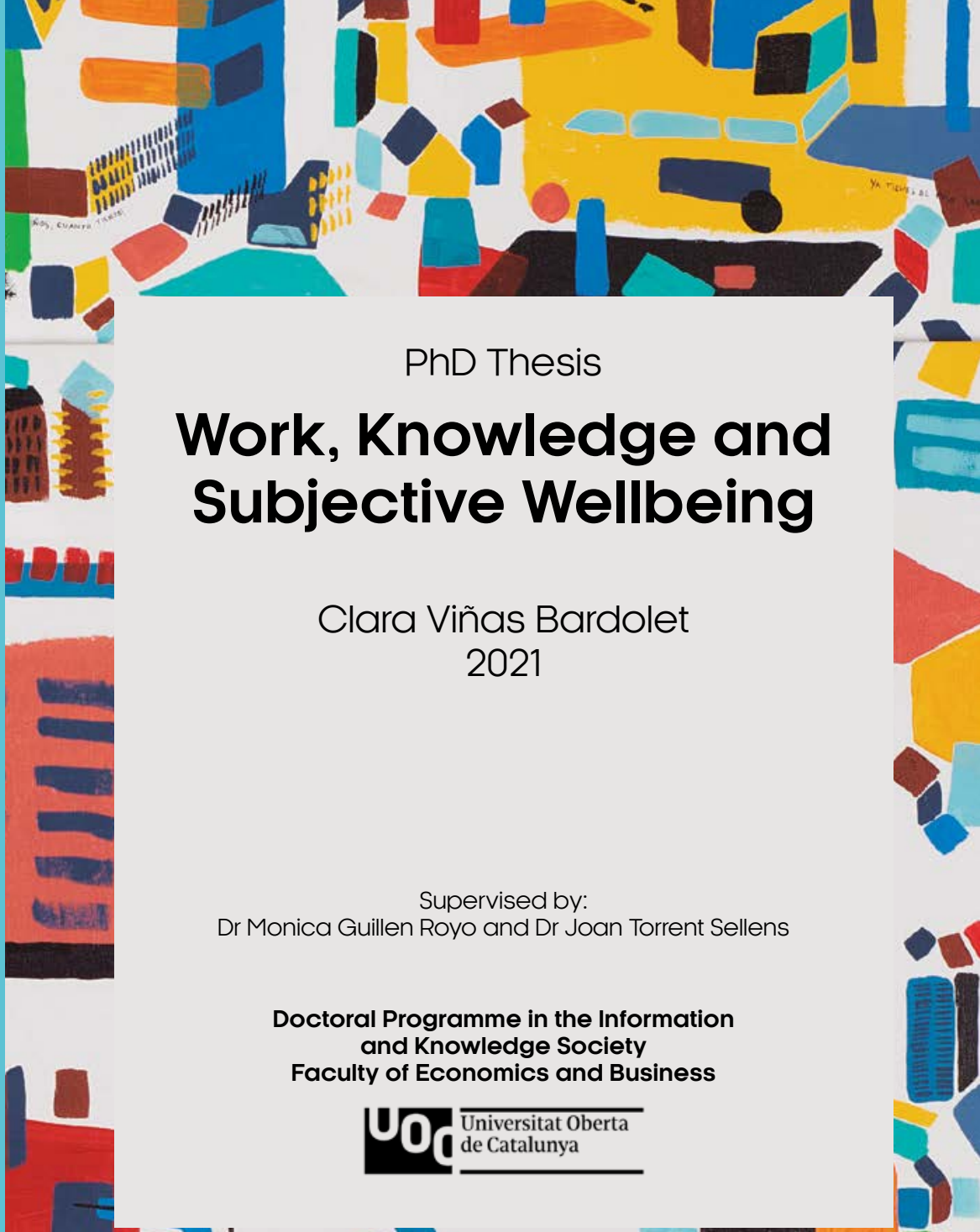

PhD Thesis

Work, Knowledge and Subjective Wellbeing

Clara Viñas Bardolet
2021

Supervised by:
Dr Monica Guillen Royo and Dr Joan Torrent Sellens

Doctoral Programme in the Information and Knowledge Society
Faculty of Economics and Business

Universitat Oberta de Catalunya

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Stilles bescheidenes Leben gibt
mehr Glück als erfolgreiches
Streben, verbunden mit
beständiger Unruhe.

‘Una vida tranquil·la i humil porta
més felicitat que la persecució
de l’èxit, que va lligada a una
inquietud permanent’.

‘A calm and modest life brings
more happiness than the
pursuit of success com-bined
with constant restlessness’.

Albert Einstein, November 1922

ALS MEUS PARES, PER DEIXAR-ME VOLAR

Abstract

This thesis examines how work characteristics affect life satisfaction in Europe – more specifically, the relationship between ICT intensification in the workplace and workers' subjective wellbeing. *How do jobs and current work characteristics associated with the increased use of ICTs affect job satisfaction and life satisfaction in Europe?* The thesis is meant as a contribution to the emerging literature on with new working patterns and subjective wellbeing.

This thesis studies the case of workers in Europe in the early 21st century, using a combination of three European sources of data from official statistical agencies. The thesis is divided in three parts. The empirical analysis applies econometric models, responding to the research questions, to study correlational relationships (Papers I and III) and causal linkages (Paper II). Human wellbeing is approached from a subjective angle, including different factors affecting job satisfaction and life satisfaction deemed relevant by social scientists today.

Paper I enquires into the determinants of job satisfaction, and differences in the perception of job satisfaction between knowledge workers (KW) and other workers (OW) in Europe. The results indicate that the non-financial job characteristics play an important role for job satisfaction among knowledge workers. Career advancement opportunities, work-schedule flexibility, work–life balance, job security and work-colleague support are factors crucial to job satisfaction among KW. By contrast, monthly income emerges as the major determinant of job satisfaction for OW.

Paper II focuses on Internet use for work purposes, analysing how this affects job satisfaction by moderating the relationships between work characteristics and wellbeing. The effects of Internet use at work emerge as heterogeneous, attenuating or strengthening the relationship between work characteristics and job satisfaction. Internet use per se does not appear to have any direct impact on workers' job satisfaction; rather, it moderates the role of job satisfaction, making the impacts stronger or weaker. Workers in some occupations with higher income and education levels benefit relatively more from the Internet than do in occupations only weakly related to ICT activities.

Finally, Paper III explores the importance of working life on subjective wellbeing of workers, on the assumption that job characteristics are important for job satisfaction, but also that the impact extends to other domains of life satisfaction. The paper also explores the differences between low-skilled and high-skilled white-collar workers as to the extent to which job characteristics explain domain-satisfaction. Job characteristics are found to explain reported levels of satisfaction across all life-domains, not only concerning job satisfaction. Moreover, job satisfaction emerges as significant in explaining life satisfaction, but it is only in fourth place in the study. Finally, domains-of-life satisfaction differs in

predictive power depending on the type of worker: job satisfaction is important in explaining life satisfaction among high-skilled workers, but the job domain ranks last as regards life satisfaction among low-skilled workers.

The conclusions provide insights that are relevant not only for academia, but also for company organizations, human resources management and policy makers. First, this thesis notes the importance of distinguishing by type of workers concerning wellbeing. Second, the findings show that income plays a relatively small role in all domains of satisfaction. Rather, factors related to working conditions and work organization should be incorporated in job contracts. Third, the effects of ICT are that they moderate the role of the determinants of job satisfaction. Finally, the thesis shows that working life characteristics affect satisfaction with most domains of life. For example, the increasing insecurity in the job market and the challenges experienced by EU workers in achieving a good work–life balance correlate negatively with satisfaction in every domain of life.

Keywords: Job satisfaction; Life satisfaction; Domains-of-life satisfaction; Knowledge work; ICT use; Working conditions; Work organization; Work–life balance; Europe.

Resum

Aquesta tesi examina com les característiques de la feina afecten la satisfacció amb la vida a Europa, més concretament, la relació entre la intensificació de les TIC al lloc de treball i el benestar subjectiu dels treballadors. *Com afecta la feina i les característiques actuals de la feina associades amb la intensificació de l'ús de les TIC la satisfacció laboral i la satisfacció amb la vida a Europa?* Aquesta tesi s'entén com una contribució a la literatura emergent sobre nous patrons de treball i el benestar subjectiu.

Aquesta tesi estudia el cas dels treballadors a Europa a principis del segle XXI, utilitzant una combinació de tres fonts de dades europees d'agències estadístiques oficials. La tesi es divideix en tres parts. L'anàlisi empíric aplica models economètrics, que responen a les preguntes de la investigació, per estudiar les relacions correlacionals (articles I i III) i les relacions causals (article II). El benestar humà s'aborda des d'un angle subjectiu, incloent diferents factors que afecten la satisfacció laboral i la satisfacció amb la vida que els científics socials consideren rellevants a dia d'avui.

L'article I indaga sobre els determinants de la satisfacció laboral i les diferències en la percepció de la satisfacció laboral entre treballadors del coneixement (KW) i altres treballadors (OW) a Europa. Els resultats indiquen que les característiques laborals no financeres juguen un paper important per a la satisfacció laboral dels treballadors del coneixement. Les oportunitats d'avenç professional, la flexibilitat de l'horari laboral, la conciliació de la vida laboral–familiar, la seguretat laboral i el suport entre companys de feina són factors crucials per a la satisfacció laboral entre els treballadors del coneixement. Per contra, els ingressos mensuals apareixen com el principal factor determinant de la satisfacció laboral per els altres treballadors (OW).

L'article II es centra en l'ús d'Internet amb finalitats laborals, analitzant com això afecta la satisfacció laboral, moderant les relacions entre les característiques de la feina i el benestar. Els efectes de l'ús d'Internet a la feina emergeixen com a heterogenis, atenuant o enfortint la relació entre les característiques de la feina i la satisfacció laboral. L'ús d'Internet per si mateix no sembla tenir cap impacte directe en la satisfacció laboral dels treballadors; més aviat, modera el paper de la satisfacció laboral, fent que els impactes siguin més forts o més febles. Els treballadors d'algunes ocupacions amb nivells d'educació i d'ingressos més elevats, es beneficien relativament més d'Internet que treballadors en ocupacions que tenen poca relació amb les TIC.

Finalment, l'article III explora la importància que la vida laboral té en el benestar subjectiu dels treballadors, suposant que les característiques de la feina són importants per a la satisfacció laboral, però també que l'impacte s'estén a altres àmbits de la satisfacció amb la vida. L'article també explora les diferències

entre els treballadors de coll-blanc poc qualificats i els treballadors de coll-blanc altament qualificats, en la mesura en què les característiques de la feina expliquen la satisfacció del domini. Aquest article troba que les característiques del lloc de feina no només expliquen la satisfacció laboral, si no que expliquen la satisfacció en tots els dominis de la vida. A més a més, la satisfacció laboral apareix com a significativa per explicar la satisfacció amb la vida, però només es troba en el quart lloc de l'estudi. Finalment, la satisfacció amb els dominis de la vida difereix en potència predictiva segons el tipus de treballador: la satisfacció laboral és important per explicar la satisfacció de la vida entre els treballadors altament qualificats, però el domini laboral ocupa l'últim lloc pel que fa a la satisfacció de la vida entre els treballadors poc qualificats.

Les conclusions d'aquesta tesi proporcionen informació que és rellevant no només per al món acadèmic, sinó també per les organitzacions d'empreses, per a la gestió dels recursos humans, i pels responsables polítics. En primer lloc, aquesta tesi constata la importància de distingir per tipus de treballadors pel què fa el benestar. En segon lloc, els resultats mostren que els ingressos juguen un paper relativament petit en tots els àmbits de satisfacció. Més aviat, els factors relacionats amb les condicions laborals i l'organització del treball són importants, i són els que s'haurien de contemplar en els contractes de treball. En tercer lloc, els efectes de les TIC són que moderen el paper dels determinants de la satisfacció laboral. Finalment, la tesi mostra que les característiques de la vida laboral afecten la satisfacció amb la majoria dels dominis de la vida. Per exemple, la creixent inseguretat en el mercat laboral i els reptes experimentats pels treballadors de la UE per aconseguir un bon equilibri entre la vida laboral i la personal es correlacionen negativament amb la satisfacció en tots els àmbits de la vida.

Paraules clau: Satisfacció laboral; Satisfacció amb la vida; Satisfacció dels dominis de vida; Treball del coneixement; Ús de les TIC; Condicions laborals; Organització del treball; Conciliació vida laboral i vida familiar; Europa.

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Table of contents

II. Research outputs

III. Coclusions

List of figures

List of tables

List of contributions

Paper I. Viñas-Bardolet, C.*; Torrent-Sellens, J.; Guillen-Royo, M. (2020) 'Knowledge workers and job satisfaction: Evidence from Europe', *Journal of the Knowledge Economy*, 11(1), 256–280. https://doi.org/10.1007/s13132-018-0541-1

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Paper III. Viñas-Bardolet, C.*; Guillen-Royo, M.; Torrent-Sellens, J. (2020) 'Job characteristics and life satisfaction in Europe: A domains-of-life approach', *Applied Research in Quality of Life*, 15(4), 1069–1098. https://doi.org/10.1007/S11482-019-09720-5

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Acronyms and Abbreviation

CAPI	Computer-assisted personal interview
CES	Constant elasticity of substitution relationship
CRSE	Cluster-robust standard error
EQLS	European Quality of Life Survey
ESS	European Social Survey
EU-SILC	European Union Statistics on Income and Living Conditions
EUROFOUND	European Foundation for the Improvement of Living and Working Conditions
EUROSTAT	Statistical Office of the European Union
EWCS	European Working Condition Survey
ICT	Information and Communication Technologies
IF	Impact Factor
i.i.d.	Independently and identically distributed error
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
IT	Information Technology
JCR	Journal Citation Report by Thomson Reuters
KW	Knowledge workers
LFS	Labour Force Survey
LS	Life Satisfaction
OLS	Ordinary Least Squares regression
OW	Other workers
PAPI	Paper and pencil interview
SBTC	Skill-biased technological change
SE	Standard Error
SJR	Scopus SCImago Journal Rank
SWB	Subjective wellbeing
VIF	Variance Inflation Factor

I

Introduction

Motivation

In the past two decades, the increase in the use of Information and Communication Technologies (ICT) and knowledge in employment flows has been transforming the labour market, changing the type of jobs available, the occupational structure, the type of tasks performed and how they are carried out (Scarpetta, 2016).

The use of ICT and automation technologies[1] has implications for job creation and job displacement, also beyond the substitution of skills and routine work. In the long term, societies are not moving towards an overall *substitution of jobs*, but towards job *polarization* (Camiña et al., 2020; Goos et al., 2014). The displacement of the occupational structure (particularly low-skilled workers in routine jobs) and the relocation of tasks have severe effects, involving significant worker exclusion. Additionally, the traditional compensatory effects (short/long-term) of the job–technology relationship[2] do not seem to apply to the digital transformation (Autor & Salomons, 2018): digital technologies are becoming less and less labour-creating and more labour-displacing (Chiacchio et al., 2018).

Concerning the internal effects within organizations, the adoption of ICT in the work sphere has been accompanied by structural changes in work organization. It has increased work intensity, cognitive demands, autonomy improvements and hierarchical control reductions (Autor et al., 2003; Torrent-Sellens et al., 2018). At the same time, according to Autor (2015) job types have undergone a process of skill or routine-biased technical change, polarizing labour demand between high-skilled non-routine jobs and low-skilled non-routine jobs. In addition, while ICTs have enabled some workers to perform complex tasks and demands, others continue to work long hours under poor conditions.

The new working patterns and the introduction of new technologies have also transformed the way work is organized (Perrons, 2003).

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[1] According to Xu et al. (2018), Industry 4.0 (I4.0) represents the current trend of automation technologies (i.e. cyber- physical systems (CPS), robotics and artificial intelligence, Internet of Things (IoT), cloud computing or 3D printing); Industry 4.0 (I4.0) symbolizes the beginning of the Fourth Industrial Revolution (Alexopoulos et al., 2016; Li, 2018; Qin et al., 2016; Xu et al., 2018).

[2] The compensatory effects of the job–technology relationship are understood as the decrease in low-skilled jobs due to the increases (over the long term, and related to productivity and demand) of higher-skilled jobs, especially skilled workers or new specializations within occupations (Ramaswamy, 2018).

They have blurred the temporal and spatial boundaries of paid work, eroding the concept and reality of a fixed working day. Work life is gradually permeating most domains of life: characteristics of jobs previous thought to affect only the work domain are becoming important determinants of how people assess their everyday experience. In other words, working conditions do not affect only job satisfaction – they overstep the boundaries of the job domain and affect other domains of life which together contribute to life satisfaction.

What is still unclear is how the shift towards high-skilled jobs, requiring greater worker autonomy, and the increasing relevance of 'knowledge work' influence the quality of work and how it is perceived by workers. Furthermore, we do not know how Internet modifies the way in which work tasks are performed, and if it affects work organization and practices. In addition, little is known about the impacts of the adoption of ICT at work has on job satisfaction and on overall life satisfaction.

The importance of studying the relationship between new working patterns and subjective wellbeing is shown in the increasing relevance of wellbeing studies for policymaking. Subjective wellbeing has become an important field of research, rising on the agendas of governments and international institutions and organizations such as the European Commission, the OECD and the UN (Llena-Nozal et al., 2019; SDSN & IEE, 2019; Stiglitz et al. , 2018). Stiglitz et al. (2009) point out that measuring progress using economic production measures and GDP is not sufficient to capture the complexities of modern societies. Shifting the emphasis from measuring economic production to people's wellbeing can fill the gap between the information included in aggregate GDP data and what defines people's quality of life.

To address these challenges, further study of the relationship between job satisfaction (and overall life satisfaction) and work characteristics in a period characterized by increased intensity of ICT use at work is needed. That is the main goal of the research presented in this thesis, which investigates how jobs and current work characteristics affect job satisfaction and life satisfaction. Focusing on the progressive uptake of ICT in the workplace, this thesis investigates the implications of ICT intensification in perceptions of job satisfaction and overall life satisfaction in Europe.

In the following, I first present how wellbeing, the domains-of-life approach and job satisfaction have been approached by economists, psychologists, sociologists and other social scientists. I also introduce the concepts of 'work' and 'knowledge' and their interrelation (section 2). Then I present the research objectives and questions of this study (section 3) and discuss the research strategy (section 4). Section 5 presents the scholarly contributions.

Theoretical Framework

The social science literature operates with two main categorizations of wellbeing. Following Delle Fave et al., (2011) and Guillen-Royo (2019) the first type is used in social psychology, where scholars distinguish between *hedonia*, which concerns the experience of pleasure versus displeasure, widely interpreted to include all judgments about the good/bad aspects of life (Ryan & Deci, 2001), and *eudaimonia* or psychological wellbeing, where wellbeing consists of fulfilling or realizing one's *daimon* (true self) (Waterman, 1993), i.e. when people act in congruence with deeply held values and are fully engaged (Frey & Stutzer, 2002). Although the two perspectives are founded on distinct views of human nature and what represents a good society (Ryan & Deci, 2001), wellbeing is understood as multidimensional, and both approaches can bring important insights into people's quality of life (Guillen-Royo, 2019).

The second type of categorization, used in the economics of happiness and welfare economics traditions, differentiates between *objective* and *subjective* perspectives (Gasper, 2005; Guillen-Royo, 2019). The former is usually supported by a list of requirements that people are expected to have satisfied in order to lead a proper, self-actualized or good life. Such definitions are normative because they define what is desirable (Diener, 1984). Concerning *subjective* wellbeing, I draw on Diener (1984) and Diener et al. (1999) in considering the hedonic and cognitive dimensions – the former linked to positive and negative effects, and the latter to life satisfaction.

One of the first economists interested in subjective wellbeing was Richard Easterlin (1974), who studied the relation between income and subjective wellbeing within countries, across countries and in longitudinal terms. Easterlin's results were considered a paradox, as they were contrary to the tenets of orthodox economists, who associated economic growth and wealth with greater wellbeing. Easterlin found that raising one's income increases happiness as long as the incomes of other people do not change. However, raising the incomes of all does not increase the happiness of all. Thereby, according to Guillen-Royo (2007) the power of social comparison overrides the power of an increase of income. Ferrer-i-Carbonell (2005) found that relative income does have a significant impact on subjective wellbeing and that individuals are happier the larger their income is, in comparison with the income of the reference group. Regardless of the popularity of Easterlin's work, his findings have been widely contested. For instance, Veenhoven (1989) found that income level was positively related to the level of happiness; and Diener et al. (1995) found substantial correlations

between GDP per capita and the mean of subjective wellbeing of the 55 nations analysed. More recently, Easterlin (2013) has attempted to find evidence of the relationship between economic growth and happiness in different countries and different types of studies. Although other studies seem to indicate a positive relationship between income and subjective wellbeing (Stevenson & Wolfers, 2008), Easterlin found that in the long term a positive relation between economic growth and subjective wellbeing could be proven – for developed countries, or even for transition countries and less developed countries (Easterlin, 2013).

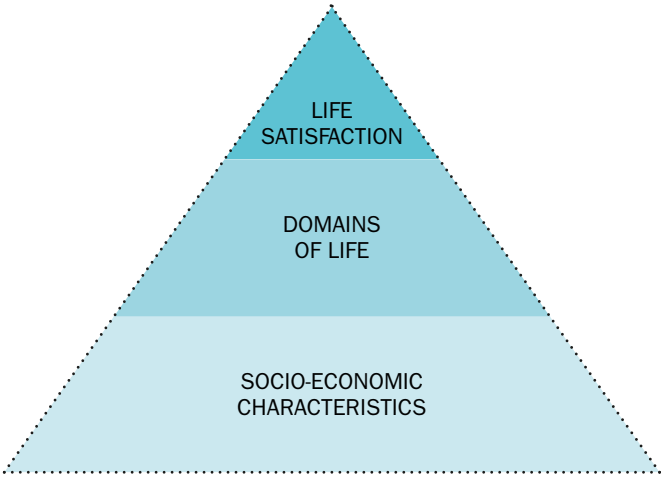
In addition to income, other demographic and socio-economic determinants of wellbeing have been widely investigated. Frey and Stutzer (2002) distinguish five conceptual dimensions: personality factors, socio-demographic factors, contextual and situational factors, economic factors and institutional factors.

The domains-of-life approach to subjective wellbeing

A few researchers have studied the relationship between life satisfaction and satisfaction in domains of life. According to Cummins (1996) there are two basic approaches to the definition and measurement to life satisfaction in the wellbeing literature: the 'top-down' perspective, which sees the construct as a single function of stable personal or socioeconomic features (Erdogan, Bauer, Truxillo & Mansfield, 2012) and of situational influences such as life events (Diener, 1996); and the 'bottom–up' perspective, which sees the construct as composed of discrete domains. Life has many separate but interrelated specific areas, which are classified into a few main domains (Cummins, 1996; Erdogan et al., 2012; Rojas, 2006; van Praag & Ferrer-i-Carbonell, 2004; van Praag et al 2003). An individual's overall life satisfaction can be seen as a complex function of satisfaction with different life domains (Cummins, 1996; Erdogan et al., 2012; Rojas, 2006). Life domains are relevant to how people assess their own lives. The fact that individual satisfaction can be quantitatively evaluated with respect to these separate domains makes scientific analysis possible (van Praag & Ferrer-i-Carbonell, 2004).

This perspective include various theories of life satisfaction that conceive of domain satisfactions as needs – as with multiple discrepancy theory (Michalos 1985), needs hierarchy theory (Maslow 1970) or bottom–up spillover theory (Andrews and Withey 1976; Campbell et al. 1976). As to the last theory, Sirgy et al. (2010), situate life satisfaction at the top of a pyramid: life satisfaction is determined by satisfaction with life domains, located one level below; in turn, domains are influenced by lower levels of life characteristics that may be common or specific to each given domain (see Fig. 1).

Figure 1. Bottom–up theory of life satisfaction



Source: Author's elaboration, based on Sirgy et al.(2010), Fig. 1.

Job satisfaction

Job satisfaction has aroused considerable interest within the social sciences. Economists and other social scientists attempt to understand people's wellbeing in the workplace, studying the determinants of job satisfaction as an important part of life satisfaction and wellbeing. Others see job satisfaction as one dimension of job quality (Chiaburu et al., 2014; Díaz-Chao et al., 2017). Pagán (2013) holds that satisfaction can provide a general (subjective) valuation of the quality of the job or a measure of the utility obtained from it.

During the 1970s, economists started to analyse the factors that shape wellbeing at work. The works of Hamermesh (1977) and Freeman (1978) are considered the first economic studies that propose estimating equations of job satisfaction where salaries, choice of occupation and the effects of training are taken into consideration. Access to subjective data about workers' job satisfaction and wellbeing has tended to moderate the importance of wage as an explanatory element. Although wages are important in explaining overall job satisfaction, this literature reports on other factors with equally or more important effects – especially workers' individual characteristics, working conditions, work organization, health and safety (Hamermesh, 1977).

Empirical studies have extensively investigated various factors – individual characteristics and work-related characteristics – using cross-section or panel data to explain why some workers report higher job satisfaction than others.

Regarding individual characteristics, empirical research clearly confirms that there is a U-shaped relationship between age and job satisfaction, declining on average until workers reach their 30s (Clark & Oswald, 1996; Clark et al., 1996). Clark et al. (1996) note various possible reasons for this pattern, emphasizing the importance of changing expectations and aspirations over the course of the individual's career. It may be that older workers are more satisfied not only because they are better rewarded but also because they have greater experience and maturity, which lead them to form less ambitious aspirations and more realistic expectations, or simply because they care less about such comparisons. Further, the evidence shows that women enjoy their jobs more than men (Clark, 1997; Oswald, 2002). Clark (1997) argue that women's expectations tend to be lower than men's, so those who expect less of their job will be more satisfied with any given job. However, he notes that a man and a woman with the same job and expectations would report identical job satisfaction. Education is another important factor extensively been studied in the job satisfaction literature. Various empirical studies have found that the relationship between job satisfaction and levels of education is negative when income is held constant (Clark & Oswald, 1996; Grund & Sliwka, 2003; Salvatori, 2010; Sousa-Poza & Sousa-Poza, 2000). This can be explained by the levels of aspirations and the utility of work. Additionally, over-educated workers report substantially lower levels of job satisfaction than those who are well matched to their job requirements (Belfield & Harris, 2002; Green, 2006; Green & Zhu, 2010). Other individual characteristics, such as reported health or type of household, seem also to be significant determinants of job satisfaction.

Focusing on the importance of the financial characteristics, Salvatori (2010) and Clark (2005) found that wages play a relatively small role, finding other variables – like health and safety, type of contract, or job status – to be also important determinants of overall job satisfaction. In another study comparing income, Clark and Oswald (1996) found that job satisfaction was inversely related to comparison wage rates, implying that workers' satisfaction decreased as the incomes of persons they compared themselves with increased. Further research has confirmed that the importance of financial remuneration for job satisfaction may vary according to the type of worker. In their study of Spanish workers, Torrent et al. (2018) found that net monthly income was a positive and highly significant variable in explaining job satisfaction only among Other Workers (OWs) – not among Knowledge Workers (KWs). And, in their study of employment flexibility and job security in Poland, Wilczyńska et al. (2016) found that income was more important for job satisfaction among OWs than among KWs.

Concerning non-financial job characteristics, research has noted the relevance of some main factors of job satisfaction: career prospects (Clark, 1996; Sousa-Poza & Sousa-Poza, 2000), job security (Clark, 2001; Wilczyńska et al., 2016) job-match quality, contract type and job status (working hours, flexibility and security) (Clark, 1997, 2005; Salvatori, 2010; Sousa-Poza & Sousa-Poza, 2000), work organization and practices (Agypt & Rubin, 2012; Golden & Veiga, 2005), workplace relationships (Colbert, Bono, & Purvanova, 2016; Mihail & Kloutsiniotis, 2016; Wood & Ogbonnaya, 2018) or work–life balance (McMillan et al., 2011; Orton, 2011).

At the beginning of the 2000s some researchers began to study the impacts of ICT on workers' wellbeing. However, few studies have explicitly investigated the relationships between Internet use at work and job satisfaction (e.g. Carlson et al., 2017; Charoensukmongkol, 2014; Robertson & Kee, 2017). Their findings have been partially replicated in the few studies of job satisfaction and type of workers – as with Huang (2011), comparing knowledge workers and blue-collar workers in China and Japan, Wilczyńska et al. (2016) in their study of the relationship between job security, employment stability, and job satisfaction in Poland, or Torrent-Sellens et al. (2018) who found that the most relevant determinants of job satisfaction among knowledge workers in Spain were non-financial factors.

Work and Knowledge

In a globalized world, with more universal access to higher education and increasing use of and advances in ICT, the workforce is constantly changing. A growing share of the workforce today is highly qualified and educated; they move internationally, following their career goals and developing relevant skills. In order to qualify for the jobs now offered, lifelong learning has become the key to developing and improving personal and professional skills (Martínez-Cerdá, 2018). Moreover, with the intensification of the use of ICT in the workplace, the characteristics of work overstep the boundaries of the job domain, greatly influencing other domains of life as well.

Torrent-Sellens (2008) empirically confirms that the link between ICT and knowledge uses at work has reinforced the role of non-technological components in explaining employment changes. Empirical studies have shown that ICT is used especially by the more highly educated workers, which indicates that skill advantages play a key role in explaining the employment structure and wages (Torrent-Sellens et al., 2018). As yet it is uncertain whether these jobs are a result of ICT returns, a consequence of unobserved heterogeneity between ICT users and

non-users, or whether there are other sources that can explain the differences (Borghans & Ter Weel, 2005).

Based on the skill-biased technological change (SBTC) approach, Handel (2007) holds that technology on its own is not the sole cause of change in employment patterns. Workers' skills, capacities and expertise; productive and organizational schemata; management decisions; labour relations systems; cultural and institutional settings and public policies – these are all interrelated factors that influence changes in the nature of employment. This means that the impacts of ICTs, for example, must be understood in terms of their complex interaction with the social and economic system in which they are applied. However, as the nature of employment shifts towards more 'knowledge work', it is unclear whether the *quality* of work is improving. Greenaway and Nelson (2001) and Greenaway et al. (2008) warn that, although skill-biased technological change and the economic globalization process have a positive effect on jobs generation, processes of labour destruction and disqualification are evident in some sectors and some sections of the population. Further,

> …human beings face major challenges in the world of work today, as a result of the growing trend towards both the division of labour into microtasks, which are manageable as projects, and the competitiveness of people, robots and computer algorithms. Gradually, labour markets are increasingly oriented towards individualism, adaptability, and total personal availability. In short, towards the precariousness of workers. (Martínez-Cerdá, 2018, p. xv)

In recent decades, the importance of knowledge in organizations has been increasing. Research in economic development and growth agree on the importance of knowledge as the most critical resource for developing countries (Krugman, 1991; Millar & Ju Choi, 2010; World Bank, 1998). In this 'New Economy',[3] a specific category of specialists – knowledge workers – is emerging. This term was introduced by Drucker (1959) to describe a new type of workers, in view of the change underway in modern organizations, where manual work was no longer the norm; instead, attention had shifted to the individuals whose main capital was

[3] Referring to the context of post-industrial transformation, where a growing body of research suggests that the ICT are configured as the basic infrastructure of the transition process towards a knowledge economy and knowledge society (Castells, 2004).

knowledge,[4] understood as a powerful resource for organizations. This concept[5] has since been both contested and extended, for example by Alvesson (2001), defining knowledge work as being intellectual rather than physical in nature.

