UNIVERSITÄT PADERBORN
Die Universität der Informationsgesellschaft

Faculty of Business Administration
and Economics
Chair of Personnel Economics

What do unions do to work design?
Technology, union presence, and tayloristic jobs in Britain

Der Fakultät für Wirtschaftswissenschaften der
Universität Paderborn
zur Erlangung des akademischen Grades
Doktor der Wirtschaftswissenschaften
- Doctor rerum politicarum -
vorgelegte Dissertation
von

Simon Eisele, M.Sc.
geboren am 18.08.1986 in 72250 Freudenstadt

Erscheinungsjahr: 2019

Executive Summary

Changes in both work characteristics and job content spur contemporary research. More recent theoretical contributions and empirical accounts have deepened our understanding of this matter by assessing more sophisticatedly the impact of ICT use or of innovative HR practices on the design of work. A gap exists, however, as most research does not elaborate further the impact of contextual factors, putting the impact of trade unions, for example, into a black box. This is quite surprising given the marked differences in both the design of work and in the management-labor relationship between liberal market economies such as the UK and coordinated market economies such as Germany. Against this backdrop, this work introduces trade union presence to the current debate over work design determinants. In particular, this dissertation scrutinizes whether trade union presence in UK workplaces has an independent influence on the design of work.

The theoretical model applies a multidisciplinary perspective integrating insights from the task literature but also from organizational studies, and from the field of industrial relations (IR). To link union presence to work design, arguments from the IR literature, power relations models, and formal models of underinvestment are used.

To facilitate hypotheses development, this work derives two ideal types of jobs that are closely related to the organization of work: tayloristic and holistic jobs.

In the empirical analysis, pooled cross-sectional data from the Skill and Employment Survey Series are utilized. The different methodological approaches used offer robust support for the quality of the developed hypotheses. The obtained results provide tentative support for the main proposition that trade union presence has a separate, independent effect on the design of work that stands in stark contrast to that of ICT use and involvement practices. This work adds comprehensive empirical evidence that trade union presence is negatively associated with both the relevance of specific tasks in a job, such as problem-solving, and work characteristics such as perceived variety or autonomy.

These results imply that the role of trade unions in shaping the design of work must be reconsidered in the field of British IR. This work complements those current endeavors, and, at best, stipulates future research to evaluate in more depth the impact of labor representation bodies on the design of work.

Table of Contents

List of figures

List of tables

List of abbreviations

AMT – Advanced Manufacturing Technologies

BIBB – Federal Institute for Vocational Education and Training

c.p. – ceteris paribus

CAD – Computer-Aided Design

CAM – Computer-Aided Monitoring

CFA – Confirmatory Factor Analysis

CNC – Computer Numerical Controlled Machines

CWU – Communication Workers Union

DOT – Dictionary of Occupational Titles

DTI – Department of Trade and Industry

EFA – Explanatory Factor Analysis

EUROFOUND – European Foundation for the Improvement of Living and Working Conditions

HC – Human capital

IAB – Institute for Employment Research

ICT – Information and communication technology

IPA – Involvement and Participation Association

IR – Industrial relations

KMO – Kaiser-Meyer-Olkin criterion

MSF – Manufacturing, Science, and Finance trade union

NUT – National Union of Teachers

OLS – Ordinary Least Square

PSM – Propensity Score Matching

SBTC – Skill-biased technological change

SES – Skills and Employment Survey Series

TUC – Trade Union Congress

VoC – Varieties of capitalism

WERS – Workplace Employment Relations Study

1 Introduction

> *"Significant technological and societal change is also affecting work and organizing, yet we know little about how this change might affect people's work design. […].. In most theory and research pertaining to the design of jobs, work design is modeled at the start of a causal chain leading to outcomes via intermediary processes. […]. This literature neglects consideration of where work design comes from and how it is constrained or enabled; that is, work design as a dependent variable."* (Parker, van den Broeck, & Holman, 2017b: 267).

With the advent of information and communication technologies (ICT), major transformations at workplaces have occurred. The digitization of the working environment, and the corresponding changes in firms' organization not only have altered job characteristics in general but also have strongly changed the content of jobs. Both trends encourage attentive analysts to speculate on and critically appraise the future of employment (Economist, 2018; The Guardian, 2015).

Cued by this parallel development, both theoretical and empirical accounts in the scientific community have been devoted to assess more sophisticatedly the impact of ICT and the organization of work on employment outcomes. Emanating research fields, such as the task literature, are of great value to augment knowledge as to how the adoption of technology influences the demand for labor or the evolution of wages for different skill groups (Autor, 2013). Similarly, research applying an organization studies' lens has accumulated an extensive body of literature in the last decades, providing in-depth insights into the characteristics of jobs, the psychological effects of changes in jobs and into individual factors moderating these effects (Grant, Fried, Parker, & Frese, 2010).

Nevertheless, in view of the altered nature of jobs within organizations (Grant & Parker, 2009), more recent calls highlight some challenges for contemporary research. For one, Parker et al. (2017b: 268) claim that this field indeed provides knowledge concerning the benefit of well-designed jobs. However, quantitative, evidence-based research analyzing the forces having an impact on jobs' structure and content is currently lacking.
Secondly, others (e.g. Acemoglu & Autor, 2011; Parker et al., 2017b) argue that the scientific

discussion on changes in work characteristics and content mainly addresses organizational level factors, but remains silent on other decisive contextual issues being independent from technology or new forms of work.
This dissertation addresses both calls for an evidence-based analysis of contextual factors by linking trade union presence in UK establishments with the design of work.

It is quite surprising that the role of UK trade unions has not been extensively considered so far in the work design or industrial relations (IR) literature, especially in the UK context, given the historical antecedent of union influence on job outcomes. In the 1970s and 1980s, for example, one reason for the continuing discussion on the reform of British industrial relations was the restrictive control exerted by British unions over job demarcations and regulation, and the rather adversarial stance of UK trade unions towards job modifications (e.g. Goldthorpe, 1974; Marsden & Thompson, 1990).
Additionally, there is no common understanding in contemporary IR literature in terms of union motives and their influence on the design of work against the backdrop of substantial changes that have occurred in the British IR. Being more precise, UK trade unions have formulated their own purposes in terms of bargaining objectives regarding the share of profits or the design of jobs in view of advancing digitalization of workplaces that do not align with former goals. Exemplarily, in a manifesto concerning future strategies, the Trade Union Congress (TUC) clearly specifies an agenda to be pursued in the upcoming years:

> *"Where digitalisation can bring benefits – and some benefits will be huge – we will ask: how can those benefits best be shared? Where it brings risks, how can we minimise and mitigate those risks [to provide good jobs]? What is the relationship between new technology, with its greater productivity, and the sharing of the gains from that productivity, so that workers are better rewarded?"* Trade Union Congress (2017b: 9).

This change in paradigm in union activity is recognized in contemporary industrial relations research, which emphasizes that UK trade unions have lately sought to focus on job-quality aspects rather than traditional pay-related bargaining objectives (e.g. Bryson & Green, 2015).
However, other researchers even question the factual influence and motive of UK trade unions on such job outcomes. They point to the contested nature of job related decisions (e.g. Simms, 2017) or stress that the implementation of innovative HR practices is not in the interest of unions

(see Godard, 2004 for a discussion).

