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Work autonomy, work pressure, and job satisfaction: An analysis of European Union countries

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Abstract
Based on European Working Conditions Survey (EWCS) micro-data, we show that, on average, work autonomy has declined and work pressure has increased in most European Union countries since 1995. Since such evolution is substantially detrimental for workers, we examine whether workers of varied skill levels in different countries have been equally impacted. Descriptive analysis shows that low-skill clerical workers are the most affected and that Scandinavian countries fare better. Econometric results show that the decline in job satisfaction is due mainly to the increase in work pressure—which might be reaching a limit for high-skill workers—and that job satisfaction is most affected by an increase in work pressure when this is not accompanied by greater work autonomy.

JEL Codes: J28, J21

Keywords
European comparisons, job satisfaction, work autonomy, work pressure

Introduction

Autonomy at work is shown to have a favorable impact on the workers' well-being (Bauer, 2004; Knudsen et al., 2011; Ryan and Deci, 2000) as well as on their performance and creativity (Gagné and Deci, 2005). Raising work autonomy would hence

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provide a "win–win" situation with benefits for both employers and employees. In contrast, enhanced work intensity, which is also known to improve performance and productivity, is associated with negative health outcomes (Danna and Griffin, 1999; Dejours, 2009) and declining job satisfaction (Green, 2006).

However, the impact of work autonomy and work intensity on workers' well-being can only be plainly assessed after taking into account the combined levels of both factors. Indeed, Karasek (1979) showed that specific combinations of work autonomy and work intensity may have effects on well-being that go beyond the isolated effect of each factor. His Demand-Control model, further developed in Karasek and Theorell (1990) and tested by hundreds of studies, is based on two hypotheses. The strain hypothesis posits that jobs defined by heavy demands—high work load and time constraints—and low control—low decision latitude on how to meet these demands—result in mental strain, stress, and health problems. The activation hypothesis posits that jobs with high demands and high control provide workers with learning and development opportunities, which results in good health indicators and job satisfaction. This is explained by the fact that high decision latitude buffers the strain-inducing effect of high work demands (De Jonge and Kompier, 1997: 239; De Lange et al., 2003: 284; Van der Doef and Maes, 2010: 88–89).

Empirical evidence reveals that while satisfaction with extrinsic aspects of jobs—pay, hours of work, health, and safety—has improved or stabilized in recent decades (Clark, 2005; European Foundation for the Improvement of Living and Working Conditions (Eurofound, 2010a), satisfaction with job content and other intrinsic aspects of work, such as work autonomy and work intensity, seems to have decreased in several European Union (EU) countries (Clark, 2005; Eurofound, 2007). In fact, the trends toward work intensification and declining discretion at work are shown to be at the root of the decline in job satisfaction in the United Kingdom (Green, 2004, 2006; Green and Tsitsianis, 2005), a result consistent with Karasek and Theorell's model.

This article aims to test the strain hypothesis by assessing the extent to which the combined evolution of work intensity and work autonomy affects job satisfaction. The empirical study is based on the EWCS micro-data for 15 EU countries since 1995. In a first step, we use several items of the questionnaire to construct reliable synthesis indicators of work autonomy and work intensity. We then assess how both constructs and job satisfaction have evolved in EU-15 countries. In a second step, we use econometric analysis to study how the joint evolution of work intensity and work autonomy affects and explains the evolution of job satisfaction.

Our analysis allows us to see whether the trends observed in the United Kingdom and their impact on job satisfaction hold in other countries and for workers of different skill levels. Countries pertaining to the Scandinavian welfare regime are known to benefit from higher job quality (Davoine et al., 2008; Gallie, 2003, 2007). It will be interesting to study how job satisfaction, work autonomy, and work intensity have evolved in these countries when compared with the United Kingdom, and the Continental and South European countries. Are we facing a deepening or a smoothing of the differences between the European welfare regimes in the intrinsic aspects of work? Are low-skill and high-skill workers equally affected by the decline in work autonomy and increase in work intensity?

Following Karasek and Theorell, our main hypothesis is that an increase in work intensity is less harmful to the worker's satisfaction if he or she enjoys high autonomy. But there may well be an upper limit to work intensity, regardless of autonomy levels. We then also test whether growing levels of work intensity are increasingly detrimental for workers. The growth of psychosocial work-related problems in Scandinavian countries (Knudsen et al., 2011), in which both work autonomy and work intensity are high, may well be a symptom of such a situation. Contrary to what is suggested by the Job Demand-Control model, the buffer effect seems to have limits.

The argument is structured as follows. We begin by questioning the use of job satisfaction as an indicator of well-being at work and explain the perspective in which it is used here. Section "Data, empirical strategy, and the evolution of job satisfaction" presents the data and empirical strategy, followed by a description of the trends in job satisfaction since 1995 in the 15 countries studied. In section "The evolution of work autonomy and work intensity in the EU," we build indicators of work autonomy and work pressure and analyze their evolution by skill level and country. Section "Examining the relation between work autonomy, work pressure, and job satisfaction" conducts econometric analyses of the relation between job satisfaction, work autonomy, and work pressure. In the last section, we discuss the results and conclude.

Job satisfaction as an indicator of well-being at work

Conventional economists take self-reported data on job satisfaction as a proxy variable for the workers' utility without further questioning. However, the interpretation of self-reported job satisfaction is a particularly perilous endeavor: it is never possible to know exactly what the respondents are saying. Job satisfaction is often defined as the way people feel about their job and whether they like it; it would hence have a primarily affective character. But it is also recognized that job satisfaction has a cognitive dimension and is therefore also an evaluative judgment about one or several aspects of the job. This makes job satisfaction a multidimensional construct difficult to interpret. Moreover, job satisfaction is shown to depend on personality traits (Judge et al., 2001) and its perception is culturally biased (Sousa-Poza and Sousa-Poza, 2000).