[4] Already in 2012, white-collar workers represented 67% of the EU labour force, and their numbers are increasing each year. Source: Eurostat Labour force data: http://ec.europa.eu/eurostat/web/lfs/data/ accessed 06/12/2017.

[5] An extension on definitions of 'knowledge work' can be found in the first article of this thesis: Viñas-Bardolet et al. (2020).

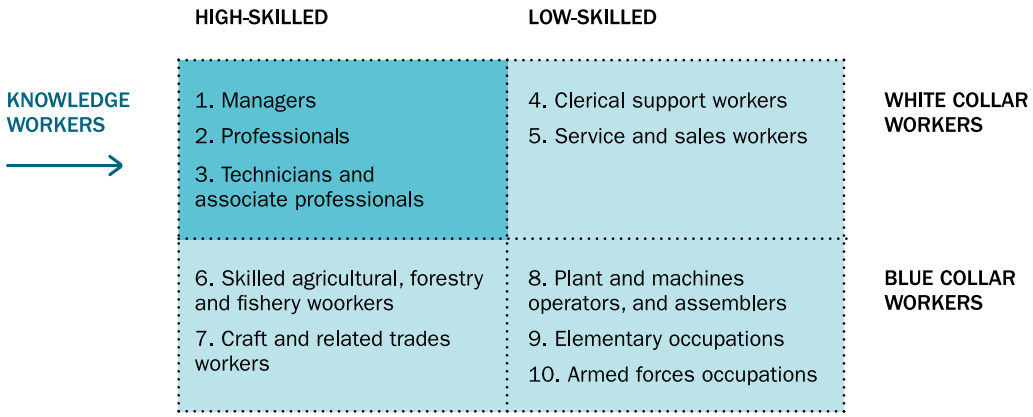
Research objectives and Questions

The overall aim of this thesis is to examine how work and, more specifically, how work characteristics affect life satisfaction. Assuming that there is an intensification in the use of ICT in the workplace, the main research objective is to elucidate the implications of this intensification in perceptions of job satisfaction and life satisfaction in general.

Following earlier research indicating differences in the determinants of life satisfaction and job satisfaction for different type of workers who also differ in their use of ICTs in the workplace, this thesis explores the differences among knowledge workers (KWs) and other workers (OWs) in the first paper; the use of ICT, the Internet in particular, in the workplace in the second paper; and low-skilled and high-skilled white-collar workers in the third paper (See Figure 2 for specification of each type of worker.)

Knowledge workers are defined as a new type of white-collar workers who possess higher academic degrees, greater skill levels or knowledge, working in the three highest standard occupational classifications (managers, professionals, associate professionals) (Brinkley, 2006; Huang, 2011). (See the top left-hand square of Figure 2).

Figure 2. Types of workers

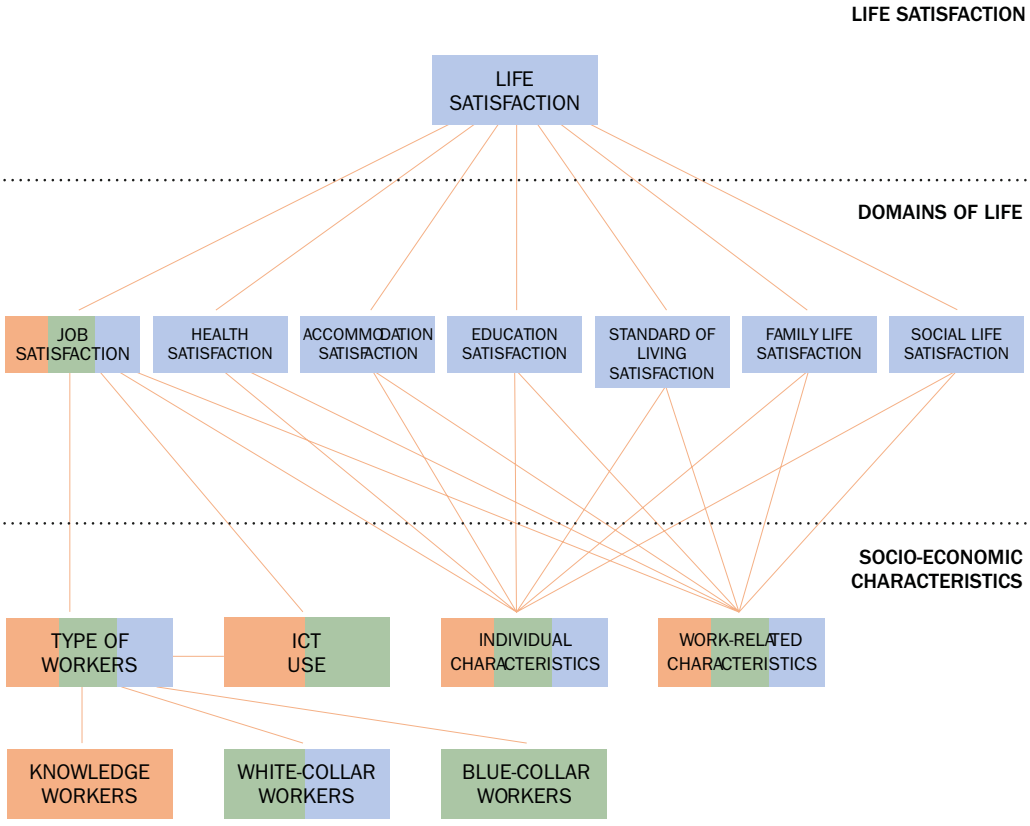


Source: Author's elaboration, based on ILO International Standard Classification of Occupations, ISCO-88.

Drawing on the bottom–up perspective, and assuming the domains-of-life approach that sees personal, socioeconomic, structural and demographic characteristics as influencing life satisfaction through their impact on domains, the three papers that form the body of the thesis address different aspects of this hierarchical relationship.

Paper I studies the determinants of job satisfaction for two type of workers: knowledge workers and other workers (see orange colour in Figure 3). Having identified the characteristics that affect job satisfaction, Paper II, investigates how Internet use for work purposes (a characteristic of knowledge workers) moderates the effects of work characteristics previously studied, strengthening or weakening their relationship to job satisfaction (green colour in Figure 3). Paper III focuses on the importance of work-related variables in explaining overall life satisfaction though their impact on life domains, and examines possible differences in these relationships between high- and low-skilled white-collar workers (see blue colour in Figure 3).

Figure 3. Empirical framework



Orange colour: subjects analysed in **Paper I**; green colour: subjects analysed in **Paper II**; blue colour: subjects analysed in **Paper III**. Source: Author's elaboration.

Four specific research objectives were developed. (1) to explore determinants of job satisfaction, and differences in the perception of job satisfaction between KWs and OWs (Paper I); (2) based on the outcomes of the first research objective, to investigate how Internet use for work purposes affects job satisfaction by moderating the relationships between work characteristics and wellbeing (Paper II); and (3) to explore the influence of work characteristics on satisfaction with several domains, and how these domains can explain life satisfaction across high- and low-skilled white-collar workers (Paper III).

To achieve the first specific research objective (Paper I), the main research questions are: (1) Do knowledge workers (KW) differ from other workers (OW) with regard to what determines their job satisfaction?; and (2) What are these determinants? In the model, job satisfaction depends on the individual's socio-demographic characteristics, as well as financial and non-financial job characteristics. The non-financial job characteristics consist of 12 indicators, grouped into work organization, work intensity, working conditions and work–life balance.

In order to achieve the second specific research objective (Paper II), the main research question is: (3) Does Internet use for professional purposes affect job satisfaction, and if so how? Paper II focuses on six main conceptual dimensions (based on the outcomes of Paper I and previous literature): income, education, occupation type, autonomy, time pressure and social interactions. Paper II argues that (a) Internet moderates the effects of work characteristics, strengthening, or weakening, their relationship to job satisfaction; (b) the Internet per se does not have any direct impact on job satisfaction, but has indirect effects.

In connection with the third and fourth specific objectives (Paper III), there are three main questions: (4) What is the relationship between job characteristics and satisfaction with the job and other domains of life?; (5) Is the job domain more important for life satisfaction than other domains of life?; and (6) Are there differences between high- and low-skilled workers as regards these relationships and their importance? In Paper III it is assumed that (a) job characteristics are important not only for job satisfaction: their impact extends to other domains of life as well; and, based on the previous outcomes, (b) there are differences in the determinants of job satisfaction among different type of workers.

Using a combination of statistical research methods, these research objectives were approached through three European sources of data: the 2010 European Social Survey (EES), ESS5 (Paper I); the 2005 and 2010 European Working Conditions Survey (EWCS) (Paper II); and the third European Quality of Life Survey (3EQLS), from 2011-2012 (Paper III).

Table 1. Research objectives and research questions

PAPER	OBJECTIVES	RESEARCH QUESTIONS	DATA SOURCE
Paper I	Explore determinants of job satisfaction, and differences in the perception of job satisfaction between KWs and OWs.	(1) Do knowledge workers (KW) differ from other workers (OW) with regard to what determines their job satisfaction?. (2) What are these determinants?.	2010 European Social Survey (EES), ESS5.
Paper II	Investigate how Internet use for work purposes affects job satisfaction by moderating the relationships between work characteristics and wellbeing.	(3) Does Internet use for professional purposes affect job satisfaction, and if so how?.	2005 and 2010 European Working Conditions Survey (EWCS).
Paper III	Explore the influence of work characteristics on satisfaction with several domains, and how these domains can explain life satisfaction across high- and low-skilled white-collar workers.	(4) What is the relationship between job characteristics and satisfaction with the job and other domains of life?. (5) Is the job domain more important for life satisfaction than other domains of life?. (6) Are there differences between high- and low-skilled workers as regards these relationships and their importance?.	3rd European Quality of Life Survey (3EQLS), from 2011-2012.

Research Strategy

Empirical quantitative research was conducted based on three different sources of data from official international statistical agencies, using different statistical research methods. The choice of drawing on different sources of data responds first, to the objectives of each of the papers; second, to my personal interest in testing my initial hypotheses with as many data-sets as possible; third, I believe that this approach yields results that are more robust and more testable. Additionally, it enables comparison of different socio-economic and socio-labour realities at the international level.

Details of the data sources used are presented in each of the three papers, with an overview in Table 1. The empirical strategy and statistical methods are presented in detail in the three papers: overviews in Table 2, 3 and 4: survey description and research survey data description in Table 2 and Table 3 respectively, and data analysis in Table 4. 3

Table 2. Survey description

	PAPER I	PAPER II	PAPER III
Universe	All persons aged 15 and over resident within private households, regardless of their nationality, citizenship, language or legal status, in the following participating countries: *EU 28 countries* Austria, Belgium, Bulgaria, Croatia[6], Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany,	All residents of the 28 EU member states and 8 non-EU countries (Iceland, Kosovo, the Former Yugoslav Republic of Macedonia, Montenegro, Norway, Serbia, Switzerland and Turkey) aged 15 or older (aged 16 or older in Spain, the UK and Norway), and who were in employment at the time of the survey.	All residents of the 28 EU member states and 6 non-EU countries (Iceland, Kosovo, the Former Yugoslav Republic of Macedonia, Montenegro, Serbia, Turkey), aged 18 or older.

[6] Croatia become the European Union's 28th member state on 1st July 2013.

	Greece, Hungary, Ireland, Lithuania, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom. *Non-EU countries:* Israel, Norway, Switzerland, Russian Federation, Ukraine.		
Sample	Cross-section. Strict random probability sampling, minimum target response rate of 70% and rigorous translation protocols.	Cross-national. Multi-stage, stratified, random sample	Cross-national. Multi-stage, stratified, random sample.
Frecuency	Every two years	Every five years	Every four years
Method	Face-to-face interviews (CAPI or PAPI).	Interview. Questionnaire-based, with face-to- face interviews conducted in private homes, in the national language(s) of the country.	Interview. Questionnaire-based, with face-to-face interviews conducted in private homes, in the national language(s) of the country.
Coverage	52,458 individuals	29,680 individuals in 2005 43,816 individuals in 2010	43,636 individuals
Data Collection	August 2010 – December 2011 (Austria: May 2013 – October 2013)	January – June 2010 September – November 2005.	September 2011 – February 2012

Overview/ Topics	Issues related to the media; social trust; political interest and participation; socio-political orientations; social exclusion; national, ethnic and religious allegiances; trust in the police and courts; demographics and socio-economics; work, family and wellbeing.	The 2005 EWCS covered issues including work organization, working time, equal opportunities, training, health & safety and job satisfaction. The 2010 EWCS covered issues of precarious employment, leadership styles, worker participation, general job context, working time, work organization, pay, work-related health risks, cognitive and psychosocial factors, work–life balance, and access to training.	Issues such as employment, income, housing and living conditions, family, health, work–life balance, life satisfaction and perceived quality of society.
Provider	ESS ERIC. Norwegian Centre for Research Data, NSD.	EUROFOUND: European Foundation for the Improvement of Living and Working Conditions.	EUROFOUND: European Foundation for the Improvement of Living and Working Conditions.
Access	Free access for academic purposes.	Free access for academic purposes.	Free access for academic purposes.
Reference	European Social Survey (2014)[7]	European Foundation for the Improvement of Living and Working Conditions (2018)[8]	European Foundation for the Improvement of Living and Working Conditions (2014)[9]

Table 3. Data description, research surveys

	PAPER I	PAPER II	PAPER III
Source	European Social Survey (ESS).	European Working Conditions Survey (EWCS).	European Quality of Life Survey (EQLS).
Year	2010	2005 and 2010	2012
Wave/ Round	5th	4th and 5th	3rd
Type of data	Cross-section. One wave.	Pooled cross-section.	Cross-section. One wave.
Geographical Coverage	Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Lithuania, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, UK.	The EU28, plus Norway and Switzerland.	The EU 28.
Sample size	14,096 employees aged 18 or older.	35,856 workers aged 16 or older.	7,624 white-collar employees aged 18 or older.

[7] I have used data from the most recent wave of the European Social Survey (ESS) that included a module on family, work, and wellbeing data, at the time of data preparation of Paper I. Referring to the ESS5 from 2010.

[8] I have used data from the two most recent waves of the EWCS survey available at the time of data preparation of Paper II, referring to the years 2005 and 2010 respectively.

[9] Paper III draws on the third European Quality of Life Survey (3EQLS), the most recent wave available at the time of data preparation, referring to the years 2011–2012.

Table 4. Data analysis

	PAPER I	PAPER II	PAPER III
Dependent variable	Job satisfaction.	Job satisfaction.	Life satisfaction. Job satisfaction. Accommodation satisfaction. Health satisfaction. Education satisfaction. Standard of living satisfaction. Family life satisfaction. Social life satisfaction.
Method/ strategy used	Microeconomic model based on maximization of the standard utility function of a worker (Frey & Stutzer, 2002).	Two-equation econometric approach.	Two-step methodology following Rojas, 2007; van Praag et al., 2003.
Econometric analysis	Binary logistic models.	Estimation the two equations simultaneously as recursive: Bivariate ordered probit models following Monfardini & Radice, 2008; Sajaia, 2008. And hierarchical ordered probit models.	Multiple linear regression analysis.
Sample size	14,096 employees aged 18 or older.	35,856 workers aged 16 or older.	7,624 white-collar employees aged 18 or older.
Source	European Social Survey (ESS).	European Working Conditions Survey (EWCS).	European Quality of Life Survey (EQLS).

Scientific Contributions

Paper I. Viñas-Bardolet, C.*; Torrent-Sellens, J.; Guillen-Royo, M. (2020) 'Knowledge workers and job satisfaction: Evidence from Europe', *Journal of the Knowledge Economy*, 11(1), 256–280. https://doi.org/10.1007/s13132-018-0541-1

Paper II. Castellacci, F.; **Viñas-Bardolet, C.*** (2019) 'Internet use and job satisfaction', *Computers in Human Behavior*, 90, 141–152. https://doi.org/10.1016/j.chb.2018.09.001

Paper III. Viñas-Bardolet, C.*; Guillen-Royo, M.; Torrent-Sellens, J. (2020) 'Job characteristics and life satisfaction in Europe: A domains-of-life approach', *Applied Research in Quality of Life*, 15(4), 1069–1098. https://doi.org/10.1007/S11482-019-09720-5

* Corresponding author

Presentation, scope and relevance

This thesis brings together a compendium of three papers, all three published in peer-reviewed journals indexed in international databases.

The first paper 'Knowledge workers and job satisfaction: Evidence from Europe' was published in the *Journal of the Knowledge* Economy, was first published online in April 2018 and in 2020 has been assigned to an issue. This journal focuses on exploring the dynamics of the knowledge-based economy, with emphasis on the role of knowledge creation, diffusion, and application across organizations, industries, nations, and regions. The journal is indexed in Scopus SCImago Journal Rank (SJR) with IF: 0.576 (2019) and ranks in the second quartile in the category 'Economics and Econometrics'.

The second paper, 'Internet use and job satisfaction', was published in the journal *Computers in Human Behavior*, first published online in September 2018.

Computers in Human Behavior is a scholarly journal dedicated to examining the use of computers from the perspective of psychology and related disciplines, as well as the psychological impact of computer use on individuals, groups and society. The journal is indexed in the Journal Citation Report (JCR) – Social Sciences Citation Index created by Thomson Reuters with IF: 5.003 (2019) and ranks in the first quartile in the categories 'Psychology, Multidisciplinary' and 'Psychology, Experimental'. It is also indexed in Scopus SJR with IF: 2.173 (2019) and ranks in the first quartile in the categories 'Human–Computer Interaction' and 'Psychology (miscellaneous)'.

The third paper, 'Job characteristics and life satisfaction in Europe: A domains-of-life approach', was published in *Applied Research in Quality of Life*, a journal that presents conceptual, methodological and empirical papers dealing with quality-of-life studies in the applied areas of the natural and social sciences. It publishes contributions with direct implications for, or impact on, practical applications of research on the quality of life. The articles are crafted from interdisciplinary, inter-professional and international perspectives. The journal is indexed in the Journal Citation Report (JCR) with IF: 1.683 (2019) and ranks in the second quartile in the category 'Social Sciences, Multidisciplinary' category. It is also indexed in Scopus SJR with IF: 0.527 (2019) and ranks in the third quartile in the category 'Lifespan and Life-course Studies'.

See Table 5.

Table 5. Scientific contributions: summary

	PAPER I	PAPER II	PAPER III
Title	Knowledge workers and job satisfaction: Evidence from Europe.	Internet use and job satisfaction.	Job characteristics and life satisfaction in Europe: A domains-of-life approach.
Journal	*The Journal of the Knowledge Economy.*	*Computers in Human Behavior*.	*Applied Research in Quality of Life.*
Publisher	Springer Nature.	Elsevier.	Springer Nature.

License Number	4518261286979	–	4684111008182
Issue	Volume 11, Issue 1, Pages 256–280.	Volume 90, January 2019, Pages 141–152.	Volume 15, Issue 4, Pages 1069–1098.
Indexes (most recent; year of publication)	**SJR-Scopus 2019: 0.576;** Q2 Economics and Econometrics	**JCR 2019: 5.003;** Q1 Psychology, Multidisciplinary; Q1 Psychology, Experimental **SJR-Scopus 2019: 2.173;** Q1 Human–Computer Interaction; Q1 Psychology (miscellaneous)	**JCR 2019: 1.683;** Q2 Social Sciences, Multidisciplinary **SJR-Scopus 2019: 0.527;** Q3 Lifespan and Life-course Studies
Received	02 March 2017	04 November 2017	11 September 2018
Accepted	09 April 2018	02 September 2018	27 February 2019
Published-Available online	21 April 2018	04 September 2018	21 March 2019
Published in the full journal issue	11 June 2020	January 2019	01 August 2020

Justification of the thematic unity

This thesis is presented as a compendium of contributions, structured around three academic articles, all published in peer-reviewed international journals.

In view of the intensification in the use of the ICT in the workplace, I have explored the implications of this for perceptions of job satisfaction and overall life satisfaction. This intensification can be controlled for mainly by the type of occupation.

The articles are organized in order, starting with an exploratory piece (Paper I) on the major determinants of job satisfaction for two types of workers: knowledge workers and other workers. Second, drawing on the finding of the first paper, Paper II investigates how Internet use for work purposes (a characteristic of knowledge workers) moderates the effects of other work characteristics, strengthening or weakening the relationship to job satisfaction. Here, the type of occupation is considered as a determinant of work-life satisfaction. Finally, Paper III employs some of the determinants of job satisfaction found significant in Papers I and II, focusing, as regards job characteristics, how these affect work and other domains of life, as well as how they contribute to life satisfaction. Moreover, Paper III investigates possible differences in these relationships between high- and low-skilled white-collar workers.

The three papers share a similar geographical scope, as all three deal with European countries. Specifically:

- Paper I: Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Lithuania, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, the United Kingdom.

- Paper II: Austria, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Slovakia, Spain, Sweden, Switzerland, the United Kingdom.

- Paper III: Austria, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Poland, Portugal, Romania, Slovenia, Slovakia, Spain, Sweden, the United Kingdom.

Finally, all the data used in the three papers were gathered during the same period, when most of the countries analysed were experiencing a period of economic hardship due to the effects of the 2008 financial crisis. Specifically, the period covered by these studies goes from 2010 to 2013. Paper II also includes data from 2005.

The thematic links between the three papers of this compendium are summarized in Table 6. The main subjects analysed in this thesis are related to job satisfaction, life satisfaction and domains-of-life satisfaction, as well as the type of workers, work conditions and work organization, work–life balance conflict and Europe.

Table 6. Thematic coherence among contributions

SUBJECT	PAPER I	PAPER II	PAPER III
Job satisfaction	✓	✓	✓
Life satisfaction			✓
Domains-of-life satisfaction			✓
White-collar workers		✓	✓
Blue-collar workers		✓	
Knowledge work	✓		
ICT use	✓	✓	
Working conditions	✓	✓	✓
Work organization	✓	✓	✓
Work–life balance	✓	✓	✓
Europe	✓	✓	✓

II

Research Outputs

Paper I

J Knowl Econ (2020) 11:256–280
https://doi.org/10.1007/s13132-018-0541-1

Knowledge Workers and Job Satisfaction: Evidence from Europe

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Abstract This article analyzes the determinants of job satisfaction among knowledge workers (KWs). Data from a representative sample of 14,096 employed workers from the European Social Survey (2010) are used for an empirical analysis drawing on multiple binary logistic regression models. Job satisfaction among KWs in 21 EU countries is found to be explained better by non-financial characteristics than by monetary rewards. Career advancement opportunities, flexible work schedules, colleague support, and work–family relations, as well as job security, emerge as central in explaining job satisfaction among KWs in our sample. Unlike the case for other workers (OWs), opportunities for further training and career experience are not determinants of job satisfaction among KWs. Management divisions in companies employing KWs would be well-advised to take these points into account.

Keywords Job satisfaction · Knowledge work · Work organization · Work–life balance · Europe · ESS

Introduction

The increase in the use of knowledge in employment flows is transforming the labor market. This transformation also concerns the economic performance of knowledge workers (hereafter: KW)—persons who are defined by, inter alia, their capacity to perform non-routine tasks, their high levels of education, and their use of information and communications technologies (ICTs) at work (Brinkley 2006; Pyöriä 2007). Because of their impact on economic performance, KWs are increasingly included in

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organizational strategic plans for improving productivity (Ramírez and Nembhard 2004, p. 602). In fact, authors like Drucker (2007) and Holtskog (2015) claim that KW productivity is a major management challenges of the twenty-first century.

The characteristics of job and work environments affect many activities people engage in, also in non-work-related domains. In general, job satisfaction is related to overall life satisfaction: indeed, the relationship seems to go both ways (Frey and Stutzer 2010). Moreover, job characteristics are closely related to health status. Thus, there will be less cost to employers and society, as well as greater productivity, if employers take into account the factors that contribute to worker satisfaction (Brinkley et al. 2010). This leads us to ask: Do KWs differ from OWs with regard to what determines their work satisfaction?

This article investigates the connections between *knowledge work* and *job satisfaction* in countries of the European Union. Despite the substantial body of research on job satisfaction, this sector has received limited attention in the empirical literature. Research has shown that KWs are allowed to exercise considerable autonomy and discretion in performing their tasks; moreover, they have better job security and higher wages than other kinds of workers (Huang 2011; Tampoe 1993). The latter are all factors consistently associated with greater job satisfaction (Torrent-Sellens et al. 2016; Wilczyńska et al. 2016). However, the literature has failed to inquire into other job characteristics related to work intensity, work organization and work–life balance, and their relevance for job satisfaction.

This study fills a gap in the literature by investigating whether KWs differ from OWs with regard to what determines their satisfaction at work. We focus on variables addressing five conceptual dimensions: *financial job characteristics*, *work organization*, *work intensity*, *working conditions*, *and work–life balance*. Using data from 21 EU countries in the European Social Survey (2010), we apply multiple binary logistic regression models to test our hypotheses. Results indicate clear differences between KWs and OWs with regard to predictors of job satisfaction. Among KWs, job satisfaction is better explained by non-financial aspects than by monetary reward. Further, factors linked to career advancement opportunities, flexible work schedules, and work-to-family conflict emerge as more relevant in explaining job satisfaction among KWs than OWs in this EU sample.

The article is structured as follows: [1] we describe the underlying literature background: studies on knowledge work and its relationships with job satisfaction; [2] we outline the characteristics of the European Social Survey (2010) and the data used in this article; [3] we develop the research hypotheses; [4] we present the empirical model and describe its main results; [5] we discuss our findings and offer some conclusions.

Literature Review

Knowledge Work

The relationship between technology, knowledge, and work is a much-discussed and controversial area in economic and social analysis (Saint-Paul 2008). Empirical studies confirm that employment generated in recent years has focused on people with more

education and training, especially in knowledge-intensive services, whereas employment losses tend to concentrate on the workforce in the manufacturing sector and on less-skilled workers (Baccini and Cioni 2010). Drawing on the skill-biased technological change (SBTC) approach, Handel (2007) holds that technology as such is not the sole cause of shifts in employment patterns. Workers' skills, capacities, and expertise; productive and organizational schemata; management decisions; labor relations systems; cultural and institutional settings and public policies—these are all interrelated factors that influence changes in the nature of employment. This means that the impacts of ICTs, for example, can only be understood in terms of their complex interaction with the social and economic system in which they are applied. However, as the nature of employment shifts towards more "knowledge work," it is unclear if the *quality* of work is improving. As Brinkley et al. (2010, p. 6) ask: Does the knowledge economy mean more "good work"? Is knowledge work good for employees?

Definitions of "knowledge economy" and "knowledge work" remain highly contested. The Organisation for Economic Co-operation and Development (OECD) defines the knowledge economy in terms of knowledge-intensive industries based on ICT production or usage and/or high shares of highly educated labor (2003). Included in the OECD classification are high- and medium-tech manufacturing, high value-added "knowledge-intensive" market service industries and business services, education, and health. As Torrent-Sellens et al. (2016) note, this definition does not take into account the fact that the knowledge economy is present in *all* sectors, not only in knowledge-intensive industries.

Drucker (1959) was the first to use the term "knowledge workers," defining them as those who work with intangible resources. He extended the term in 1994, defining knowledge workers as high-level workers who apply theoretical and analytical knowledge, acquired through formal education, to develop new products or services (Drucker 1994). In 1999, he again widened the term to include "knowledge technologists" (Drucker 1999). Sulek and Marucheck (1994, p. 5) use the term "knowledge worker" to refer to those who possess high levels of formal education, experience, and organizational status and are thus allowed to exercise considerable autonomy and discretion in performing their work. Others use "knowledge workers" as a term to describe a specific subgroup of highly skilled workers (Pernicka and Lücking 2012) or professionals (Alvesson 2001), whereas Olsen (2016) apply the term to the broader category of highly skilled workers, including professionals and highly technical occupations.

Most definitions and attempts at conceptualizing KWs are difficult to operationalize. We follow Brinkley's (2006) definition: (1) those who work in the three highest standard occupational classifications (managers, professionals, associate professionals); (2) those with high-level skills, indicated by university degrees or equivalent qualifications (bachelor's degree or higher); and (3) those who perform tasks that require expert thinking and complex communication skills involving the use of computers. We agree with Wilczyńska et al. (2016, p. 639) that, to minimize error, employees should be categorized as "knowledge workers" (hereafter: KWs) if and only if they fulfill all three conditions. The advantage of this definition is that it is standard, used in most studies on the topic and in macro-level accounts. It is also close to Huang's (2011) definition of KWs as a new type

of white-collar workers who generally possess higher educational degrees and greater skill levels or knowledge.

Job Satisfaction

Job satisfaction has been widely studied as an important part of overall life satisfaction and well-being (see, for instance, Veenhoven 1999). Economists like Hamermesh (1977) and Freeman (1978) began to analyze the factors that shape well-being at work by introducing *job satisfaction* as a subjective economic variable, enriching explanatory models of labor market behavior in economic research. Later, when studying the importance of the financial component of a work position, Clark and Oswald (1996) found that job satisfaction was inversely related to comparison wage rates, implying that workers' satisfaction decreased as the incomes of people they compared with increased. Salvatori (2010) and Clark (2005) confirmed the relatively insignificant role of wages, finding other variables—like health and safety, type of contract, or job status—to be important determinants of overall job satisfaction. The importance of financial remuneration for job satisfaction may vary according to the type of worker. Torrent et al. (2016), in their study of Spanish workers, found that net monthly income was a positive and highly significant variable in explaining job satisfaction only among other workers (OWs)—it was not significant for KWs. And, in their study of employment flexibility and job security in Poland, Wilczyńska et al. (2016) found that income was more important for job satisfaction among OWs than among KWs.