Such ambiguities call for a theoretical assessment of trade union's role in job related decisions, and for an in-depth empirical analysis of the trade unions' effect on job outcomes for the UK context. This dissertation, hence, not only strives against theoretical parsimony currently present in the extant literature (Green, 2012). It also provides rationales to refocus on trade unions' effect on job outcomes, which is acknowledged to be an under-researched topic (Acemoglu & Autor, 2011: 1160).

In sum, the following main research question is derived:

How do technologization, workplace reorganization, and trade union presence affect job characteristics and job content in Britain?

By conducting research addressing those inquiries, this dissertation offers several new insights. First, a framework is outlined that – in addition to the usual posited organizational level determinants of job characteristics and content – introduces trade union presence as an additional explanatory factor. By focussing on trade union presence, the management-union relationship in the UK, and the power relation between management, employees, and unions are recognized as important features shaping the design of jobs. Hence, this dissertation evaluates changes in job outcomes in the light of power relations between employer and employee and rent distribution considerations. These aspects have been mostly absent in contemporary contributions.

Another novel facet in this work is the derivation of ideal types of jobs that are close to an important differentiation concerning work organization: tayloristic and holistic jobs. Whereas a holistic job includes a higher level of variety, autonomy, or a higher relevance of specific tasks such as problem-solving, a tayloristic job has, in turn, lower levels of the same job attributes.

For the empirical assessment of the research question, data from the Skill and Employment Survey Series (SES) is used. The SES combines several related surveys that took place in the UK between 1986 and 2012. This micro-level data is especially suitable for the research question under consideration. It not only supplies information on the posited work design

determinants, but contains rich and stable data for job characteristics, and for the tasks carried out at the job.

The ensuing chapter 1.1 entails definitions of the underlying concepts such as work design, technology, and HR practices used throughout this work. Then, the different research domains are outlined on which the following line of argumentation builds upon.

1.1 Work design, technology, and industrial relations

In this thesis, work design is defined in a broader sense by incorporating two job dimensions: specific job characteristics such as autonomy and variety, and the tasks conducted in a job (see Humphrey, Nahrgang, and Morgeson, 2007). As reasoned by Parker, Morgeson, and Johns (2017a), such a definition takes into account that employees are engaged in flexible work roles within a job, and do not only carry out static tasks.

Research on work design and its effect on employment outcomes has a long-standing tradition. Early writings can be found in Smith (1776) or Babbage (1832) that serve as the intellectual bedrock for accounts promoting job simplification and scientific management. Morgeson and Humphrey (2008) summarize that the history of work design research is shaped by manifold innovative contributions, and is rich of distinct models[1] shedding light upon how specific work characteristics influence specific employment outcomes (see also Parker et al., 2017a for a comprehensive summary). During the last 40 years, those models have produced a rich body of empirical analyses. Meta-studies, such as Humphrey et al. (2007), reveal that most of the models' predictions of a positive association between e.g. autonomy or variety and job satisfaction or motivation have been confirmed.

Technology and work design

At the same time, the retrieved arguments from such models treating job characteristics as an explanatory factor have been complemented by contributions, which speculate on the enabling

[1] The two-factor theory emanating from the work supplied by Herzberg (1966), and Turner and Lawrence (1965), or the job characteristic model introduced by Hackman and Oldham (1975; 1976) are only two examples.

or constraining effect of technology on work design outcomes. One dominating theme in this debate has been the critical comments made in the industrial sociology literature, and the labor process debate (e.g. Braverman, 1974) in particular. Accounts following this tradition stress that changes in production techniques caused by *mechanization* favors a fragmented work design, centralization of responsibility, and specialization by tasks (Littler, 1978), which all lead to workforce deskilling (Fraser, 2010).

To assess the impact of technological progress on the design of work, this thesis outlines and measures, however, the association between ICT and work characteristics/content. The rationale is twofold. For one, focusing on ICT is compelling because ICT represent most of modern technical progress in the service sector, and is a key driver of new forms of employment (Bresnahan & Yin, 2017: 95). Secondly, with the diffusion of ICT in the 1970s, a change in the theoretical discourse in the economic literature occurred (Goldin & Katz, 1998; Acemoglu, 2002). Since then, changes in work design due to technology adoption have been increasingly evaluated in view of the increased demand for higher skilled employees. In this work, such a perspective is applied.

In principle, a large number of models in this research field offer a formalization of the skill-biased technological change (SBTC) concept (see Acemoglu, 2002 for a summary). Those models have long been used to make anecdotal inferences on how the installment of ICT affects the design of work (see e.g. Goldin & Katz, 1998; Friedberg, 2003). For clear theoretical guidance to link the design of work with ICT use, this thesis builds upon two complementary research streams that emanate from the SBTC literature, but that describe the mechanisms at work more sophisticatedly. In particular, to link ICT with changes in work characteristics, this study draws upon the seminal work supplied by Milgrom and Roberts (1990; 1995) and Lindbeck and Snower (2000). Both supply a formal representation of how the implementation of new production technologies or ICT goes hand in hand with modifications in work organizations. Although originally developed to explain changes in the organization within firms, the key arguments therefrom still function as a theoretical bedrock in contemporary research evaluating the impact of ICT on job characteristics (see, for instance, Bayo-Moriones, Billon, & Lera-López, 2017).

Secondly, to link ICT with changes in job content, this thesis builds upon the task framework first introduced by Autor, Levy, and Murnane (2003). As outlined by Acemoglu and Autor (2012), by focusing on changes in job tasks caused by ICT, the task framework provides rationales for some of the observed labor market trends being irreconcilable with the SBTC-

approach.
Both models emanating from the SBTC-literature present important insights to link ICT with changes in the design of work, and, thus, are at the heart of the ensuing elaboration.

Involvement practices and work design

To link workplace reorganization measures with changes in work design, this dissertation draws upon a substantial body of literature providing knowledge on the installment of innovative HR practices and its effect on employment outcomes (see Boxall & Macky, 2009 for a summary). In more detail, this thesis focusses on the impact of involvement practices, such as participation in quality circles or team work. The rationale is that such organizational measures aim at reversing the Taylorist form of work organization, and are directly related to the way the work itself is organized (Boxall & Macky, 2009: 7).

To link involvement practices with the design of work, this thesis builds upon the school of thought that originated with the contribution by Lawler III (1986), and on the rich body of literature emanating therefrom. In more detail, Lawler's III (1986) work provides descriptive reasoning on the impact of such practices on various employment outcomes, and is at the center of a vast body of empirical studies assessing their impact on e.g. job satisfaction (e.g. Mohr & Zoghi, 2008), the quality of work (e.g. Gittleman & Pierce, 2011), employee well-being (Boxall & Macky, 2014) or firm performance (e.g. Huselid, 1995).
One major contribution in this domain is the work by Appelbaum, Bailey, Berg, Kalleberg, and Bailey (2000). The authors not only describe in detail how the implementation of involvement practices is associated with improvements in skill development or communication among workers, but also supply quantitative evidence on this matter.
The key arguments from both contributions and that from corresponding analyses (e.g. Ashton & Sung, 2002; Green, 2012) are used to describe the link between the installment of such practices and changes in the design of work.

Industrial relations and work design

Besides considering technology and involvement practices as important determinants that shape the characteristics and content of jobs, this dissertation scrutinizes the role of industrial

relations, and that of trade unions in particular.