Empirically, this intricacy results in the existence of substantive divergences between objective working conditions and self-reported job satisfaction. Bustillo et al. (2011) clearly show that there is hardly any congruence between actual working conditions and job satisfaction across countries. The range of variation of the latter is extremely small even when comparing very different countries in terms of their economic development. In fact, the range of variation in job satisfaction is higher within than across countries, but it is still not clear whether it captures real differences in job quality.

Social scientists generally explain these discrepancies by the fact that workers adapt to their actual work experience. Job satisfaction is assessed by workers in part in relation to what they expect from the job. While some workers might be led to expect a lot, others might be resigned to expecting little. So everything depends on the norms against which preferences and judgments are formed. It is difficult for both the analyst and the respondent to distinguish between true satisfaction and resignation—adaptation of preferences and aspirations to the opportunities actually available. For instance, low-wage workers

sometimes express higher satisfaction than high-wage workers: low earners may report being "satisfied" in their jobs simply because they have a low benchmark level of norms and aspirations (Brown et al., 2007).

Despite these important limitations, information on job satisfaction remains valuable. On one hand, it is robustly proven to relate to actual behaviors such as absenteeism and turnover (Spector, 1986; Utman, 1997). On another, job satisfaction transmits useful information about how workers perceive their work life, about how they feel about and evaluate their job, even though it is not an accurate indicator of the value of a job—the extent in which a job objectively provides the conditions for human flourishing. In this article, like Green (2006) and Green and Tsitsianis (2005), we consider that even if the *levels* of job satisfaction do not convey adequate measures of workers' true well-being, *changes* in job satisfaction over time constitute reliable indications of changes in well-being at work. The analysis below therefore focuses on trends in job satisfaction and on its relationship with other variables rather than on the comparison of job satisfaction between individuals and across countries. Also, the use of successive cross-sectional samples helps in moderating the influence of individual traits and expectations, and the period of time covered—1995–2010—has not witnessed societal changes able to provoke major shifts in collective expectations toward work.

In the United Kingdom (but not in Germany), the decline in job satisfaction is found to be associated with the decrease in work autonomy[1] and with the increase in work intensity (Green, 2004, 2006; Green and Tsitsianis, 2005). Indeed, job satisfaction is shown to increase in line with the degree of autonomy enjoyed in the job (Nguyen et al., 2003), a result which holds in different countries and for a wide array of job autonomy indicators (Eurofound, 2007). Conversely, work pressure is found to be associated with negative health outcomes (Danna and Griffin, 1999; Dejours, 2009), which predicts a strong negative association with job satisfaction. Karasek and Theorell (1990) made a decisive contribution to the understanding of both phenomena by showing that the positive effect of work autonomy on job satisfaction may be partially or totally outweighed by the negative effect of work intensity.

Data, empirical strategy, and the evolution of job satisfaction

The levels and trends in work autonomy, work intensity, and job satisfaction are studied using the 1995, 2000, 2005, and 2010 waves of the EWCS (Eurofound, 1995, 2000, 2005, 2010b), a cross-sectional dataset that provides unique and detailed information on work in Europe. The EWCS is a questionnaire-based survey, administered using face-to-face interviews with approximately 1000 individuals in their homes in each EU country. Every wave sample is representative of those aged 15 years and over who are in employment. In 2010, a multistage, stratified random sampling design was used in each country. Previous waves used a multistage, "random walk" procedure.[2]

The data analysis follows various steps. We first analyze the evolution of job satisfaction from 1995 to 2010 in the 15 EU countries for which data is available for the four waves (see Table 6 in Appendix 1 for a description of the variables). In the second step, we build indicators of work autonomy and work intensity and examine their evolution by

Table 1. Average job satisfaction by year and skill level.

	1995	2000	2005	2010	Total
High-skill clerical	3.30	3.26	3.23	3.21	3.25
Low-skill clerical	3.17	3.14	3.12	3.12	3.14
High-skill manual	3.04	2.95	2.96	2.97	2.98
Low-skill manual	2.94	2.89	2.88	2.91	2.90
Total	3.13	3.08	3.07	3.08	3.09

Job satisfaction goes from 1 = not at all satisfied to 4 = very satisfied.

skill level and country (section "The evolution of work autonomy and work intensity in the EU"). The association between work autonomy, work intensity, and job satisfaction is studied in the third step by using regression models (section "Examining the relation between work autonomy, work pressure, and job satisfaction").

As the sole observation of the aggregate trends at the national level might conceal significant divergences between workers of different skill levels, we distinguish between groups of workers by using the Eurofound classification of the occupational classes of the workers' jobs in four categories:[3] high-skill clerical (HSC), low-skill clerical (LSC), high-skill manual (HSM), and low-skill manual (LSM) (see Table 6).

The analysis of average job satisfaction by skill level reveals that, in each wave and overall, high-skill workers display higher levels of satisfaction than low-skill workers, and clerical workers are on average more satisfied than manual workers (Table 1). As for trends, average satisfaction in 1995 was higher than in any other year for all skill levels. There is a marked decline in the satisfaction of clerical workers over the years, whereas the satisfaction of manual workers seems to have stabilized in the 2000s.

Although declining, there is not a very pronounced trend in average job satisfaction. In contrast, the percentage of very satisfied workers decreased significantly. Differences between 1995 and 2010 are significant ($p < 0.001$) for all skill levels (Table 2). It appears that the steadiness of the average level of job satisfaction results from two phenomena: the decline in the number of very satisfied workers, which lowers the average satisfaction, and the decline in the not at all satisfied workers, which has the opposite effect.

The evolution of work autonomy and work intensity in the EU

If the findings mentioned in the introduction hold, that is, if work autonomy is actually related to job performance and job satisfaction, one would expect to see work autonomy steadily increasing for all workers over time and space. However, some studies show that there is no performance advantage to autonomous motivation for low-skill jobs (Gagné and Deci, 2005). While work autonomy is shown to promote performance in jobs requiring high levels of commitment, control devices have been found to yield superior short-term performance in unskilled tasks. Managers seeking efficiency would therefore discriminate between workers and a polarization process would be observed, marked by a long-term decline in job autonomy for the workers in less-skilled jobs.

Table 2. Proportion of very satisfied workers by year and skill level.

