	.13	.09	-.04***	.10	.09	-.01*
<i>Organisational exposure</i>	.24	.21	-.03***	.14	.09	-.05***	.10	.09	-.01*
Choice									
<i>No time arrangement</i>	.24	.21	-.03***	.11	.10	-.01**	.12	.08	-.03***
<i>No choice in work organisation</i>	.25	.21	-.04***	.09	.10	.02***	.12	.09	-.03***
<i>Not involved in decisions</i>	.28	.19	-.08***	.11	.10	-.01	.14	.08	-.06***
Demography									
<i>Men</i>	.21	.22	.02***	.08	.12	.04***	.08	.11	.03***
<i>Women</i>	.22	.21	-.02***	.12	.08	-.04***	.11	.08	-.03***
Education									
<i>Primary</i>	.25	.21	-.04***	.08	.11	.03***	.10	.09	-.00
<i>Secondary</i>	.22	.21	-.03	.10	.11	.01*	.09	.09	-.00
<i>Tertiary</i>	.15	.24	.09***	.11	.10	-.02***	.07	.10	.03***
Age									
<i>30-44</i>	.17	.24	.07***	.11	.10	-.01	.09	.10	.01
<i>45-59</i>	.29	.17	-.12***	.11	.10	-.02***	.11	.08	-.03***
<i>60-74</i>	.34	.21	-.13***	.09	.10	.02**	.08	.09	.01*
<i>75+</i>	.53	.21	-.32***	.08	.10	.03	.10	.09	-.01
<i>Foreigner</i>	.22	.21	-.01	.12	.10	-.02***	.10	.09	-.01***
At work									
<i>Supervisor</i>	.18	.22	.04***	.09	.10	.01*	.07	.09	.02***
<i>Compensated for hard work</i>	.21	.21	-.00	.10	.10	-.00	.09	.10	.01*

Interpretation: ***: difference significant at the 1% level, **: difference significant at the 5% level, *: difference significant at the 10% level. The proportion of individuals declaring a poor self-assessed health status while being exposed to physical strains at work is 0.30. In the non-exposed sample, this number is 0.18 (which is significantly lower at the 1% level).

Source: European Working Conditions Survey (EWCS), wave 2010.

4.2. Main results

Table 3 and Table 4 present a summary of the results obtained by simple logistic regressions for specification (1), respectively for men and women.

Men's self-assessed health status appears logically as particularly vulnerable to physical and environmental exposures to detrimental working conditions, but a little less to psychosocial risk factors. Not being involved in decisions also seems to be the most relevant determinant of self-assessed health status, followed by work organisation and the impossibility to make time arrangements. Detrimental interactions between choice indicators and working conditions can be observed. Notably, environmental exposures seem all the more risky for one's health if he/she is not involved in decisions but the most harmful combinations all involve a high job demands. Depression or anxiety happen more often in men exposed to a psychosocially demanding job. Even though the absence of choice does not seem to be relevant in terms of mental health itself, being exposed to a high physical load while having no possibility to make time arrangements and having no say in work organisation or facing psychosocial risk factors and no choice is organisation all induce detrimental mental health outcomes. A high physical or environmental load and psychosocial strains are correlated with poorer levels of well-being. Involvement in the life of the firm is predominant in explaining well-being followed by time and organisational choices, but no apparent supplementary effect of combinations between strains and choice indicators can be spotted.