Against the backdrop of substantial changes that have occurred in the British IR, linking union presence with the design of work requires a nuanced approach that not only incorporates knowledge from the field of British IR but also from related bodies of research.
Specifically, this thesis draws upon that part of the British IR literature that provides in-depth considerations on the union-management relationship. In particular, contributions that outline the history of trade unions in the UK (e.g. Clegg, 1979), and that evaluate outcomes of partnership agreements (e.g. Oxenbridge & Brown, 2002; Samuel & Bacon, 2010) are used to infer on the contemporary relationship between both actors. Additionally, this thesis builds upon corresponding models produced in the field of IR (e.g. Grout, 1984) outlining managements' behavior in cases where contracts are non-binding and unions are present at workplaces.

Furthermore, this thesis relies on ideas supplied by a related research field that originates from the work by Kochan, McKersie, and Cappelli (1984) and Schuler (1989). Specifically, the developed framework that links arguments from strategic choice with both human resource management and with IR is highly valuable. These accounts offer a rationale that the design of work must not necessarily be *mechanistic* (i.e. rational), but that political and power aspects are pivotal elements affecting management decisions as well (e.g. Wright & McMahan, 1992).
By combining these insights, this thesis proposes a novel line of thought that emphasizes the impact of power considerations and rent distribution aspects in work design decisions.

1.2 British industrial relations and trade unions

The aim of chapter 1.2 is to sketch the specific context of British industrial relations. This step is important as the specific British IR system itself underwent major transformation in the period after 1980 and differs markedly from other IR systems.

In this thesis, a narrow definition of the term industrial relations is applied. In particular, this work centers on trade union activity. As reasoned by Kaufman (2014: 1), such a more narrow perspective aligns with the origins of British IR, whose core focus was on trade unions and collective bargaining. Ackers and Wilkinson (2003) and Kaufman (2014) provide well

described summaries of the different historical sections in this field, whose roots can be traced back to the landmark work by Webb and Webb (1894; 1897).

Some of the characteristics of today's British unionism are influenced by the developments of union formation in the mid-nineteenth century. Two distinct outcomes are crucial for the ensuing discussion: craft/multi-unionism and decentralized bargaining.

The prevalence of skilled craft unions has its roots in early union formation as they were the dominant form of early unionism (Marchington, Waddington, & Timming, 2011: 38). Two major reasons are identified for this evolution. Fiorito and Jarley (2008: 191) outline that the system of skilled craft unions has been the result of "*organic"* solidarity among workers with common skills, and Dobson (1997: 548) refers to the non-existence of a central body setting general framework conditions in terms of union design. Clegg (1979: 174) summarizes that these circumstances led to the bizarre and complex structure of UK unionism; culminating in multiple unions being recognized for bargaining.

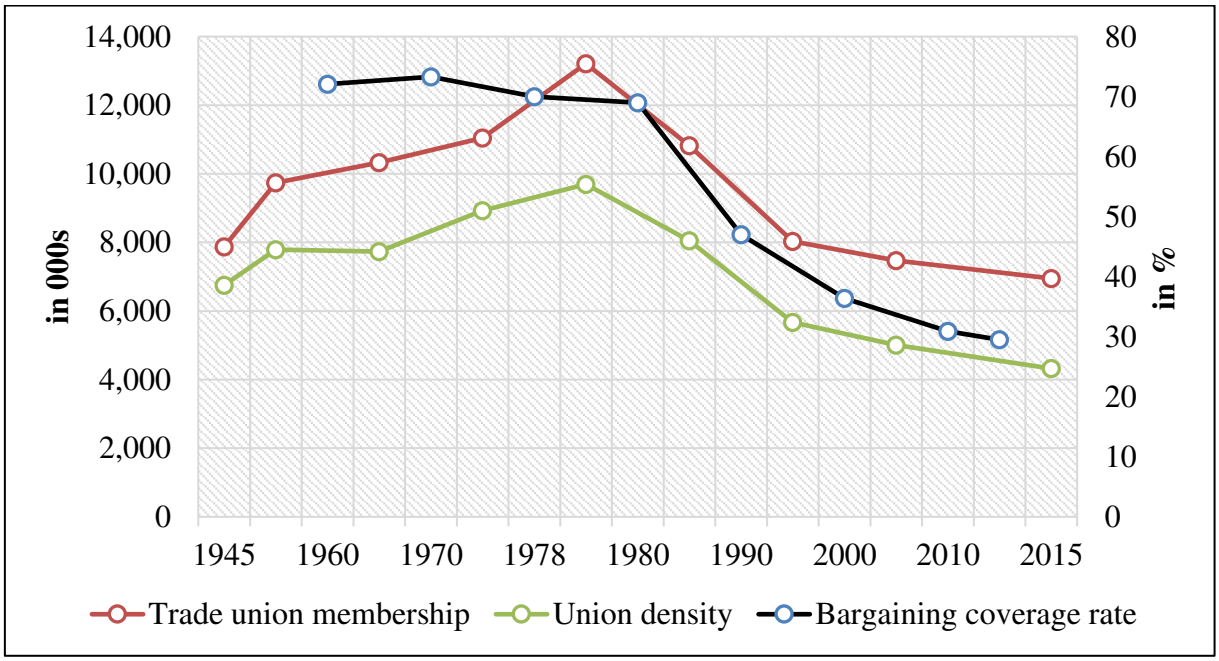
The historical evolution of British craft unionism has consequences for contemporary British industrial relations as well. Exemplarily, Gall (2008) states that unions remain in constant conflict over job demarcations and stand in competition with one another. Besides that, union formation along skills and occupations has led to the presence of multi-unionism favoring trade division and sectionalism; a marked feature of present UK labor unionism (Gall, 2008: 357). Critical commentators, such as Dobson (1997), ascribe this specificity to be a major source of problems as it adversely affects firm performance due to an increase in strike incidences or time consuming bargaining.

Another key feature of British IR is its system of decentralized collective bargaining. As sketched by Marchington et al. (2011: 49), especially after World War II, shop stewards became more involved in the bargaining process. They supplemented the industry-wide negotiations, as centralized agreements failed to specify workplace rules in sufficient detail. Ultimately, this led to a strengthening of the shop stewards' role, and firm-level bargaining increased gradually. From the mid-1970s onwards, collective bargaining was decentralized throughout much of the private sector. This trend further evolved in the 1980s and early 1990s as multi-employer agreements declined in numbers, and, on the contrary, an increase in single-employer or even plant-level contracts has occurred (Katz, 1993; Hyman, 1997).

Trade unions' motive and influence on the design of work

In the post-World War II period, two distinct phases in the British IR in terms of scope and influence of unions are identified as being crucial for sketching the context of the analysis: the pre- and post-1979 era.

Figure 1: Unionization in the UK



Note: Own compilation. Data on union membership is retrieved from the Department for Business, Energy & Industrial Strategy (2017). Data on union density is retrieved from Price and Bain (1983). For the year 1985, data is provided by Visser (2016). For the ensuing years, data is retrieved from Department for Business, Energy & Industrial Strategy (2017). Trade union density is measured constantly by the percentage of employees that were members of trade unions. Data on bargaining coverage rate is based on Visser (2016).

As outlined in Figure 1, trade union membership grew during the period of 1945 to 1965 from 7.9 to 10.3 million. This increase, however, lagged behind employment growth in that time span (Marchington et al., 2011: 38). Besides that, union density increased in the same period, but was more volatile compared to membership levels.