	1995	2000	2005	2010	2010–1995
High-skill clerical	0.42	0.36	0.35	0.33	−0.09*
n	2313	3300	2585	3832	
Low-skill clerical	0.33	0.31	0.29	0.27	−0.06*
n	5599	8097	5342	8708	
High-skill manual	0.24	0.19	0.18	0.17	−0.07*
n	2135	2893	1659	2495	
Low-skill manual	0.22	0.19	0.16	0.18	−0.04*
n	2415	3519	2611	3479	
Total	0.31	0.28	0.26	0.25	−0.06*
n	12,462	17,809	12,197	18,514	

*Significant difference at the 0.001 level.

With regard to work intensity, the competitive pressure due to the progressive catching-up of emerging economies might lead European firms to intensify work in an effort to maintain higher levels of competitiveness. However, work intensification is not an unlimited process and there is evidence that European workers are already subject to high work strain. As predicted by Karasek and Theorell (1990), evidence shows that the combination of high work intensity and low autonomy is associated to high risks of cardiovascular disease, depression, insomnia, and musculoskeletal disorders (De Lange et al., 2003; Siegrist, 2006; Van der Doef and Maes, 2010). An increase in work intensity is hence to be expected for all skill levels, but it might be less pronounced for workers with already high work intensity and/or low work autonomy.

Although all countries face similar competitive demands and economic constraints, national institutional settings and cultural specificities may strongly impact the levels and trends of work-related variables. In effect, the different welfare regimes exhibit substantially different levels of job quality (Davoine et al., 2008; Esser and Olsen, 2012; Gallie, 2003). Because of their more egalitarian regimes, higher trade union membership, and labor-oriented policies, we expect the Scandinavian countries to display better levels of intrinsic job quality and less difference among groups of workers. Conversely, South European countries are expected to fare worse in terms of both work autonomy levels and polarization trends, while Continental and Anglo-Saxon countries would display average positions.

As for the measurement of work autonomy, we rely on the indicators of Lopes et al. (2014), which are based on seven questions of the EWCS that reasonably cover what Karasek (1979) calls job control. We conducted the same principal components analyses (PCA) and obtained the same (standardized) scores, which we use in the analysis below. Our PCA also systematically revealed that work autonomy is a bi-dimensional phenomenon.[4] We nonetheless prefer not to keep the terms used by Lopes et al. (2013) and name instead the first factor procedural autonomy (PA) and the second factor content autonomy (CA).

Despite some divergences, these two factors broadly correspond to the two distinct constructs that, for Karasek (1979), constituted job control, namely, decision authority

Table 3. Work pressure and work autonomy scores over time, all countries pooled.

	1995	2000	2005	2010	2010–1995
Work pressure					
High-skill clerical	−0.144	−0.162	0.157	0.214	0.358*
n	2326	3310	2599	3847	
Low-skill clerical	−0.291	−0.278	0.043	−0.024	0.267*
n	5631	8118	5373	8758	
High-skill manual	0.15	0.19	0.533	0.41	0.260*
n	2140	2912	1671	2508	
Low-skill manual	−0.047	0.014	0.094	0.179	0.226*
n	2433	3558	2625	3515	
Total	−0.141	−0.122	0.145	0.122	0.263*
n	12,531	17,898	12,267	18,628	
Work autonomy					
PA	0.023	0.011	−0.028	−0.008	−0.031*
n	12,517	17,880	12,249	18,598	
CA	0.116	−0.012	−0.054	−0.030	−0.146*
n	12,517	17,880	12,249	18,598	

PA: procedural autonomy; CA: content autonomy.
The 0.00 score corresponds to the average level of work pressure or work autonomy of all workers for all waves; a negative score means below average work pressure/work autonomy, while a positive score means above average work pressure/autonomy.
*Significant difference at the 0.001 level.

and skill discretion. In effect, PA refers to the degree of control that workers perceive that they exert on when and how they carry out their tasks and CA refers to the learning opportunities available in their job and to whether workers assess the quality of their work (see Table 6). In other words, PA shows the control workers have over their methods and schedules, while CA shows the control workers have over their work content and the use of their skills. In most studies, the two constructs are combined in a single index of work control in spite of evidence that the constructs are empirically distinct (Mansell and Brough, 2005). Like Karasek and Theorell, we prefer not to subsume the two dimensions into a single additive scale. In fact, results show that the behavior of both measures differs across the four skill levels in a meaningful way.

Overall, work autonomy declined significantly over the period (see last rows of Table 3). Results confirm the Scandinavian exception: work autonomy levels in Denmark, Finland, the Netherlands, and Sweden are above the EU average for all groups of workers, and there is much less difference between clerical and manual workers and between low-skill and high-skill workers than in all other countries, where manual workers systematically suffer from below average work autonomy (Lopes et al., 2014). In addition, whereas work autonomy decreased in all other countries from 1995 to 2010, it stabilized or increased in Denmark, Finland, the Netherlands, and Sweden. As for polarization processes, the situation of manual workers in the 15 studied countries has not deteriorated when compared to clerical workers. By contrast, a clear polarization process is underway between HSC and LSC workers. Hence, our expectations regarding polarization trends and welfare regimes are

confirmed, but, contrary to expectations, autonomy at work for high-skill workers slightly decreased rather than increased (for complete analysis, see Lopes et al., 2014).

We now concentrate on examining the levels and trends in work intensity and analyzing the combined evolution of work intensity and work autonomy by skill level and country. Measuring work intensity—or job demands, in Karasek's terms—requires information on work load or work effort. However, no such data are available in the four EWCS waves. To construct our indicator, we used the two questions traditionally examined in studies of work intensity based on EWCS (job involving working at very high speed and working to tight deadlines) to which we added questions related to potentially stressful patterns of work such as reliance on work done by colleagues, defined performance targets, and time constraint. The set of possible responses to the time constraint question differs across waves: the 1995 and 2000 waves required a yes or no answer, while the 2005 and 2010 waves proposed an ordered set of categories (see Table 7 in the Appendix 1). The ordinal nature of some variables and the dichotomous nature of others led us to use Categorical Principal Components Analysis (CatPCA). CatPCA also presents the advantage of incorporating a sophisticated option that only takes into account the nonmissing data when the loss function is minimized (Meulman et al., 2004), and it allows the score computation for all objects with at least one valid response. Thus, the time constraint question could be included in the analysis. CatPCA reveals that the five items load on a single factor (eigenvalue = 2.43). Cronbach's alpha for the index is 0.71, indicating sufficient internal consistency.