Table 3: Regression results (logit) – male population

Variables	Poor self-assessed health		Depression or anxiety		Poor well-being	
	Coeff.	Std. error	Coeff.	Std. error	Coeff.	Std. error
Physical indicators						
<i>Physical exposure</i>	.60***	.07	.28***	.10	.41***	.10
<i>No time arrangement</i>	.06	.08	-.04	.12	.14	.12
<i>Physical and No time arrangement</i>	.10	.12	.45***	.17	.17	.16
<i>No choice in work organisation</i>	.19**	.09	.34**	.16	.16	.13
<i>Physical and No choice in work org.</i>	.01	.13	.43**	.21	.06	.18
<i>Not involved in decisions</i>	.32***	.09	.15	.14	.42***	.13
<i>Physical and Not involved in decisions</i>	.04	.13	.04	.19	.14	.17
Environmental indicators						
<i>Environmental exposure</i>	.49***	.07	.29***	.10	.48***	.10
<i>No time arrangement</i>	.07	.08	.10	.11	.32***	.11
<i>Environmental and No time arrangement</i>	.10	.12	.25	.17	.18	.16
<i>No choice in work organisation</i>	.16*	.09	.12	.13	.17	.12
<i>Environmental and No choice in work org.</i>	.10	.13	.10	.21	.03	.18
<i>Not involved in decisions</i>	.21**	.09	.12	.13	.47***	.12
<i>Environmental and Not involved in decisions</i>	.30**	.13	.07	.20	.15	.17
Psychosocial strains						
<i>Psychosocial exposure</i>	.38***	.07	1.14***	.09	.46***	.10
<i>No time arrangement</i>	.15**	.07	.17	.12	.22**	.10
<i>Psychosocial and No time arrangement</i>	.03	.13	.09	.17	.05	.17
<i>No choice in work organisation</i>	.21***	.08	.29*	.15	.19*	.11
<i>Psychosocial and No choice in work org.</i>	.09	.15	.61***	.21	.11	.20
<i>Not involved in decisions</i>	.32***	.08	.10	.14	.47***	.11
<i>Psychosocial and Not involved in decisions</i>	.06	.15	.35*	.20	.26	.19
Job demands indicators						
<i>Job demands exposure</i>	.37***	.08	.42***	.10	.27**	.11
<i>No time arrangement</i>	.22***	.07	.19*	.10	.27***	.09
<i>Job demands and No time arrangement</i>	.32**	.15	.25	.19	.01	.20
<i>No choice in work organisation</i>	.37***	.07	.07	.12	.27***	.10
<i>Job demands and No choice in work org.</i>	.49***	.19	.15	.25	.20	.24
<i>Not involved in decisions</i>	.41***	.07	.23**	.11	.57***	.10
<i>Job demands and Not involved in decisions</i>	.35**	.18	.04	.23	.01	.22
Organisational strains						
<i>Organisational exposure</i>	.25***	.08	.37***	.10	.31***	.11
<i>No time arrangement</i>	.13*	.07	.15	.10	.18*	.10
<i>Organisational and No time arrangement</i>	.14	.13	.20	.18	.23	.18
<i>No choice in work organisation</i>	.28***	.07	.12	.13	.24**	.11
<i>Organisational and No choice in work org.</i>	.05	.15	.07	.23	.09	.21
<i>Not involved in decisions</i>	.30***	.07	.19	.12	.51***	.10
<i>Organisational and Not involved in decisions</i>	.01	.16	.03	.22	.22	.20

Interpretation: Coefficients. ***: difference significant at the 1% level, **: difference significant at the 5% level, *: difference significant at the 10% level. Standard errors in italics.

Source: European Working Conditions Survey (EWCS), wave 2010.

Just like in men, women's poor self-assessed health status is mostly correlated with physical and environmental exposures. All choices indicators are strongly correlated as well, especially job involvement. A supplementary effect is also to be found between job demands, organisational strains and the impossibility of time arrangements. Psychosocial strains are the most relevant factors for the declaration of depression and anxiety. Involvement is still a predominant characteristic, followed by time arrangements. High supplementary effects are to be found with psychosocial exposures and all choice indicators as well as respectively a high job demand and low organisational latitude and poor organisational conditions and no time arrangements. Women's well-being seems degraded specifically by environmental exposures, but all other types of exposures seem equally relevant. As usual, involvement and time constraints are of prime importance overall. Not being involved in decisions is particularly harmful when combined to physical and environmental strains. Psychosocial exposures and

no time arrangements as well as organisational strains combined with no option to alter it also induce supplementary effects on well-being.