During the 1970s, trade union membership and union density grew markedly and reached an all-time high of 13.2 million members (and 55.4%, respectively). This made the UK the most heavily organized large OECD country (Freeman & Pelletier, 1990: 141). Similarly, union coverage had been on a steady level between 1960 and 1978.

Several hypotheses have been proposed to explain union's growth in that period. For one, scholars point out favourable structural determinants, such as a good economic climate,

supportive labor law and government policies (e.g. Price & Bain, 1983; Freeman & Pelletier, 1990). Other accounts lay bare the observation that explicit union strategies in terms of recruitment favoured union growth. As noted by Marchington et al. (2011: 38), one source of union surge in that time were the successful attempts of unions to attract white-collar workers to join unions.

Union strategy in workplace organization and work design before 1979 and management strategies towards unions

The union strategies pursued in the pre-1979 era in the UK are in accordance with the ideal type of classic unionism.[2] This kind of strategy emphasizes the traditional oppositional role towards employers posing threats to employers through activism and mobilization (Boxall & Haynes, 1997: 577). Actions closely associated with this form of unionism included closed shop practices, the rejection of modern machinery or pursuing tight regulatory job rules to seek control over job assignments and job demarcations between occupational classes (see Addison, 1984 for a comprehensive overview). The overall aim of the tight regulatory job rules was to gain control over the work environment and to reduce the bargaining power of employers (Nickell & Nicolitsas, 1997; Flanders, 1975). Such strategies remained pervasive and reflect the post-war pattern of British unionism (Daniel, 1987).

Looking at the pre-1979 era, case study evidence proffers insights that unions succeeded in establishing and preserving strict workplace rules (e.g. Dubois, 1982; McGoldrick, 1983). Moreover, supportive empirical evidence reveals that between 1920 and 1970, issues concerning work flexibility and job demarcation had been the chief motivation for non-pay related strikes in the UK (Devereux & Hart, 2011). Those findings align with the general consensus in the field of British IR that trade unions had the motive, the legislative possibility and the organizational strength on the ground to directly influence the design of work in that period (Böheim & Booth, 2004).

Against the backdrop of such union attempts, it comes as no surprise that management strategies

[2] Trade union strategy depends on several specific union features such as their identity Hyman (1997), the balance of power Kelly (2004), or their tradition Hyman (2007). For a more comprehensive evaluation on the various determinants shaping union strategy, see Boxall (2008).

towards unionization before 1979 had been shaped by anti-unionism; measures to curb union power or even to avoid unions (see Dundon, 2002; or Hyman, 1989 for an overview).

Union strategy in workplace organization and work design after 1979 and management strategy towards unions

The year 1979 proved to be a turning point for both trade unions and workplace industrial relations in practice and for IR as an academic discipline (Ackers & Wilkinson, 2003). That year marks the beginning of successive Conservative governments that displayed a much greater degree of ideological hostility towards trade union activity. This becomes apparent through concrete policy initiatives that shifted the legal balance against unions (Pendleton, 1997: 162). The Employment Act 1980, for example, posed restrictions on union activity as statutory compulsory recognition procedures were removed. The Employment Act 1982 further eroded union immunity in areas of strike and dispute, and the Employment Act 1984 and 1986 introduced liabilities for industrial action under specific conditions (see Freeman and Pelletier, 1990 for a comprehensive summary).

In addition to the unfavourable legislation, union membership, density and bargaining coverage began to decline after 1979 (see Figure 1), and are currently at an all-time low. This leads some writers to proclaim "*the crisis of labor"* (Dundon, 2002: 234). Unfavourable legislation was not the only cause, though, for trade union struggle in the UK. Various reasons have been advanced: such as the changing composition of labour force, new patterns of industrial relations, a rise in power of global capital or a shift from Fordist to more flexible modes of production (see Dundon, 2002, for a summary).

These developments induced unions to reconfigure their strategies as it became increasingly difficult to maintain restrictive practices (Metcalf, 1989), which were subject to heavy disputes in the flexibility agreements negotiated with management during the 1980s (Marsden & Thompson, 1990). In those agreements, unions primarily attempted to secure a minimal degree of influence over day-to-day workplace issues. As an exchange, unions guaranteed support for the installment of flexible work practices (Kelly, 2004: 269). In the aftermath of these negotiations, management say in terms of job tasks increased, and restrictive practices were removed (Dunn & Wright, 1994). However, unions barely succeeded in securing their influence on workplace issues (Kelly, 1990).

Along the same lines, the disparities between union objectives in the so-called new technology "model agreements" during the 1980s (McLoughlin, 1991: 303) and their realization in practice are another documentation of the prevailing adversarial stance of management towards unions and unions' diminishing influence.[3]

In the 1990s, confronted with that failure, trade unions pursued further attempts to cooperate in more depth with management. Specifically, they sought to cooperate in core components of management decision-making such as flexibility or job security (Kelly, 2004). The debate on this form of collaboration gained momentum in the late 1990s, as attempts to ease the relationship between management and trade unions were made by both the Trade Union Congress (TUC), and the then elected Labor government. This development culminated in more favorable legislation, such as the Employment Relations Act in 1999, which eased some of the restrictions imposed by Conservative government upon the organization of trade unions.

Furthermore, efforts have been made to promote social partnership agreements (Brown & Oxenbridge, 2004: 146). Such agreements have been primarily an attempt to reform a union's relationship with management, and to support unions to organize in a hitherto union-free environment. The general debate over this form of cooperation has tended to polarize. Whereas scholars (e.g. Ackers & Payne, 1998) and official organizations such as the Trade Union Congress (TUC), the Involvement and Participation Association (IPA) or the Department of Trade and Industry (DTI) emphasize the benefits associated with such agreements, other IR scholars remained skeptical. In particular, Kelly (2001) noticed that those partnership agreements have little influence on wages, conditions of work or in terms of union say in the long run. Others raised the question, whether those agreements are a sign that trade union representatives have been "*forced to sell the conquests their grandfathers fought for"* (Marsden & Thompson, 1990: 95).

Case study evidence shows that the partnership agreements have been largely used to dilute or to curb union power. In particular, they have been utilized to restrict union involvement in work design matters or to refuse collaboration with "difficult" trade union officials (Brown & Oxenbridge, 2004: 151–152). These findings concur with the forecast made by Guest and

[3] See Dodgson and Martin (1987) for a comprehensive summary. More specifically, the authors reasoned that trade unions had a tougher position to negotiate with management over such issues as the prevailing recession from the late 1970s to the beginning of the 1980s made it harder to pursue innovative bargaining objective. Moreover, management, against the backdrop of stricter legislation, pursued strategies to remove crucial decisions from the bargaining area (Dodgson & Martin, 1987: 12ff). See Daniel (1987) for numerical evidence.

Peccei (2001: 231) who state that the partnership agreements allow firms to exert a "*constrained mutuality with the balance of advantage […] leaning clearly towards management"*. In a similar vein, Marsden (1995: 18) notes that management has used the general shift of power balance to target labor practices such as craft and tight job demarcations rules. Likewise, Samuel and Bacon (2010: 430) emphasize that the second-generation partnership agreements between the years 1990 and 2007 contain, at best, modest overall commitment on behalf of management to a cooperative relationship.

Basically, these outcomes are an additional piece of evidence for employer resistance to trade unionism in the UK (Cullinane & Dundon, 2014), indicating the prevalence of a low-trust relationship between both actors.