The resulting indicator, named work pressure rather than work intensity for the sake of rigor, fully exploits the information available in the EWCS and contains reliable information on an important dimension of job demands. The (standardized) score on this factor is used hereafter as the Work Pressure (WP) indicator (dataset pooled).

Table 3 shows that, with minor exceptions, perceived work pressure has been steadily increasing over the years for all skill levels. Differences for the period are significant at the 0.001 level for all workers. The increase in work pressure has been higher for HSC workers—who suffer from the highest levels of work pressure at the end of the period while enjoying relatively low levels at the beginning—and lower for LSM workers. These findings suggest that it is HSC workers who have seen their situation deteriorate the most, but definite conclusions can only be drawn from the analysis of the combined evolution of work autonomy and work pressure.

The analysis reveals that, overall, work pressure increased and work autonomy decreased over the period. More specifically, Figure 1 shows that job strain clearly increased for all workers over the period: work pressure rose for all skill levels without being compensated for by any increase in work autonomy. Work autonomy decreased more intensely and work pressure increased the most between 2000 and 2005, since then, both phenomena seem to have stabilized, but no reversion of the overall negative trends can be observed. Work pressure for HSC workers increased markedly but they still benefit from high, though declining, work autonomy levels,[5] especially when compared to LSC workers. But according to Karasek and Theorell (1990)'s model, it is HSM workers who suffer from the highest job strain since they experience the larger excess of work pressure over decision latitude. The large discrepancy between work autonomy and work pressure for manual workers may partly explain their lower levels of job satisfaction.
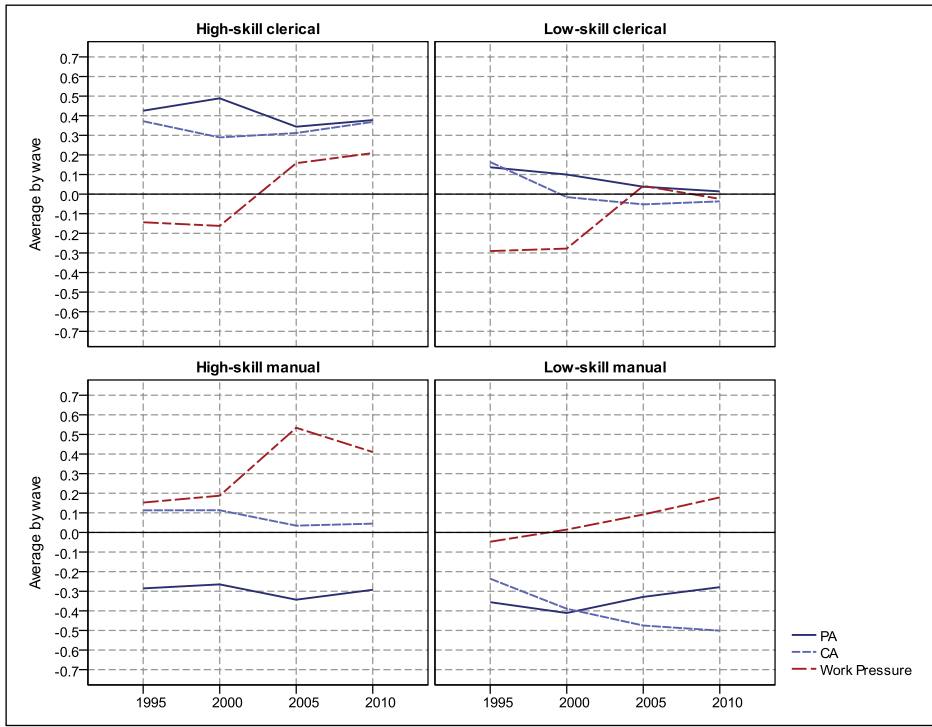
Figure 1. Work autonomy (PA and CA) and work pressure by skill level and year for all countries.
PA: procedural autonomy; CA: content autonomy.

Turning now to the analysis of countries, we can see in Figure 2 that Finland and Sweden have the highest perceived work pressure over the period, followed by the Netherlands and Denmark—the four countries where work autonomy is also the highest. But we can also note that work pressure was already very high in Finland and Sweden in 1995. While closer to the Continental countries for work autonomy, the United Kingdom stands closer to the Scandinavian countries regarding work pressure, which indicates high levels of job strain in this country.

Another interesting finding is that Continental countries (Belgium, Austria, Germany, France, and Luxemburg) and Ireland[6] display quite high work pressure at the end of the period—in fact, these are the countries where work pressure increased the most—and yet are still characterized by rather low work autonomy. Finally, South European countries—with the exception of Greece for work pressure—display low levels of both work pressure and work autonomy. Italy stands between Continental and South European countries.