Table 4: Regression results (logit) – female population

Variables	Poor SAH		Depression or anxiety		Poor well-being	
	Coeff.	Std. error	Coeff.	Std. error	Coeff.	Std. error
Physical indicators						
<i>Physical exposure</i>	.67***	.07	.33***	.09	.42***	.09
<i>No time arrangement</i>	.25***	.07	.15**	.08	.22**	.09
<i>Physical and No time arrangement</i>	.03	.11	.23*	.13	.10	.14
<i>No choice in work organisation</i>	.09	.09	.04	.12	.17	.11
<i>Physical and No choice in work org.</i>	.19	.13	.02	.17	.08	.16
<i>Not involved in decisions</i>	.38***	.08	.29***	.10	.30***	.10
<i>Physical and Not involved in decisions</i>	.04	.12	.02	.15	.32**	.16
Environmental indicators						
<i>Environmental exposure</i>	.68***	.10	.30**	.12	.59***	.13
<i>No time arrangement</i>	.30***	.06	.23***	.07	.26***	.07
<i>Environmental and No time arrangement</i>	.02	.14	.21	.18	.03	.18
<i>No choice in work organisation</i>	.20***	.07	.10	.10	.10	.09
<i>Environmental and No choice in work org.</i>	.13	.17	.22	.21	.37*	.07
<i>Not involved in decisions</i>	.42***	.07	.25***	.09	.36***	.09
<i>Environmental and Not involved in decisions</i>	.01	.16	.36*	.20	.45**	.20
Psychosocial strains						
<i>Psychosocial exposure</i>	.42***	.06	.64***	.08	.42***	.09
<i>No time arrangement</i>	.26***	.07	.06	.10	.42***	.09
<i>Psychosocial and No time arrangement</i>	.08	.11	.33**	.13	.27**	.14
<i>No choice in work organisation</i>	.15*	.09	.19	.13	.26**	.11
<i>Psychosocial and No choice in work org.</i>	.15	.13	.35**	.18	.01	.17
<i>Not involved in decisions</i>	.36***	.08	.18	.11	.41***	.10
<i>Psychosocial and Not involved in decisions</i>	.19	.12	.35**	.15	.14	.16
Job demands indicators						
<i>Job demands exposure</i>	.07	.08	.36***	.09	.32***	.10
<i>No time arrangement</i>	.28***	.06	.29***	.07	.34***	.08
<i>Job demands and No time arrangement</i>	.37***	.14	.01	.16	.20	.17
<i>No choice in work organisation</i>	.22***	.07	.07	.10	.23**	.09
<i>Job demands and No choice in work org.</i>	.03	.19	.44**	.22	.12	.23
<i>Not involved in decisions</i>	.46***	.07	.26***	.09	.42***	.09
<i>Job demands and Not involved in decisions</i>	.07	.18	.37*	.20	.21	.21
Organisational strains						
<i>Organisational exposure</i>	.27***	.08	.38***	.09	.28***	.11
<i>No time arrangement</i>	.23***	.06	.18**	.08	.29***	.08
<i>Organisational and No time arrangement</i>	.33***	.12	.35**	.14	.00	.16
<i>No choice in work organisation</i>	.18**	.08	.11	.10	.16	.10
<i>Organisational and No choice in work org.</i>	.19	.16	.36*	.19	.46**	.19
<i>Not involved in decisions</i>	.40***	.07	.29***	.09	.42***	.09
<i>Organisational and Not involved in decisions</i>	.12	.15	.28	.17	.16	.19

Interpretation: Coefficients. ***: difference significant at the 1% level, **: difference significant at the 5% level, *: difference significant at the 10% level. Standard errors in italics.

Source: European Working Conditions Survey (EWCS), wave 2010.