The upshots in this chapter are threefold: First, the outcomes of the partnership agreements unveil that unions – in view of shifts in power balance – forfeit their scope of influence in work design decisions. Whereas in the pre-1979 era, unions directly influenced the design of work by enforcing strict workplace rules, the reassertion of managerial prerogative after 1979 leaves contemporary unions little direct say in work design decisions.

Secondly, the widespread decentralization of the collective bargaining system has moved the area of bargaining to company or plant-level. This implies that wages and other key conditions are not taken out of competition. This further underscores that management and trade unions in the UK are competing interest groups; a claim that is not only prevalent in the IR literature but also in other research domains such as in the Varieties if Capitalism (VoC) literature (e.g. Holman, Frenkel, Sørensen, & Wood, 2009).

Thirdly, this review indicates that despite decline in union power and influence, UK trade unions remain a key party in the employment relation. This line of thought is supported by such accounts emphasizing management intention to curb union power in view of those partnership agreements (e.g. Cullinane & Dundon, 2014). By pointing to management's reluctance to cooperate with unions, such accounts lay bare that despite decline in union membership, coverage, and bargaining power, trade unions have still maintained their organizational strength on the ground. This point is supported by Bryson and Green (2015: 139–140), who express that *perceived* union influence in the workplace was resilient during the 1990s.

1.3 Contribution and structure of thesis

Summing up the preceding remarks, union presence has been mostly absent in recent debates on changes in the design of work. The introductory chapter outlines some tentative explanations for why the union effect on work design is not well researched: Decline in union power, reassertion of managerial prerogative on work design issues or the prominence of deterministic models leaving out contextual factors. At best, the role of trade unions in work design issues has been explained on a passing note (see e.g. Felstead & Gallie, 2004) even against the fact that the unions' motives or impact are far from being obvious. Even the UK IR literature calls for more interdisciplinary research approaches to study work design related outcomes to contribute *"to debates"* in other research fields and to take *"from the disciplines new themes from which IR can learn"* (Edwards, 2005: 277).

This thesis addresses this call for a more interdisciplinary perspective on work design determinants. It provides theory development by combining several strands of literature that have coexisted for a long time, and an empirical assessment of the association between technology, involvement practices, union presence, and work design. The empirical analysis contributes robust evidence, questioning the tenability of leaving out union presence as a crucial determinant.

By focusing on trade union presence, this thesis contributes to the work design, task and UK industrial relations literature. More specifically, this thesis adds valuable insights to the task literature emanating from the work supplied by Autor et al. (2003). One concern in this research stream is the deterministic nature of the underlying model (Green, 2012; Acemoglu & Autor, 2011; Fernández-Macías, 2012), that insinuates a mono-causal relationship in which the diffusion of ICT is considered to be the sole determinant influencing the relevance of specific tasks. Such a narrow perspective, though, leads to a rather broad explanation of why certain tasks in a job become more important than others. As research suggests that technological change affects the relevance of tasks in a similar way (Green, Felstead, Gallie, & Henseke, 2016; Fernández-Macías, 2012), the task framework is not suitable to explain differences in required job tasks across countries (see Holman et al., 2009 for evidence). Hence, broadening this model and introducing contextual factors extends the framework's explanatory power.

Furthermore, the line of thought provided in this work complements work design research by

introducing the power relations between employer and employees. Basically, the power relation between employer and employees is at the heart in the sociology of work and organization (Olsen, 2016: 390), and more recent calls propose a more nuanced analysis of how the relative bargaining power of employees is affected by technological change in general (e.g. Kristal, 2013). This thesis adds to those recent accounts by shedding light upon the nexus between work design and bargaining power for specific stakeholders, and by analyzing whether work design is affected by the presence of an institution capable of extracting rents in favor of employees.

Moreover, this thesis complements contemporary IR literature in the UK that refocuses on trade unions' role in non-wage aspects of work in terms of job quality (e.g. Bryson & Green, 2015). Such contributions build upon accounts emphasizing the representational remit of unions around job quality issues (Doellgast, Holtgrewe, & Deery, 2009). This renewed interest in job quality and UK trade union's influence on it not only stems from declining union influence over matters of work (Bryson & Green, 2015: 139), but also from the belief that such union efforts lead to union renewal (Simms, 2017).
However, analyzing the effect of onsite union representation on job quality has some pitfalls. For one, no clear theoretical consent has been reached in the IR literature on how union presence affects the quality of work (see, for example, Hoque, Earls, Conway, & Bacon, 2017 for a discussion). Secondly, only limited attention in empirical research has been paid to job quality measures, and how they are influenced by union presence (see Bennett & Kaufman, 2004 for a review). This thesis adds insights by contributing to both questions. Specifically, a line of thought is proposed that links theoretically union presence with important job quality indicators. Additionally, this thesis supplies an extensive empirical analysis testing the association of a variety of job indicators typically associated with job quality (Green, Mostafa, Parent-Thirion, Vermeylen, van Houten, Biletta, & Lyly-Yrjanainen, 2013) with union presence.

Finally, this work complements a rich body of literature in the field of British IR devoted to analyzing trade unions' impact on firm performance (see Doucouliagos & Laroche, 2013 for a meta-analysis). By evaluating unions' effect on work design, this thesis provides alternative insights into this nexus. Specifically, unions' effect on productivity is typically assessed by using financial indicators as dependent variables (see e.g. Bryson, Ebbinghaus, Visser, Forth, & Laroche, 2011 or Denny & Nickell, 1991). This thesis offers a novel view because work design variables are shown to be important predictors of firm performance as well (e.g. Takahashi, 2011).

To present a firm line of reasoning, the remaining chapters are structured as follows.

Chapter 2 reviews the relevant literature and sketches the theoretical model. At the heart of sub-section 2.1, two ideal types of jobs (tayloristic and holistic) are derived. Sub-section 2.2 revisits the nexus between technology and work design. In sub-section 2.3, the focus is placed on the relationship between involvement practices and both work characteristics and the content of jobs. Sub-section 2.4 presents several lines of reasoning in the IR and related literature with the main point being that trade union presence is associated with more tayloristic jobs. Finally, sub-section 2.5 summarizes the research model and presents testable hypotheses.

Chapter 3 introduces the dataset, the operationalization strategy, provides several descriptive statistics, and addresses the nexus between the design of work and pay. More specifically, the information used in the empirical analysis stem from the Skills and Employment Survey Series (SES), which is a series of surveys that gathers information about the employed workforce in Great Britain (summarized in section 3.1). Sections 3.2 and 3.3 document the operationalization of the central variables. Likewise, the other main variables of interest are presented as well as the control variables used. Section 3.4 addresses the link between the work design variables and paid wages. Finally, section 3.5 outlines the estimation strategy.

Chapter 4 reports the empirical findings. Section 4.1 presents the findings of the main econometric model. Thereafter, the results of several robustness checks are shown in section 4.2. Most notably, matching and fixed-effect panel-estimations are conducted. Both techniques yield qualified support for the results obtained by the main model. At the end, section 4.3 provides a summarizing assessment of the empirical findings.

Chapter 5 concludes this dissertation by describing some implications of the presented findings. Finally, limitations of this work are outlined as well as avenues for further research.

2 Theory: Technology, HR practices, unions, and work design

Before deriving two ideal types of jobs (section 2.1), reviewing the relevant literature (2.2 – 2.4), and developing testable hypotheses (2.5), this chapter commences by laying out arguments from contract theory. In particular, this field contributes constitutive reflections regarding the interaction between management, labor (representation), and the design of work. This domain also sheds light upon why several aspects of the employment relation are incompletely specified ex ante. These ideas present a valid starting point for the ensuing discussion.