As for trends, the evolution for workers in Continental countries and Greece is the most negative: work pressure rose significantly without being compensated for by increases in work autonomy. Workers in Scandinavian countries have seen their situation slightly worsen or stabilize. Analysis by skill level and country (results not shown,
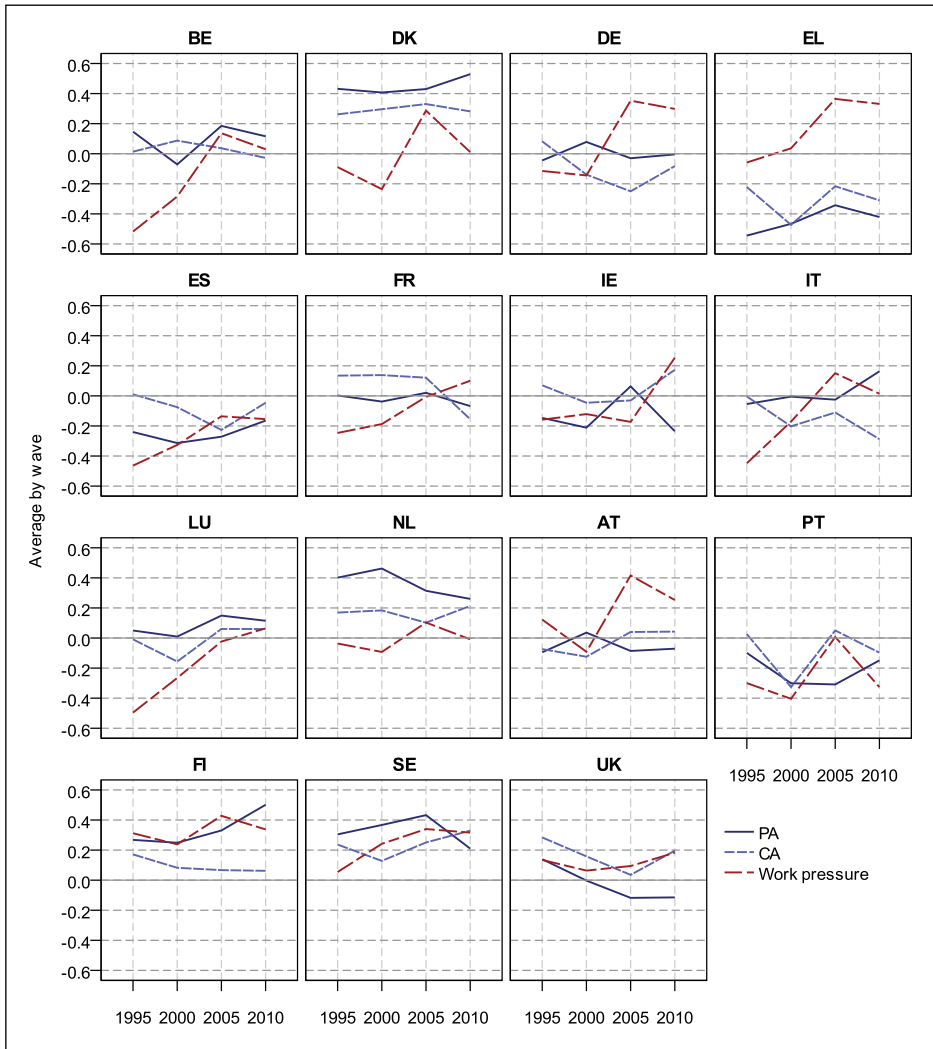
Figure 2. Work autonomy (PA and CA) and work pressure by country and year.
PA: procedural autonomy; CA: content autonomy.

available on request) shows that whereas most clerical workers benefited from lower work pressure than manual workers in Continental countries over the period, workers of all skill levels in Scandinavian countries have always experienced similar—high—levels of work pressure. The conclusions concerning polarization trends and welfare regimes are the same for work pressure and work autonomy: overall, a polarization trend is observed between HSC and LSC workers with a deeper worsening of the latter group's situation, and Scandinavian countries offer markedly more egalitarian and higher-quality jobs.

Examining the relation between work autonomy, work pressure, and job satisfaction

To analyze the extent to which the evolution of work autonomy and work pressure affects job satisfaction, we estimate econometric models using worker-level data and controlling for several explanatory variables of job satisfaction.

Since job satisfaction is measured through an ordered multilevel scale, we use an ordered logit regression model. Our main interest is in the work autonomy and work pressure variables, measured using the scores obtained previously. We also introduce an interaction term between work autonomy and work pressure to capture the effect of the relation between both variables on job satisfaction. As mentioned, our hypothesis is that an increase in work pressure is less harmful to the worker's satisfaction if he or she enjoys high autonomy. This means that the coefficients of the interaction terms should be positive.

We introduce sequentially our explanatory variables, starting with the control variables. Next, we test the autonomy variables, followed by work pressure. The quadratic terms of both variables are then introduced. Finally, the interaction terms between autonomy and work pressure are considered. The quadratic terms are introduced prior to the interaction terms to rule out the possibility that the significance of the interaction is the spurious result of a curvilinear impact of work autonomy or work pressure on job satisfaction (Mansell and Brough, 2005). One advantage of this sequential approach is that it allows understanding what occurs to the unexplained time trend as additional variables are introduced.

Our first estimated model includes only control variables (Model 1, Table 4)—that is, the variables available in the four EWCS waves that theory and previous evidence show to influence job satisfaction: socio-demographic features, skill level, hours of work, dummies for years, countries, fixed-term contract, and economic sector (description of variables in Table 6). Results confirm those of the descriptive analysis reported earlier: low-skill workers are less satisfied than high-skill workers, and manual workers experience less satisfaction than clerical workers. The coefficients for the other control variables are in line with previous studies on the determinants of job satisfaction. The time dummies indicate a significant unexplained decline in job satisfaction between 1995 and 2010.

In the second model, the introduction of the autonomy variables (Model 2, Table 4) reveals that work autonomy has a significant and positive effect on job satisfaction, a result consistent with the literature. Even though the time dummies continue to be statistically significant, the reduction in their size shows that work autonomy contributes to explain the observed decline in job satisfaction.

Next, we introduced work pressure, which, as expected, proved to be negatively and significantly related to job satisfaction (Model 3, Table 4). Any one unit increase in work pressure (the value of the standard deviation) decreases the odds of a higher level of job satisfaction compared with a lower level by a factor of 0.40. Likewise, PA and CA increase the odds ratio by a factor of 0.25 and 0.22, respectively. It can also be observed that the 2005 and 2010 time dummies become insignificant after introducing work pressure, which means that the increase in work pressure is highly significant in explaining the decline in job satisfaction.

Table 4. Regressions for job satisfaction.