Non-financial job characteristics appear to influence job satisfaction considerably (Pichler and Wallace 2009). Hence, concerning work organization and working conditions, Salvatori (2010) and Sousa-Poza and Sousa-Poza (2000) agree that job-match quality, type of contract, and job status (working hours, flexibility, and security) are major determinants of overall job satisfaction. Other determinants, such as influence on company decision-making, colleague work support, or career advancement opportunities (Clark et al. 1996; Sousa-Poza and Sousa-Poza 2000), also appear important. In his study of the importance of the autonomy of professional workers (medical doctors, nurses, teachers, social workers), Mastekaasa (2011) found that, although autonomy was important for both samples (general population and professional workers), having interesting work, with varied work tasks and good social support, was more crucial to professional workers. Pichler and Wallace (2009), studying levels of job satisfaction at the individual level in 27 European countries, found that workers in higher occupational categories were more satisfied with their jobs. They concluded that job satisfaction can be explained by objective working conditions, the type of contract, job-related training, working hours, and by subjective evaluations of job characteristics (such as job security and supervisory responsibilities). Lastly, Tampoe (1993) holds that certain motivational needs—like organizational environments and personal growth that encourage operational autonomy and task achievement—contribute to well-being among KWs.

The above findings have been partially replicated in the few studies of job satisfaction specifically among KWs. For example, Huang (2011), comparing KWs and blue-collar workers in China and Japan, found that KWs share more motivational characteristics than do blue-collar workers, but report similar levels of job satisfaction. Additionally, KWs who experienced highly motivating workplace characteristics

(job complexity, problem solving, skill variety, and specialization) were likely to report higher levels of job satisfaction than OWs. Other studies employing Brinkley et al.'s (2010) definition have found that KWs report greater role challenges, autonomy, and social capital and less absenteeism and enjoy significantly better job quality and job satisfaction than other types of workers. Additionally, in their study of the relationship between job security, employment stability, and job satisfaction in Poland, Wilczyńska et al. (2016) found that KW job satisfaction was more influenced by job security. This emerged as the single most influential factor regarding job satisfaction; also, significant for KWs was work-time (schedule) flexibility. Similarly, Torrent-Sellens et al. (2016) found that the most relevant determinants of job satisfaction among KWs in Spain were non-financial factors—like workplace relations, career advancement opportunities, or influence on the company's decision-making.

Hypotheses

Drawing on the literature reviewed above, we develop several research hypotheses concerning the relationship between financial and non-financial characteristics of work and job satisfaction. In line with the widespread finding in the happiness literature on the diminishing marginal utility of income (Frey and Stutzer 2002) and the results on research on knowledge work (Torrent et al. 2016; Wilczyńska et al. 2016), we assume that once workers achieve high monetary compensation in their jobs, they will tend to give priority to non-financial aspects. KWs are known to have higher average wage levels than OWs. Our first hypothesis is that income matters less to KWs because they tend to earn more already.

> *H1*: KW job satisfaction is less influenced by financial aspects—monthly salary in particular—than is the case with OWs.

Concerning non-financial job characteristics and drawing on the studies of Wilczyńska et al. (2016), Brinkley et al. (2010), Huang (2011), and Torrent-Sellens et al. (2016), it seems reasonable to expect KW job satisfaction to be more influenced by non-financial characteristics, like those linked to work organization, work intensity, and/or flexibility, than is the case for OWs. Thus, we test these additional hypotheses:

> *H2*: KWs are more likely to be satisfied with jobs that offer career advancement opportunities, work colleague support, and influence in firm's decision-making than OW.
> *H3*: KWs are more likely to be satisfied with jobs with flexible schedule arrangements than OW.
> *H4a*: KWs are more likely to be satisfied with jobs that offer greater job security and opportunities for further training than OW.
> *H4b*: OW job satisfaction is better explained by general career experience.

Further, in line with research indicating that work–family conflicts are more prevalent among highly skilled and professional workers (Gallie and Russell 2009; Ginnity and Calvert 2009), we hypothesize that:

H5: KW job satisfaction is better explained by work–life balance than is the case with OWs.

Data and Descriptive Statistics

Data Sources

Our data are drawn from the 2010 European Social Survey (ESS), specifically the ESS5 questionnaire. The *ESS* provides data from EU countries on attitudes, beliefs, and behaviors of EU citizens. In 2010, the rotating section of the survey included a module on "family, work, and well-being" that captures specific working conditions such as work intensity, job security, and work–life balance.

Out of the population included in the ESS survey, we focus on those aged 21 and over, in paid employment, living in private households (regardless of their nationality, citizenship, language, or legal status), in EU countries[1]—Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Lithuania, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom—at the time of data collection. Data collection was conducted between October 2010 and June 2011 through computer-assisted personal interviews. We excluded individuals for whom values were missing on the most relevant variables. The final sample contains 14,096 observations. Throughout the analysis, the data have weighted by national weights that correct for response biases within countries. This data set has been used several times for analyzing job satisfaction, for example, by Esser and Olsen (2012), Lange (2012), and Mysíková and Večerník (2013).

Following Brinkley (2006) and Wilczyńska et al. (2016), the definition of "knowledge worker" is articulated around three criteria: occupation classification, skills, and tasks. Regarding the data available from the 2010 European Social Survey, we consider KWs are seen as those who fulfill all three conditions: (1) whose educational achievement is a bachelor's degree or higher (5 medium to 8 first digit of the ISCED code[2]); (2) whose occupational classification categorizes them as legislators, senior officials, and managers, (1 to 1319 ISCO-88 code[3]), professionals (2 to 2470 ISCO-88 code), technicians and associate professionals (3 to 3480 ISCO-88 code)—and who reported their main tasks as working with text and/or figures, reading, writing, counting, and computing.

Descriptive Statistics

Table 1 compares some features of KWs (7% of the total workforce) with OWs in EU countries. Job satisfaction was approximated by declared worker satisfaction, measured on a scale from 0 (extremely dissatisfied) to 10 (extremely satisfied), to the question: "How satisfied are you in your main job?". As expected, the distribution of this

[1] We have excluded Finland due to a filter error in the interviewer phase (European Social Survey 2014, p. 76) of one of the relevant variables.

[2] A detailed list of ISCED codes can be found at the UNESCO website: http://www.uis.unesco.org/Education/Documents/isced-2011-en.pdf [accessed on 3/02/17]

[3] A detailed list of ISCO-88 codes can be found at International Labour Organization website: http://www.ilo.org/public/english/bureau/stat/isco/isco88/alpha.htm [accessed on 3/02/17]

variable was significantly positively skewed. For that reason, for the regression analysis, we collapsed answers into two categories—satisfied and dissatisfied—using the sample mean (7.25) as a benchmark.

Table 2 shows the distribution of job satisfaction according to the full sample and the two subsamples. We see that 56.2% of KWs report being very satisfied (score above the sample mean, 8 to 10) compared to 52.2% of OWs. Job satisfaction mean score is 7.40 for KWs and 7.24 for OWs. Table 3 compares the means of the indicators for the two groups of workers; we see that the two groups differ substantially on most indicators.

Empirical Model

Drawing on the economics of happiness (Frey and Stutzer 2010), we present a microeconomic model based on the maximization of the standard utility function of a worker. In our model, job satisfaction depends on the individual's socio-demographic characteristics, as well as various factors like working conditions, work organization, work intensity, and work–life balance.

A binary logit regression model is employed in the econometric analysis. We assume that there are N workers ($i = 1....N$), with a vector x_{ki} with observations on K independent variables related to workers' job satisfaction. Empirically, job satisfaction is treated as a latent response variable, y_i^*, and job satisfaction can be presented by the following equation:

$$y_i^* = \sum_{k=1}^{K} \beta_{ki} x_{ki} + \varepsilon_i \quad \varepsilon_i \sim \text{Logistic } (0, I) \tag{1}$$

where ε_i is a normally distributed random error term with expected value 0, independently and identically distributed between surveyed workers i. Further, x_{ki} is a vector of independent variables that explain job satisfaction, and β_k are parameters that indicate the effect of x_k on y_i^*.

The discrete binary variable y_i takes the value 0 if the value of reported job satisfaction is lower than the sample median, and value 1 otherwise:

$$y_i = \begin{cases} 1 & if \quad y_i^* > d \\ 0 & if \quad y_1^* \leq d \end{cases}$$

where d is the value of the sample mean, used as a benchmark.

For reasons explained above, the eleven scores of the original job satisfaction scale were regrouped into two (0, 1), using the sample mean (7.25) as a benchmark. Thus, for any worker who reported a score above the sample mean, a value of 1 was imputed; otherwise, it was 0. Moreover, using a binary job satisfaction variable removes some of the unexplained variation in the original scale. The analysis was conducted using SPSS 21.

Independent Variable

The set of independent variables used for explaining job satisfaction comprises individual and household characteristics, as well as financial and non-financial job characteristics. The age variable was not included in the model due to its high correlation with other

Table 1 Worker characteristics, EU countries, 2010

	Full sample	Subsamples	
		Knowledge workers (KWs)	Other workers (OWs)
Total employment[1]	14,096	957	13,139
%	100.0	6.8	93.2
Gender (%)			
Male	48.1	47.1	48.2
Female	51.9	52.9	51.8
Age (%)			
21 to 30	18.2	23.4	17.9
31 to 40	26.4	33.0	25.9
41 to 50	28.5	23.1	28.9
51 to 60	22.2	16.2	22.6
61 or older	4.7	4.3	4.7
Age of respondent (mean)	42	40	42
Education (%)			
Completed primary	4.9	0.0	5.3
Secondary	53.1	0.0	57.0
Post-secondary	13.2	0.0	14.2
University, higher education	28.8	100.0	23.6
Household (%)			
Couples with children	51.0	45.3	51.4
Couples without children	5.8	8.3	5.6
Separated, divorced, or widowed, with children	12.1	7.9	12.5
Separated, divorced, or widowed, no children	1.7	2.8	1.7
Single, with children	7.5	6.5	7.6
Single, no children	21.8	29.3	21.2
Labor relations system (%)			
Continental	23.9	24.1	23.9
Anglo-Saxon	11.4	9.5	11.5
Mediterranean	15.8	16.7	15.8
Scandinavian	9.3	12.7	9.0
Eastern Europe	39.6	36.9	39.9
Size of the firm (%)			
Under 10 workers	23.2	13.0	24.0
10 to 24 workers	19.3	17.5	19.5
25 to 99 workers	26.4	25.8	26.5
100 to 499 workers	17.9	22.6	17.6
500 or more workers	13.1	21.2	12.5
Economic sector (%)			
Agriculture and construction	7.8	3.2	8.1
Industry	20.0	12.8	20.5
Services	72.2	84.0	71.4

Table 1 (continued)

	Full sample	Subsamples	
		Knowledge workers (KWs)	Other workers (OWs)
Type of work contract (%)			
Unlimited	82.7	85.9	82.4
Limited	12.2	11.8	12.2
No contract	5.1	2.3	5.3
Monthly income: mean in euros (SE)	2233.23	3030.98	2174.23

Source: Authors' calculations from ESS5

[1] All figures refer to weighted data

variables, like type of household or career experience, which cover the life cycle stage of the worker, and experience. The non-financial job characteristics consist of 12 indicators that include the following dimensions: work organization, work intensity, working conditions, and work–life balance. Figure 1 presents the conceptual model, while Table 4 presents the descriptions of the independent variables.

Table 2 Overall job satisfaction, EU countries, 2010

	Full sample		Subsamples			
			KWs		OWs	
	N	%	*N*	%	*N*	%
Original scale						
0 (Extremely dissatisfied)	71	0.5	3	0.3	68	0.5
1	94	0.7	6	0.6	88	0.7
2	194	1.4	9	0.9	185	1.4
3	364	2.6	25	2.6	339	2.6
4	417	3.0	19	2.0	398	3.0
5	1401	9.9	57	6.0	1344	10.2
6	1320	9.4	92	9.6	1228	9.3
7	2842	20.2	208	21.7	2634	20.0
8	3818	27.1	304	31.8	3514	26.7
9	2200	15.6	155	16.2	2045	15.6
10 (Extremely satisfied)	1375	9.8	79	8.3	1296	9.9
Total	14,096	100%	957	100.0%	13,139	100.0%
Grouped levels						
Satisfied (above the sample mean)	7393	52.4	538	56.2	6855	52.2
Dissatisfied (below the sample mean)	6703	47.6	419	43.8	6284	47.8
Total	14,096	100.0%	957	100.0%	13,139	100.0%
Job satisfaction (mean score)	7.25		7.40		7.24	
Job satisfaction (SD)	1.93		1.76		1.94	

Source: Authors' calculations from ESS5

SD standard deviation

Table 3 KWs versus OWs: results of the Wilcoxon Mann-Whitney test

	KWs	OWs	Difference (z score)
Job satisfaction	7.40	7.24	−2.228**
Gender (Male)	0.47	0.48	−0.623
Household			
Couples with children	0.45	0.51	−3.601***
Couples without children	0.08	0.06	−3.479***
Separated, divorced or widowed, with children	0.06	0.08	−1.276
Separated, divorced or widowed, no children	0.29	0.21	−5.851***
Single, with children	0.08	0.12	−4.168***
Single, no children	0.03	0.02	−2.471**
Labor relations system			
Continental	0.24	0.24	−0.195
Anglo-Saxon	0.10	0.12	−1.894
Mediterranean	0.17	0.16	−0.789
Scandinavian	0.13	0.09	−3.849***
Eastern Europe	0.37	0.40	−1.810
Economic sector			
Agriculture	0.00	0.02	−4.180***
Industry	0.13	0.20	−5.749***
Construction	0.03	0.06	−3.838***
Services	0.83	0.71	−8.028***
Company size	3.21	2.75	−10.230***
Monthly income	3.33	3.10	−15.114***
Influence on company decision-making	4.45	3.39	−11.131***
Career advancement opportunities (dummy)	0.40	0.30	−5.980***
Work effort (dummy)	0.70	0.70	−0.200
Health and safety risk at work (dummy)	0.06	0.22	−11.647***
Work-colleague support (dummy)	0.81	0.75	−3.884***
Working hours per month	149.13	149.07	−2.130**
Extra work hours (dummy)	0.09	0.12	−2.322**
Schedule flexibility (dummy)	0.41	0.19	−15.884***
Job security (dummy)	0.66	0.57	−5.412***
Participation in training activities (dummy)	0.59	0.37	−13.201***
General career experience	16.13	20.55	−11.318***
Work/family conflict	2.88	2.76	−4.632***

***1% significance level

**5% significance level

Results

Table 5 reports the results for the three models: first using the total sample (model 1), and then dividing the sample into two subsamples, one representing KW model 2 and

Fig. 1 Job satisfaction conceptual model. Source: Authors' own elaboration

the other representing OW model 3. For all regressions, we see that the hypothesis that the coefficients associated with each of the explanatory variables are jointly zero can be rejected (the p value for the chi-square test is smaller than 0.001 for each of the specifications). The goodness of fit (Cox and Snell and the Nagelkerke measures) is adequate in all three models, as the independent variables in the logistic model explain between 14 and 20% of the variation of job satisfaction, depending on the sample and goodness of fit indicator chosen. The Hosmer-Lemeshow test shows that all three models fit well and that the chosen model form is appropriate. The models correctly predict job satisfaction for 66% of the workers included in models 1, 2, and 3.

Model 1 considers socio-demographic features, location variables, the knowledge variable, and financial and non-financial job characteristic variables for the whole sample. Women declare higher job satisfaction than men—a common finding in such studies (Clark 1997; Wilczyńska et al. 2016). Job satisfaction is higher among couples with children than for other categories (single persons with/without children, or separated, divorced or widowed persons with/without children). These results resonate with those of previous studies: workers living together with partners report higher levels of job satisfaction than others (Clark and Oswald 1996; Green 2010; Lange 2012). Workers living in Anglo-Saxon[4] countries display lower job satisfaction when compared to Continental countries. Further, workers in large companies show lower job satisfaction than those in small or micro-firms. When mean scores were calculated, KWs were found to be generally more satisfied than OWs (7.4 versus 7.2). However,

[4] Assuming that national differences in institutional regimes may affect the level of job satisfaction, we define a new variable following Esser and Olsen (2012) and Holman's (2013) classification of five institutional regimes.

including job characteristics in the analysis led to the opposite result. That finding is not common in the literature, although most studies have focused on country-level data. For example, Torrent-Sellens et al. (2016) did not find the knowledge work variable to be significant when they controlled job satisfaction with non-financial job characteristics in Spain; Wilczyńska et al. (2016) reported higher KW job satisfaction only for those on temporary contracts, compared with OWs with the same type of contract. However, the consensus among previous studies may be due to the fact that the variables linked to job satisfaction were likely to differ between KWs and OWs. This is what we set out to explore in models 2 and 3.

Monthly income plays a positive role, in line with findings reported in other studies (Clark 2005; Wilczyńska et al. 2016), but the non-financial aspects of a job also emerge as important determinants of job satisfaction. Workers who have influence on company decision-making report higher job satisfaction than workers who do not, as also found by Mysíková and Večerník (2013). Career advancement opportunities, work effort, and work-colleague support are also positively linked to job satisfaction, whereas health and safety risks at work are associated with lower levels of job satisfaction. These findings partially echo those of Clark (1997) and by Sousa-Poza and Sousa-Poza (2000).

However, the number of working hours per month emerges as negatively associated with job satisfaction: those who say they work extra hours report higher levels of job satisfaction than others. The research of Pereira and Coelho (2013) provides contradictory evidence concerning the relationship between work hours and job satisfaction. This result might perhaps be related to the economic recession and the extra pay resulting from overtime work. Schedule flexibility, being able to decide when to start and finish at work, is found to be a positively significant determinant of job satisfaction. Further, with respect to working conditions, job security is positively linked to job satisfaction. This is in line with the views of Clark (1997), Wilczyńska et al. (2016), and Souza-Pouza's (2000) on the importance of perceiving a job as secure. Opportunities for attending further training programs have a positive effect on job satisfaction; also, Lange (2012) has found empirical support for this. General career experience is also positively linked to job satisfaction, in line with the results obtained by Mysíková and Večerník (2013). Moreover, the variable capturing work–life balance is shown to be a significant determinant of job satisfaction.

These findings are interesting when we compare the results of model 1 with the results of estimating the model for the subsamples of KWs and OWs. Most variables remain significant for OWs, but not for KWs, where labor relations, company size, and financial job characteristics emerge as non-significant determinants of job satisfaction. One reason for this difference lies in the sample size of the two groups, as only 7% of workers in our (total) sample can be defined as knowledge workers. However, certain differences are worth noting. Regarding the OW model (model 3), higher levels of education have a negative impact on job satisfaction, in line with findings by Lange (2012). Further, we find that career advancement is a more important determinant of job satisfaction for KWs than for OWs. By contrast, health and safety risks at work have a negative impact only on OW job satisfaction, perhaps because of the type of work and workplace involved: OWs are more likely to have jobs entailing such risks.

Table 4 Independent variables

Variable	Description	Obs	Mean	SD	Min	Max
Individual characteristics						
Male	1 if male	14,092	0.481	0.500	0	1
KW (dummy)	1 if knowledge worker	14,096	0.068	0.252	0	1
Type of household	Couples with children	14,096	0.505	0.500	0	1
	Couples without children	14,096	0.057	0.232	0	1
	Separated, divorced, or widowed, with children	14,096	0.075	0.263	0	1
	Separated, divorced, or widowed, no children	14,096	0.216	0.411	0	1
	Single, with children	14,096	0.120	0.325	0	1
	Single, no children	14,096	0.017	0.130	0	1
Labor relations system	Continental	14,096	0.239	0.426	0	1
	Anglo-Saxon	14,096	0.114	0.318	0	1
	Mediterranean	14,096	0.158	0.365	0	1
	Scandinavian	14,096	0.093	0.290	0	1
	Eastern Europe	14,096	0.396	0.489	0	1
Economic sector	Agriculture	14,096	0.019	0.136	0	1
	Industry	14,096	0.198	0.398	0	1
	Construction	14,096	0.058	0.234	0	1
	Services	14,096	0.716	0.451	0	1
Company size	Under 10 workers; 10 to 24 workers; 25 to 99 workers; 100 to 499 workers; 500 or more workers	13,964	2.645	0.620	1	5
Financial job characteristics						
Monthly income (log)	Based on questions "What is your usual gross pay before deductions for tax and insurance?" and "how long a period does the pay cover?" Logged income	9975	3.116	0.405	1.7	5.0

Table 4 (continued)

Variable	Description	Obs	Mean	SD	Min	Max
Work organization (non-financial job characteristics)						
Influence on company decision-making	Based on question "How much does the management allow you to influence policy decisions about the activities of the company?"	14,018	3.463	3.225	0	10
Career advancement opportunities (dummy)	1 if worker agrees/strongly agrees that his/her opportunities for advancement are good	13,789	0.311	0.463	0	1
Work effort (dummy)	1 if a worker agrees/strongly agrees that his/her job requires very hard work	14,054	0.701	0.458	0	1
Health and safety risk at work (dummy)	1 if a worker states that his/her health or safety is at risk because of his/her work	14,003	0.210	0.407	0	1
Work-colleague support (dummy)	1 if a worker states that s/he can get support and help from co-workers when needed	13,988	0.755	0.430	0	1
Work intensity (non-financial job characteristics)						
Working hours per month	We restricted the sample to persons working at least 40 h per month	13,928	148.824	29.456	40	210
Extra work hours (dummy)	Work involves working extra hours once a week or more	14,069	2.645	1.564	0	1
Schedule flexibility (dummy)	1 if a worker states that s/he can decide at what time to start and finish at work	14,034	0.210	0.407	0	1
Working conditions (non-financial job characteristics)						
Job security (dummy)	1 if a worker states that his/her job is secure	13,734	0.579	0.494	0	1
Participation in training activities (dummy)	1 if a worker states that s/he has taken a course or attended a lecture or conference to improve his/her knowledge or work skills during the last 12 months	14,073	0.385	0.487	0	1
General career experience	Total number of years (experience) in the labor market (in full or part-time work)	13,858	20.243	11.772	0	64
Work–life balance (non-financial job characteristics)						
Work/family conflict	Subjective indicator of work–life balance, based on the individual's own assessment. Average of three measures: "How often do you keep worrying about work problems when you are not at work?"; "How often do you feel too tired after work to enjoy the things you would like to do at home?," and "How often do you find that your job prevents you from spending the time you want with your partner or family?"	14,066	2.764	0.813	1	5

Source: Authors' own elaboration

Turning to the work intensity dimension, we find that monthly working hours are negatively significant and working extra hours positively significant only for OWs. However, more research, with larger samples of KWs, is needed to confirm this. Schedule flexibility has a positive impact in both samples, but is more important for KW job satisfaction. Related to the working condition dimension, while job security significantly increases the chances of job satisfaction in both samples, opportunities for further training and general career experience, are significantly positive only for OWs. General career experience could be related to the age of KWs, who tend to be younger—and younger workers are often less satisfied, as Belfield and Harris (2002) report from their study of job satisfaction among young workers in the UK.

Concerning the work–life balance, the work/family conflict variable emerges as highly significant in both samples. These results are in line with the findings of Mysíková and Večerník (2013). Additionally, worrying about work when not on the job is one of the most powerful factors that lower job satisfaction. The odds of job dissatisfaction for KWs who report difficulties in enjoying family relations or life in general because they are worried about work are 39% higher than for KWs who do not, while for OWs, the odds are 37% higher. Moreover, as Gallie and Russell (2009) point out, long working hours, high work intensity, and low job security all have strongly negative effects on work–life conflict.

To analyze the robustness of the classification of knowledge work, Table 6 presents a set of three models of *soft KW* samples, deconstructing the knowledge work variable. Thus, model 4 categorizes KWs without accounting for the characteristic of belonging to the top three standard occupational classifications. Model 5 excludes from the categorization the condition concerning high-level skills, as indicated by academic degrees or equivalent qualifications; and model 6 does not include in the classification of knowledge work the characteristic describing the complexity of tasks performed in terms of expert thinking and complex communication skills.

As Table 6 shows, in model 4 (which excludes those working in the top three standard occupational classifications sample), KWs have the same non-financial job determinants of job satisfaction as do KWs classified by the three characteristics shown in Table 5. Working extra hours becomes positively significant and company size negatively significant for KWs when the classification of knowledge work does not account for all those with high-level skills (model 5). Model 6 (which excludes those who perform tasks requiring expert thinking and complex communication skills) is the model where KWs are more similar to OWs in Table 5 as to the predictors of job satisfaction. This indicates that the level of complexity of tasks performed with regard to the expertise and the communication skills required is what distinguishes KWs from OWs in our sample.

Conclusions

This article has investigated the determinants of job satisfaction for knowledge workers (KWs) and other workers (OWs) in European Union countries, using micro-data from the 2010 European Social Survey concerning 14,096 workers. Before elaborating on the conclusions of this study, we should note two types of limitations. The first

Table 5 Logit determinants of job satisfaction in EU countries, 2010

	Model (1) all sample		Model (2) KW[1]		Model (3) OW[2]	
	Coefficient	Odds ratio	Coefficient	Odds ratio	Coefficient	Odds ratio
Individual characteristics						
Male	−0.248***	0.780	−0.609***	0.544	−0.228***	0.797
KW (dummy)	−0.292***	0.747				
Education (ref cat.: completed primary)						
Secondary					−0.403***	0.668
Post-secondary					−0.414***	0.661
University, higher education					−0.493***	0.611
Type of household (ref. category: couples with children)						
Couples without children	−0.215**	0.807	−0.619**	0.538	−0.179*	0.836
Separated, divorced, or widowed, with children	−0.423***	0.655	0.235	1.264	−0.468***	0.626
Separated, divorced, or widowed, no children	−0.186***	0.831	−0.500**	0.606	−0.163**	0.850
Single, with children	−0.207***	0.813	−0.108	0.898	−0.206***	0.814
Single, no children	−0.199	0.819	−0.807*	0.446	−0.138	0.871
Labor system (ref category: Continental)						
Anglo-Saxon	−0.456***	0.634	−0.106	0.900	−0.493***	0.611
Mediterranean	−0.096	0.909	0.621	1.861	−0.184**	0.832
Scandinavian	−0.016	0.984	−0.178	0.837	−0.001	0.999
Eastern Europe	0.097	1.102	0.259	1.296	0.148	1.160
Economic sector (ref category: agriculture)						
Industry	0.030	1.031	1.005	2.731	−0.005	0.995
Construction	0.082	1.086	0.044	1.045	0.050	1.052
Services	−0.121	0.886	0.682	1.977	−0.135	0.873

Table 5 (continued)

	Model (1) all sample		Model (2) KW[1]		Model (3) OW[2]	
	Coefficient	Odds ratio	Coefficient	Odds ratio	Coefficient	Odds ratio
Company size	−0.063***	0.939	−0.008	0.992	−0.062***	0.940
Financial job characteristics						
Monthly income (log)	0.651***	1.917	0.227	1.255	0.753***	2.123
Work organization (non-financial job characteristics)						
Influence on company decision-making	0.071***	1.074	0.012	1.012	0.078***	1.081
Career advancement opportunities (dummy)	0.640***	1.896	0.971***	2.641	0.607***	1.834
Work effort (dummy)	0.107**	1.113	−0.266	0.767	0.133**	1.142
Health and safety risk at work (dummy)	−0.308***	0.735	−0.037	0.964	−0.326***	0.722
Work-colleague support (dummy)	0.633***	1.883	0.434*	1.543	0.651***	1.918
Work intensity (non-financial job characteristics)						
Working hours per month	−0.002***	0.998	0.003	1.003	−0.003***	0.997
Extra work hours (dummy)	0.272***	1.313	0.492	1.635	0.265***	1.303
Schedule flexibility (dummy)	0.321***	1.378	0.545***	1.724	0.316***	1.371
Working conditions (non-financial job characteristics)						
Job security (dummy)	0.520***	1.683	0.467**	1.594	0.532***	1.702
Participation in training activities (dummy)	0.114**	1.121	0.098	1.103	0.128***	1.137
General career experience	0.009***	1.009	0.003	1.003	0.007***	1.007
Work–life balance (non-financial job characteristics)						
Work/family conflict	−0.480***	0.619	−0.493***	0.611	−0.474***	0.626
Constant	−1.212***	0.298	−1.314	0.269	−1.100***	0.333
Statistics						
Observations	9135		646		8489	
Prob > chi2	0.000		0.000		0.000	

Table 5 (continued)

	Model (1) all sample		Model (2) KW[1]		Model (3) OW[2]	
	Coefficient	Odds ratio	Coefficient	Odds ratio	Coefficient	Odds ratio
-2 log likelihood	12,182.134		848.265		11,273.003	
Cox and Snell R square	0.140		0.143		0.145	
Nagelkerke R square	0.187		0.192		0.194	
Hosmer and Lemeshow test	0.200		0.113		0.233	
Observations correctly predicted (%)	66.2		66.2		66.4	

Source: Author's calculations based on ESS5 micro-data

All figures refer to weighted data

*$p < 0.1$

**$p < 0.05$

***$p < 0.01$

[1] KWs

[2] OWs

Table 6 Logit determinants of job satisfaction, *soft* knowledge workers, EU countries, 2010

	Model 4[1]		Model 5[2]		Model 6[3]	
	Coefficient	Odds ratio	Coefficient	Odds ratio	Coefficient	Odds ratio
Individual characteristics						
Male	−0.413**	0.662	−0.418***	0.658	−0.309***	0.735
Education (ref cat.: completed primary)						
Secondary			−0.161	0.851		
Post-secondary			−0.510	0.600		
University, higher education			−0.370	0.690		
Type of household (ref. category: couples with children)						
Couples without children	−0.327	0.721	−0.413*	0.662	−0.450***	0.637
Separated, divorced, or widowed, with children	0.372	1.451	−0.153	0.858	−0.524***	0.592
Separated, divorced, or widowed, no children	−0.455**	0.634	−0.271	0.762	−0.436***	0.646
Single, with children	−0.152	0.859	−0.137	0.872	−0.121	0.886
Single, no children	−0.674	0.510	−0.299	0.741	0.055	1.057
Labor system (ref category: Continental)						
Anglo-Saxon	−0.340	0.712	−0.314*	0.731	−0.154	0.857
Mediterranean	0.562**	1.754	0.487**	1.628	−0.077	0.926
Scandinavian	−0.163	0.849	−0.225	0.798	−0.070	0.932
East European	0.405	1.500	0.230	1.259	0.280	1.324
Economic sector (ref category: agriculture)						
Industry	0.984	2.675	0.348	1.416	−0.150	0.861
Construction	0.644	1.905	−0.140	0.869	−0.816	0.442
Services	0.687	1.987	−0.067	0.935	−0.046	0.955
Company size	0.014	1.014	−0.144***	0.866	−0.093**	0.911

Table 6 (continued)

	Model 4[1]		Model 5[2]		Model 6[3]	
	Coefficient	Odds ratio	Coefficient	Odds ratio	Coefficient	Odds ratio
Financial job characteristics						
Monthly income (log)	0.348	1.416	0.474	1.606	0.597***	1.816
Work organization (non-financial job characteristics)						
Influence on company decision-making	0.044	1.045	0.024	1.025	0.0480***	1.049
Career advancement opportunities (dummy)	1.050***	2.856	0.610***	1.841	0.837***	2.310
Work effort (dummy)	−0.186	0.830	−0.108	0.898	0.174	1.190
Health and safety risk at work (dummy)	−0.216	0.806	0.165	1.179	−0.430***	0.651
Work-colleague support (dummy)	0.411*	1.509	0.515***	1.674	0.656***	1.927
Work intensity (non-financial job char.)						
Working hours per month	−0.002	0.998	0.003	1.003	−0.002	0.998
Extra work hours (dummy)	0.508	1.662	0.788***	2.200	0.426***	1.531
Schedule flexibility (dummy)	0.579***	1.785	0.819***	2.267	0.300***	1.350
Working conditions (non-financial job char.)						
Job security (dummy)	0.383**	1.467	0.286**	1.332	0.385***	1.470
Participation in training activities (dummy)	0.116	1.123	0.022	1.023	−0.047	0.954
Career general experience	0.001	1.001	0.009	1.009	0.008	1.008
Reconciling work/family life (non-financial job char.)						
Work/family conflict	−0.315***	0.730	−0.438***	0.645	−0.637***	0.529
Constant	−1.732	0.177	−0.808	0.446	−0.405	0.667
Statistics						
Observations	751		1061		2252	
Prob > chi2	0.000		0.000		0.000	
-2 log likelihood	976.934		1481.607		2812.485	

Table 6 (continued)

	Model 4[1]		Model 5[2]		Model 6[3]	
	Coefficient	Odds ratio	Coefficient	Odds ratio	Coefficient	Odds ratio
Cox and Snell R square	0.141		0.124		0.141	
Nagelkerke R square	0.189		0.165		0.191	
Hosmer and Lemeshow test	0.885		0.039		0.007	
Observations correctly predicted (%)	66.5		66.2		67.2	

[1] KWs, excluding all those who work in the top three standard occupational classifications sample

[2] KWs, excluding all those with high-level skills, indicated by academic degrees or equivalent qualifications

[3] KWs, excluding all those who perform tasks that require expert thinking and complex communication

Source: Author's calculations based on ESS5 micro-data

All figures refer to weighted data

*$p < 0.1$

**$p < 0.05$

***$p < 0.01$

concerns the relatively small percentage in changes in well-being explained by socio-economic, demographic, and organizational variables, which gives only a partial picture of the factors that matter for the subjective well-being of workers. The second links to the problem of endogeneity: when well-being is studied with cross-sectional data, it is it is difficult to account for unobserved characteristics that may influence both dependent and independent variables, thus reducing the possibility of interpreting results in causal terms (Ferrer-i-Carbonell and Frijters 2004).