Originally, contract theory as an academic discipline emerged through accounts studying more complex exchange activities such as the allocation and sharing of risk in the presence of private information (Bolton & Dewatripont, 2005: 1–2). This discipline can be subdivided into two different streams: Complete and incomplete contracts whereas the latter is relevant for the ensuing discussion.

The roots of the incomplete contract paradigm can be traced back to the intellectual ideas formulated by Klein, Crawford, and Alchian (1978), Grossman and Hart (1986), and Hart and Moore (1990). Those accounts supply a formal base for explaining organizational properties such as firm size or the distribution of authority within organizations. One central assumption inherent in those models is that not all possible contingencies nor all (future) actions can be specified ex ante by the contractual parties due to the bounded rationality of the actors involved (see Tirole, 1999 for an in-depth discussion).

The key points from this research field are important for this dissertation as they provide fundamental premise on authority in the employment relations.[4]

Incorporating the concept of authority within the employment relationship puts the focus on the related issue of managerial prerogative. For the UK context, it is generally acknowledged that managerial prerogative is prevalent concerning various decisions within a firm (e.g. Oswald, 1993). This implies that management has the right to change work arrangements ex post without

[4] Authority plays an important role in the employment relation as per definition, the labor exchange in an incomplete employment contract setting admits an employer the right to determine within certain limits what employees should do (Harcourt, Lam, and Croucher, 2015). The term authority, coined by Simon (1951), is more in line with the idea of formal authority than real authority. See Aghion and Tirole (1997) for a differentiation.

dealing with an extensive amount of frictions (Bacon, Blyton, & Morris, 1996).
Another important feature of the open-ended employment relationship is its incomplete nature. This fact highlights the importance for ex post bargaining between e.g. employer and unions or employer and employees, as contractual terms such as the content of jobs (e.g. Townley, 1993) are subject to ex post modification (Blaug, 1993). Multiple accounts applying this perspective acknowledge that the design of work is set unilaterally by management (e.g. Marsden, 2000; Brown & Rea, 1995). In both theoretical (e.g. Holmstrom & Milgrom, 1991) and practical contributions (e.g. Rönnmar, 2004), it is suggested that UK management possess the prerogative to modify and assign the design of work to match its own organizational needs. As suggested by Brown and Rea (1995), the bounded rationality of the actors involved makes it feasible not to specify ex ante the tasks to be performed in an open-ended employment relationship. Similarly, Marsden (2000: 323) notes that it is impossible to frame exhaustive job descriptions either due to the involved costs in setting up such a contract or due to the scope of then required job-level bargaining.

To sum up, these insights from contract theory provide two crucial points being relevant for this thesis. First, the described authority inherent in the employment relationship acknowledges that management retains some form of managerial prerogative to set specific work arrangements ex post that correspond to organizational needs. Secondly, accounts from this research stream emphasize that the design of work is subject to change as it is not possible to frame exhaustive job descriptions ex ante. In consequence, this logic implies that the design of work is contingent on specific determinants that e.g. alter the way output is produced.

Before proceeding with a review of literature concerning work design determinants, the ensuing sub-section sketches the derivation of two ideal types of jobs.

2.1 Tayloristic and holistic jobs

To derive two types of jobs, this thesis draws upon the idea of utilizing typologies. Typologies are *conceptually* developed compilations of certain distinct characteristics commonly occurring together (Meyer, Tsui, & Hinings, 1993: 1175). In particular, typologies are conceptually

derived interrelated sets[5] of ideal types that are a unique combination of attributes believed to determine the relevant outcome (Doty & Glick, 1994: 232). According to McKinney (1969: 1), the application of typologies in social research has the overarching aim to "*identify, simplify, and to order data"*.

There is some doubt over the extent to which typologies can function as theoretical models (see e.g. Meyer et al., 1993). Hence, this thesis follows Weber (1949) and treats ideal types as logical constructs to compare empirical reality with economic theory. According to this logic, ideal types are not hypotheses per se but rather offer guidance to the formulation of hypotheses. Hence, as outlined by McKinney (1969: 3), conceptualizing ideal types is a suitable tool for making real world phenomenon intelligible and explicable by reducing real world complexity. The utilization of ideal types in forming typologies has at least two important implications. First, ideal types represent forms or an outcome of certain attributes whose pure form must not necessarily exist. Secondly, ideal types are a complex form that encompasses multiple different attributes leading to a specific outcome. The overarching aim of the utilization of ideal types is therefore to facilitate the formulation of hypotheses, but one ideal type is not a hypothesis (Weber, 1949: 90).

To derive the two ideal types of jobs, this dissertation draws from Lindbeck and Snower's (2000) seminal work that characterizes two ideal types of work organizations: tayloristic and holistic organizations. According to the authors, a tayloristic organization is defined by specialization through tasks emphasizing strict occupational barriers or a hierarchical setting. On the contrary, a holistic organization is specified by decentralization of responsibility within a firm, an increased role for team work, job rotation, or the blurring of occupational barriers (Lindbeck & Snower, 2000: 354f).

The concepts of a tayloristic/holistic organization are utilized to derive ideal types of jobs. Building on Lindbeck and Snower (2000) and related contributions by work design researchers (e.g. Appelbaum et al., 2000), it is assumed that a more holistic job is one that is more versatile, as decentralization of decision-making permits employees to expand their role in organizations. Likewise, in accordance with Appelbaum (2002), a holistic job is assumed to possess a higher degree of autonomy as the decentralization of decision making enhances control over decisions

[5] Typologies stand in stark contrast to taxonomies that are empirically derived constructs (Fiss, 2011: 395).

of work tasks. On the contrary, a more tayloristic job is expected to have a lower degree of autonomy as a central tenet of a tayloristic job is the adherence to formally defined roles and procedures (Hunt, 2002: 153).

In line with Lindbeck and Snower (2000), it is also assumed that a more holistic job requires the application of one's own skills. The rationale is that a holistic environment requires continuous learning on behalf of the employees. In contrast, it is assumed that there is a lower degree of skill utilization in a taylorized job. Early remarks backing this claim can be found in Braverman (1974: 113) who links classical Taylorism to "*a dissociation of the labor process from the skills of the workers".* Parker (2003) similarly hypothesizes that skill utilization is depressed in a more tayloristic job because much more emphasis is put on simplifying procedures.

Finally, it is argued that a higher level of control is a key feature of a tayloristic job. This conclusion is backed by a considerable amount of literature that links Taylorism with managerial and supervisory prerogative (see Kochan and Dyer, 1993 for an overview). Braverman (1974: 62) reasons that one feature of Taylorism is to ensure control on behalf of management through division and specialization of labor and the implementation of automated production processes. A similar train of thought regarding new forms of work is described by Barker (1993). Some scholars describe it colorfully by pointing out that "*the shadow of scientific management continues to fall over contemporary work organization"* (Smith & Thompson, 1998: 555).
On the contrary, following the line of thought offered by Lindbeck and Snower (2000: 355), it is supposed that supervision and management control indeed continue to be important elements. Nevertheless, supervision should be less detailed, less tied to specific activities, and more closely associated with post facto performance in a more holistic environment, leading to a lower level of perceived supervision.