	Model 1	Model 2	Model 3	Model 4	Model 5
PA		0.328*** (0.013)	0.255*** (0.013)	0.286*** (0.016)	0.290*** (0.016)
CA		0.135*** (0.013)	0.216*** (0.013)	0.252*** (0.018)	0.250*** (0.018)
WP			-0.402*** (0.0137)	-0.396*** (0.013)	-0.392*** (0.013)
PA squared				0.049*** (0.014)	0.062*** (0.015)
CA squared				0.034*** (0.011)	0.024** (0.012)
WP squared				-0.029*** (0.011)	-0.027** (0.011)
PA*WP					0.050*** (0.012)
CA*WP					0.047*** (0.012)
LSC	-0.246*** (0.039)	-0.130*** (0.040)	-0.195*** (0.041)	-0.192*** (0.041)	-0.190*** (0.041)
HSM	-0.610*** (0.050)	-0.397*** (0.050)	-0.391*** (0.051)	-0.388*** (0.051)	-0.380*** (0.051)
LSM	-0.826*** (0.045)	-0.530*** (0.047)	-0.544*** (0.048)	-0.540*** (0.048)	-0.526*** (0.048)
Hours of work	-0.008*** (0.001)	-0.009*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)
Fixed contract	0.258*** (0.035)	0.217*** (0.035)	0.225*** (0.035)	0.224*** (0.035)	0.219*** (0.035)
Women	-0.064** (0.030)	-0.032 (0.030)	-0.021 (0.030)	-0.019 (0.030)	-0.015 (0.030)
Age	-0.024*** (0.007)	-0.036*** (0.007)	-0.028*** (0.007)	-0.027*** (0.007)	-0.028*** (0.007)
Age squared	0.0003*** (0.00009)	0.0004*** (0.00009)	0.0003*** (0.00009)	0.0003*** (0.00009)	0.0003*** (0.00009)
Year 2000	-0.135*** (0.037)	-0.118*** (0.038)	-0.089** (0.038)	-0.092** (0.038)	-0.094** (0.038)
Year 2005	-0.173*** (0.041)	-0.137*** (0.042)	0.009 (0.042)	0.010 (0.042)	0.009 (0.042)
Year 2010	-0.195*** (0.036)	-0.167*** (0.036)	-0.015 (0.037)	-0.018 (0.037)	-0.021 (0.037)
No. of observation	59,388	59,278	59,278	59,278	59,278
Pseudo R²	0.0703	0.0873	0.1149	0.1150	0.1076
F(sig)	98.69 (0.000)	110.90 (0.000)	127.77 (0.000)	117.31 (0.000)	112.31 (0.000)

WP: work pressure; PA: procedural autonomy; CA: content autonomy; LSC: low-skill clerical; HSM: high-skill manual; LSM: low-skill manual.
The base categories are as follows: high-skill clerical for skill level, services for economic sector, and United Kingdom for country. Standard deviations in brackets.
Other control variables also included: dummies for economic sector and country dummies.
*Significant at 10% level of significance, **significant at 5%, and ***significant at 1%.

Quadratic terms for CA, PA, and WP were then introduced because, besides the reason pointed out above, autonomy and work pressure may have nonlinear effects on job satisfaction (Karasek, 1979). Indeed, the detrimental effect of work pressure on job satisfaction may increase as work pressure increases: an increase in work pressure would have a greater negative impact on job satisfaction for a worker with an already high work pressure. Results confirm the curvilinear effects of autonomy and pressure on job satisfaction (Model 4, Table 4). For example, assuming autonomy constant, if work pressure increases one unit for a worker with low work pressure (work pressure = −1), the odds of a higher level of job satisfaction compared to a lower level decreases by a factor of 0.34, while the same increase in work pressure in a worker with high work pressure (work pressure = 1) has an impact of −0.45.

Interestingly, the impact of both autonomy indicators increases with the level of autonomy, as can be seen by the positive sign of the squared terms of autonomy. In other words, both work pressure and work autonomy have an increasing marginal impact on job satisfaction, the former being negative and the latter positive. Workers with already large autonomy are those who most benefit from an increase in autonomy. Other aspects constant, an increase in PA for a worker with high PA (= −1) has a two times larger effect on job satisfaction than for a worker with low PA (= −1): the odds ratios increase 0.38 and 0.19, respectively. A possible explanation for this result is that there may be a learning process on how to cope with autonomy, a process yielding satisfaction.

Finally, we introduced the interaction terms between work pressure and work autonomy (Model 5, Table 4). The interaction terms are positive, confirming our expectation: an increase in work pressure has a smaller negative impact on job satisfaction when the workers' autonomy is high. This indicates that the moderating influence of autonomy on the effect of work pressure on job satisfaction—the buffer effect—is significant. Furthermore, a simultaneous increase of one unit in PA, CA, and WP increases the odds ratio of job satisfaction by a factor of 0.11.[7] This confirms Karasek (1979)'s prediction that high work pressure and high work autonomy may be associated with higher job satisfaction than low work pressure and low autonomy.

We also estimated the model for each country separately (results not shown, available on request). For all countries, the coefficients of the work autonomy variables are significant and positive, while the work pressure coefficients are negative and of larger amplitude. It is in the countries where work pressure increased the most and where work autonomy is around average (Austria, Belgium, Denmark, France, Germany, and Luxemburg) that the negative effect of work pressure on job satisfaction is higher (above EU average). Conversely, for low levels of work autonomy and work pressure (Spain and Portugal), the negative effect of work pressure is below average, as is the positive effect of work autonomy. In other words, increases in work autonomy are more valued by workers in Continental and Scandinavian countries, which confirm the results obtained with the aggregate data at the European level.

Attending to the limitations of job satisfaction as an indicator of well-being at work (see section "Job satisfaction as an indicator of well-being at work"), we wanted to know whether our results hold when job satisfaction is replaced by work-related health problems. We constructed a variable with the number of diseases likely to be generated by job strain that the employee says have been caused by his job: anxiety, heart diseases, overall

Table 5. Explaining the average change in job satisfaction.