Our aim was to explore the variables that can explain job satisfaction for KWs and OWs. As predicted, we find that monthly income plays an important role only for job satisfaction among OWs and is not significantly related to KW job satisfaction: this shows support for *H1*. This finding is in line with Wilczyńska et al.' (2016) study in Poland as well as with findings in the happiness literature on the diminishing marginal utility of income (Frey and Stutzer 2002). As KWs tend to earn more than OWs, the importance they place on economic rewards when assessing job satisfaction is probably lower, and other non-financial characteristics of their job are likely be central.

The importance of non-financial characteristics (work organization, work intensity, working conditions, and work–life balance) for the job satisfaction among KWs and OWs was explored through five hypotheses drawn from previous literature on the topic. Concerning work organization, although KW job satisfaction was influenced by career advancement opportunities and work-colleague support, having influence on company decision-making was not a significant predictor, indicating only partial support for *H2*. The opportunity for career advancement was the most important variable in explaining KW job satisfaction. This accords with Pyöriä's study (Pyöriä 2007) of trust and length of employee relations in Finland. That study found that meritocracy (the degree to which employees perceive that their rewards and career advancement are based on merit and not other forms such as nepotism or seniority) had a direct effect on organizational commitment among KWs. This is an interesting result that calls for further research: is the relative emphasis on this variable linked to factors like labor market characteristics, regulations, or gender issues? Another possible factor to consider following Carayannis and Campbell (2011) could be the national or regional innovation systems determining the capacity of workers to advance their position in firms or its corresponding clusters.

Regarding work intensity, our analysis confirmed that work-schedule flexibility is crucial for KW job satisfaction. For KWs who have flexible schedule arrangements, the odds of being satisfied with one's job are 72% higher than for KWs who do not have such arrangements, whereas for OWs, the odds are only 37% higher. This, together with the level of significance of this variable, supports our *H3*.

Related to working conditions, job security emerges as an important predictor of job satisfaction for KWs. Contrary to expectations, opportunities for further training were not found to be significantly related to KW job satisfaction. Following Huang (2011), a possible explanation could be that, in KW jobs, continued learning is usually deemed a prerequisite for growth and development and a requirement for successful performance. Thus, we do not find support for *H4a*. However, this does not mean that non-formal learning is not relevant for knowledge workers as knowledge acquisition can also come internally from interaction with customers (Santoro et al. 2016) and the local research communities (Del Giudice et al. 2013) and from the improved quality of firm and business levels information systems (Carayannis et al. 2017). Furthermore, we can

accept *H4b*, as OW job satisfaction is better explained by general career experience than is KW job satisfaction. As noted, this finding could be related to age: KWs tend to be younger than OWs—56% of our sample are under 40 years, against 44% for OWs.

According to *H5*, work–life balance will be more decisive for understanding job satisfaction among KWs than with OWs. Our results indicate that this is the case, as this balance emerges as the third most important determinant, among non-financial job characteristics. However, coefficient values are very similar between types of jobs, so we find only partial support for this hypothesis. The relatively higher importance of work–life balance for KWs resonates with the work of McGinnity and Calvert (2009), indicating that professionals work longer hours and experience more work pressure than other groups. The increase in women's participation in the labor force, particularly in knowledge work, could also have influenced our findings.

KWs are a very diverse group, ranging from employees who attend frequent refresher courses and training (and enjoy high levels of autonomy, and are committed to their work) to those who experience considerable techno-stress, working long hours with precarious and temporary contracts. These divergent situations and experiences of KWs must be disentangled in order to fully understand and respect the complexity of employment relations in highly skilled work. This diversity calls for further examination in future studies of KWs. One approach could be through cluster analysis, accounting for the relevant organizational and contractual categories that define the different types of KWs. Future research should deepen the analysis of job satisfaction, replicating the model differentiating by labor relation systems and by gender. Further research could also extend the findings of our study by focusing on job satisfaction among KWs in specific organizations or sectors.

Finally, our results indicate that managers seeking to improve the well-being of their employees should incorporate the growing body of evidence on the determinants of job satisfaction among KWs. For instance, interventions could address the work–life balance of these employees by providing greater flexibility in work schedules and with discussion of clear pathways for further promotion within the company. By contrast, measures directed towards OWs could focus on traditional labour issues, like providing lifelong training opportunities, protecting against health and safety risks, and guaranteeing company compliance with legally binding agreements on working hours.

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Paper II

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Full length article

Internet use and job satisfaction

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ABSTRACT

Does the use of Internet for professional purposes foster employees' job satisfaction? We focus on six main work characteristics – income, education, occupation type, autonomy, time pressure and social interactions – and we develop new hypotheses on how Internet use moderates the effects of these factors. We use data from the *European Working Conditions Survey*, and estimate a bivariate ordered probit model, and a hierarchical ordered probit model. The results point out that Internet technologies enhance job satisfaction by improving access to data and information, creating new activities, and facilitating communication and social interactions. However, these positive effects are skewed. Workers in some occupations, and with higher income and education levels, benefit relatively more from the Internet *vis-a-vis* workers in occupations that are more weakly related to ICTs activities.

1. Introduction

Internet technologies have by now become a fundamental working tool in several professions. Despite the widespread diffusion and great relevance of Internet, however, there is still limited knowledge about the impacts that these have on workers' well-being. Specifically, does Internet use for professional purposes affect job satisfaction, and if so how?

The literature on job satisfaction has extensively investigated a variety of factors that explain why some employees report higher subjective well-being than others. In particular, extant research points out the relevance of some main antecedents of job satisfaction: income earnings and career prospects (Chen, Ployhart, Thomas, Anderson, & Bliese, 2011; Ockenfels, Sliwka, & Werner, 2014), education and skill levels (Green & Zhu, 2010), work organization and practices (Agypt & Rubin, 2012; Golden & Veiga, 2005), and workplace relationships (Colbert, Bono, & Purvanova, 2016; Mihail & Kloutsiniotis, 2016; Wood & Ogbonnaya, 2016).

However, it is noteworthy to observe that only few studies have until now explicitly investigated the relationships between Internet use at work and job satisfaction (e.g. see recent papers in this journal: Carlson, Carlson, Zivnuska, Harris, & Harris, 2017; Charoensukmongkol, 2014; Huang & Liu, 2017; Robertson & Kee, 2017). This paper studies this relevant and still unexplored question. The general idea that we investigate is that Internet moderates the effects of work characteristics previously studied in the literature, strengthening, or attenuating, their relationship to job satisfaction. Specifically, we posit that Internet use at work can have four distinct types of effects on workers' well-being. First, it provides users with unprecedented opportunities to access data and information. Second, Internet technologies have also led to the emergence of new activities and services, and hence to the rise of brand new occupations, with consequent new opportunities for skilled workers. Third, Internet use for professional purposes may lead to time saving effects, so that employees can perform time consuming and repetitive tasks in a more efficient manner than they did before. Finally, Internet enables distance communication among workers through a variety of cheap and powerful tools, which provide unprecedented opportunities for internal communication and leadership, and facilitate the information flow between managers and employees (Castellacci & Tveito, 2018).

These four channels, however, can have distinct effects on employees' well-being. In fact, as pointed out by the coping model of user adaptation to information technology (Beaudry & Pinsonneault, 2005), employees that are faced with new ICTs at work make an effort to understand, manage and adapt to these changes. Some employees will perceive them as an opportunity, and will therefore be more likely to use them as an active working tool to improve their performance and job satisfaction (Bala & Venkatesh, 2016). Hence, Internet use at work

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will have heterogenous effects on employees, depending on their personal characteristics and background, and the type of tasks and activities they carry out.

To investigate this general idea, we focus on six of the most important antecedents of job satisfaction previously studied in the literature – income, education, occupation type, autonomy, time pressure and social interactions – and for each of them we develop a specific hypothesis on how Internet use moderates its effect on well-being. Studying the moderating effects of Internet means that we seek to investigate the extent to which Internet use at work magnifies (or attenuates) the effect of work characteristics on job satisfaction, and it is therefore a suitable approach to uncover the heterogenous impacts of digital working tools.

To test empirically these hypotheses, we use data from the *European Working Conditions Survey* (EWCS), which provides a rich variety of information on more than 35,000 workers across European countries. The econometric analysis of this dataset faces a potential selection bias issue, since the main explanatory variable of interest (intensity of Internet use) is arguably not exogenous and randomly assigned, but it depends on some employee- and work-specific characteristics. For this reason, we specify two equations, one estimating the determinants of Internet use, and the other estimating the relationships between Internet use and job satisfaction.

The econometric results provide support for the general idea that Internet use fosters job satisfaction by improving access to data and information, creating new activities and opportunities, and facilitating communication and social interactions. Further, the results also indicate that these positive effects are not equally distributed among different occupations and groups of workers. Employees in some specific occupations, and particularly those with higher income and education levels, tend to benefit relatively more from Internet technologies *vis-a-vis* workers in other occupations that are more weakly related to ICTs activities.

On the whole, the contribution of this paper to the academic literature on the subject is twofold. First, we show that Internet use at work has multi-dimensional effects on workers' well-being through several different channels (income, education, occupation type, autonomy, time pressure and social interactions). Although each of these channels should be further investigated in future research, our work presents a broad and encompassing multidimensional framework that shows the importance of considering these distinct factors together. Second, we develop and test new theoretical hypotheses that show that the effects of Internet use at work are heterogenous, so that digital technologies may lead to polarization patterns that may beneficial to some groups of workers and less so for others.

2. Theory and hypotheses

The main argument we develop in this paper is that Internet use affects job satisfaction by moderating the relationships between work characteristics and well-being. Specifically, the effects of Internet use may vary substantially among workers. An important argument to understand these differences is based on the so-called coping model of user adaptation to information technology (Beaudry & Pinsonneault, 2005). According to this model, employees that are faced with new ITs at work respond through cognitive appraisal and adaptation strategies, i.e. they undertake efforts to understand, make sense of, manage and adapt to these changes. Bala and Venkatesh (2016), in particular, point out that workers have different attitudes towards the adoption of ITs: some employees will perceive them as an opportunity, and will therefore be more likely to use them as an active working tool to improve their performance and job satisfaction. Other workers, by contrast, will perceive the new technologies as a threat, and consequently will resist their adoption, use them less intensively, and thus fail to exploit the related opportunities. These different attitudes of workers towards digital technologies, in turn, are related to a variety of employees' personal characteristics and the type of working activities and tasks they perform.

Hence, to study heterogenous effects of Internet use at work, we make use of a broad and encompassing theoretical framework. The framework is multi-dimensional, and it considers six major work characteristics that have been studied in the literature, rather than focusing on one or few of them only. Other papers have recently made use of a multi-dimensional model to study the determinants of job satisfaction (Chiaburu, Thundiyil, & Wang, 2014; Díaz-Chao, Ficapal-Cusí, & Torrent-Sellens, 2017; Erdogan, Bauer, Truxillo, & Mansfield, 2012). However, the specific novelty of our framework is that it is built up to investigate the effects of Internet use at work, and that it points out that such impacts can be analyzed as moderating effects via different work characteristics. Fig. 1 summarizes our theoretical framework and the six hypotheses that will be empirically investigated in the next sections.

Income. One first important antecedent of job satisfaction refers to income and career prospects. The wage of a worker is obviously an

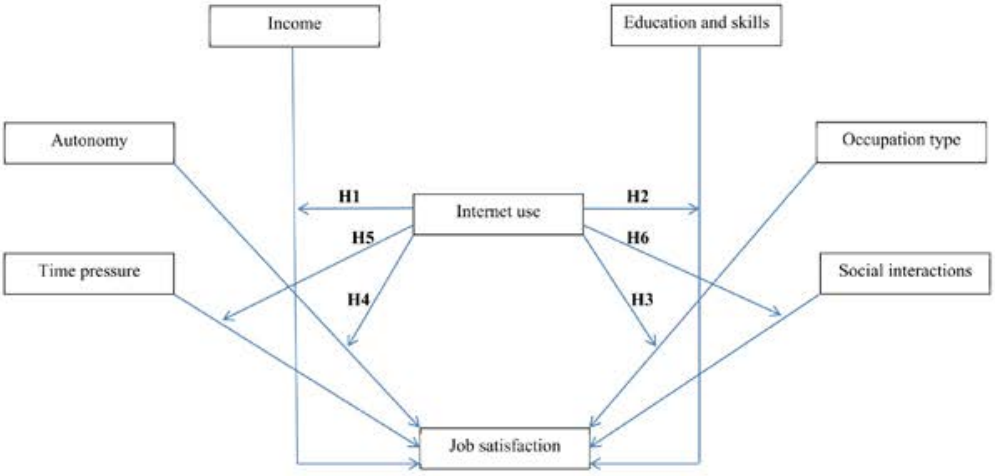

Fig. 1. Theoretical framework and hypotheses.

important rewarding factor. Several empirical studies have found a positive relationship between income earnings and job satisfaction (Clark, 2005; Pichler & Wallace, 2009; Sousa-Poza & Sousa-Poza, 2000). However, extant research also indicates that the relative importance of wage *vis-à-vis* other determinants of job satisfaction is relatively small (Salvatori, 2010). Social comparison theory points out that a more important factor than the absolute level of income earnings is workers' subjective perception of their wage level, which is in turn affected by how the wage level compares to that of other workers within the same company and/or occupation type (Clark & Oswald, 1996; Diener, Diener, & Diener, 1995; Easterlin, 1974; Ockenfels et al., 2014). Furthermore, job satisfaction is not only affected by financial characteristics and rewards at present, but also by future prospects, and in particular job security and prospects for career advancement (Chen et al., 2011; Clark, 2009; Giannikis & Mihail, 2011; Hackman & Oldham, 1976).

We argue that Internet use strengthens the positive relationship between income and job satisfaction. The reason is twofold. First, based on social comparison, we posit that workers use Internet to compare their income and career prospects to those of other colleagues and relevant neighbours. This social comparison will tend to increase (decrease) further job satisfaction for workers that have above (below) average income earnings, and hence increase the elasticity of the income-job satisfaction relationship. Second, workers that actively use Internet as a major working tool typically belong to occupations (or organizational functions) that have on average higher wage levels than others. These workers often perform tasks that are closely related to the production and diffusion of ICT general purpose technologies, and work in organizations and sectors that face positive demand conditions and rising market opportunities (Bresnahan, Brynjolfsson, & Hitt, 2002). According to the coping model of user adaptation to information technology, (Bala & Venkatesh, 2016; Beaudry & Pinsonneault, 2005), these employees will be more likely to perceive Internet technologies as an opportunity, and use them actively as a professional tool to increase their performance. We therefore expect to find a stronger impact of income earnings on job satisfaction for workers in these high-opportunities ICT-based activities, where Internet technologies represent a main working tool, and a correspondingly lower effect for workers that do not actively need to use Internet to perform their daily tasks. In short, the joint effect of income and Internet use creates a polarization pattern, which, in a cross-section of workers, implies an increase in the elasticity of the income-job satisfaction relationship.

Hypothesis 1. Internet use strengthens the positive effect of income on job satisfaction.

Education and skills. Another central factor affecting job satisfaction is workers' human capital and education level. On the one hand, a higher education level increases the chances that an employee will have a higher wage level and a more interesting and rewarding job. On the other hand, however, various empirical studies have found that – after controlling for income earnings – the correlation between education level and subjective well-being at work is actually negative (Clark & Oswald, 1996; Salvatori, 2010; Sousa-Poza & Sousa-Poza, 2000). This can be explained in the light of prospect theory (Kahneman & Tversky, 1979): when an individual invests more time in education and human capital formation, her/his expectations about the desired job will also be higher, and it will therefore be more likely that the worker will feel more critical and less satisfied with her actual working conditions. In particular, empirical research indicates that overqualified workers report significant lower levels of job satisfaction than others (Belfield & Harris, 2002; Green & Zhu, 2010). By contrast, feelings of competence provide personal satisfaction (Hackman & Oldham, 1976), and on the job training, which fosters workers' ability to master and manage complex working tasks, is typically reported to be important for job satisfaction (Pichler & Wallace, 2009).

We claim that Internet use moderates the negative relationship between education and workers' well-being. This is due to two reasons. First, since Internet makes it possible to easily access a great amount of information, it is reasonable to argue that highly educated workers will have better and more complete information about working conditions in their sector of occupation (and/or in the specific organization in which they work), and hence they will be less likely to form wrong expectations about the job corresponding to their education level, and more likely to make realistic and well-informed expectations. The use of Internet as an instrument to get information about the job market and expected working conditions will therefore attenuate the negative effect of education on job satisfaction. Second, Internet provides the opportunity to access specialized information that the worker needs to master complex tasks, as well as to learn new things and get additional on-the-job professional training. These information access and learning effects will arguably increase workers' well-being, foster their feelings of competence and ability to master working tasks (Venkatesh & Speier, 1999), and hence attenuate their dissatisfaction with actual working conditions. Further, these moderating effects are likely to be stronger for highly educated workers, which, according to the coping model of user adaptation (Bala & Venkatesh, 2016; Beaudry & Pinsonneault, 2005), are more likely to perceive Internet as an opportunity rather than a threat, and hence actively use it as a professional learning tool.

Hypothesis 2. Internet use attenuates the negative effect of education on job satisfaction.

Occupation type. The analysis of the determinants of work-life satisfaction also has to consider that there exists a great variety of occupation types, which in turn affect the array of tasks that workers must perform and the working environment that characterizes different sectors of the economy. Specifically, the distinction between white collar and blue collar work has important implications for job satisfaction and its determinants. In general, white-collar employees report higher levels of well-being than blue collar workers (Giannikis & Mihail, 2011; Lopes, Calapez, & Lagoa, 2014). Physical and safety conditions are typically better in white collar occupations (Sousa-Poza & Sousa-Poza, 2000). Further, white-collar work is often characterized by less monotonous and repetitive working tasks (Pichler & Wallace, 2009), as well as greater skill variety, namely the degree to which a job involves a variety of different tasks that require the use of a number of distinct skills (Hackman & Oldham, 1976).

We expect Internet use to make the positive relationship between white-collar work and subjective well-being stronger. The reason is as follows. Internet technologies do in principle provide opportunities to improve working conditions in many sectors of the economy – e.g. by improving physical safety at the workplace; or by enhancing task variety, and making it easier to manage monotonous and repetitive tasks. However, these effects are arguably polarized. Internet is not used to the same extent by workers in different occupations, but it is more intensively used in white-collar occupations and tertiary activities (Bresnahan et al., 2002; Salanova, Cifre, & Martin, 2004). An active and skilled use of Internet as a working tool in white-collar occupations strengthens the performance and job satisfaction of workers in these sectors, which are more likely to perceive Internet as an opportunity rather than a threat (Bala & Venkatesh, 2016; Beaudry & Pinsonneault, 2005). By contrast, in blue collar occupations characterized e.g. by physical work and repetitive tasks, Internet is not yet a major working tool, and it is therefore less likely that employees will regard it as an important professional instrument, and that it will then have important effects on job satisfaction. In short, the fact that Internet use is stronger in white-collar occupations creates a polarization effect, and this, in a cross-section of workers, implies an increase in the elasticity of the relationship between white-collar work and job satisfaction.

Hypothesis 3. Internet use strengthens the positive effect of white-collar occupation on job satisfaction.

Autonomy. Another important factor that has extensively been

studied in the job satisfaction literature is autonomy. Research shows that when workers perform their tasks in an autonomous manner and without being strictly dependent on their boss, other colleagues and/or external partners, they are typically more motivated and satisfied (Carlson et al., 2017; Golden & Veiga, 2005; Hackman & Oldham, 1976; Lopes et al., 2014; Sousa-Poza & Sousa-Poza, 2000). For instance, self-employed workers have been found on average to report higher levels of job satisfaction than employed workers (Belfield & Harris, 2002; Clark, 2009; Pichler & Wallace, 2009).

A key point to develop our hypothesis is that the degree of autonomy that a worker has is largely defined by the leadership of the organization for which she works, and the way in which her working activities and tasks are organized. The availability of Internet technologies *per se* will not have any direct effect on the worker's degree of autonomy. Rather, we hypothesize that Internet use will have a moderating effect, i.e. it will strengthen the positive relationship between autonomy and job satisfaction. In fact, workers that are allowed to have some autonomy to define their own tasks and activities will find it convenient to use Internet technologies to adopt innovative work practices (e.g. telework; Askenazy & Caroli, 2010; Golden & Veiga, 2005). Internet can also be used as a powerful source to get access to specialized information and external knowledge, which may increase the worker's ability to find own solutions to complex tasks without being dependent on other colleagues or external partners. On the other hand, workers that are not allowed to carry out their activities in an autonomous manner will not be able to experiment with and benefit from the use of Internet-based organizational tools. In summary, since Internet use will increase job satisfaction relatively more for workers that are allowed to have a certain degree of autonomy, we hypothesize the following moderation effect:

Hypothesis 4. Internet use strengthens the positive effect of autonomy on job satisfaction.

Time pressure. Another crucial dimension shaping employees' well-being is the time that workers have available to perform their tasks and the time pressure that they are subject to. In general terms, job satisfaction is negatively related to the number of working hours that an individual works per week (Clark & Oswald, 1996; Lopes et al., 2014; Salvatori, 2010). Long work days also lead to a worse work–life balance, which in turn affects subjective well-being (Gallie & Russell, 2009; Scandura & Lankau, 1997). In addition to the amount of working time, work-life satisfaction is substantially affected by the pace of work itself: working under pressure, having frequently tight deadlines, and not having enough time to carry out daily tasks are obviously negative factors for workers' well-being (Agypt & Rubin, 2012). In particular, Lopes et al. (2014), using the European Working Conditions Survey (EWCS) for 15 EU countries, find that workers who report not having enough time to complete their tasks report a lower level of job satisfaction; and Pichler and Wallace (2009), using the European Quality of Life Survey (EQLS), find that job satisfaction is on average lower for those workers who frequently have to comply with tight deadlines.

Similarly to what argued in relation to autonomy, the extent of time pressure to which a worker is subject is a mere work characteristic that is defined by the leadership of the organization and/or the way in which working tasks are organized. Internet technologies will have a moderating effect on this. Specifically, we posit that Internet attenuates the negative effect of time pressure on well-being at work. This is because of time-saving mechanisms that can benefit workers that are subject to a high degree of time pressure. One of the central strengths of Internet technologies is that they enable to perform working tasks in a much more efficient and more rapid manner than before (Castellacci & Tveito, 2018). The use of e-commerce, online banking, search engines and Intranet portals, for example, makes it possible to carry out purchase, marketing, sales and human resource management activities in a more systematic and faster way. These time-saving mechanisms are potentially relevant for workers' well-being, if employees can reduce the time they spend on time consuming, annoying and repetitive tasks, and correspondingly allocate more time to other more rewarding and interesting activities (Askenazy & Caroli, 2010; Dolan, Peasgood, & White, 2008; Van der Doef & Maes, 1999). On the other hand, for workers that are not subject to strong time pressure, the time-saving effect of Internet use will provide a less relevant channel to enhance well-being at work. This means that, in a cross-section of workers, we will observe the following moderation relationship[3]:

Hypothesis 5. Internet use attenuates the negative effect of time pressure on job satisfaction.

Participation and social interactions. A sixth major antecedent of well-being at work, according to extant research, is related to employees' social interactions with their colleagues, managers and external partners. Research points out the relevance of having good relationships and a positive social environment at work. According to social exchange theory, good relationships help employees to achieve their goals, thus fostering job satisfaction (Colbert et al., 2016). Further, a high degree of internal cohesion, i.e. strong commitment to team work and membership to an organization, is important to enhance employees' creativity and well-being (Clark, 2009; Hülsheger, Anderson, & Salgado, 2009). Active participation of employees in decision-making is also important and it increases the trust in the leadership and management of the organization (Helliwell & Huang, 2010; Sousa-Poza & Sousa-Poza, 2000). By contrast, bad social relationships – e.g. characterized by conflicts, discrimination and harassment – are factors that hamper well-being at work (De Clercq & Belausteguigoitia, 2017).

In general, the extent to which workers engage in social interactions at the workplace is also an inherent work characteristic, which is dependent on the leadership style, organizational setting and type of tasks that employees perform. We argue that Internet use may strengthen the positive relationship between participation and social interactions, on the one hand, and well-being at work, on the other. The reason for this is that Internet-based communication platforms – such as Intranet, Skype meetings, video conferences, and social media at work – may enable and facilitate social interactions at the workplace, and particularly so in large and complex organizations in which workers are not co-located. These ICT-based devices facilitate communication and informal interactions between workers of the same organization, improve the information flow between managers and employees, and also create new channels to have closer contact with external agents such as suppliers, users and clients (Charoensukmongkol, 2014; Huang & Liu, 2017; Moqbel, Nevo, & Kock, 2013; Robertson & Kee, 2017). These new communication channels provide therefore increased opportunities to strengthen the employees' sense of participation and organizational commitment, which are important for their feelings of well-being at work. The key point of our hypothesis is that Internet-based communication technologies will provide enhanced opportunities for social interactions for those workers and organizational settings in which the latter represent an inherent part of working activities. On the other hand, for workers in occupations that are more based on individual work and less dependent on social interactions, Internet-based communication technologies will not represent a relevant channel to enhance well-being. In short, this argument implies the following:

Hypothesis 6. Internet use strengthens the positive effect of participation on job satisfaction.

[3] However, it would also be possible to point out an opposite argument (in line with Agypt & Rubin, 2012): Internet may possibly increase the fragmentation of work and intensify the frequency of unexpected (irregular) deadlines. If this effect prevails on the one pointed out in Hypothesis 5, Internet use may then turn to exacerbate the negative effect of time pressure on job satisfaction.

Table 1
Indicators: definitions and descriptive statistics.