Building on the dichotomy provided by Lindbeck and Snower (2000), one novelty in this thesis is the linkage of specific task domains to the ideal types of a job. Insights supplied by Lindbeck and Snower (2000), Appelbaum (2002), or Lawrence (2010) give an idea on the relevance of certain tasks in a tayloristic job. More specifically, Lawrence (2010) describes – based on his own experience gained in an automobile plant in the 1940s – that the traditional tayloristic jobs

he experienced are structured in a way that there is lower need to communicate and to direct others.

In addition, the reduced need for problem-solving activities is also commonly acknowledged. Becker and Gerhart's (1996) summary indicates that the implementation of so-called problem-solving groups or quality circles is typically associated with a more holistic setting. Along the same lines, Edwards and Wright (2001) propose that a holistic environment increases the relevance of tasks such as thinking about solutions to problems or working out the cause of problems or faults. These claims concur with Appelbaum's (2002) elaboration.

Finally, Giordano (1992: 79) attributes centralized planning as being one key principle required for division of labor. Similarily, Ross (2010) summarizes that the need to exert planning tasks is reduced in a more taylorist setting, as workers are obliged to do exactly what they are told. Opposed to this, Appelbaum (2002) emphasizes the relevance of planning activities in a more holistic setting.

To recapitulate, Table 1 summarizes the arguments from the preceding delineation of the two ideal types of jobs with their corresponding attributes.

Table 1: Distinction between tayloristic and holistic job and corresponding attributes

	Tayloristic job	**Holistic job**
Task domains	*less* problem-solving *less* directive communication *less* planning	*more* problem-solving *more* directive communication *more* planning
Work characteristics	*lower* degree of variety *lower* degree of autonomy *lower* degree of skill utilization *lower* degree of absence of control	*higher* degree of variety *higher* degree of autonomy *higher* degree of skill utilization *higher* degree of absence of control

Note: Own compilation.

Taken together, whereas a tayloristic job is assumed to score lower on work characteristics such as autonomy, variety, skill utilization or absence of control, a holistic job scores higher on the respective attributes. Correspondingly, specific tasks within a job (problem-solving, directive, and planning) are supposed to be more relevant in a holistic job and less relevant in a tayloristic

job.

This selection of various attributes characterizing a tayloristic/holisitic job concurs with other sources as well (see, for instance, Eurofound, 2009; Lorenz and Valeyre, 2005).

Bargaining power in a tayloristic and holistic job

Pivotal for the ensuing hypotheses development is a reflection on the association between the two ideal types of jobs and corresponding bargaining power of labor and management.

For this work, scholarly accounts analyzing intraorganizational bargaining power distribution (e.g. Hickson, Hinings, Lee, Schneck, & Pennings, 1971 or Hinings, Hickson, Pennings, & Schneck, 1974) proffer first valuable arguments into this matter.

Originally, this field of research identifies three organizational features having an impact on the power of subunits within a firm: the degree of coping with uncertainty, substitutability, and centrality of the unit (Hickson et al., 1971: 219). Building on this body of work, more recent accounts focusing on the resource-based advantage of internal stakeholders analyze the bargaining power within an organization. Coff (1999), for instance, links the resource-based-view with the bargaining power literature to assess which party will appropriate economic rents once generated. Along parallel lines, Coff (1999) identifies four determinants shaping the bargaining power of distinct stakeholders: the capability of unified action, access to information, replacement costs to the firm if a stakeholder exits, and control of exiting to the stakeholder itself.

In this tradition, Steigenberger (2013) goes one step further and links bargaining power to the design of work. Specifically, he presents in-depth reasoning over the association between the shift towards more involvement-based organizations and changes in the relative bargaining power of distinct stakeholders. His analysis offers valuable arguments. Following his logic, a holistic job increases the knowledge and abilities of employees by giving them access to necessary information, which, again, can be used in the bargaining process. Additionally, a more holistic job is considered to go hand in hand with an increase in specific investments in the skills and capabilities of employees that are costly for employers (Steigenberger, 2013: 1169). This argument, though, can be reversed, indicating that the exit costs for employees increase when higher specific skills are accumulated. The rationale is that firm specific knowledge and capabilities are not equally remunerated in other establishments. However, as training is only partially firm-specific (see e.g. Lazear, 2009), this offsetting effect on

bargaining power is assumed to be smaller compared to that associated with the higher costs to replace well-trained employees (Steigenberger, 2013).

Building on the work by Steigenberger (2013), it is derived that a holistic job favors the empowerment of employees at the expense of other stakeholders. This implies that a more holistic job is assumed to be positively associated with employees' bargaining power over economic rents.[6]

Empirical evidence supports this reasoning. Guy (2003) reveals that the implementation of high-involvement work practices is positively associated with the bargaining outcome for the part of employees. Likewise, Rochas' (2009) findings retrieved from a longitudinal case study of a Brazilian company suggest that power imbalances between management and employees have been diminished as a result of a more holistic organization of work. Similarly, results of the meta-analysis conducted by Steigenberger (2013) indicate that a more holistic environment shifts the balancing power towards employees. More specifically, the author found that a more holistic environment is strongly associated with employee share of rents at the expense of other stakeholders such as management.

After delineating the two ideal types of jobs and providing evidence on the relationship with bargaining power, the ensuing sections review the literature on the work design determinants considered in this thesis.

2.2 Technology and work design

This chapter reviews the relevant literature that provides insights into the relationship between ICT diffusion and the design of work. In principle, technological progress and its effect on the design of work has been a core concern in the field of economics. Two circumstances spurred theoretical accounts on this matter during the 1960s and 1970s: the availability of suitable micro-level data, and the evolution of higher wage premiums in the US for better qualified graduates compared to lower qualified ones (Acemoglu & Autor, 2012).

Historically, the discussion on this matter had, however, not been unidirectional, and a vivid

[6] This relationship, however, is far from being well-established theoretically (Ramirez, Guy, & Beale, 2007).

debate took place over the source of the rising skill demand in the 1960s and afterwards. From the perspective of trade theory, one valid argument was that the expansion of international trade increases the demand for better qualified employees (e.g. Baldwin, 1971 or Bernard & Jensen, 1997).

However, both theoretical (e.g. Krugman, 2000) and empirical accounts (e.g. Machin & van Reenen, 1998) provide convincing evidence why international trade cannot be considered as the main determinant leading to plummeted demand for lower skilled workers. Such arguments have not only persuaded labor economists but also scholars from other disciplines that the parallel running diffusion of new technologies remains the culprit for explaining higher demand for better qualified personnel (see Berman, Bound, & Machin, 1998).

The leading explanation for this nexus is the concept of skill-biased technological change (SBTC) (Tinbergen, 1974) that draws upon the idea of capital-skill complementarity introduced by Griliches (1969). The traditional SBTC hypothesis predicts that the implementation of new technologies increases the marginal product of skilled labor[7] due to their comparative advantage when the production environment becomes more complex (Bartel & Lichtenberg, 1987; Johnson, 1997).