Variable	Explained change in job satisfaction	Explained change in job satisfaction in %
PA	−0.0029	5.7
CA	−0.0118	23.1
Work pressure	−0.0343	67.1
Other variables	+0.0038	−7.4
Total explained change in job satisfaction	−0.0453	88.5

PA: procedural autonomy; CA: content autonomy.

fatigue, sleep difficulties, and some muscular pains. This variable was used as dependent variable in the estimation of an equation similar to Model 5 (in Table 4). Both the correlation and the regression analyses show that more PA is associated to a smaller number of reported diseases, while more CA and work pressure contribute to an increase in the number of diseases (results available on request). The interaction terms between each of the autonomy indicators and work pressure are not statistically significant, but they have a negative sign. Therefore, when job satisfaction is replaced by the number of work-related diseases, we find weaker but still positive evidence supporting the Karasek–Theorell's model, which is consistent with results reported in meta-analyses (De Lange et al., 2003; Van der Doef and Maes, 2010).

Finally, to assess the extent to which the evolution of work pressure and work autonomy accounts for the average decline in satisfaction, we followed Green (2006) and Bartolini et al. (2013). First, to simplify calculations and the interpretation of results, we estimated the job satisfaction model using ordinary least squares (OLS). Then, we computed the average change between 1995 and 2010 in each regressor. Finally, we multiplied each variable's coefficient obtained in the first step by the respective average change in the variable, but using only the coefficients significant at the 10% level. We thereby obtained the contribution of each regressor to the explanation of the average change in job satisfaction. The sum of the contributions of each explanatory variable gives us the overall predicted change in job satisfaction, which can be compared with the observed variation in job satisfaction (−0.047).

The application of this method shows that the increase in work pressure is the main factor explaining the decline in job satisfaction, accounting for around 67% of the decline (Table 5). The decrease in CA was also an important factor, explaining around 23% of the reduction in job satisfaction. PA accounted for only 6% of the decline in satisfaction. As suggested in the literature (Clark, 2005; Rose, 2003), the deterioration of the quality of intrinsic aspects of work outweighed the beneficial effects on job satisfaction of other features of work.

Discussion and concluding remarks

Our main contribution in this article is to shed light on the long-term evolution of some intrinsic aspects of work, namely work autonomy and work pressure, in 15 EU countries,

and of its impact on the well-being of workers. Because job satisfaction is an imperfect measure of well-being at work, we concentrated on assessing the effect of the combined evolution of work pressure and work autonomy on the change in, rather than the level of, job satisfaction since 1995.

Karasek and Theorell (1990) have long since highlighted the need to monitor the levels of both variables simultaneously. Our hypothesis, derived from Karasek (1979)'s strain hypothesis, that an increase in work intensity is less harmful to the worker's satisfaction if the worker enjoys high work autonomy, is confirmed by the econometric results. Regression analyses show that our model also performs well at the country level. The use of the method suggested in Bartolini et al. (2013) revealed that the increase in work pressure and decrease in work autonomy account for most of the observed average decline in job satisfaction. Our results support the existence of additive and interactive effects of work intensity and work autonomy, which is in line with the evidence surveyed by De Lange et al. (2003) and Van der Doef and Maes (2010) that shows that high levels of work intensity not accompanied by high levels of work autonomy are detrimental for the workers' well-being.

It must be noted that the well-being generated by autonomy is not simply a subjective experience of pleasure; work autonomy has also an objective function related to vitality, psychological flexibility, and self-realization. What is at stake in work autonomy is hence more than the pleasantness of given work conditions; it involves one's self-esteem and opportunity for personal growth, that is, the eudaimonic dimension of well-being.

Overall, our results document a clear deterioration in the psychosocial work environments in the EU. Work pressure has risen considerably in the last 15 years and work autonomy has not kept up with this development. On the contrary, and in contradiction to dominant managerial discourses, it seems that the changes in the organization of work of the last two decades have led to a decline in the workers' influence on when and how to do their work and, for most workers, also on the content of work. Workers are pressured to deliver more results while the tools provided to cope with such demanding situations have decreased. This means that high-strain working situations are becoming more predominant in the EU, which is shown to be highly detrimental to physical and psychological health and to result in premature retirement from work (Siegrist, 2006).

Most existing studies examine job quality at the country level without differentiating by skill level. In contrast, we have been able to document (a) the very discrepant situation of manual and clerical workers in most countries and (b) the substantial divergent process taking place between HSC and LSC workers in all but Scandinavian countries. We also show that the differences between welfare regimes in terms of job quality are deepening rather than diminishing. Some of the distinguishing features of Scandinavian countries are (a) the stabilization of work autonomy at high levels, (b) a less marked increase in work pressure than in other countries (probably because work pressure levels were already high in 1995), and (c) the fact that workers of all skill levels face similar intrinsic job characteristics.

Our analysis confirms the results obtained by Dhondt et al. (2002)'s for the year 2000 and testifies to their structural nature: most workers in Scandinavian countries work in active jobs which, by combining high levels of work autonomy and work intensity, are hypothesized to be favorable to the workers' self-development (Karasek

and Theorell, 1990). By contrast, most South European workers are in passive jobs, hypothesized to be related to low overall activity and reduced problem-solving ability. These results strongly suggest that institutional factors, for example, the strength of trade union membership and the public policy commitment to work-life quality, and societal factors, which influence firm-level management policies and work attitudes, may be of great importance. Future research should aim at better understanding the role played by institutional and cultural factors in influencing work autonomy.

Mention should be made of some limitations of this study. First, the cross-sectional nature of the data does not allow the establishment of causal relationships, even though it was difficult to avoid mentioning causality when interpreting the results. We are aware of the potential endogeneity of working conditions in a job satisfaction model, but the features of the data make it difficult to control properly for it. Second, as previously mentioned, self-reported measures of intrinsic facets of work are always subject to expectations biases—this is why (a) our indicators of work autonomy and work pressure comprise more information than usually found in the literature, resulting in more rigorous constructs, and (b) our analysis devotes particular attention to the interpretation of observed changes.