Variable	Definition	Mean	SD	Min	Max
Job satisfaction	On the whole, are you satisfied with working conditions in your main paid job? Three categories: 1 = Not satisfied; 2 = Satisfied; 3 = Very satisfied.	2.06	0.65	1	3
Internet use	Does your main paid job involve using internet, email for professional purposes? Seven categories: from 1 = 'Never' to 7 = 'All of the time'.	2.82	2.27	1	7
Income and career prospects					
Income earnings	Net monthly income earnings from main job. Three categories: 1 = below the country mean; 2 = at the country mean; 3 = above the country mean.	2.00	0.85	1	3
Income (perceived)	Are you well paid for the work that you do? Five categories: from 1 = 'Strongly disagree' to 5 = 'Strongly agree'.	3.03	1.16	1	5
Insecurity	Do you agree you might lose the job in the next 6 months? Five categories: from 1 = 'Strongly disagree' to 5 = 'Strongly agree'.	2.17	1.23	1	5
Career prospects	Does your job offers good prospects for career advancement? Five categories: from 1 = 'Strongly disagree' to 5 = 'Strongly agree'.	2.69	1.22	1	5
Education and skills					
Education	What is the highest level of education or training that you have successfully completed? Seven ISCED codes: from 0 = 'pre-primary education' to 6 = 'second stage of tertiary education'.	3.39	1.26	0	6
Training needs	1 if worker states s/he needs further training to cope well with the duties.	0.12	0.33	0	1
Over qualification	1 if worker states the demands are too low in relation to his/her skills.	0.32	0.47	0	1
Learning	1 if worker states his/her main paid job involves learning new things.	0.70	0.46	0	1
Training	1 if worker states s/he has undergone some training activities during the past 12 months.	0.32	0.47	0	1
Occupation type					
White collar-skilled	1 if worker is working in the top three standard occupational categories (legislators, senior officials and managers, professionals and technicians and associate professionals)	0.38	0.49	0	1
White collar-unskilled	1 if worker is working in the 4 and 5 ISCO codes (clerks and service workers and shop and market sales workers)	0.27	0.44	0	1
Blue collar-skilled	1 if worker is working in the 6 and 7 ISCO codes (skilled agricultural and fishery workers and craft and related trades workers)	0.15	0.36	0	1
Blue collar-unskilled	1 if worker is working in the 8 and 9 ISCO codes (plant and machine operators and assemblers and elementary occupations)	0.20	0.40	0	1
Autonomy					
Own ideas	You are able to apply your own ideas in your work. Five categories: from 1 = 'Never' to 5 = 'Always'.	3.63	1.37	1	5
Autonomy	1 if worker states s/he is able to choose the order of tasks, methods of work and speed or rate of work.	0.66	0.47	0	1
Problem solving	1 if worker states his/her main paid job involves solving unforeseen problems on his/her own.	0.82	0.39	0	1
Supervision	Number of people supervised. Three categories, from 1 = 'none' to 3 = '10 or more'.	1.22	0.52	1	3
Flexible time	1 if worker states his/her working hours are entirely self-determined.	0.16	0.36	0	1
Self-assessment	1 if worker states his/her main paid job involves self-assessing the quality of his/her own work.	0.74	0.44	0	1
Working partners	You have a say in the choice of your working partners. Five categories, from 1 = 'Never' to 5 = 'Always'.	2.33	1.56	1	5
Time pressure					
Pace	Your job involves working at very high speed and with tight deadlines. Seven categories: from 1 = 'Never' to 7 = 'All of the time'.	3.71	1.89	1	7
Available time	1 if worker states s/he has enough time to get the job done.	0.90	0.30	0	1
Working hours	How many hours do you usually work per week in your main paid job?	38.60	11.95	1	106
Work-life balance	Do your working hours fit in with your family or social commitments outside work? Four categories: from 1 = 'not at all very well' to 4 = 'very well'.	3.08	0.79	1	4
Participation and social interactions					
Management support	Your manager helps and supports you. Five categories, from 1 = 'Never' to 5 = 'Always'.	3.71	1.29	1	5
Colleagues	Worker agree s/he has very good friends at work. Five categories, from 1 = 'strongly disagree' to 5 = 'strongly agree'.	3.91	0.97	1	5
Discrimination	1 if worker states s/he has been subject to discrimination (on the basis of his/her gender, sexual orientation, or disability) during the last 12 months.	0.06	0.24	0	1
Other work characteristics					
Work quality	Your job gives you the feeling of work well done. Five categories: from 1 = 'Never' to 5 = 'Always'.	4.25	0.92	1	5
Employee	1 if worker employment status is employee.	0.84	0.36	0	1
Monotonous	1 if worker states his/her main paid job involves monotonous tasks.	0.44	0.50	0	1
Rotating	1 if worker states his/her job involves rotating tasks between him/herself and colleagues.	0.45	0.50	0	1
Personal characteristics					
Gender	1 if worker is male.	0.49	0.50	0	1
Age	Age of worker.	41.80	11.75	16	89
Safety	1 if worker think his/her health or safety is at risk because of his/her work.	0.29	0.45	0	1
Health	Number of days absent because of health problems. Six categories: from 0 = 'never' to 5 = '50 days or more'.	0.85	1.39	0	5
Partner and children	1 if worker is living with spouse/partner and son/daughter under 15.	0.32	0.47	0	1
Partner and no children	1 if worker is living with spouse/partner and without son/daughter.	0.35	0.48	0	1
Single and children	1 if worker is living without spouse/partner and with son/daughter under 15.	0.06	0.23	0	1
Single and no children	1 if worker is living without spouse/partner and without son/daughter.	0.27	0.44	0	1

Note: N = 35,856.

3. Data and methods

The empirical analysis makes use of data from the European Working Conditions Survey (EWCS), which is a large scale survey of workers in European countries (for previous works using this data source, see Green & McIntosh, 2001; Lopes et al., 2014; Martin & Omrani, 2015). We use data from the two most recent waves of the survey, referring to the years 2005 and 2010 respectively. We include all workers older than 16, and whose place of residence is in the European Union countries. The final sample contains 35,856 workers. Respondents in the 2005 survey are not the same as those in 2010 wave, so that the dataset is not a panel but rather as a pooled cross-section. Table 1 presents the indicators that we use in the empirical analysis, the corresponding EWCS, p. 7363 survey questions, and some descriptive statistics.[4]

We group the indicators into some main categories corresponding to the major conceptual dimensions noted in section 2. The top of Table 1 reports descriptives for the two main variables in our analysis. The dependent variable, job satisfaction, is a categorical indicator ranging between 1 and 3 (not satisfied; satisfied; very satisfied). The main explanatory variable is a categorical indicator of intensity of Internet use at work ranging between 1 and 7. The next groups of variables are the six conceptual dimensions on which our hypotheses focus: (1) income and career prospects, (2) education and skills, (3) occupation type, (4) autonomy, (5) time pressure, and (6) participation and social interaction. Finally, the bottom of Table 1 lists some variables measuring other work characteristics and personal characteristics (e.g. age, gender, health, etc.), which we will use as control variables in the econometric analysis.

The objective of the econometric analysis is to investigate how workers' job satisfaction (dependent variable) is affected by their use of Internet for professional purposes. An important issue that has to be taken into account in this analysis is that the main explanatory variable of interest, Internet use, is arguably not an exogenous and randomly assigned variable, but it is in turn dependent on a set of work-related and personal characteristics. In particular, workers that report above-average Internet use are more likely to be in white-collar occupations, and they have higher education and skill level than other workers. This means that when we estimate the relationship between job satisfaction and Internet use we have to take into account this sample selection pattern.

To take this issue into account, we adopt a two-equation econometric approach. The first step is a selection equation that investigates the factors explaining why some workers have higher Internet use intensity than others, whereas the second equation studies the relationship between job satisfaction and Internet use (plus a set of control factors). The econometric model is the following:

$$\mathrm{INT}_{itc} = \alpha + \sum_k [\beta^k \mathrm{WC}^k_{itc}] + \sum_k [\gamma^k \mathrm{PC}^k_{itc}] + \psi \mathrm{Z}_{tc} + \sigma_{itc} \quad (1)$$

$$\mathrm{JS}_{itc} = \mu + \eta \mathrm{INT}_{itc} + \sum_k [\pi^k \mathrm{WC}^k_{itc}] + \sum_k [\rho^k (\mathrm{INT}_{ij} * \mathrm{WC}^k_{itc})] + \sum_k [\varphi^k \mathrm{PC}^k_{itc}] + \varepsilon_{itc} \quad (2)$$

where INT denotes internet use, JS job satisfaction, WC the set of work characteristics, PC the vector of personal characteristics, Z is a peer effect included as instrumental variable (see below), and σ and ε are the error terms of the two equations. The subscripts i, t and c indicate the individual worker, time period and country respectively. The subscript k indicates the kth variable in the vectors of work and personal characteristics.

In equation (1), two main variables account for work-related characteristics (WC), i.e. occupation type and education level, since it is reasonable to expect that workers in high-skilled white collar occupations are more likely to actively use Internet as a central working tool (Bresnahan et al., 2002). Among the personal characteristics (PC) that may affect intensity of Internet use, equation (1) controls for workers' age, gender and health conditions. Finally, to improve identification of the model, we include an instrumental variable Z that is not included in equation (2) and that is uncorrelated with the error term of the second equation.

We exploit cross-country differences in broadband take-up among European nations as a source of exogenous variation that affects workers' Internet use intensity. Specifically, the instrumental variable we use is the average level of computer infrastructures in each country, which supposedly facilitate and foster Internet adoption by firms and a consequent active use of it for professional purposes by individual workers (Forman, 2005). We measure this variable as the share of households in each country that report having at least one personal computer in their home (source: Eurostat and OECD statistics). This variable is a so-called *peer effect*, based on the idea that the intensity of Internet use of each individual worker will partly depend on the overall level of ICT infrastructures in the country, in line with models of ICT adoption and diffusion (Agarwal, Animesh, & Prasad, 2009; Goolsbee & Klenow, 2002; Pénard, Poussing, & Suire, 2013). We take lagged values of this variable (two years before each survey period) in order to ensure that it predates the outcome variable and it is thus uncorrelated with common shocks (see discussion of this point in Angrist & Pischke, 2009: 192–197).

The key assumption of this identification strategy is that the instrumental variable affects job satisfaction only through its impact on Internet use intensity, and that it is therefore uncorrelated with any possible unobserved determinant of job satisfaction. This is a reasonable assumption, since for each worker i in our dataset, the extent of the diffusion of computers and broadband Internet in the country in which i lives is determined by a set of country-level dimensions that cannot be affected by each individual worker (and particularly so since our country-level instruments predate the individual-level outcome variable).

In equation (2), we include among the regressors a large number of work-related and personal characteristics that have previously been studied in the job satisfaction literature (for a full list and definition of these variables, see Table 1). Further, we add a set of interaction effects between internet use and each work characteristic, which test the six hypotheses put forward in section 2. The vector of estimated coefficients ρ does therefore represent the results of these hypotheses tests.

We estimate the two equations simultaneously as a *recursive bivariate ordered probit model*. The recursive bivariate probit is a model with correlated disturbances, in which the dependent variable of the first equation (INT) appears on the right-hand-side of the second equation (Monfardini & Radice, 2008; Sajaia, 2008).

An additional issue that has to be taken into account relates to the multi-level nature of the data, since individual workers in our sample belong to (are clustered within) different countries. We consider this aspect in two ways. First, we estimate the bivariate ordered probit by clustering standard errors at the country level. Second, we also estimate the same equations by using a *hierarchical ordered probit*, which explicitly takes into account the multi-level nature of the data.

Finally, we also estimated these two regression models (bivariate and hierarchical) in two different ways in order to assess robustness of the results. First, we have estimated them as *ordered* probit models, since the dependent variables in the two equations are defined as categorical indicators. Then, we have redefined the two dependent variables as dummy indicators (low vs. high job satisfaction), and estimated the same model specification through a *probit* model.

[4] We will use the indicators listed in Table 1 as separate variables, and we will not combine together the various factors relating to the same conceptual dimension. The reason for this is that the Cronbach's alpha for each dimension are low on average (below 0,50 in most cases), hence it is not appropriate to combine the various items together into a single composite factor. We also think that working with single-item indicators, rather than composite factors, enable a much clearer interpretation of the empirical results.

Table 2
Regression results: equation (1). Dependent variable: Internet use. Baseline results (without interaction variables).

	(1.1)	(1.2)	(1.3)	(1.4)
	Bivariate ordered probit	Hierarchical ordered probit	Bivariate probit	Hierarchical probit
	Coef. (Cluster SE)	Coef. (Robust SE)	Coef. (Cluster SE)	Coef. (Robust SE)
Education	0.229*** (.029)	0.272*** (.020)	0.420*** (.059)	0.494*** (.045)
White collar-skilled	1.433*** (.085)	1.338*** (.067)	1.436*** (.061)	1.381*** (.064)
White-collar-unskilled	1.093*** (.041)	1.031*** (.039)	1.145*** (.050)	1.108*** (.039)
Blue collar-skilled	0.129* (.067)	0.197*** (.035)	0.052 (.073)	0.144*** (.041)
Company size	0.062*** (.016)	0.044*** (.006)	0.072*** (.014)	0.071*** (.007)
Age	−0.003** (.001)	−0.005*** (.001)	−0.004*** (.001)	−0.006*** (.001)
Health	−0.006 (.005)	−0.006 (.004)	−0.016*** (.006)	−0.012** (.005)
Gender	0.128*** (.025)	0.163*** (.020)	0.109*** (.030)	0.142*** (.019)
Computer access	0.004 (.003)	0.008*** (.002)	0.003 (.004)	0.006** (.003)
Year 2005	−0.094 (.063)	−0.085* (.048)	−0.114 (.085)	−0.134** (.053)
Observations	35,856	36,684	35,856	36,684
LR test of independent equations	7077.200***			
Wald test of rho=0			5.571***	
Country variance (cons)		0.024 (.009)		0.023 (.007)

Note: Clustered standard errors in parentheses in 2.1 and 2.3 equations. Robust standard errors in parentheses in 2.2 and 2.4 equations. Constant and country dummies included. Dependent variable in regression 1.1 and 1.2: Internet use (categorical). Dependent variable in regression 1.3 and 1.4: Internet use dummy (1 if worker reports use of Internet for half of her working time or more; 0 if worker reports use of Internet for less than half of her working time).
*Significant level at 10%. ** Significant level at 5%. *** Significant level at 1%.

4. Results

4.1. Baseline results

We first present regression results for the baseline model that does not include any interaction variable. Table 2 reports the baseline results for equation (1), where the dependent variable is the intensity of Internet use. As expected, the workers' education level is positively and significantly related to their intensity of Internet use for professional purposes. A higher education level does in fact increase the probability that a worker is employed to carry out skilled and advanced tasks in which Internet is a main working tool. Relatedly, the white-collar occupation variables are also positive and significant, confirming that workers in tertiary occupations are more likely to actively use Internet as a main professional instrument. The skilled blue-collar occupation variable has also a positive, though lower, estimated coefficients (the reference category is the group of unskilled blue collar occupations, which on average use Internet much less frequently than others). Further, the estimated coefficient of the company size variable is positive and significant, in line with extant research suggesting that larger organizations are more likely to adopt Internet early, and to use it as an instrument of internal communication between teams and establishments that are not co-located (Forman, 2005). Next, a set of personal characteristics turn out to be significant in the regressions. Age has a negative coefficient (younger workers are more used to work with digital technologies). Gender has a positive coefficient (male workers more likely to actively use Internet for professional purposes). The sick leave variable indicates that workers that have had health issues in recent months report on average a lower intensity of Internet use at work (see columns 1.3 and 1.4). Finally, the results in Table 2 also point out a positive relationship between the (lagged) computer access variable and Internet use at work. This result is statistically significant in the hierarchical models reported in columns 1.2 and 1.4. The interpretation of this is that the average level of computer infrastructures in each country is a pre-condition that fosters Internet adoption by firms and a consequent active use of it for professional purposes by individual workers.

Table 3 shifts the focus to the equation of main interest (equation (2)), which estimates the determinants of job satisfaction. Before we discuss the relevant interaction effects (hypotheses tests), let us first look at the baseline regression results for the main explanatory and control variables included in equation (2). First, income earnings *per se* do not have a significant effect on work-life satisfaction. However, the perceived income variable (measuring the extent to which workers report they are satisfied with their wage level) is positively and significantly correlated with job satisfaction. The other two variables included in the model as part of the same conceptual dimension – job security and career prospects – are also positively related to job satisfaction. These results indicate the importance of perceived income and career prospects as important factors that motivate workers and spur their well-being at work.

The next set of variables measure education and skill-related effects. The indicator of workers' education level is negative (as expected on the basis of previous studies). The negative sign suggests that highly educated workers are more likely to have higher expectations about their job and so more easily be disappointed of their actual working conditions. The other variables in this dimension corroborate this interpretation. Employees that consider themselves overqualified for the job report on average lower satisfaction at work. On the other hand, workers that feel they would need further training (i.e. feeling themselves not enough qualified for the tasks they perform) report lower job satisfaction. Overall, these findings indicate that the key aspect to foster well-being is not the education and skill-level *per se*, but rather the extent to which workers' skills match those that are required to perform their daily working tasks. Regarding the three dummy variables accounting for the type of occupation, these confirm that white-collar workers have typically better working conditions and higher well-being than blue-collar workers. This effect is stronger and more significant for workers in high-skilled white-collar occupations.

Shifting the focus to the variables measuring autonomy, the regression results confirm that workers that have greater autonomy to apply their own ideas, choose their working partners, and organize their working schedule in a flexible manner are on average more satisfied than other workers in the sample. Further, the variables accounting for the time pressure dimension do also turn out to be important and in line with extant research. In particular, we do not find job satisfaction to be affected by the number of working hours *per se*, but rather by the extent of time pressure that the work is subject to, e.g. measured by its pace (frequency of tight deadlines), available time to complete tasks, and the work-life balance that the worker reports to have.

The sixth relevant work-related dimension that is considered in the

Table 3
Regression results: equation (2). Dependent variable: Job Satisfaction. Baseline results (without interaction variables).

	(2.1)	(2.2)	(2.3)	(2.4)
	Bivariate ordered probit	Hierarchical ordered probit	Bivariate probit	Hierarchical probit
	Coef. (Cluster SE)	Coef. (Robust SE)	Coef. (Cluster SE)	Coef. (Robust SE)
Internet use	0.003 (.028)	0.000 (.004)	−0.398** (.171)	−0.019 (.020)
Income earnings	−0.016 (.013)	−0.020 (.013)	0.050 (.035)	0.044 (.035)
Income (perceived)	0.261*** (.011)	0.265*** (.011)	0.588*** (.048)	0.602*** (.050)
Insecurity	−0.128*** (.018)	−0.129*** (.018)	−0.341*** (.059)	−0.336*** (.054)
Career prospects	0.150*** (.011)	0.148*** (.010)	0.409*** (.044)	0.420*** (.040)
Education	−0.017 (.016)	−0.018** (.008)	−0.038 (.059)	−0.089** (.038)
Training needs	−0.081*** (.024)	−0.075*** (.025)	−0.208*** (.036)	−0.210*** (.038)
Over qualification	−0.047* (.025)	−0.046* (.025)	−0.134*** (.036)	−0.132*** (.038)
Learning	0.024 (.018)	0.029 (.021)	0.107*** (.025)	0.118*** (.023)
Training	0.023* (.013)	0.031** (.014)	0.070*** (.016)	0.078*** (.015)
White collar-skilled	0.083 (.083)	0.097** (.040)	0.216** (.091)	0.110* (.060)
White collar-unskilled	0.062 (.052)	0.077*** (.024)	0.194** (.075)	0.135*** (.045)
Blue collar-skilled	−0.033 (.036)	−0.022 (.036)	0.059 (.044)	0.073 (.048)
Own ideas	0.054*** (.007)	0.056*** (.008)	0.145*** (.047)	0.149*** (.045)
Autonomy	0.042* (.023)	0.044* (.023)	0.060 (.037)	0.063 (.039)
Self-assessment	0.027 (.022)	0.033 (.023)	0.054 (.037)	0.059 (.040)
Flexible time	0.227*** (.056)	0.223*** (.058)	0.129* (.070)	0.122* (.070)
Working partners	0.023*** (.007)	0.023*** (.007)	0.031 (.042)	0.029 (.046)
Problem solving	-0.037* (.02)	−0.042** (.019)	−0.061*** (.020)	−0.059*** (.020)
Supervision	−0.027** (.013)	−0.024 (.015)	0.010 (.055)	0.011 (.055)
Pace	−0.036*** (.007)	−0.035*** (.007)	−0.149*** (.024)	−0.152*** (.022)
Working hours	0.000 (.001)	0.000 (.001)	0.000 (.002)	0.000 (.002)
Available time	0.135*** (.021)	0.126*** (.023)	0.291*** (.031)	0.275*** (.034)
Work-life balance	0.289*** (.015)	0.290*** (.016)	0.456*** (.041)	0.462*** (.041)
Management support	0.093*** (.005)	0.092*** (.004)	0.340*** (.014)	0.344*** (.013)
Colleagues	0.144*** (.013)	0.148*** (.013)	0.300*** (.051)	0.311*** (.046)
Discrimination	−0.275*** (.040)	−0.278*** (.042)	−0.433*** (.049)	−0.441*** (.045)
Work quality	0.203*** (.011)	0.200*** (.010)	0.341*** (.029)	0.339*** (.027)
Employee	−0.165 (.113)	−0.161 (.112)	−0.073 (.118)	−0.102 (.114)
Monotonous	−0.144*** (.024)	−0.141*** (.024)	−0.178*** (.022)	−0.182*** (.025)
Rotating	−0.029 (.021)	−0.029 (.021)	−0.053*** (.017)	−0.055*** (.016)
Gender	−0.011 (.010)	−0.010 (.007)	0.043** (.020)	0.039** (.016)
Age	−0.001 (.002)	−0.001 (.002)	−0.002 (.002)	−0.001 (.002)
Safety	−0.417*** (.047)	−0.419*** (.047)	−0.587*** (.042)	−0.597*** (.041)
Health	−0.067*** (.010)	−0.067*** (.009)	−0.078*** (.015)	−0.076*** (.013)
Partner and children	0.057*** (.018)	0.058*** (.020)	0.098* (.053)	0.107** (.054)
Partner and no children	0.051*** (.015)	0.047*** (.016)	0.116*** (.034)	0.114*** (.032)
Single and children	0.028 (.046)	0.041 (.042)	0.059 (.037)	0.084** (.041)
Year 2005	−0.065* (.036)	−0.063 (.041)	−0.056 (.046)	−0.034 (.048)
Observations	35,856	36,684	35,856	36,684
LR test of independent equations	7077.20***			
Country variance (cons)		0.028 (.007)		0.049 (.013)
Wald test of rho = 0			5.275**	

Note: Clustered standard errors in parentheses in 2.1 and 2.3 equations. Robust standard errors in parentheses in 2.2 and 2.4 equations. Constant and country dummies included. Dependent variable in regression 2.1 and 2.2: Internet use (categorical). Dependent variable in regression 2.3 and 2.4: Internet use dummy (1 if worker reports use of Internet for half of her working time or more; 0 if worker reports use of Internet for less than half of her working time). In regressions 2.3 and 2.4 all variables are included as dummies.
*Significant level at 10%. ** Significant level at 5%. *** Significant level at 1%.

regression model includes indicators of participation and social interactions at work. In line with previous research, we find that workers that report to have support from their organization's management and good relationships with their colleagues feel more committed and contempt at work; whereas employees that experience discrimination report significantly lower levels job satisfaction.[5]

[5] Further down, Table 3 also reports the estimated coefficients for some relevant personal characteristics that are included in the model as control variables. Neither the gender nor the age variable turns out to have a strong coefficient in the regressions. On the other hand, safety and health conditions are significantly and strongly correlated with well-being. Finally, the civil status dummy variables indicate that individuals that have a partner (or a spouse) report above-average levels of job satisfaction.

4.2. Results of hypotheses tests

We then test the six hypotheses previously outlined in section 2 by adding a set of interaction variables in equation (2). We first include each of these interaction effects alone, and then insert all of them jointly in the regression model. When assessing the regression results for the interaction effects, it is important to note that in discrete choice econometric models the relevance and significance of interaction variables must be evaluated by looking at their marginal effects (Ai & Norton, 2003). Table 4 reports the estimated predicted probabilities and related marginal effects (corresponding to regression 2.4 in Table 3), which represent the results of our hypotheses tests.

Hypothesis 1: **Income.** All four interaction variables relating to this dimension have the expected sign: the interaction effects for income earnings, perceived income and career prospects are positive, and the one for job insecurity is negative. These indicate that the active use of

Table 4
Results of hypotheses tests: estimated marginal effects of interaction variables.

Interaction variable	Predicted probabilities and marginal effect		Test of hypotheses
Income earnings * Internet use	Pr (Internet = 0; Income earnings = 0)	0.792	H1: **Income**
	Pr (Internet = 1; Income earnings = 1)	0.869	
	Marginal effect	**+0.078*** **	
Income (perceived) * Internet use	Pr (Internet = 0; Perceived income = 0)	0.735	
	Pr (Internet = 1; Perceived income = 1)	0.940	
	Marginal effect	**0.205*** **	
Insecurity * Internet use	Pr (Internet = 0; Insecurity = 0)	0.854	
	Pr (Internet = 1; Insecurity = 1)	0.679	
	Marginal effect	**−0.175*** **	
Career prospects * Internet use	Pr (Internet = 0; Career prospects = 0)	0.771	
	Pr (Internet = 1; Career prospects = 1)	0.930	
	Marginal effect	**+0.159*** **	
Education * Internet use	Pr (Internet = 0; Education = 0)	0.801	H2: **Education**
	Pr (Internet = 1; Education = 1)	0.854	
	Marginal effect	**+0.053*** **	
Training needs * Internet use	Pr (Internet = 0; Training needs = 0)	0.821	
	Pr (Internet = 1; Training needs = 1)	0.805	
	Marginal effect	**−0.016**	
Over qualification * Internet use	Pr (Internet = 0; Over qualification = 0)	0.834	
	Pr (Internet = 1; Over qualification = 1)	0.784	
	Marginal effect	**−0.050*** **	
Learning * Internet use	Pr (Internet = 0; Learning = 0)	0.755	
	Pr (Internet = 1; Learning = 1)	0.851	
	Marginal effect	**+0.096*** **	
Training * Internet use	Pr (Internet = 0; Training = 0)	0.797	
	Pr (Internet = 1; Training = 1)	0.862	
	Marginal Effect	**+0.064*** **	
White collar-skilled * Internet use	Pr (Internet = 0; White collar-skilled = 0)	0.787	H3: **Occupation type**
	Pr (Internet = 1; White collar-skilled = 1)	0.874	
	Marginal effect	**+0.087*** **	
White collar-unskilled * Internet use	Pr (Internet = 0; White collar-unskilled = 0)	0.818	
	Pr (Internet = 1; White collar-unskilled = 1)	0.817	
	Marginal Effect	**−0.001**	
Blue collar-skilled * Internet use	Pr (Internet = 0; Blue collar-skilled = 0)	0.825	
	Pr (Internet = 1; Blue collar-skilled = 1)	0.783	
	Marginal effect	**−0.042** **	
Own ideas * Internet use	Pr (Internet = 0; Own ideas = 0)	0.745	H4: **Autonomy**
	Pr (Internet = 1; Own ideas = 1)	0.881	
	Marginal effect	**+0.136*** **	
Autonomy * Internet use	Pr (Internet = 0; Autonomy = 0)	0.755	
	Pr (Internet = 1; Autonomy = 1)	0.852	
	Marginal effect	**+0.097*** **	
Problem solving * Internet use	Pr (Internet = 0; Problem solving = 0)	0.778	
	Pr (Internet = 1; Problem solving = 1)	0.837	
	Marginal Effect	**+0.059*** **	
Supervision * Internet use	Pr (Internet = 0; Supervision = 0)	0.810	
	Pr (Internet = 1; Supervision = 1)	0.872	
	Marginal Effect	**+0.062*** **	
Flexible time * Internet use	Pr (Internet = 0; Flexible time = 0)	0.815	
	Pr (Internet = 1; Flexible time = 1)	0.879	
	Marginal Effect	**+0.064*** **	
Self-assessment * Internet use	Pr (Internet = 0; Self-assessment = 0)	0.779	
	Pr (Internet = 1; Self-assessment = 1s)	0.833	
	Marginal Effect	**+0.054*** **	
Working partners * Internet use	Pr (Internet = 0; Working partners = 0)	0.810	
	Pr (Internet = 1; Working partners = 1)	0.872	
	Marginal Effect	**+0.062*** **	
Pace * Internet use	Pr (Internet = 0; Pace = 0)	0.872	H5: **Time pressure**
	Pr (Internet = 1; Pace = 1)	0.773	
	Marginal effect	**−0.099*** **	
Available time * Internet use	Pr (Internet = 0; Available time = 0)	0.648	
	Pr (Internet = 1; Available time = 1)	0.821	
	Marginal effect	**+0.173*** **	
Work-life balance * Internet use	Pr (Internet = 0; Work-life balance = 0)	0.628	
	Pr (Internet = 1; Work-life balance = 1)	0.858	
	Marginal effect	**+0.230*** **	

(*continued on next page*)

Table 4 (*continued*)

Interaction variable	Predicted probabilities and marginal effect		Test of hypotheses
Management support * Internet use	Pr (Internet = 0; Management support = 0)	0.722	H6: **Participation**
	Pr (Internet = 1; Management support = 1)	0.888	
	Marginal effect	**+0.167*** **	
Colleagues * Internet use	Pr (Internet = 0; Colleagues = 0)	0.697	
	Pr (Internet = 1; Colleagues = 1)	0.859	
	Marginal effect	**+0.162*** **	
Discrimination * Internet use	Pr (Internet = 0; Discrimination = 0)	0.835	
	Pr (Internet = 1; Discrimination = 1)	0.560	
	Marginal effect	**−0.275*** **	

Note: ** Significant level at 5%.
***Significant level at 1%.

Internet in higher income groups of workers increases the probability that the workers are satisfied with their job by around 8–20%. These positive marginal effects provide support for the first hypothesis, according to which Internet use strengthens the positive relationship between income and job satisfaction. The interpretation of this result is twofold. First, Internet use may induce social comparison mechanisms that will benefit relatively more workers with higher than average income. Second, workers that actively use Internet as a major working tool have on average higher wage levels and better career prospects than others. They work in organizations and sectors that, due to their relatedness to ICT general purpose technologies, face positive demand conditions and rising market opportunities, and tend for this reason to perceive Internet technologies as an opportunity to improve their performance and job satisfaction.

Hypothesis 2: **Education.** In this dimension, we find three interaction effects to be particularly important: those for the education level, learning and training variables. All three have positive marginal effects. Specifically, the interaction effect for the education variable indicates that highly educated workers that make active use of Internet are about 5% more likely to be satisfied with their job. In line with Hypothesis 2, this finding confirms that Internet use moderates the negative relationship between education and job satisfaction. And the interaction effects for the learning and training variables suggest that the reason for this is that Internet makes it easier to access information, learn new things and carry out specialized on-the-job training. These information access and learning effects contribute to increase workers' well-being, enhance their feelings of competence, and hence attenuate their dissatisfaction with actual working conditions.

Hypothesis 3: **Occupation type.** Two interaction effects turn out to be important and provide support for this hypothesis. The first is the one between Internet use and high-skilled white-collar occupations, which has a positive and strong estimated marginal effect: workers in these occupations and which also actively use Internet for professional purposes are nearly 9% more likely to report above-average job satisfaction. The second is the interaction between Internet use and blue-collar occupations, which, conversely, has a negative marginal effect (indicating that the active use of Internet in blue-collar occupations does actually lead to lower well-being). Taken together, these two interaction effects confirm the hypothesis that Internet use makes the positive relationship between white-collar work and subjective well-being stronger. The interpretation of this finding is that an active and skilled use of Internet as a working tool in white-collar occupations strengthens opportunities and outcomes relatively more for workers in these sectors (in line with the model recently put forward by Bala & Venkatesh, 2016).

Hypothesis 4: **Autonomy.** The results provide support to the idea that there is a joint effect of Internet use and autonomy of work on job satisfaction. All seven interaction variables related to this dimension have a positive and statistically significant marginal effect, ranging between 5% and 13%. This evidence corroborates the idea that Internet use strengthens the positive relationship between autonomy and job satisfaction. The reason for this is that Internet facilitates the implementation of new work practices in which employees have a higher degree of autonomy of working tasks, and greater flexibility in their working schedule. Internet does also spur the access to information and external knowledge, which may then increase workers' ability to find own solutions to complex tasks. These effects are more beneficial for workers that are allowed to have a certain degree of autonomy at work, explaining why we observe such interaction effects in this large cross-section of workers.