5. Discussion and conclusion

Using a wealth of working conditions indicators on European data, we are able to test interactions between work strains, choice at work and two dimensions of health status and well-being. Our results indicate varying supplementary effects of facing detrimental working conditions and being restrained in terms of decision latitude or involvement in firms' decisions, on top of the classical effects of these indicators considered separately. Our results, much like those of the literature (Schmidt and Diestel, 2011), demonstrate mixed and rather inconsistent effects, yet with interesting differences according to gender and the health and well-being outcome retained.

6. Acknowledgements

The author would like to especially thank Thomas Barnay (Upec Érudite), Sandrine Juin (Ined, Upec Érudite), François Legendre, Dorian Verboux and Yann Videau (Upec Érudite) and participants of the European Health Economics Association Ph.D./Supervisor conference in Barcelona (2016) for their useful advice.

REFERENCES

- Aittomäki, A., Lahelma, E., Rahkonen, O., Leino-Arjas, P., Martikainen, P., 2008. Job decision latitude as a potential modifier of the contribution of physical workload to poor functioning in middle-aged employees. *International Archives of Occupational and Environmental Health* 81, 975–982. doi:10.1007/s00420-007-0291-z
- Barnay, T., 2016. Health, work and working conditions: a review of the European economic literature. *The European Journal of Health Economics* 17, 693–709. doi:10.1007/s10198-015-0715-8
- Bassanini, A., Caroli, E., 2015. Is Work Bad for Health? The Role of Constraint versus Choice. *Annals of Economics and Statistics* 13. doi:10.15609/annaeconstat2009.119-120.13
- Bell, D., Otterbach, S., Sousa-Poza, A., 2012. Work Hours Constraints and Health. *Annals of Economics and Statistics* 35. doi:10.2307/23646455
- Bentley, R.J., Kavanagh, A., Krnjacki, L., LaMontagne, A.D., 2015. A Longitudinal Analysis of Changes in Job Control and Mental Health. *American Journal of Epidemiology* 182, 328–334. doi:10.1093/aje/kwv046
- Bildt, C., Michélsen, H., 2002. Gender differences in the effects from working conditions on mental health: a 4-year follow-up. *International Archives of Occupational and Environmental Health* 75, 252–258. doi:10.1007/s00420-001-0299-8
- Blake, H., Garrouste, C., 2012. Collateral effects of a pension reform in France. *Health Econometrics and Data Group Working Paper*.
- Canivet, C., Choi, B., Karasek, R., Moghaddassi, M., Staland-Nyman, C., Östergren, P.-O., 2013. Can high psychological job demands, low decision latitude, and high job strain predict disability pensions? A 12-year follow-up of middle-aged Swedish workers. *International Archives of Occupational and Environmental Health* 86, 307–319. doi:10.1007/s00420-012-0766-4
- Coe, N.B., Zamarro, G., 2011. Retirement effects on health in Europe. *Journal of Health Economics* 30, 77–86. doi:10.1016/j.jhealeco.2010.11.002
- Cottini, E., Lucifora, C., 2013. Mental health and working conditions in Europe. *ILRRReview Working paper* 4, 958–989.
- Dalgard, O.S., Sørensen, T., Sandanger, I., Nygård, J.F., Svensson, E., Reas, D.L., 2009. Job demands, job control, and mental health in an 11-year follow-up study: Normal and reversed relationships. *Work & Stress* 23, 284–296. doi:10.1080/02678370903250953
- Datta Gupta, N., Kristensen, N., 2008. Work environment satisfaction and employee health: panel evidence from Denmark, France and Spain, 1994–2001. *The European Journal of Health Economics* 9, 51–61. doi:10.1007/s10198-007-0037-6
- de Jonge, J., Bosma, H., Peter, R., Siegrist, J., 2000. Job strain, effort-reward imbalance and employee well-being: a large-scale cross-sectional study. *Social Science & Medicine* 50, 1317–1327. doi:10.1016/S0277-9536(99)00388-3
- de Jonge, J., Mulder, M.J.G., Nijhuis, F.J., 1999. The incorporation of different demand concepts in the job demand-control model: effects on health care professionals. *Social Science & Medicine* 48, 1149–1160. doi:10.1016/S0277-9536(98)00429-8
- Defebvre, É., 2016. Harder, better, faster... yet stronger? Working conditions and self-declaration of chronic diseases. *Tepp working paper*.
- Devaux, M., Jusot, F., Sermet, C., Tubeuf, S., 2008. Hétérogénéité sociale de déclaration de l'état de santé et mesure des inégalités de santé. *RFAS* 2008, 29–47.