The observed trends in intrinsic aspects of work clearly go against the desired evolution. We appear to be developing work environments that place impossible demands on workers and lead to severe health and social problems. A normative recommendation follows directly from our theoretical framework and empirical results: work processes should provide increased work autonomy, as work pressure is not likely to substantially decrease in the near future. Moreover, one of our econometric findings (to our knowledge previously unobserved) suggests that work pressure has increasing negative marginal effects on job satisfaction. Since high-skill jobs already have high work pressure, this result suggests that work pressure may be reaching an upper limit for high-skill workers. As pointed out by Van der Doef and Maes (2010) and others, Karasek (1979) might have been wrong when suggesting that work autonomy would always buffer the negative effects of work intensity. Beyond a certain level, it is highly probable that these negative effects cannot be mitigated.

Notwithstanding the pressures from product and financial markets, employers can do a great deal to improve working conditions, as evidenced by the wide differences in the quality of psychosocial environments observed in the EU. Securing healthy psychosocial work environments is a major responsibility as their effects no doubt spill over to the whole society.

Acknowledgements

Notes

1. Terminology is far from stabilized. Green and Gallie use task discretion, while Karasek prefers job control or decision latitude. Such oscillations are only partially explained by the information included in the indicators. We use "work autonomy" as this seems to be the term common to psychologists, sociologists, and economists, notwithstanding the many facets of the phenomenon and the corresponding necessary nuances.
2. See http://www.eurofound.europa.eu/surveys/ewcs/2010/sampling.htm and http://www.eurofound.europa.eu/docs/ewco/4EWCS/Methodology.pdf for further information.
3. See http://www.eurofound.europa.eu/surveys/ewcs/2010/methodology.htm.
4. A two-factor model was adjusted using Confirmatory Factor Analysis that supported the results of our PCA. Due to the dichotomous nature of the variables considered, we used Mplus v6.11 and WLSMV (robust Weighted Least Squares for categorical data) estimators. General fit measures were generally adequate (comparative fit index (CFI) = 0.963, Tucker–Lewis coefficient (TLI) = 0.956, and root mean square error of approximation (RMSEA) = 0.043).
5. It is interesting to note that content autonomy (CA), that is, control over work content, has risen for high-skill clerical (HSC) but declined for low-skill manual (LSM) workers. Conversely, LSM workers now have more control over their work methods and schedules (increasing procedural autonomy (PA)) while HSC workers have less.
6. Note that for labor-related matters, the Anglo-Saxon countries do not appear to create a distinct model, a fact already pointed out by Davoine et al. (2008) in their study of job quality in the European Union (EU).
7. Two notes should be made. First, an increase of one unit in those variables is equivalent to one standard deviation increase. Second, in this exercise, we assume the initial values of work pressure and both work autonomies to be zero, the average value.

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Appendix I

Table 6. Definition of variables.

PA—procedural autonomy (1—yes; 0—no)

Is the respondent able to choose or change his/her method of work?
   Speed or rate of work?
   Order of tasks?
Is the respondent's pace of work dependent on the direct control of his or her boss?

CA—content autonomy (1—yes; 0—no)

Does the respondent's main paid job involve assessing the quality of his/her own work?
   Learning new things?
   Resolving unforeseen problems on his/her own?

Classification of occupations into skill levels

High-skilled clerical	Isco1—Legislators, senior officials, and managers
	Isco2—Professionals
Low-skilled clerical	Isco3—Technicians and associate professionals
	Isco4—Clerks
	Isco5—Service workers and shop and market sales workers
High-skilled manual	Isco6—Skilled agricultural and fishery workers
	Isco7—Craft and related trades workers
Low-skilled manual	Isco8—Plant and machine operators and assemblers
	Isco9—Elementary occupations
	Isco10—Armed forces

Other variables

Work pressure: see Table 7 below.
Satisfaction: satisfaction with working conditions in main paid job? 1—not at all satisfied to 4—very satisfied.
Women—1 and 0—men.

Age: in years
Year 2000: 1—2000 and 0—otherwise.
Year 2005 and Year 2010: similar to Year 2000.
LSC—1 and 0 otherwise.
HSM—1 and 0 otherwise.
LSM—1 and 0 otherwise.
Hours of work: per week
Contract: 1 if the worker has an indefinite contract and 0 otherwise.

LSC: low-skill clerical; HSM: high-skill manual; LSM: low-skill manual.

Table 7. Distribution of work pressure variables, by year.

		1995	2000	2005	2010
q45a. Does your job involve working at very high speed?	Never	29.00%	26.60%	20.50%	20.00%
	Almost never	16.40%	17.30%	18.20%	17.70%
	Around 1/4 of the time	11.20%	11.60%	12.70%	13.80%
	Around half of the time	11.60%	12.10%	12.30%	14.10%
	Around 3/4 of the time	6.10%	7.40%	10.30%	10.90%
	Almost all of the time	14.30%	13.80%	15.70%	14.40%
	All of the time	11.40%	11.10%	10.30%	9.20%
q45b. Does your job involve working to tight deadlines?	Never	28.60%	23.10%	18.10%	17.80%
	Almost never	13.90%	16.90%	18.90%	17.60%
	Around 1/4 of the time	11.00%	11.70%	12.70%	13.90%
	Around half of the time	9.80%	10.90%	11.80%	13.70%
	Around 3/4 of the time	5.90%	8.10%	10.10%	9.90%
	Almost all of the time	14.30%	14.50%	15.10%	14.60%
	All of the time	16.40%	14.80%	13.30%	12.40%
q46a. Is your pace of work dependent on the work done by colleagues?	% yes responses	40.90%	47.10%	46.20%	43.30%
q46c. Is your pace of work dependent on numerical production/performance targets?	% yes responses	36.40%	30.80%	44.40%	43.00%
q51g. You have enough time to get the job done (ordinal).	Always			38.20%	29.60%
	Most of the time			29.00%	43.50%
	Sometimes			19.50%	16.40%
	Rarely			7.90%	7.30%
	Never			5.40%	3.20%
q51g_01. You have enough time to get the job done (dichotomous).	% yes responses	77.10%	77.80%		