Hypothesis 5: **Time pressure.** The hypothesis we formulated is that Internet use may attenuate the negative effect of time pressure on well-being at work, due to time-saving effects that digital technologies typically provide. The interaction variable for the variable work-life balance is positive and significant, as expected, and it has a strong estimated marginal effect of 23%. The interaction effect relating to the available time variable is also positive, significant and large in magnitude (17%). On the other hand, the interaction between Internet use and the pace variable turns out to be negative (instead of positive as expected).[6]

Hypothesis 6: **Participation and social interactions.** The interaction effects that we have retained in the model to test this hypothesis are those for the variables management support, colleagues, and discrimination. The first two have positive and significant marginal effects. The findings support the idea that Internet use strengthens the positive relationship between participation and job satisfaction, and they point out that this interaction effect is strong for both management support and for the relationships with peers and colleagues (around 16%). The interpretation of this mechanism is that Internet-based communication platforms facilitate social interactions at the workplace, and in particular contribute to improve the information flow between managers and employees, which in turn fosters transparency and social trust in the organization. These new communication channels provide therefore increased opportunities to strengthen the employees' sense of participation and organizational commitment, which are important for their feelings of well-being at work.

5. Discussion and conclusions

The paper has investigated the channels through which the use of Internet for professional purposes affects job satisfaction. The main idea presented in the study is that job satisfaction is determined by a variety

[6] One possible reason for this is that the extent to which a worker is under time pressure may depend on how the work is organized and the type of objectives and delivery times that the organization has. Internet use *per se* will not necessarily be able to change these structural features of the occupation, at least not in the short term. If workers who are under time pressure intensively use Internet as a major working tool, this may even turn out to decrease their job satisfaction. For instance, it is our daily experience that when the work is subject to tight deadlines and pressure, the use of e-mail may not work as a time-saving device but rather as a tool to increase the working pressure further.

of work characteristics, and the use of Internet moderates the effect of these characteristics on workers' well-being. The empirical results of the study provide support for this idea, and confirm the set of specific hypotheses that we have developed on the moderating effects of Internet use. We now discuss the significance of the main results and their implications.

To begin with, two variables play a crucial role according to our results: employees' education level and their occupational category. Both of these variables turn out to be central in our analysis, since they have a threefold impact on job satisfaction. First, they affect the intensity of Internet use, given that employees with higher education level and in high-skilled white-collar occupations are more likely to actively use Internet as a main professional tool. Second, they are among the main (direct) determinants of job satisfaction. Third, their interaction with Internet use fosters well-being at work. As noted in the paper, though, these two interaction effects have a different conceptual underpinning. For the education variable, the role of Internet use is linked to information access (enabling workers to form realistic expectations and perceptions of their working conditions) and learning effects (fostering employees' competencies and training). For the occupation variable, the interaction effect indicates that Internet technologies tend to benefit relatively more high-skilled workers in white-collar occupations, which typically use digital technologies as a major professional tool, and much less so employees in blue-collar jobs. The results also highlight the important role of the income variable. Income earnings – and workers' perceptions of these – represent a relevant determinant of job satisfaction. And the use of Internet as a central working tool reinforces this positive effect, since it is more concentrated in occupations and sectors where workers have on average higher skills and wage levels, and better career prospects.

Taken together, the findings related to these three variables – education, white-collar work and income – have some important implications. The rise of Internet technologies has led to a rapid process of structural change, in which workers in knowledge-based occupations, and with higher income and education levels, have improved further their job satisfaction *vis-à-vis* workers in other sectors that are less closely related to ICTs activities. Characteristics such as workers' educational level, sector of occupation and income earnings are quite hard to change in the short run, since they largely depend on workers' background and personal capabilities. This means that Internet technologies, according to our results, potentially lead to long-lasting polarization effects, with increasing differences in job satisfaction between highly educated, high-wage white-collar employees, on the one hand, and less educated, lower-wage blue-collar workers. Such a polarization dynamics in the labour market represents an important potential risk that policy makers should carefully consider when they design policies to foster digitalization and Internet use in work-life.

Further, the results also point out the role of three other variables, which represent different aspects of work organization: autonomy, time pressure, and social interactions at work. The baseline results confirm the (direct) role of these variables as main antecedents of job satisfaction. The related interaction effects provide support to the idea that Internet use fosters well-being by interacting with these features of work organization. On the one hand, we find support for the hypothesis that time saving effects of digital technologies can contribute to alleviate employees' work pressure. On the other hand, we also confirm the hypotheses related to the other two interaction effects, the one for autonomy and the one for participation and social interactions. These findings do on the whole support the idea that new Internet-based communication platform can enhance job satisfaction by creating a greater sense of participation and organizational commitment, and by making it possible to carry out working tasks in a more autonomous and more flexible way.

This second set of results also have some relevant practical implications. In fact, as pointed out above, the work characteristics noted here – autonomy, time pressure, and social interaction patterns – are largely defined and shaped by each organization's objectives, task nature and external environment, which Internet alone is not able to affect. The role of Internet, according to our results, is rather to magnify the positive effects of these work organization features for workers' well-being (or alleviate their negative effects). The implication of this is that, in an era in which Internet is increasingly used as a professional tool in a great number of occupations, employers should understand the benefits and make more active use of work practices such as autonomy, flexibility, participation and social interactions at work, because the benefits of these are magnified by the use of digital technologies. The combination of new work practices and Internet-based activities will arguably increase workers' well-being and job satisfaction, in turn increasing their organizational commitment and work performance.

In terms of theoretical implications, two of them are important. First, the paper has shown that the investigation of the effects of Internet for professional purposes calls for a holistic and multi-dimensional theoretical framework that must simultaneously consider a variety of relevant factors, relating to both workers' background and characteristics (income, education, occupation type), and workplace organization (degree of autonomy, time pressure, extent and quality of social interactions). In previous research, it has been common to focus on one of these factors at a time and neglect the others. Such theoretical strategy of focusing on one single factor at a time has the obvious advantage of enabling a detailed investigation of a given specific domain of work-life. However, the traditional approach misses the point that the effects of Internet on job satisfaction are pervasive and arise through distinct channels. Some of these channels lead to positive impacts, and others have negative effects. Hence, in order to achieve a broad and balanced understanding of the positive and negative effects of Internet use at work, it is important that future research will increasingly use a multi-dimensional theoretical approach and empirical investigation, and consider potential interactions between different spheres of working life.

Second, the paper has shown that Internet use *per se* does not have any direct impact on workers' job satisfaction. Rather, the effects of digital technologies are that they moderate the role of the primary antecedents of job satisfaction, making their impacts stronger, or weaker. In particular, Internet use has magnifying effects on workers' characteristics, i.e. improving working conditions and job satisfaction relatively more for high-skilled white collar workers. On the other hand, relating to work-place characteristics, Internet will have relevant effects only for organizations and employers in which working tasks can be organized in an autonomous and flexible way, whereas it will have negligible impacts in other types of occupations. This approach based on the study of moderation effects of Internet may potentially have a large number of extensions in future research, i.e. to extend this model to include other worker-specific characteristics (e.g. age, gender, personality, culture) and organizational factors (e.g. leadership culture, incentives and rewards structure, knowledge sharing practices).

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.chb.2018.09.001.

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Paper III

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Job Characteristics and Life Satisfaction in the EU: a Domains-of-Life Approach

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Abstract

Working life has come to permeate every domain of life. Characteristics once thought to affect only the job domain have become important determinants of how people assess their daily lives. This article explores the influence of job characteristics on satisfaction with several life domains in 28 EU countries, asking: 1) What is the relationship between job characteristics and satisfaction with work and other domains of life? 2) Is the job domain more important for life satisfaction than other domains of life? Additionally, we apply a domains-of-life perspective to investigate possible differences in these relationships between high- and low-skilled workers, using data on white-collar workers from the third European Quality of Life Survey (3EQLS) and multiple Ordinary Least Squares (OLS) regressions to estimate the models.Work–life balance and perceived job (in)security emerge as important determinants of satisfaction regarding all domains and both types of workers studied. Satisfaction in the work domain ranks fourth in contributing to overall life satisfaction, after the standard of living, family life and social life domains. This relatively low direct contribution to life satisfaction of the work domain is particularly visible among low-skilled workers. We conclude with a discussion of the implications for workers' wellbeing of the increasing insecurity in the job market and the fact that meaning is often sought through work despite the effects of poor work–life balance on most life-domains.

Keywords Domains of life satisfaction · Job satisfaction · Life satisfaction · White-collar workers · Working conditions · Work–life balance conflict

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Introduction

On an everyday basis, the work domain exerts a pervasive influence, conditioning our relationships with others, our opportunities for exercise and outdoor recreation, and our physical and emotional health, among many other factors. This influence stems from specific job characteristics and from the time spent at work and in commuting (Eurofound and ILO 2017). The influence of work across life-domains has been studied by classical sociologists and organizational theorists such as Durkheim (1947) with his theory of division of labour, and Marx (1976, 1927) in his theories of labour process and alienation. Also most recent researchers such as Near et al. (1980) have studied the relationship between aspects of work life and non-work domains. Kalleberg (2009) notes that work is a core activity in society: "perhaps only kin relationships are as influential in people's everyday lives" as work. However, the literature on subjective wellbeing[1] has paid relatively little attention to the linkages between work characteristics and non-work domains.

This paper analyses the importance of working life on the subjective wellbeing of workers in EU countries, through two main mechanisms. The first relates to how various work characteristics affect job satisfaction and other domains, such as accommodation, health, education, standard of living, family and social life. The second concerns the extent to which job satisfaction contributes to life satisfaction, as compared with the contributions of the above-mentioned six domains. As earlier research has indicated differences in the determinants of job satisfaction for different types of workers(Batinic et al. 2010; Bujacz et al. 2017; Silla et al. 2005), we explore the extent to which these differences apply to how job characteristics relate to domain satisfaction, and how job satisfaction contributes to life satisfaction among low-skilled and high-skilled white-collar workers.

The study focuses on white-collar workers[2] in the top five occupations in the standard classification.[3] By 2012, they represented 67% of the EU labour force,[4] and their numbers are increasing each year. Distinguishing between low- and high-skilled workers, Bujacz et al. (2017) and Batinic et al. (2010) and Eurofound (2014a) have shown important differences between highly skilled and low-skilled workers concerning their experiences and appraisal of the intrinsic qualities of their jobs. This

[1] Following Gough and McGregor (2007) we understand "wellbeing" as an umbrella term comprehending both objective and subjective approaches. Concerning *subjective* wellbeing, we draw on Diener (1984) and Diener et al. (1999) in considering its hedonic and cognitive dimensions, the former linked to positive and negative effects and the latter to life satisfaction.

[2] The transformation from mass production to flexible production, characteristic of the post-Ford era, has also altered the political and economic structure of society and its production systems. Thompson (2003) found that flexible production dramatically reduced the demand for unskilled labour, requiring workers with flexible specialization and multi-skilled (social and technical skills). The number of unskilled industrial workers has been falling for nearly thirty years. This decrease is reflected in the transformation of the workforce, with the growth of managerial and professional services, and the increase in white-collar jobs to the detriment of blue-collar jobs: towards to a service economy, with a decline in the mass production and manufacturing sectors. This change also implies global competition, flexible production systems, flatter and more flexible organizational structures, with the emphasis on innovation, diversification and subcontracting (Avis 1996; Brown and Lauder 1992).

[3] Legislators, senior officials and managers, professionals and technicians, associate professionals, clerks, service workers, and shop and market sales workers.

[4] Eurostat Labour force data: http://ec.europa.eu/eurostat/web/lfs/data/ accessed 06/12/2017.

is supported by research indicating that the determinants of job satisfaction differ for knowledge workers and non-knowledge workers (Huang 2011; Viñas-Bardolet et al. 2018) – a classification that expands systems based on occupational categories to encompass educational levels and skills.[5]

Our study, like that of Rojas (2007), follows a domains-of-life approach, whereby personal and socioeconomic characteristics are seen as influencing life satisfaction through their effect on various life-domains. It extends Rojas' work by adding job characteristics as explanatory variables in addition to the usual socio-demographic factors. Our study also links to the work of van Praag and colleagues (van Praag et al. 2003) on life satisfaction, as we assume that the latter is a function of satisfaction with various domains. However, unlike the van Praag study, we focus on the relationship between work-related variables and satisfaction with work and non-work domains, ignoring other domain-specific predictors such as square meters per capita in housing.

First, we present the literature background describing the importance of the work domain, then describe the domains-of-life approach to subjective wellbeing (SWB) and how work-related factors have been studied in the SWB literature. Then, after outlining the characteristics and hypotheses of this study, we introduce the European Quality of Life Survey (EQLS) and the data used in the analysis. Next we present the empirical models and describe the main results for the general sample and for the subsamples of high- and low-skilled workers. We conclude with a discussion of the findings and some broader policy implications.

Theory and Hypotheses

The Domains-of-Life Approach to SWB

Two main perspectives characterize approaches to life satisfaction in the literature on subjective wellbeing: "top–down" and "bottom–up" (Diener 1984; Erdogan et al. 2012; Headey et al. 1991; Loewe et al. 2014). The former sees life satisfaction as a function of sd personal or socioeconomic features (Erdogan et al. 2012) and of situational influences such as life events (Diener 1996). By contrast, the basic assumption in the "bottom–up" perspective is that an individual's overall life satisfaction depends on satisfaction in many separate and specific areas of life, which can be classified into different life domains (Cummins 1996; Easterlin 2006; Rojas 2006; van Praag and Ferrer-i-Carbonell 2004; van Praag et al. 2003). This perspective encompasses various theories of life satisfaction that conceive of domain satisfactions as "needs" – such as multiple discrepancy theory (Michalos 1985), the needs hierarchy theory (Maslow 1970) or the bottom–up spillover theory (Andrews and Withey 1976; Campbell et al. 1976). As Sirgy et al. (2010) note concerning bottom–up spillover theory, life satisfaction is situated at the top of a pyramid: life satisfaction is determined by satisfaction with life domains, located one level below; in turn, life domains are influenced by lower levels of life characteristics that may be common or specific to each given domain.

[5] Knowledge workers' are defined as a new type of white-collar workers who generally possess higher academic degrees, greater skill levels or knowledge, working in the three highest standard occupational classifications (managers, professionals, associate professionals) (Huang 2011).

Life domains are relevant to how people assess their own lives. The fact that individual satisfaction can be quantitatively evaluated with respect to these separate domains makes scientific analysis possible (van Praag and Ferrer-i-Carbonell 2004). In his survey of the literature on life satisfaction, Cummins (1996) operated with seven life domains: material wellbeing, health, productivity, intimacy, safety, community, and emotional wellbeing; otherwise, however, the number has varied from one study to another.[6] Rojas (2006, p. 469) has highlighted how restricting the number of domains to specific categories may be misleading: "the enumeration and demarcation of the domains of life is arbitrary. Nevertheless, the number of domains must be manageable and domains should refer to clearly separable information."

Although domains should be easy to identify and perceive as separate dimensions, they are also interrelated and overlapping. Van Praag et al. (2003) see this interrelatedness as stemming from the fact that domains have common explanatory variables, which leads them to suggest that general satisfaction may be seen as an aggregate of satisfaction in the six domains. Rojas (2006) expands this perspective by arguing that life satisfaction might not be indicated by a simple average of domains satisfaction, as people may differ in the weight they allocate to each domain. Additionally, and because there may be diminishing or increasing marginal returns when one domain rises or declines, Rojas proposes using alternative specifications such as semi-logarithm, logarithm-logarithm or the constant elasticity of substitution (CES) relationship to model the contribution of each domain to life satisfaction. Other scholars have recommended asking respondents to appraise the importance of each domain, and then using the resulting scores as weights (Hsieh 2004, 2016). Hsieh's findings indicate that domain importance plays a significant role in determining the type of relationship between life satisfaction and domain satisfaction at the individual level, and that weighting of domain importance should be incorporated in any study on the topic.

The domains-of-life approach sees socioeconomic, structural and demographic variables as influencing life satisfaction through their impact on life domains. Regarding the work domain, for example, Drobnič et al. (2010) and colleagues found that working conditions contribute to high levels of job satisfaction, which in turn serve to increase life satisfaction. Conversely, Near and Rechner (1993) compared variations in predictors of life satisfaction among ten Western European countries, focusing on work variables as predictors. Using working conditions, living conditions, job satisfaction and non-work satisfaction (an index created from thirteen other life-domains) to predict life satisfaction, they found job satisfaction to be a weak predictor of life satisfaction compared with non-work satisfaction. An additional study by Rode and Near (2005) found that job satisfaction was positively related to overall life satisfaction; this relation emerged when variables concerning work characteristics (inter alia, working hours) and demographic characteristics were controlled for (Fig. 1).

Using a domains-of-life approach, our study explores the importance of work-related variables in explaining overall life satisfaction in 28 EU countries, 2011–2012. We assumenot only that job characteristics are important for job satisfaction, but also that their impact extends to other domains of life. Thus, we consider that job characteristics usually studied for their importance solely to the work domain are also significant determinants of how people assess their everyday experience. We ask:

[6] For an exhaustive list of life domains used in other studies see Loewe et al. (2014, pp. 74–75).

Fig. 1 Bottom–up theory of life satisfaction. Source: Authors' elaboration following Sirgy et al. (2010), Fig. 1

"What is the relationship between job characteristics and workers' satisfaction with the domains of accommodation, health, education, standard of living, family and social life in EU countries?" This leads us to our first hypothesis:

> **H1:** Job characteristics can explain reported levels of satisfaction across all life-domains, not only concerning job satisfaction.

Previous work has studied job characteristics by distinguishing between occupational types, often analysing the differences between high- and low-skilled workers. A Eurofound (2014b) study based on data from the fifth European Working Conditions Survey (EWCS) showed that workers in mid-skilled manual and low-skilled occupations reported lower earnings, lower career prospects and lower intrinsic job quality, but high levels of working-time quality – whereas workers in high-skilled occupations fared relatively well on almost all job-quality indicators *except* quality of working time. In another study, Eurofound (2014a) found considerable differences between occupations with regard to workers' influence over working-time arrangements. High-skilled workers reported considerable influence here, whereas low-skilled workers reported far less autonomy in scheduling their working time.

In their study of seven Western European countries,Gallie and Russell (2009) found that higher-skilled workers tend to experience greater work–family conflict. Also McGinnity and Calvert (2009) noted higher work–life conflict among professionals compared to non-professionals; this they saw as partially explained by the fact that professionals work longer hours and experience more work pressure than other groups. However, it should be noted that this effect seems to remain even after accounting for these two potentially mediating variables.

Job insecurity is another important factor. Silla et al. (2005) found that low-skilled workers reported higher levels of job insecurity than did high-skilled workers, and noted that job insecurity depended mainly on employability or employees' perceptions of the chances of finding another job if they should lose their present one. From the literature indicating differences among types of workers concerning their working conditions, we hypothesize that:

H2: High- and low-skilled workers differ in the extent to which job characteristics explain domain-satisfaction.

Importance of the Work Domain

At the turn of the twentieth century, in a context of rapid economic development, classical sociologists and organizational theorists such as Marx and Durkheim understood socioeconomic institutions as interrelated and inseparable. They saw the work domain as highly important in society, pervading other aspects of social life. As Near and colleagues (Near et al. 1980) put it:

> Marx, for one major example, argued that the advent of capitalism resulted in alienating conditions, associated with work itself as well as its surrounding circumstances, which in turn produced alienative behavior among workers, both on and off the job [Marx & Engels, 1939]. Durkheim [1947] suggested that basic work-related divisions of labor produced interdependence among institutions, thus serving, ideally, to integrate the members of society. (Near et al. 1980, p. 415)

More recently, sociologists such as Sennett (1998) have noted how post-Fordism[7] and its labour needs are opposed to family needs. The need for flexibility and adaptation to changes at work requires great personal involvement, to the detriment of family life – leading to an imbalance between the values required for a successful working life and those required for a stable family life. Likewise, Perrons (2003) has indicated that, in this system of work organization, new working patterns and new technologies have allowed the temporal and spatial boundaries of paid work to be extended, eroding the boundaries and collective rhythms of working life and the concepts and realities of a "fixed" working day. This may be seen as positive for some workers (e.g. as an opportunity to work) but as negative for others (e.g.work invading the home and family sphere). What is clear is that the characteristics of work overstep the boundaries of the job domain, greatly influencing other domains of life.

Empirical studies of the differing contributions of domains satisfaction to life satisfaction among workers accord a significant role to the work domain (Loewe et al. 2014; Near and Rechner 1993; van Praag et al. 2003). In their study of West German and East German workers, van Praag and colleagues (van Praag et al. 2003) found that finances, health and job satisfaction were the three main determinants in explaining overall life satisfaction, whereas housing, leisure-time and satisfaction with one's surroundings appeared less important. In a study based on a sample of Chilean workers, similar results were obtained by Loewe and colleagues (Loewe et al. 2014). They found that, having controlled for age and gender, satisfaction with one's financial situation emerged as the dominant predictor of overall life satisfaction. Satisfaction with family, work, and health was also relevant, but leisure-time or social relationships were not found to have statistically significant effects on life satisfaction.

[7] "Post-Fordism" refers to the dominant system of economic production, consumption, and associated socioeconomic phenomena in most industrialized countries since the late twentieth century. It describes an approach to work organization that relies on flexibility, adaptation and innovation (Heery and Noon 2008).

In samples encompassing the general population, findings on the importance of the job domain are less conclusive. For example, Rojas (2007), studying a representative sample of 579 observations in Mexico, found that life satisfaction could be predicted mainly by family, economic and personal satisfaction, whereas job and health seemed less important. By contrast, in his life-cycle study of overall life satisfaction in the USA, Easterlin (2006) found that financial satisfaction, followed by job satisfaction and family life, were the central domains in explaining life satisfaction, with health as a less important determinant.

Studies investigating the contribution of job satisfaction to life satisfaction have generally confirmed the importance of the work domain, particularly when focusing on workers and when the individual's position in the life-cycle is accounted for (Easterlin 2006; Loewe et al. 2014; van Praag et al. 2003). Nevertheless, none of the studies reviewed find that the work domain is the greatest contributor to life satisfaction. In principle, that would call into question the relative importance of the work domain as indicated by sociologists and organizational theorists: however, it could also be taken to strengthen our H1 on the relevance of job characteristics for other life domains. Thus, work characteristics could be seen as contributing to life satisfaction through their relationship with job satisfaction and through their effect on satisfaction with other domains of life – in turn, leading to the following hypothesis:

> **H3**: Job satisfaction is a significant contributor to life satisfaction, but work characteristics have a broader impact on life satisfaction through their relationship with non-work domains.

As noted, there is evidence in the literature on subjective wellbeing to suggest that high- and low-skill workers differ regarding how job characteristics affect their subjective wellbeing (Argyle & Martin, 1991; Batinic et al. 2010). In general, low-skilled workers have less autonomy and less flexible time arrangements than high-skilled workers (Batinic et al. 2010; Bujacz et al. 2017; Silla et al. 2005), and more highly skilled and highly paid jobs are associated with greater job satisfaction (Argyle & Martin, 1991). In addition, greater life and job satisfaction has been found for high-skilled white-collar workers (top 3 ISCO codes); see Argyle and Martin (1991) and Batinic et al. (2010). Thus, our fourth hypothesis:

> **H4:** There are significant differences between high- and low-skilled workers as regards the contribution of job satisfaction to life satisfaction.

Data and Methods

The Survey

Our study draws on the third European Quality of Life Survey (3EQLS) from the Dublin-based European Foundation for the Improvement of Living and Working Conditions (2014) encompassing 28 EU countries for the period 2011–2012. The EQLS is conducted every four years; it is a unique survey that examines the objective circumstances of the lives of EU citizens, their feelings and assessments of their

situation, and that provides a remarkable amount of quality information for scholars of subjective wellbeing. For example, in studying job-related determinants of life satisfaction in EU countries, Drobnič et al. (2010) has drawn on data from the first EQLS (2003); and Voicu (2015) has used the three waves of EQLS (2003, 2007 and 2011) to study the priming effects of domain-satisfaction questions on responses to ensuing satisfaction questions and the question capturing overall life satisfaction.

Of the populations included in the EQLS survey, we focus on white-collar employees, defined as all employees working in the top five standard occupational classifications (managers, professionals, associate professionals, clerical support workers, and services/sales workers), aged 18 or over, whose usual place of residence at the time of data collection was in any of the EU countries. We excluded 132 individuals who could not report satisfaction in each of the domains of life under consideration, as these are the dependent variables of the study and important determinants of life satisfaction. Our final sample consisted of 7624 employees.

Variables and Descriptive Analysis

Table 1 presents the list of indicators used in the empirical analysis, the corresponding description and some descriptive statistics. Our dependent variables are life satisfaction (the dependent variable of the study) and the seven domains-of-life satisfaction studied in the Third EQLS: job, accommodation, health, education, standard of living, family life and social life. The use of these seven domains for the analysis is in line with previous studies[8] such as Rojas (2006, 2007), Sirgy et al. (2010), van Praag and Ferrer-i-Carbonell (2004), van Praag et al. (2003). As shown in Table 1, the mean value for life satisfaction is 7.37; the highest mean value across the domains is 8.08 for the domains of family life and of health (7.99), and the standard of living satisfaction domain is lowest (7.21). The domains-of-life classification is close to that of van Praag and Ferrer-i-Carbonell (2004), Rojas (2006) and Loewe et al. (2014).

Regarding independent and control variables we follow Rojas (2007) and van Praag et al. (2003), and use gender, age, age squared, education and income as main socio-demographic variables. We also include other variables widely studied in the literature on life domains and job satisfaction, such as health status and working hours (Clark 2010; Clark and Oswald 1996; van Praag et al. 2003); job insecurity, flexible schedule, type of contract and work–life balance conflict, in line with the work of Sousa-Poza and Sousa-Poza (2000), Dolan et al. (2008) and Erdogan et al. (2012). These work characteristics have been widely used in studies of life satisfaction. Among others, Drobnič et al. (2010) and Silla et al. (2005) found that job insecurity was a major negative factor influencing life satisfaction. Drobnič et al. (2010) also found that the effects of working conditions on overall life satisfaction were not symmetric: "bad jobs" had a stronger effect on reducing life satisfaction than "good jobs" had in increasing it. Additionally, we agree with Maertz and Boyar (2010) and

[8] For an exhaustive list of life domains used in other studies see Loewe et al. (2014, pp. 74–75).

Erdogan et al. (2012) on the importance of workers' experience of conflict or balance between work and non-work domains, and have included a work–life balance conflict variable to capture its relevance.

Our sample of white-collar employees is defined by type of occupation according to the International Standard Classification of Occupations, ISCO-88.[9] In line with Eurofound (2010), we distinguish two categories of employees here:

- high-skilled white collar (ISCO codes 1, 2 and 3): legislators, senior officials and managers, professionals and technicians, and associate professionals;
- low-skilled white collar (ISCO codes 4 and 5): clerks, service workers, and shop and market sales workers.

This classification has been used in other works, such as Lopes et al. (2014).

Table 1 shows the mean and standard deviation of life satisfaction and satisfaction in each life-domain according to the two sub-samples. High-skilled workers report better life satisfaction (7.61) than the low-skilled workers (7.16) and greater satisfaction regarding all domains of life.

Family life, and then education and health, are the top satisfaction domains for the highly skilled workers, whereas family life followed by health and accommodation are rate highest among low-skilled workers. Standard of living is the lowest-rated item for low-skilled workers, as is standard of living together with social life satisfaction for highly skilled workers.

Table 5 (in the Appendix) shows Pearson's correlations across satisfaction in the seven domains of life. All correlations are positive; some are relatively high. Even though correlations are statistically significant, each separate domain of life can provide additional useful information (Rojas 2006, p. 494). Additionally, Table 6 (in the Appendix) shows Pearson's correlations across the control and independent variables and domains of life; and Table 7 (in the Appendix) shows responses to each of the domains and life satisfaction on the Likert-type scales (1 to 10).

Table 8 (also in the Appendix), compares the means of the domains-of-life results for the two groups of workers. Regarding all domains, highly skilled workers emerge as more satisfied than low-skilled workers.

Empirical Model

Following Rojas (2007) and van Praag et al. (2003) we undertake a two-step strategy to analyse first, the relationship between socioeconomic, demographic and work-related variables, and satisfaction with seven life domains (job, accommodation, health, education, standard of living, family life, social life); and second, the contribution of job satisfaction and non-work-related domains to life satisfaction. We have chosen a two-step methodology, following van Praag and colleagues (van Praag et al. 2003). Even though some previous studies have used Structural Equation Modelling, SEM, we do not consider SEM a suitable model due to the characteristics of our data (all

[9] ISCO detailed classification: http://www.ilo.org/public/english/bureau/stat/isco/index.htm [accessed 29/01/18].