- Dockery, A.M., 2006. Mental health and labour force status: panel estimates with four waves of HILDA. Centre for Labour Market Research Discussion Paper series.
- Eibich, P., 2015. Understanding the effect of retirement on health: Mechanisms and heterogeneity. *Journal of Health Economics* 43, 1–12. doi:10.1016/j.jhealeco.2015.05.001
- Ferrie, J.E., Shipley, M.J., Marmot, M.G., Stansfeld, S., Smith, G.D., 1998. The health effects of major organisational change and job insecurity. *Social Science & Medicine* 46, 243–254. doi:10.1016/S0277-9536(97)00158-5
- Fischer, J.A.V., Sousa-Poza, A., 2009. Does job satisfaction improve the health of workers? New evidence using panel data and objective measures of health. *Health Economics* 18, 71–89. doi:10.1002/hec.1341
- Fletcher, J.M., Sindelar, J.L., Yamaguchi, S., 2011. Cumulative effects of job characteristics on health. *Health Economics* 20, 553–570. doi:10.1002/hec.1616
- Johnson, J.V., Hall, E.M., Theorell, T., 1989. Combined effects of job strain and social isolation on cardiovascular disease morbidity and mortality in a random sample of the Swedish male working population. *Scandinavian Journal of Work, Environment & Health* 15, 271–279. doi:10.5271/sjweh.1852
- Karasek, R.A., 1979. Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign. *Administrative Science Quarterly* 24, 285. doi:10.2307/2392498
- Lindeboom, M., Kerkhofs, M., 2009. Health and work of the elderly: subjective health measures, reporting errors and endogeneity in the relationship between health and work. *Journal of Applied Econometrics* 24, 1024–1046. doi:10.1002/jae.1077
- Lollivier, S., 2006. *Économétrie avancée des variables qualitatives, Économie et Statistiques Avancées*. Economica.
- Muurinen, J.-M., Le Grand, J., 1985. The economic analysis of inequalities in health. *Social Science & Medicine* 20, 1029–1035. doi:10.1016/0277-9536(85)90259-X
- Ose, S.O., 2005. Working conditions, compensation and absenteeism. *J Health Econ* 24, 161–188. doi:10.1016/j.jhealeco.2004.07.001
- Robone, S., Jones, A.M., Rice, N., 2011. Contractual conditions, working conditions and their impact on health and well-being. *Eur J Health Econ* 12, 429–444. doi:10.1007/s10198-010-0256-0
- Rosen, S., 1974. Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. *Journal of Political Economy* 82, 34–55.
- Schmidt, K.-H., Diestel, S., 2011. Differential effects of decision latitude and control on the job demands–strain relationship: A cross-sectional survey study among elderly care nursing staff. *International Journal of Nursing Studies* 48, 307–317. doi:10.1016/j.ijnurstu.2010.04.003
- Shmueli, A., 2003. Socio-economic and demographic variation in health and in its measures: the issue of reporting heterogeneity. *Soc Sci Med* 57, 125–134.
- Siegrist, J., 1996. Adverse health effects of high-effort/low-reward conditions. *J Occup Health Psychol* 1, 27–41.
- Smith, P.M., Frank, J.W., Mustard, C.A., Bondy, S.J., 2008. Examining the relationships between job control and health status: a path analysis approach. *Journal of Epidemiology & Community Health* 62, 54–61. doi:10.1136/jech.2006.057539