Table 1 Indicators: definitions and descriptive statistics

Variable	Description	Min	Max	Full sample		High-skilled		Low-skilled	
				N	Mean (SD)	Obs.	Mean (SD)	N	Mean (SD)
Life Satisfaction	All things considered, how satisfied would you say you are with your life these days? From 1, 'very dissatisfied' to 10, 'very satisfied'.	1	10	7624	7.37 (1.80)	3635	7.61 (1.64)	3989	7.16 (1.92)
Job	How satisfied are you with your present job? From 1, 'very dissatisfied' to 10, 'very satisfied'.	1	10	7624	7.62 (1.94)	3635	7.97 (1.74)	3989	7.29 (2.04)
Accommodation	How satisfied are you with your accommodation? From 1, 'very dissatisfied' to 10, 'very satisfied'.	1	10	7624	7.78 (1.91)	3635	7.95 (1.80)	3989	7.64 (1.98)
Health	How satisfied are you with your health? From 1, 'very dissatisfied' to 10, 'very satisfied'.	1	10	7624	7.99 (1.82)	3635	8.11 (1.73)	3989	7.89 (1.90)
Education	How satisfied are you with your education? From 1, 'very dissatisfied' to 10, 'very satisfied'	1	10	7624	7.60 (2.05)	3635	8.11 (1.80)	3989	7.14 (2.15)
Standard of living	How satisfied are you with your present standard of living? From 1, 'very dissatisfied' to 10, 'very satisfied'.	1	10	7624	7.21 (1.98)	3635	7.60 (1.81)	3989	6.85 (2.06)
Family life	How satisfied are you with your family life? From 1, 'very dissatisfied' to 10, 'very satisfied'.	1	10	7624	8.08 (1.91)	3635	8.19 (1.84)	3989	7.98 (1.96)
Social life	How satisfied are you with your social life? From 1, 'very dissatisfied' to 10, 'very satisfied'.	1	10	7624	7.48 (1.91)	3635	7.60 (1.82)	3989	7.37 (1.98)
Male	1 if worker is male.	0	1	7624	0.39 (0.49)	3635	0.49 (0.50)	3989	0.31 (0.46)
Age	Age of worker.	18	78	7624	42.00 (10.95)	3635	42.95 (10.74)	3989	41.11 (11.06)
Age^2	Age of worker squared.	3.24	90.25	7624	18.84 (9.36)	3635	19.63 (9.44)	3989	18.12 (9.22)
Education level	What is the highest level of education you completed? (Seven ISCED codes: from 'pre-primary education' to second stage of tertiary education'.)	0	6	7591	3.84 (1.18)	3628	4.40 (1.03)	3963	3.33 (1.06)

Table 1 (continued)

Variable	Description	Min	Max	Full sample		High-skilled		Low-skilled	
				N	Mean (SD)	Obs.	Mean (SD)	N	Mean (SD)
Income	Household income in euro (categories). [a]	1	22	7624	14.67 (4.67)	3635	15.71 (4.66)	3989	13.73 (4.46)
Health status	In general, would you say your health is…? Five categories, from 'very bad' to 'very good'.	1	5	7621	4.02 (0.79)	3635	4.05 (0.78)	3986	4.00 (0.79)
High-skilled worker	1 if type of occupation is 1,2 or 3 of ISCO codes: worker is legislator, senior official, manager, professional, technician, or associate professional.	1	0	7624	0.48 (0.50)				
Working hours	How many hours do you normally work per week in your main job?	1	120	7594	38.12 (9.77)	3619	39.08 (9.11)	3975	37.24 (10.26)
Unlimited contract	1 if worker has an unlimited contract.	0	1	7614	0.85 (0.36)	3630	0.88 (0.32)	3984	0.82 (0.38)
Work–life balance conflict	Work–life balance conflict. Three categories, from 'no or weak conflict' to 'both work and home conflict'.	0	2	7624	0.71 (0.69)	3635	0.69 (0.67)	3989	0.73 (0.70)
Flexible schedule	1 if worker states s/he can vary her/his start and finish times.	0	1	7543	0.41 (0.49)	3599	0.47 (0.50)	3944	0.35 (0.48)
Job Insecurity	How likely or unlikely does worker think is it that s/he might lose the job in the next 6 months? Five categories, from 'very unlikely' to 'very likely'.	1	5	7426	2.00 (1.16)	3561	1.83 (1.08)	3865	2.15 (1.22)

Annual income categories: 1 = 'less than €600' 2 = '€600 to €1199' 3 = '€1200 to €1799' 4 = '€1800 to €2399' 5 = '€2400 to €2999' 6 = '€3000 to €4199' 7 = '€4200 to €5399' 8 = '€5400 to €7199' 9 = '€7200 to €8999' 10 = '€9000 to €10,799' 11 = '€10,800 to €13,499' 12 = '€13,500 to €16,199' 13 = '€16,200 to €19,799' 14 = '€19,800 to €23,399' 15 = '€23,400 to €26,999' 16 = '€27,000 to €32,399' 17 = '€32,400 to €37,799' 18 = '€37,800 to €43,199' 19 = '€43,200 to €48,599' 20 = '€48,600 to €53,999' 21 = '€54,000 to €65,999' 22 = '€66,000 or more'

Obs. Observations, *SD* Standard Deviation, *Min* minimum, *Max* maximum

variables are observed) and the main focus of this paper – on the relationship of work-related characteristics to domain and general life satisfaction, and not the relationship between all explanatory variables and SWB.[10]

Following Rojas (2007), we chose a multiple linear regression analysis for the econometric analysis:

$$\mathrm{DS_k} = \mu + \sum_j \left[\beta^j IC_{ic}^j\right] + \sum_j \left[\pi^j JC_{ic}^j\right] + \sum_j \left[\rho^j \left(HS_{ic} * JC_{ic}^j\right] + \varepsilon_{ic} \right. \quad (1)$$

To study the contribution of job satisfaction and the various domains to life satisfaction, we follow Rojas (2007), and use a semi-logarithm specification[11] for modelling the contribution of each domain of life; this takes the following functional form:

$$e^{LS} = e^{\alpha} * \prod_k [DS_{ic}^{\gamma}] * e^{\sigma} \quad (2)$$

Logarithmic transformation of the Eq. (2) – taking logarithms in both sides of equation – yields Eq. (3), which is a common way of expressing the semi-logarithm specification.

$$LS = \alpha + ln\left[\sum_k \left[\gamma^k \mathrm{DS}_{ic}\right]\right] + \sigma_{oic} \quad (3)$$

where DS denotes worker's domain satisfaction and LS indicates life satisfaction. The subscript k indicates the domains 1 to 7: *job, accommodation, health, education, standard of living, family life* and *social life*. IC denotes the set of individual characteristics, JC the vector of job characteristics, HS high-skilled worker, and ε and σ are the error terms of the two equations. The subscripts i and c indicate the individual worker and country respectively. The subscript j indicates j[th] variable in the vectors of individual and job characteristics.

In the Eq. (1), among the individual characteristics (IC) that may affect domains of life satisfaction, we control for gender, age, age squared, education level, income and health status. We include among the regressors six work-related variables that have previously been studied in the job satisfaction literature accounting for job

[10] Structural equation modelling is an umbrella term that incudes 'methodologies that seek to represent hypotheses about the means, variances and covariances of observed data in terms of a smaller number of 'structural' parameters defined by a hypothesized underlying model' (Kaplan, 2009, p. 1). In our study, all variables (independent, control and dependent variables) are observed – and not psycho-social constructs or latent variables, which are the type of variables SEM was designed to model (Nachtigall et al., 2003). The literature on subjective wellbeing has examples of studies using SEM (Loewe et al. 2014; Rode and Near 2005) when the dependent variables were not observed and the study of particular paths was not the aim of the research. Two-step models were preferred when all subjective wellbeing variables were observed and the goal was to examine particular relationships – as in the case in this paper, which focuses on the role of work-related variables.

[11] "The semi-logarithm specification implies diminishing returns to any domain satisfaction, an increasing marginal rate of substitution between satisfaction in any two domains, and concavity of life satisfaction in domains" (Rojas 2007, p. 11).

characteristics (JC): occupation type, working hours, having an unlimited contract, work–life balance conflict, flexible schedule and job insecurity. In Eqs. (2) and (3), we include the k domains of life satisfaction that may affect life satisfaction: *job, accommodation, health, education, standard of living, family life, social life*. Figure 2 illustrates the two-step model presented here.

An additional issue to be taken into account concerns the existence of country-level specificities that imply differences in domain satisfaction across countries. Following Rojas (2008), it would be possible for the error term not to be *i.i.d.* (independently and identically distributed) within each country, which could imply using cluster-robust standard error (CRSE) in the estimation. However, Kézdi (2004) argues that with a small number of clusters (less than 50), inference using the CRSE may be incorrect: estimation that assumes *i.i.d.* may be preferable. Because the number of clusters in our analysis is less than 50 (28 countries), the econometric results are presented for estimation assuming errors to be independently and identically distributed. Additionally, we have estimated the linear regression model in two different ways in order to assess the robustness of the results: by cluster-robust standard errors (CRSE), and by using a hierarchical linear regression model. These results are available upon request.

Results

The results of the regression analysis for all domains are presented in Table 2. All models have also been estimated using an ordered probit model to check the robustness of the results. The coefficients and significance of the estimators did not differ notably between specifications. Hence, following Rojas (2007), we decided to maintain the OLS specification. As Table 2 shows, the variables in the model explain some (low to a moderate) variability in domains-of-life satisfaction, as the adjusted R^2 coefficients vary from 6.8% for family life to 41.1% for health satisfaction. When job-related variables are introduced, the goodness-of-fit increases, particularly concerning satisfaction with standard of living and social life, but remains low regarding satisfaction with

Fig. 2 Two-layer model. Source: Authors' elaboration following van Praag et al. (2003), Fig. 1

Table 2 Satisfaction in life-domains, and demographic, socio-economic and work-related variables (OLS)

	Job		Accommodation		Health			
	(1)	(2)	(3)	(4)	(5)	(6)		
Socio-demographic variables								
Male	−0.046	−0.236***	−0.105	−0.142*	−0.071	−0.102*		
Age	−0.027	−0.017	−0.045**	−0.040*	−0.039**	−0.029*		
Age^2	0.049*	0.029	0.080***	0.068**	0.041*	0.026		
Education level	0.135***	0.011	0.098***	0.085**	0.041*	0.027		
Income	0.055***	0.027**	0.074***	0.067***	0.021**	0.019**		
Health status	0.450***	0.364***	0.325***	0.271***	1.487***	1.470***		
Work-related variables								
High-skilled worker		0.422***		0.003		0.070		
Working hours		0.007*		−0.001		−0.002		
Unlimited contract		−0.069		0.192*		−0.089		
Flexible schedule		0.260***		0.016		0.016		
Work–life balance conflict		−0.393***		−0.282***		−0.241***		
Job insecurity		−0.442***		−0.131***		−0.082***		
Intercept	4.580***	6.516***	5.301***	5.952***	2.259***	2.691***		
Adjusted R^2	0.073	0.170	0.074	0.090	0.420	0.441		
Observations (N)	7587	7280	7587	7280	7587	7280		
	Education		Standard of living		Family life		Social life	
	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Socio-demographic variables								
Male	−0.190***	−0.300***	0.058	−0.103	−0.065	−0.073	0.048	0.010
Age	−0.054**	−0.045*	−0.094***	−0.087***	−0.037*	−0.025	−0.094***	−0.082***

Table 2 (continued)

	Job		Accommodation			Health		
	(1)	(2)	(3)		(4)	(5)	(6)	
Age^2	0.073**	0.058**	0.117***	0.101***	0.043*	0.025	0.117***	0.098***
Education level	0.583***	0.512***	0.175***	0.092***	−0.017	−0.030	0.028	−0.013
Income	0.021*	0.010	0.126***	0.102***	0.085***	0.081***	0.045***	0.035***
Health status	0.327***	0.283***	0.503***	0.425***	0.398***	0.338***	0.756***	0.692***
Work-related variables								
High-skilled worker		0.375***		0.288***		0.008		0.135*
Working hours		0.001		0.004		−0.008**		−0.007*
Unlimited contract		−0.066		0.117		0.006		−0.047
Flexible schedule		0.070		0.247***		0.082		0.125*
Work–life balance conflict		−0.183***		−0.397***		−0.339***		−0.382***
Job insecurity		−0.192***		−0.292***		−0.151***		−0.181***
Intercept	4.645***	5.581***	4.386***	5.796***	5.658***	6.644***	5.315***	6.525***
Adjusted R^2	0.168	0.194	0.185	0.245	0.068	0.096	0.147	0.183
Observations (N)	7587	7280	7587	7280	7587	7280	7587	7280

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. All figures refer to weighted data. Country effects calculated. Robust standard errors were computed. All Variance Inflation Factor, VIFs ≤2

Source: Authors' calculations, based on 3EQLS micro-data

accommodation (9%) and family life (9.6%), and moderately high concerning health satisfaction (44.1%).

As shown in Table 2, women declare higher satisfaction with education, accommodation job and health than do men. There is a U-shaped relationship between age and accommodation, education standard of living satisfaction and social life, whereas (as expected) health satisfaction declines as workers grow older. The results concerning satisfaction with standard of living and health are in line with Easterlin (2006): individuals with more education report higher levels of satisfaction regarding accommodation, education and standard of living, where satisfaction in other domains does not emerge as dependent on education. Higher income contributes to greater satisfaction in all domains, except for education. Health status is a major contributor to satisfaction across domains, as noted by Frey and Stutzer 2010 and Layard 2010.

As to job characteristics, *work–life balance conflict* and *job insecurity* emerge as significant determinants of job satisfaction and of satisfaction with all other domains of life. Workers with higher levels of conflict regarding work–life balance and job insecurity report lower levels of satisfaction across domains. Conflict in the work–life balance emerges as an important determinant of satisfaction with standard of living, social life, job and family life. Specifically, workers moving from "no or weak conflict" to "either work or home conflict" or from "either work or home conflict" to "both work and home conflict" experience a decrease of 0.40 units in their satisfaction with standard of living. This reduction in satisfaction is lowest concerning education: moving from "no or weak conflict" to "either work or home conflict" or from "either work or home conflict" to "both work and home conflict" brings a reduction of 0.18 units in satisfaction with the education domain. Job insecurity is an important determinant of satisfaction with job, standard of living and social life. As job insecurity increases by 1 unit, satisfaction with standard of living decreases by 0.29 units. Moreover, working in a high-skilled occupation is a significant determinant of job, education, standard of living and social life satisfaction. Enjoying a flexible work-schedule is a significant determinant of satisfaction with job, standard of living and social life. Finally, long working hours are positively associated with job satisfaction and negatively with satisfaction with family and social life. Having an unlimited contract appears to determine only satisfaction as regards accommodation.

To test whether type of occupation (high-skilled/low-skilled) affects the importance of work-related variables in explaining domain-satisfaction, we included interactions between type of occupation (specifically, a dummy variable identifying 'high-skilled worker') and the five work-related variables. We added the set of interaction variables in Eq. 1, including each of these interaction effects alone, and controlling for socio-demographic and work-related variables. Table 3 reports the estimated coefficients of these interactions.

Table 3 shows that there are minor differences between high- and low-skilled workers on the importance of work-related variables in explaining domain-satisfaction: (1) Among high-skilled workers, satisfaction with social life satisfaction is less negatively affected by job insecurity than is the case among low-skilled workers. (2) Among high-skilled workers, satisfaction with social life satisfaction and health is less negatively affected by long working hours than is the case among low-skilled workers. (3) However, having a flexible schedule has a more positive effect on satisfaction with social life for low-skilled workers than for high-skilled workers.

Table 3 Satisfaction in life-domains. OLS estimation with interaction variables

Alternative models	Job	Accommodation	Health	Education	Standard of living	Family life	Social life
Working hours	0.005	−0.001	−0.006*	0.003	0.005	−0.008	−0.011**
High-skilled	0.278	−0.021	−0.341*	0.601**	0.331	0.015	−0.277*
Working hours * High-skilled	0.004	0.001	0.011*	−0.006	−0.001	−0.000	0.011*
Unlimited contract	−0.086	0.229	−0.176*	−0.030	0.108	0.061	−0.045
High-skilled	0.384*	0.086	−0.118	0.454**	0.268	0.128	0.139
Unlimited contract * High-skilled	0.043	−0.094	0.215	−0.091	0.023	−0.138	−0.005
Flexible schedule	0.295***	0.120	0.016	0.113	0.289***	0.213**	0.233**
High-skilled	0.452***	0.092	0.070	0.412***	0.324***	0.120	0.228**
Flexible schedule * High-skilled	−0.073	−0.214	0.001	−0.089	−0.086	−0.271*	−0.223*
Work–life balance conflict	−0.425***	−0.282***	−0.239***	−0.223***	−0.425***	−0.367***	−0.390***
High-skilled	0.370***	0.003	0.073	0.312***	0.245**	−0.037	0.123
Work–life balance conflict * High-skilled	0.075	−0.000	−0.005	0.090	0.062	0.064	0.017
Job insecurity	−0.465***	−0.155***	−0.100***	−0.197***	−0.307***	−0.147***	−0.243***
High-skilled	0.320**	−0.106	−0.009	0.350**	0.220*	0.025	−0.143*
Job insecurity * High-skilled	0.054	0.058	0.042	0.013	0.036	−0.009	0.148**

Note: all models correspond to models from Table 2 (controlling for socio-demographic and work-related variables) adding the interaction variables stepwise

$N = 7280$. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. All figures refer to weighted data. Country effects calculated. Robust standard errors were computed. All Variance Inflation Factor, VIFs ≤2.

Authors' calculations, based on 3EQLS micro-data

Table 4 presents the results of the OLS estimation[12] of the life-satisfaction equation. We estimated the model after splitting the sample between high-skilled and low-skilled workers. All models estimated are significant (p value<0.001); goodness-of-fit of the regressions is moderately high, as the domains included in the model account for approximately 19% of the variance in the life-satisfaction variable, slightly higher than the results obtained by Easterlin (2006).

All domains of life except education are shown to be positive and significant in explaining life satisfaction (Table 4). For the whole sample, job satisfaction ranks fourth in explaining life satisfaction, behind satisfaction with standard of living, family life, and social life, in that order. Satisfaction with standard of living – the closest variable we have to income or financial satisfaction – emerges as the most important contributor to life satisfaction for the whole sample, and also when the sample is split between high- and low-skilled workers. Standard of living, family life and social life are still major contributors to life satisfaction for both high- and low-skilled workers. Satisfaction with accommodation, a variable not significant in explaining life satisfaction for high-skilled workers, ranks fourth in importance for low-skilled workers. Interestingly, job satisfaction is relegated to the second-last position as regards importance for life satisfaction among low-skilled workers, with a coefficient ($\beta_1 = 0.267$) less than half the size of the coefficient of job satisfaction in the high-skilled workers regression ($\beta_1 = 0.639$). However, differences in the magnitude of the contribution of life-domains between type of workers are significant only concerning social life.

Discussion

This study has examined the influence of job characteristics on worker satisfaction as regards various life domains and the contribution of the work domain to life satisfaction among a large sample of workers in EU countries, as well as the differences between high- and low-skilled workers in this regard. Four research hypotheses were put forward. Results from regression analysis indicate, in line with H1, that job characteristics – particularly conflict regarding the work–life balance and job insecurity – are important determinants of satisfaction with the seven domains of the study.

Minor differences emerged between type of workers as regards the influence of work-related indicators, which partly confirms our H2. In particular, satisfaction with social life emerged as the domain with greatest differences between high- and low-skilled workers. Among high-skilled workers, satisfaction with social life satisfaction is less affected by job insecurity or by long working hours than is the case among low-skilled workers. By contrast, having a flexible schedule is more positively associated with social life satisfaction for low-skilled workers than for high-skilled workers. Low-

[12] As we did with the work-life characteristics and satisfaction with domains of life regressions (equations 1), we have estimated the linear regression model in two additional ways in order to assess the robustness of the results. First, by cluster-robust stander errors (CRSE); second, by using a hierarchical linear regression model. The results obtained from CRSE estimation and from using a hierarchical linear model are available upon request.

All models were also estimated using an ordered probit model to check the robustness of the results. The coefficients and significance of the estimators did not differ notably between specifications. Hence, following Rojas (2007) we decided to maintain the OLS specification.

Table 4 OLS regression analysis: Life satisfaction and satisfaction in domains of life

	All sample	High-skilled	Low-skilled	Test of difference Chi²
Job	0.411***	0.639***	0.267*	6.060*
Accommodation	0.327**	0.096	0.462**	1.540
Health	0.381***	0.426**	0.341*	1.510
Education	0.145	0.145	0.125	0.010
Standard of living	1.158***	1.043***	1.250***	0.000
Family life	0.746***	0.846***	0.686***	0.320
Social life	0.702***	0.812***	0.623***	3.200*
Intercept	−0.070	−0.330	−0.309	
R^2	0.337	0.336	0.331	
Adjusted R^2	0.190	0.188	0.183	
Observations (N)	7624	3635	3989	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. All figures refer to weighted data. Country effects calculated. Robust standard errors were computed. All VIFs ≤2. Source: Authors' calculations based on 3EQLS micro-data

skilled workers appear to have fewer opportunities for flexible schedules, as indicated by our literature review (Batinic et al. 2010; Bujacz et al. 2017; Silla et al. 2005). It may well be that low-skilled workers appreciate having flexible work-time arrangements precisely because this is relatively uncommon in their jobs and greatly influences their opportunities to socialize.

Earlier empirical research has found job satisfaction significant in explaining life satisfaction, but it is only in fourth place in our study, confirming our expectations in H3. Satisfaction with standard of living (similar to van Praag et al. and Loewe's financial satisfaction domain) was found to be the most important factor in the studies of Loewe et al. (2014) and van Praag et al. (2003); satisfaction with family life was also an important factor in the studies by Loewe et al. (2014) in Chile and Rojas (2007) in Mexico; and social life (similar to Rojas' domain 'personal satisfaction') was an important factor in Rojas' study. Finally, as hypothesised in our H4, job satisfaction differs in predictive power depending on the type of worker: job satisfaction is important in explaining life satisfaction among high-skilled workers, but the job domain ranks last as regards life satisfaction among low-skilled workers. Further research is needed to explain why low-skilled workers assign relatively less weight to the job satisfaction domain. It might be that, for low-skilled workers, some of the relationship between work characteristics and life satisfaction is captured, not by the work domain but by the relative importance of social life. Among low-skilled workers, satisfaction with social life is strongly linked to work-related variables such as job insecurity, long working hours and job flexibility, thus connecting working conditions to life satisfaction through a non-work domain.

Our study has some important limitations. First, the cross-sectional data may cause problems of endogeneity, as it is difficult to account for unobserved characteristics that may influence both dependent and independent variables and the fact that the independent and dependent variables might cause each other (simultaneity) (Powdthavee 2010). This limits the possibility of interpreting results in causal terms, and could be addressed by using

panel data or identifying instrumental variables for each of the job characteristics under study. Second, the third EQLS survey did not include some work-related variables that might be relevant when studying certain domains – specifically, measures related to career prospects or work autonomy. Moreover, future research should incorporate into the analysis the skills–job match variable (skills corresponding/ not corresponding with actual job duties) and preference for type of contract variable (not considering temporary workers as a homogeneous group, but differentiating by their preference for temporary work), to grasp better the characteristics of the actual labour market.

This study provides evidence indicating that the increasing insecurity in the job market and the challenges experienced by EU workers in achieving a good work–life balance correlate negatively with satisfaction in every domain of life, in turn determining overall life satisfaction. This is due not solely to their relevance to job satisfaction, but also because of the impact on other domains recognized as important for life satisfaction, such as family life, social life, accommodation and standard of living. Our results indicate that employers and policy-makers concerned with workers' wellbeing should accord greater priority to dealing with the high levels of temporary employment in many EU countries (27% in Spain, 26% in Poland, 22% in, for example, Portugal or the Netherlands; 14% on average in the EU)[13] and the difficulties experienced by workers in balancing personal and working life In 2011, 22% of EU workers surveyed expressed dissatisfaction with their work–life balance: at least several times a month, 53% reported leaving their workplace too tired to do household jobs; 30% had difficulties fulfilling family responsibilities due to their working hours; and 14% found it difficult to concentrate at work because of family responsibilities (Davies 2013; Eurofound 2012).

Managers and policy-makers should consider the reasons underlying these negative effects of work-related variables. The negative impacts of greater job insecurity extend across all domains of life. Incentives for companies to offer long-term rather than short-term contracts, as well as measures to protect workers and/or engage them in the future of the company – for example, by discussing clear pathways for promotion – could help to promote both social and company wellbeing. Also the negative impacts of work–life balance conflicts extend across all domains of life. Interventions aimed at improving the work–life balance – such as teleworking to reduce commuting time, or greater autonomy enabling flexibility in the organization of the individual's working time – could foster a better overall work–life balance and serve as powerful instruments for promoting general wellbeing.[14]

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

[13] Percentage of temporary employees in 2017, data from Eurostat, Employment and unemployment (LFS) statistics: http://ec.europa.eu/eurostat/web/lfs/data/database [accessed 20/05/2018]

[14] See Jeffrey et al. (2014) for additional measures to improve wellbeing at work and overall life satisfaction.

Appendix

Table 5 Pearson's correlations across domains

Full sample								
	1	2	3	4	5	6	7	8
1. Life Satisfaction	1							
2. Job	0.381**	1						
3. Accommodation	0.382**	0.342**	1					
4. Health	0.351**	0.285**	0.294**	1				
5. Education	0.295**	0.431**	0.318**	0.270**	1			
6. Standard of living	0.560**	0.516**	0.551**	0.368**	0.405**	1		
7. Family life	0.429**	0.325**	0.431**	0.409**	0.276**	0.444**	1	
8. Social life	0.446**	0.377**	0.388**	0.472**	0.310**	0.487**	0.472**	1
High-skilled								
	1	2	3	4	5	6	7	8
1. Life Satisfaction	1							
2. Job	0.371**	1						
3. Accommodation	0.380**	0.314**	1					
4. Health	0.368**	0.279**	0.288**	1				
5. Education	0.281**	0.416**	0.307**	0.261**	1			
6. Standard of living	0.560**	0.465**	0.563**	0.361**	0.346**	1		
7. Family life	0.457**	0.327**	0.436**	0.431**	0.282**	0.457**	1	
8. Social life	0.450**	0.355**	0.378**	0.478**	0.281**	0.445**	0.479**	1
Low-skilled								
	1	2	3	4	5	6	7	8
1. Life Satisfaction	1							
2. Job	0.366**	1						
3. Accommodation	0.374**	0.349**	1					
4. Health	0.332**	0.280**	0.293**	1				
5. Education	0.271**	0.401**	0.311**	0.267**	1			
6. Standard of living	0.543**	0.522**	0.537**	0.366**	0.397**	1		
7. Family life	0.404**	0.317**	0.423**	0.388**	0.265**	0.433**	1	
8. Social life	0.437**	0.386**	0.390**	0.463**	0.323**	0.514**	0.463**	1

Significance level: ** 1%

Table 6 Indicators and domains, Pearson's correlations

	Male	Age	Education level^	Income^	Health status^	Working hours	Unlimited contract	Work-life balance conflict^	Flexible schedule	Job security^
Male	1									
Age	0.002	1								
Education level^	0.004	−0.040**	1							
Income^	0.079**	0.080**	0.185**	1						
Health status^	0.067**	−0.252**	0.091**	0.156**	1					
Working hours	0.249**	−0.041**	0.042**	−0.118**	0.017	1				
Unlimited contract	0.033**	0.151**	0.037**	0.056**	−0.043**	0.071**	1			
Work–life balance conflict^	−0.098**	−0.068**	−0.019	−0.108**	−0.125**	0.132**	−0.026*	1		
Flexible schedule	0.094**	0.029*	0.117**	0.244**	0.046**	−0.023*	0.046**	−0.086**	1	
Job insecurity^	−0.042**	−0.079**	−0.104**	−0.257**	−0.077**	0.069**	−0.173**	0.120**	−0.107**	1
Life Satisfaction	0.030**	−0.011	0.113**	0.306**	0.245**	−0.064**	0.060**	−0.201**	0.158**	−0.250**
Job	0.004	0.068**	0.134**	0.146**	0.155**	0.012	0.067**	−0.187**	0.118**	−0.268**
Accommodation	0.003	0.104**	0.092**	0.189**	0.154**	−0.032**	0.060**	−0.153**	0.070**	−0.150**
Health	0.048**	−0.176**	0.094**	0.118**	0.642**	0.021	−0.021	−0.162**	0.055**	−0.093**
Education	−0.021	0.006	0.359**	0.109**	0.154**	0.012	0.050**	−0.089**	0.067**	−0.169**
Standard of living	0.047**	0.018	0.188**	0.381**	0.225**	−0.027*	0.078**	−0.216**	0.172**	−0.279**
Family life	0.010	−0.005	0.056**	0.149**	0.189**	−0.020	0.033**	−0.134**	0.058**	−0.137**
Social life	0.041**	−0.060**	0.058**	0.141**	0.319**	−0.044**	0.014	−0.198**	0.087**	−0.167**

^ ^ Spearman's correlation coefficient is calculated. * Correlation significant at 5%. ** Correlation significant at 1%

Table 7 Likert-type scales: Life and domains-of-life satisfaction responses

Life satisfaction	Full sample		High-skilled		Low-skilled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
1 - very dissatisfied	62	0.81	14	0.39	48	1.20
2	79	1.04	20	0.55	59	1.48
3	167	2.19	58	1.60	109	2.73
4	221	2.90	79	2.17	142	3.56
5	621	8.15	240	6.6	381	9.55
6	697	9.14	282	7.76	415	10.4
7	1595	20.92	727	20.00	868	21.76
8	2246	29.46	1166	32.08	1080	27.07
9	1169	15.33	672	18.49	497	12.46
10 - very satisfied	767	10.06	377	10.37	390	9.78
Total	7624	100%	3635	100%	3989	100%
Job satisfaction	Full sample		High-skilled		Low-skilled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
1 - very dissatisfied	79	1.04	20	0.55	59	1.48
2	100	1.31	32	0.88	68	1.70
3	145	1.90	45	1.24	100	2.51
4	175	2.30	61	1.68	114	2.86
5	567	7.44	162	4.46	405	10.15
6	649	8.51	246	6.77	403	10.10
7	1344	17.63	573	15.76	771	19.33
8	1965	25.77	1020	28.06	945	23.69
9	1212	15.90	708	19.48	504	12.63

Table 7 (continued)

Life satisfaction	Full sample		High-skilled		Low-skilled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
10 - very satisfied	1388	18.21	768	21.13	620	15.54
Total	7624	100%	3635	100%	3989	100%
Accommodation satisfaction	Full sample		High-skilled		Low-skilled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
1 - very dissatisfied	61	0.80	26	0.72	35	0.88
2	73	0.96	23	0.63	50	1.25
3	144	1.89	58	1.60	86	2.16
4	191	2.51	62	1.71	129	3.23
5	496	6.51	202	5.56	294	7.37
6	566	7.42	250	6.88	316	7.92
7	1261	16.54	558	15.35	703	17.62
8	1844	24.19	931	25.61	913	22.89
9	1393	18.27	725	19.94	668	16.75
10 - very satisfied	1595	20.92	800	22.01	795	19.93
Total	7624	100%	3635	100%	3989	100%
Health satisfaction	Full Sample		High-skilled		Low-skilled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
1 - very dissatisfied	41	0.54	10	0.28	31	0.78
2	54	0.71	22	0.61	32	0.8
3	112	1.47	44	1.21	68	1.7
4	170	2.23	78	2.15	92	2.31
5	437	5.73	174	4.79	263	6.59

Table 7 (continued)

Life satisfaction	Full sample		High-skilled		Low-skilled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
6	533	6.99	233	6.41	300	7.52
7	1030	13.51	470	12.93	560	14.04
8	1830	24.00	894	24.59	936	23.46
9	1639	21.50	841	23.14	798	20.01
10 - very satisfied	1778	23.32	869	23.91	909	22.79
Total	7624	100%	3635	100%	3989	100%
Education satisfaction	Full sample		High-skilled		Low-skilled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
1 - very dissatisfied	96	1.26	22	0.61	74	1.86
2	83	1.09	19	0.52	64	1.6
3	165	2.16	43	1.18	122	3.06
4	245	3.21	70	1.93	175	4.39
5	655	8.59	192	5.28	463	11.61
6	618	8.11	213	5.86	405	10.15
7	1277	16.75	512	14.09	765	19.18
8	1742	22.85	895	24.62	847	21.23
9	1071	14.05	656	18.05	415	10.40
10 - very satisfied	1672	21.93	1013	27.87	659	16.52
Total	7624	100%	3635	100%	3989	100%
Standard of living satisfaction	Full sample		High-skilled		Low-skilled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
1 - very dissatisfied	96	1.26	27	0.74	69	1.73

Table 7 (continued)

Life satisfaction	Full sample		High-skilled		Low-skilled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
2	105	1.38	27	0.74	78	1.96
3	216	2.83	65	1.79	151	3.79
4	301	3.95	97	2.67	204	5.11
5	720	9.44	243	6.69	477	11.96
6	818	10.73	341	9.38	477	11.96
7	1517	19.90	669	18.40	848	21.26
8	1908	25.03	1010	27.79	898	22.51
9	1034	13.56	615	16.92	419	10.50
10 - very satisfied	909	11.92	541	14.88	368	9.23
Total	7624	100%	3635	100%	3989	100%
Family life satisfaction	Full sample		High-skilled		Low-skilled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
1 - very dissatisfied	60	0.79	29	0.8	31	0.78
2	74	0.97	24	0.66	50	1.25
3	135	1.77	55	1.51	80	2.01
4	158	2.07	71	1.95	87	2.18
5	372	4.88	155	4.26	217	5.44
6	473	6.20	209	5.75	264	6.62
7	992	13.01	434	11.94	558	13.99
8	1657	21.73	792	21.79	865	21.68
9	1580	20.72	829	22.81	751	18.83
10 - very satisfied	2123	27.85	1037	28.53	1086	27.22

Table 7 (continued)

Life satisfaction	Full sample		High-skilled		Low-skilled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Total	7624	100%	3635	100%	3989	100%
Social life satisfaction	Full sample		High-skilled		Low-skilled	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
1 - very dissatisfied	61	0.8	20	0.55	41	1.03
2	78	1.02	32	0.88	46	1.15
3	170	2.23	59	1.62	111	2.78
4	242	3.17	101	2.78	141	3.53
5	623	8.17	267	7.35	356	8.92
6	768	10.07	349	9.60	419	10.50
7	1378	18.07	664	18.27	714	17.90
8	1935	25.38	954	26.24	981	24.59
9	1200	15.74	627	17.25	573	14.36
10 - very satisfied	1169	15.33	562	15.46	607	15.22
Total	7624	100%	3635	100%	3989	100%

Table 8 Occupation mean comparison: results from T-test across domains

	Full sample, mean	High-skilled, mean	Low-skilled, mean	Variance homogeneity Levene statistic (Sig)	T-test t (Sig.) - assuming equal variance	T-test t (Sig.) - Not assuming equal variance
Life Satisfaction	7.37	7.61	7.16	67.32*	11.12*	11.20*
Job	7.62	7.97	7.29	140.79*	15.52*	15.64*
Accommodation	7.78	7.95	7.64	59.20*	7.10*	7.13*
Health	7.99	8.11	7.89	28.25*	5.26*	5.28*
Education	7.60	8.11	7.14	131.97*	21.38*	21.56*
Standard of living	7.21	7.60	6.85	57.77*	16.95*	17.05*
Family life	8.08	8.19	7.98	9.48*	4.73*	4.75*
Social life	7.48	7.60	7.37	30.67*	5.34*	5.36*

*two-tailed significance level at 5%

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CORRECTION

Correction to: Job Characteristics and Life Satisfaction in the EU: a Domains-of-Life Approach

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The original version of the article unfortunately contained an error in Table 2. The correct Table 2 is shown below.

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Table 2 Satisfaction in life-domains, and demographic, socio-economic and work-related variables (OLS)

	Job		Accommodation		Health	
	(1)	(2)	(3)	(4)	(5)	(6)
Socio-demographic variables						
Male	-0.046	-0.236***	-0.105	-0.142*	-0.071	-0.102*
Age	-0.027	-0.017	-0.045**	-0.040*	-0.039**	-0.029*
Age^2	0.049*	0.029	0.080***	0.068**	0.041*	0.026
Education level	0.135***	0.011	0.098***	0.085**	0.041*	0.027
Income	0.055***	0.027**	0.074***	0.067***	0.021**	0.019**
Health status	0.450***	0.364***	0.325***	0.271***	1.487***	1.470***
Work-related variables						
High-skilled worker		0.422***		0.003		0.070
Working hours		0.007*		-0.001		-0.002
Unlimited contract		-0.069		0.192*		-0.089
Flexible schedule		0.260***		0.016		0.016
Work–life balance conflict		-0.393***		-0.282***		-0.241***
Job insecurity		-0.442***		-0.131***		-0.082***
Intercept	4.580***	6.516***	5.301***	5.952***	2.259***	2.691***
Adjusted R^2	0.073	0.170	0.074	0.090	0.420	0.441
Observations (N)	7,587	7,280	7,587	7,280	7,587	7,280

Table 2 (continued)

	Education		Standard of living		Family life		Social life	
	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Socio-demographic variables								
Male	-0.190***	-0.300***	0.058	-0.103	-0.065	-0.073	0.048	0.010
Age	-0.054**	-0.045*	-0.094***	-0.087***	-0.037*	-0.025	-0.094***	-0.082***
Age^2	0.073**	0.058**	0.117***	0.101***	0.043*	0.025	0.117***	0.098***
Education level	0.583***	0.512***	0.175***	0.092***	-0.017	-0.030	0.028	-0.013
Income	0.021*	0.010	0.126***	0.102***	0.085***	0.081***	0.045***	0.035***
Health status	0.327***	0.283***	0.503***	0.425***	0.398***	0.338***	0.756***	0.692***
Work-related variables								
High-skilled worker		0.375***		0.288***		0.008		0.135*
Working hours		0.001		0.004		-0.008**		-0.007*
Unlimited contract		-0.066		0.117		0.006		-0.047
Flexible schedule		0.070		0.247***		0.082		0.125*
Work–life balance conflict		-0.183***		-0.397***		-0.339***		-0.382***
Job insecurity		-0.192***		-0.292***		-0.151***		-0.181***
Intercept	4.645***	5.581***	4.386***	5.796***	5.658***	6.644***	5.315***	6.525***
Adjusted R^2	0.168	0.194	0.185	0.245	0.068	0.096	0.147	0.183
Observations (N)	7,587	7,280	7,587	7,280	7,587	7,280	7,587	7,280

III

Conclusions

The overall aim of this thesis has been to provide insights into how jobs – more specifically, work characteristics – affect job satisfaction and life satisfaction in Europe; further, to shed light on the relationship between ICT intensification[10] in the workplace and workers' subjective wellbeing, and to contribute to the emerging literature on the link between new working patterns and subjective wellbeing.

This thesis has studied these issues in the case of European workers in the beginning of 21st century (data gathered between 2005 and 2013) using European data sources from official statistical agencies. Being able to draw on different data sources that provide information on the work characteristics and subjective wellbeing of European workers has helped to increase the robustness and reliability of the findings. The empirical analysis, applying different econometric models responding to the different research questions, has made it possible to study correlational relationships (Papers I and III) as well as causal linkages (Paper II). This thesis has approached human wellbeing from a subjective angle and has included, at different stages of the analysis, the factors affecting job satisfaction and life satisfaction deemed relevant by social scientists. I conducted three quantitative studies of European workers and drew on three separate literatures in discussing relevant aspects for each study. The overall research question has been as follows: *How do jobs and current work characteristics associated with the increased use of ICTs affect job satisfaction and life satisfaction in Europe?*

The thesis adds to the social science literature on the link between subjective wellbeing and work organization. The specific contribution to the debate on this link is to study the effects that the new working patterns and the introduction of ICTs in the work sphere have on this relationship. The results of this research provide insights that are relevant not only for academia, but also for company management organizations, human resources management, policymakers and for any worker.

In this final section, I summarize the goal and the results presented in this thesis: the impact of this research, and its contributions to the research fields of subjective wellbeing and work organization. Finally, I note some limitations of this thesis, and highlight possible future improvements and research directions which can be derived from this work.

[10] This intensification was controlled mainly by the type of occupation.

Impact of the research

This thesis presents comprehensive analyses of different aspects of work-related characteristics and subjective wellbeing. Each of the papers included in this thesis takes a different angle of subjective wellbeing and explores a distinct aspect of working conditions and workers' characteristics, always with a view to the central role of ICTs. Paper I is an exploratory article, on the most important determinants of job satisfaction for two type of workers: knowledge workers and other workers. Paper II then investigates how Internet use for work purposes (a characteristics of knowledge workers) moderates the effects of other work characteristics, strengthening or weakening their relationship to job satisfaction. Here, the type of occupation is considered as a determinant of job satisfaction. Finally, Paper III uses some of the determinants of job satisfaction found significant in Paper I and Paper II. Focusing on white-collar workers, it explores the influence of job characteristics on satisfaction with various domains of life, and how these domains can explain life satisfaction. Paper III also investigates whether job satisfaction and other domains of life contribute differently to life satisfaction, depending on the nature of workers' skills.

The summaries presented below present the main ideas of the three papers, how they contribute to the overall research interest of the thesis, and the empirical and theoretical motivation. Finally, they outline the findings and implications.

Paper I: Knowledge workers and job satisfaction: Evidence from Europe

The first paper contributes to the overall topic of the thesis – knowledge, work and subjective wellbeing – by studying the determinants of job satisfaction, and differences in the perception of job satisfaction between knowledge workers and other workers in Europe. The research question is as follows: *Do knowledge workers (KW) differ from other workers (OW) with regard to what determines their job satisfaction?*

The aim was to find what these determinants are, and the differences between the two groups of workers. The set of variables were grouped into various dimensions, comprising individual, household characteristics, as well as financial

job characteristics. Non-financial job characteristics consisted of 12 indicators, grouped in five dimensions: work organization, work intensity, working conditions, and work–life balance. The paper engages in the debate on the inclusion of knowledge workers in organizational strategic plans in order to improve productivity (Holtskog, 2015; Ramírez & Nembhard, 2004), where new value-generation processes and co-innovative sources of productivity call for quality jobs and satisfied workers (Díaz-Chao et al., 2016). The paper contributes to this debate by shedding light on the importance of wellbeing, in terms of job satisfaction for all type of workers.

The results indicate that non-financial job characteristics play an important role for job satisfaction among KWs. Specifically, career advancement opportunities, work-schedule flexibility, work–life balance, job security and work-colleague support are crucial factors in determining job satisfaction of KWs. As predicted, monthly income was an important determinant of job satisfaction only for OWs – indeed, it was the most important for that group of workers.

The findings indicate that the interventions aimed at improving the wellbeing of workers should consider the type of workers, and should incorporate the growing body of evidence on the determinants of job satisfaction among the two types of workers, KWs and OWs. Work–life balance emerges as a major determinant of job satisfaction for both types of workers, and should be dealt with at the societal level. However, interventions related to improving work–life balance could be focused differently for the two groups – for example, by providing greater work schedule flexibility to KWs, and by guaranteeing company compliance with legally binding agreements on working hours to OWs.

Paper II: Internet use and job satisfaction

The second paper studies how Internet moderates the effects of work characteristics studied in Paper I and in the literature in general, strengthening (or weakening) their relationship to job satisfaction. The main argument developed here is that *Internet use for professional purposes affects job satisfaction by moderating the relationships between work characteristics and wellbeing.*

The specific focus is on six main dimensions that encompass different indicators of job characteristics and antecedents of job satisfaction: income, education, occupation type, autonomy, time pressure and social interactions. For each of them, I developed a specific hypothesis on how Internet use weakens or strengthens the effect on wellbeing. The empirical results of the study confirm

the set of specific hypotheses.

The findings show that Internet use strengthens the positive relationship between income and job satisfaction. The interaction effects for income earnings, perceived income and career prospects are positive; the interaction effect for job insecurity is negative. Second, the findings indicate that Internet use weakens the negative effect of education on job satisfaction. Educational level, learning and training variables have positive marginal effects. Specifically, the interaction effect for the education variable indicates that highly educated workers who make active use of Internet are approximately 5% more likely to be satisfied with their jobs. On the other hand, over-qualification has negative marginal effects on job satisfaction. Third, Internet use strengthens the positive effect of white-collar occupation on job satisfaction. Two interaction effects emerge as important in relation to type of occupation. High-skilled white-collar occupations have a positive and strong estimated marginal effect: workers in these occupations who actively use Internet for work purposes are nearly 9% more likely to report above-average job satisfaction. By contrast, blue-collar occupations have a negative marginal effect. Fourth, Internet use strengthens the positive effect of autonomy on job satisfaction. All seven interaction variables related to this dimension – own ideas, autonomy, problem solving, supervision, flexible time, self-assessment and working partners – have a positive and statistically significant marginal effect, ranging between 5% and 13%. Fifth, Internet use weakens the negative effect of time pressure on wellbeing at work, due to time-saving effects provided by digital technologies. Two interaction effects emerge as positive and significant: work–life balance is positive, with a strong estimated marginal effect of 23%; available time is also positive and significant, and with a strong estimated marginal effect as well (17%). By contrast, the interaction between Internet use and the pace variable (frequency of tight deadlines), proves negative (instead of positive as expected). Finally, Internet use strengthens the positive effect of participation on job satisfaction. All three interaction variables of this dimension are significant. Management support, colleagues have positive marginal effects, whereas discrimination has negative marginal effects. This interaction effect is strong for management support and for relationships with peers and colleagues (around 16%) and for discrimination (27%).

This paper contributes to the wellbeing and work organization literature in three ways. First, by showing that Internet use at work has a broad multi-dimensional effect on job satisfaction through several dimensions and relevant factors, relating to both workers' background and characteristics (income, education, occupation type), and workplace organization (degree of autonomy, time pressure, quality of social interactions). Second, the effects of Internet use at work are heterogeneous: digital technologies may lead to polarization patterns that may be advantageous for some groups of workers but less so for others: increasing differences in job satisfaction between highly educated, high-salaried white-col-

lar employees on the one hand, and less-educated, lower-wage blue-collar workers on the other. Third, the paper has shown that Internet use *per se* does not have any direct impact on workers' job satisfaction. Internet use moderates the role of job satisfaction, making the impacts stronger or weaker.

Paper III: Job characteristics and life satisfaction in Europe: A domains-of-life approach

This third paper studies the importance of working life on subjective wellbeing of workers. It examines how job characteristics have become important determinants of how people assess their daily lives, on the assumption that job characteristics are important for job satisfaction, but that their impact extends also to other domains of life satisfaction, which also affect life satisfaction. Further, the paper explores the differences between low-skilled and high-skilled white-collar workers in terms of how job characteristics explain domain-satisfaction. There are two research questions here: *What is the relationship between job characteristics and satisfaction with work and other domains of life? Is the job domain more important for life satisfaction than other domains of life?* Further, the paper applies a domains-of-life perspective to investigate possible differences in these relationships between high- and low-skilled workers, using data on white-collar workers.

The empirical results confirm the hypothesis that job characteristics can explain reported levels of satisfaction across all life-domains, not only as regards job satisfaction. Problems in the work–life balance and job insecurity emerge as two of the most important determinants of satisfaction within the seven domains of this study. Further, working in a high-skilled occupation is found to be a significant determinant of job, education, standard of living and social life satisfaction. Having a flexible work-schedule is a significant determinant of satisfaction with job, standard of living and social life. Additionally, long working hours are positively associated with job satisfaction, and negatively with satisfaction with family and social life. Having an unlimited contract appears to determine only satisfaction as regards accommodation. Regarding the differences between type of workers as regards the influence of work-related indicators, the results partly confirm the second hypothesis of the paper. In particular, satisfaction with social life emerges as the domain with greatest differences between high- and low-skilled workers. Among high-skilled workers, satisfaction with social life is less affected by job insecurity or by long working hours than is the case among low-skilled workers. By contrast, having a flexible schedule is more positively associated

with social life satisfaction for low-skilled workers than for high-skilled workers. Further, among high- skilled workers, satisfaction with health is less affected by long working hours than is the case among low-skilled workers. As to the third hypothesis, the empirical research confirms that job satisfaction is significant in explaining life satisfaction, but it ranks only in fourth place in this study. Finally, and as hypothesized, job satisfaction differs in predictive power, depending on the type of worker: job satisfaction is important in explaining life satisfaction among high-skilled workers, but the job domain ranks last as regards life satisfaction among low-skilled workers.

This study of EU countries provides evidence indicating that the increasing insecurity in the job market and the challenges experienced by workers in achieving a good work–life balance correlate negatively with satisfaction in every domain of life, in turn determining overall life satisfaction. This is due not solely to their relevance to job satisfaction, but also because of the impact on other domains recognized as important for life satisfaction, such as family life, social life, accommodation and standard of living.

Contributions of this research

Theoretical implications

One of the contributions of this research to subjective wellbeing theory is the finding that working life characteristics affect satisfaction with most domains of life. This implies that scholars of wellbeing might be advised to contemplate the cross-pollination between domains when addressing determinants of domain satisfaction. For example, the pervasiveness of the job domain indicates that work–life balance should be considered as a determinant of most life domains – whereas interest rates, for example, should remain within the remit of satisfaction with housing or consumption.

The research reported in this thesis contributes to the literature of the domains-of-life approach to subjective wellbeing, extending the works of Rojas (2007) and van Praag et al. (2003) on life satisfaction – assuming that the latter is a function of satisfaction with various domains – by adding job characteristics as explanatory variables in addition to the usual socio-demographic factors, and focusing on the relationship between job characteristics variables and satisfaction with all domains of life. It also extends the work of Rode and Near (2005), whose goal was to contrast non-work characteristics with work characteristics and how all these characteristics explain life satisfaction. The research presented in this thesis has shown that all domains of life are influenced by several job characteristics, and that all domains are relevant explaining life satisfaction. Therefore, the relationship between the explanatory variables and domains of life satisfaction, and the relationship between domains of life and life satisfaction, cannot be ignored. This calls for a multi-dimensional theoretical framework that simultaneously considers all domains of life in studying the subjective wellbeing of individuals.

Further, the importance of job domain explaining life satisfaction might prove to be contextual. With greater attention to the context, the study of the determinants of job satisfaction or the determinants of domains-of-life satisfaction should pay attention to the relevance of the characteristics of particular domains for satisfaction with seemingly unrelated domains. For example, in the context of COVID-19 (World Health Organization, 2020), it would not be surprising to find that ‘availability of health care services in the vicinity’ would affect not only satisfaction with health or accommodation but also satisfaction with such apparently unrelated domains as work or social life.

Methodological implications

Following economists, who tend to interpret subjective wellbeing as ordinally comparable (Ferrer-i-Carbonell & Frijters, 2004; Pagán, 2013) and use ordered response models (i.e. ordered probit or ordered logit), this thesis has used ordered models where possible (Paper II and Paper III). In the case of Paper I, a binary logistic models were used, because – as expected – the distribution of the dependent variable was significantly positively skewed, and it was collapsed into two categories, using sample benchmarks (satisfied and dissatisfied, above and below the benchmark, respectively). In Paper III all models were estimated using a linear regression model to check the robustness of the results. The coefficients and significance of the estimators did not differ notably between specifications. Hence, in line with Rojas (2007), the OLS specification was used for the analysis.

This thesis has methodological implications for wellbeing research – for the determinants of subjective wellbeing in particular. The methodological strategy employed in Paper II and Paper III overcomes two of the main problems involved in using cross-sectional data, and consolidates a robust approach for dealing with this type of data. First, it has used instrumental variables (Paper II) in order to avoid endogeneity problems using cross-sectional data, so that the results could be presented in causal terms (McIntosh, 2014). The key assumption of this identification strategy is that the instrumental variable affects the main variable (dependent variable) under study only through its impact on an independent variable, and is thus uncorrelated with any possible unobserved determinant of the main variable. Second, in Paper II and Paper III, an issue related to the multi-level nature of the data has been taken into account, as individual workers in the sample are clustered within different countries. First, the models (bivariate ordered probit and linear regression model respectively) were estimated by clustering standard errors at the country level. Second, the same equations were estimated by using a hierarchical ordered probit for Paper II and ordered probit model for Paper III, explicitly taking into account the multi-level nature of the data.

The findings of this thesis also indicate the use of moderating variables – those which affect the strength or nature of the relationship between two other variables (Dawson, 2013) – in the models of subjective wellbeing. The use of moderating variables makes it possible to capture the influence of relevant variables that at first glance appear not to influence the wellbeing of workers directly. In Paper II, the Internet use for work purposes was not a variable that seemed to directly influence job satisfaction, but it acted as a moderating factor, affecting the relationship of other variables and job satisfaction.

The findings contribute to the debate on the use and definition of knowledge

work, overcoming the limitations of most frequently cited proxy measures of such work. Common approaches focus, for example, on investment in research and development (R&D), supposed to indicate the extent of being knowledge-driven (Warhurst & Thompson, 2006). Or they focus on the occupational or educational background of individuals. Moreover, the OECD or European Commission define the 'knowledge economy' and 'knowledge work' in terms of knowledge-intensive industries based on ICT production or usage and/or high shares of highly educated labour (Milasi et al., 2020; OECD, 2003). Used separately, these approaches are susceptible to errors; these measures are often flawed, as they do not grasp the whole concept of what is meant by 'knowledge work'. As Warhurst and Thompson (2006) note, there is a need for alternatives that can provide more conceptually and empirically robust accounts of knowledge work. The results of this thesis show that the definition used here offers a solution to minimize such errors – an alternative definition that is empirically and methodologically robust. It uses both occupation and education of individuals categorizing factors and adds a third condition related to the use of ICTs for work purposes to reflect the complexity entailed in such work. As it is based on the nature of job content itself, this measure offers an accurate definition that is easy to operationalize, and with possibilities for comparison of results with future studies.

Empirical implications

The empirical implications of this thesis differ for company managers and for policy makers. First, the results show that income plays a relatively small role in satisfaction in all domains Second, the effect of Internet work-use is to moderate the role of the determinants of job satisfaction. Third, as regards wellbeing, it is important to distinguish by type of workers. Finally, the use of ICTs at work and structural changes in the workplace have implications in all domains of life, not only the job domain.

The findings of this thesis show that income is important in explaining job satisfaction and other domains-of-life satisfaction, but that it plays a relatively small role in satisfaction in *all domains* – a result in line with other studies, like Clark (2005). Moreover, differentiating for type of workers proved relevant: income emerged as not important in explaining job satisfaction for KWs (Paper I). This decreasing marginal utility of income indicates that job compensation should not be solely a monetary reward: other types of job compensation are also important. This thesis sheds light on factors related to working conditions and work organization that should be incorporated in job contracts. I have shown the importance of work–life balance, flexible work-schedule, job security and career

prospects as factors that motivate workers and spur their wellbeing at work and thereby their general wellbeing.

Further, this thesis has shown that Internet use *per se* does not have any direct impact on workers' job satisfaction. Rather, digital technologies moderate the role of the determinants of job satisfaction. Internet use has magnifying effects on workers' characteristics, improving working conditions and job satisfaction relatively more for high-skilled white-collar workers. On the one hand, this relates to worker adaptation to ICT, which resonates with the coping model of user adaptation to information technology (Beaudry & Pinsonneault, 2005), where workers have different attitudes towards the adaptation of ICT; and, on the other hand, to the type of job and type of work activities, the tasks performed by each worker, and various personal characteristics. Concerning workplace characteristics, this indicates that ICT will have positive effects only for organizations/ employers where work tasks can be organized in an autonomous and flexible way, whereas it will have negative impacts in other types of occupations. Secondly, the study has implications related to the negative marginal effects of Internet use, indicating that active use of Internet may lead to lower wellbeing, at least among blue-collar workers and overqualified workers. This implies that the field of intervention should be carefully designed in order to protect workers, especially when there is a negative moderation effect. But who is to implement these interventions? One possibility could be at the company level. Another option is society, through different sectoral agreements – or governments, through labour laws.

This thesis also sheds light on the importance of distinguishing by type of workers as regards wellbeing. As discussed in the introduction to this thesis (section 1), new evidence shows a movement towards greater job polarization (Camiña et al., 2020; Goos et al., 2014), with a displacement of the occupational structure, particularly for low-skilled workers in routine jobs, and an increase of skilled work with new specializations (Bessen, 2016; Camiña et al., 2020). As much of this scenario has become reality today, policymakers and managers seeking to improve the wellbeing of workers would be well-advised to incorporate this distinction. Workers in high-skilled occupations, with strong digital skills and more knowledge-based jobs, seem better positioned to respond to the demands of new working patterns – and, in the context of changes generated by the COVID-19 pandemic, to face the upcoming uncertain economic and labour future. By contrast, workers in manual occupations and/or with low level of digital skills have the perception of lower job security and are more likely to lose their jobs. Thus, it is essential to provide greater institutional protection to specific groups of workers – for instance, through measures and actions focused on unskilled workers, who are also among the lowest-paying segments of the workforce. Actions should aim at developing workers' digital skills in order to meet the challenges from changing technologies and new ways of working. For instance, policies for re-training and upskilling workers may be crucial for ensuring life-long

employability of workers, and maintaining or improving their subjective wellbeing.

The results of this thesis indicate that ICT use at work and structural changes in the workplace have implications beyond the workplace and job satisfaction, affecting other domains of life as well – overall life satisfaction in particular. Policymakers should take into account the implications of working life on all domains of life, more specifically, the influence of work characteristics on all domains-of-life satisfaction and thereby the subjective wellbeing of workers. Interventions aimed at improvement (focusing on work–life balance, greater autonomy enabling flexible work-schedules, job security measures) could foster better, more decent jobs, and improved general wellbeing of workers. Such interventions are not suggested solely for human resources managers or organizational managers: they should also involve the public policy level.

Limitations of the study

This thesis has studied the relationships between work-related characteristics and subjective wellbeing. It has clarified some relations, but it has also given rise to some further issues for exploration. Moreover, as in most empirical research, this thesis has some limitations. Two relate to the empirics. The first concerns the problem of endogeneity of Paper I and Paper III: this can appear when wellbeing is studied using cross-sectional data, limiting the possibility of interpreting results in causal terms. It is difficult to account for unobserved characteristics that may influence both dependent and independent variables, and the fact that the independent and dependent variables might cause each other (simultaneity) (Powdthavee, 2010). This could be addressed by using panel data or identifying instrumental variables (as in Paper II) for each of the work-related characteristics under study.

Second, cross-sectional research is connected to data availability, as is the case with this research. The use of secondary data has great advantages: such data are free of charge for academic research purposes, and involve large representative samples that meet the highest quality standards in methodology and data. However, they may fail to include some variables or dimensions that could prove relevant for the specific study. Therefore, researchers must resort to proxies, without including or ignoring some measures that might be relevant for the study. Further research could use an *ad hoc* data, questionnaires tailored for the specific study. For instance, one could incorporate into the analysis variables related more specifically to knowledge work, or to the skills–job match, or to preferences as to the type of contract variable, to grasp better the characteristics of the actual labour market.

Finally, one problem of this thesis has been how to define the key concept of knowledge work/worker, as there is no universally accepted definition, and the matter remains highly contested.[11] It is generally assumed knowledge work is related to individual and professional characteristics: (1) level of skills and education, (2) professional category and (3) the intensity of ICT use at work. It has not been easy to find all three dimensions in the same data base. Knowledge workers are a diverse group in need of deeper examination in future studies, so that we may fully understand and respect the complexity of employment relations in highly skilled work.

Further research

To overcome the conceptual and methodological limitations of this study, further research is necessary. In the ongoing process of digital transformation of firms, the use of ICT and the automation technologies[12] are expanding rapidly. There is a clear need for analysis of the work-related factors that affect subjective wellbeing, mainly at the company and policy levels, to take full advantage of these improvements. In order to extend the results of this thesis, future research might replicate the domains-of-life analysis conducted Paper III, focusing on workers who interact with these second-order disruptive technologies (specifically, working with robots and collaborative platforms), analysing the relationship between job characteristics and satisfaction with work and other domains of life and their effects on productivity and employment.

The worldwide COVID-19 pandemic has changed the physical, geographical and socio-economic context in which work is carried out, affecting the relationship between many of the variables characterizing knowledge work and subjective wellbeing. An *ad hoc* online survey from Eurofound (2020) estimated that over one third (37%) of employees currently working in the EU began to telework as a result of the COVID-19 pandemic (Eurofound, 2020). This percentage has risen since then: teleworking had been increasing over the last decade at a slow pace, mostly as an occasional work practice for employees (Milasi et al., 2020). In 2019, the share of employed persons in the EU occasionally working from home was only 5.1% (Eurostat LFS, 2020). Sostero et al. (2020) and Milasi (2020)

[11] An extended discussion appears in the Literature Review section of Paper I.

[12] Automation technologies are also known as second-order disruptive technologies. Today we are deep in the second digital wave – the wave of the new technologies, automation technologies like robotics and artificial intelligence, big data, Internet of Things or Cloud computing among others (Pratt, 2015; Xu et al., 2018).

indicate that the large expansion of telework since the COVID-19 outbreak has been strongly skewed towards high-paid white-collar employment and has been unequal across countries and firms. It is feared that these differences in the expansion of telework could lead to greater inequalities between workers, companies and countries (Milasi et al., 2020). The recent Eurofound (2020) survey also shows that, as a result of COVID-19, achieving work–life balance has been challenging for workers responsible for young children or elderly persons: they report difficulties in concentrating on their job, or having to work in their free time to meet the demands of their job. Further, the Eurofound survey showed that 16% of workers in the EU felt that they were likely to lose their jobs in the near future – thus increasing job insecurity in the region. In view of the importance of this contextual change on the job market, there is an urgent need for further studies in this area: work–life balance, job security, flexible schedule and teleworking all require for deeper study of the consequences for wellbeing. Polices aimed at supporting the transition to more accessible work (flexible schedule, teleworking) must carefully consider the potential benefits and costs for productivity, job quality, and workers' work–life balance and subjective wellbeing.

The acceleration towards teleworking and flexibilization of work schedules caused by the COVID-19 pandemic brings additional challenges and implications (Sostero et al., 2020), that might spill over into the work and business sphere. For example, increased teleworking and flexible schedules might lead to the redistribution of the population throughout a given territory, depopulating parts of the cities where firms have been clustered (Cox, 2009). This could lead to reduced workplace spaces at business headquarters (using hot desks), creating co-working spaces throughout the territory, perhaps with salary increases in order to pay expenses of workplace home facilities or for renting co-working spaces. Future studies should investigate the extent to which changing working conditions affect labour market access across regions, the quality and quantity of jobs, the environmental impact of these changes and their relationship to the subjective wellbeing of workers.

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