The validity of the SBTC framework has widely been tested, and its main implications are generally supported. Englehardt (2009), for example, found that an increase in software investment increased the skill-premium of better qualified personnel in the US during the 1990s. In a study using information for 18 EU countries, Afonso, Albuquerque, and Almeida (2013) show that a 1% increase in the annual share of R&D expenditure on GDP between 1997 and 2009 is associated with a 11.09 percentage point increase in the wage ratio of college graduates compared to secondary graduates. Analogously, Berman et al. (1998) add tentative cross-country evidence that technology usage increases the skill premium in developing countries. Correspondingly, Michaels, Natraj, and van Reenen (2014) reveal in a cross-country analysis using data spanning a 25-year-period, that those industries experiencing the fastest growth in

[7] As reminded by Goldin and Katz (1998: 694), the technology-skill complementarity has not always been present. The authors refer to the technological developments at the beginning of the nineteenth century that allowed physical capital – and also unskilled labor – to be substitutes for highly skilled artisans. So new capital available at that time was by no means a relative complement to skills. In more detail, the authors argue that complementarities between capital and skills existed since the beginning of the twentieth century. Similarly, Acemoglu (1998) emphasizes that technology is not by nature complementary to skills but by design and that contemporary technologies appear to be complementary to skills.

ICT-capital had the fastest growth in demand for higher skilled employees.

Although the theoretical implications of the SBTC approach and its explanatory power has been empirically confirmed, critical voices exist that point to specific trends being irreconcilable with this approach. Acemoglu and Autor (2012), for example, refer to the evolution of wage inequality between skill groups that cannot be explained by skill-biased technological change. In particular, the authors show that it has increased substantially less than predicted for the 1990s onwards to the late 2000s. They further demonstrate that a non-monotone development of real wages among lower- and middle-skilled workers occurred from the 1960s onwards to 2008. Analogously, Autor, Katz, and Kearney (2006) revealed a polarized wage growth since 1988. Being more precise, the wages in the US grew in the bottom and upper quartile in comparison to the wages in the middle of the wage distribution, culminating in relative losses for employees in middle-skilled occupations. Moreover, the empirical data discloses job polarization patterns (e.g. Goos, Manning, & Salomons, 2009; Autor & Dorn, 2013; Autor et al., 2006), indicating a simultaneous rise in the demand for lower and higher skilled occupations, and decreasing demand for middle-skilled employees.[8]

In general, the SBTC approach cannot explain these developments. It fails to specify the effects of technology diffusion on lower-skilled employees nor does it offer firm explanations for how jobs change through the application of new technologies (Autor, 2013). Beyond that, Acemoglu and Autor (2012: 444f) argue that many of the shortcomings of the SBTC framework might be mitigated when relaxing the assumed equivalence between the skill-level of an employee and tasks performed on the job. In fact, they advocate to interpret skills as being a stock of capabilities for performing various tasks. This distinction becomes then relevant when technological progress makes specific tasks obsolete (Acemoglu & Autor, 2012). [9]

Essentially, the observed polarization patterns call for a more nuanced approach of the SBTC approach that focusses on the link between ICT and the design of work.

Scholars, such as Dean and Snell (1991) or Bresnahan, Brynjolfsson, and Hitt (2002), claim that research is required that evaluates more sophisticatedly how technology diffusion influences work characteristics. Such a more subtle analysis of corresponding changes in work characteristics would complement the SBTC approach by outlining in more depth why

[8] See Card and DiNardo (2002) for further developments being irreconcilable with the SBTC framework.

[9] History shows that there are many examples when certain skills became redundant. One example is the manufacturing production by artisans which was shifted into factories between 1830 and 1880 as a result of the usage of new machinery (Goldin and Katz, 1998: 695).

technology is skill biased (Fernandez, 2001).
In a similar vein, an assessment on the changes in job content due to technology diffusion is required. The task framework first developed by Autor et al. (2003) provides a firm theoretical framework on this matter. This approach dissociates itself from the SBTC framework by focusing on the changing job content due to ICT diffusion. Arguing along parallel lines, Acemoglu and Autor (2012: 426) reason that the task framework refines the mechanism behind the skill-biasedness of technological change.

In the next two sub-sections, the literature that elaborates the nexus between technology and job characteristics / content and its underlying mechanism will be reviewed separately.

2.2.1 Technology and work characteristics

Elaborations on the interrelatedness of technology and work characteristics have a long tradition, and can be found in e.g. the sociotechnical systems theory (Trist & Bamforth, 1951) or classical research on scientific management (Taylor, 1911).
Despite the impressive body of research originating from such work, a theoretical assessment of the impact of technology diffusion on work characteristics is not straightforward. One problem is to define technological change (see, for example, Dosi, 1982), another is the changing nature of technological progress (Goldin & Katz, 1998). Additionally, theoretical accounts evaluating the relationship between technology and work characteristics are not uniform in the sense that they share a common belief on the impact of technology on work characteristics. Being influenced by their own research background, such discourses culminate in competing views that emphasize either the skill-biasedness of technological change or deskilling (e.g. Wood, 1987; Berman et al., 1998).

To address those issues, this dissertation focusses, as stated in the introductory chapter, on the impact of ICT on work characteristics. For one, focusing on ICT to approximate technological progress is compelling because it represent most of modern technical progress in the services sector, and are a key driver of new forms of employment and work arrangements (Bresnahan & Yin, 2017: 95). To back up this claim, recent data underlines the importance of ICT within occupations and industries across Europe (see Eurofound, 2017: 84ff. for a comprehensive

summary). Secondly, ICT is considered to complement skilled labor (Acemoglu, 2002). Therefore, analyzing ICT and its effect on the design of work aligns with the SBTC-view utilized in this thesis.

Applying a SBTC-view, a common approach in extant literature to establish theoretically the nexus between ICT and work characteristic is the application of the complementarity framework developed by Milgrom and Roberts (1990; 1995). Although originally developed to link changes in production technologies with new forms of organization, this framework provides useful indication for how ICT diffusion changes work characteristics (e.g. Bresnahan et al., 2002; Bayo-Moriones et al., 2017).

A number of accounts applying this complementarity perspective add insights into the relationship between ICT and work characteristics. Hoogervorst, Koopman, and van der Flier (2002), for instance, reason that ICT deployment necessitates the integration of organizational units, leading to a blurring of traditional job boundaries. A similar claim is made by Lindbeck and Snower (2000), who formally derive that the spread of ICT encourages the exercise of multiple tasks. Along the same lines, Venkatesh, Bala, and Sykes (2010) outline that the diffusion of ICT generally increases the breadth of jobs as employees are required to act more versatilely as occupational boundaries cannot be upheld.

Concerning job autonomy, Rubery and Grimshaw (2001) summarize that the widespread availability of codified knowledge through the diffusion of ICT helps to dismantle traditional hierarchical forms of management. Hence, decentralization of decision-making and the delayering of hierarchies is the logical consequence, leading to higher autonomy among employees (Rubery & Grimshaw, 2001: 169). A similar point is made by Dewett and Jones (2001: 316). The authors emphasize that the spread of ICT leads to information efficiencies and information synergies, resulting in expanded roles of employees within the organization. Bayo-Moriones et al. (2017) concur by emphasizing that the availability and access to information simplifies to decide how to do their job and when to exert certain tasks.

Apart from job variety and autonomy, related accounts suggest that the spread of ICT facilitates the general usage and application of own knowledge. Lopez-Nicolas and Soto-Acosta (2010), assure that ICT promotes information and knowledge exchange, and thus, the distribution and sharing of individual knowledge within an organization. A similar claim is made by Lin (2007: 320), who emphasizes that ICT simplifies rapid search, access, and retrieval of information,

and incentivizes employees to collaborate (by means of collecting and sharing information) within the organization. A similar line of thought is presented by Van den Hoff and de Ridder (2004).

Finally, accounts concurring with this complementarity approach emphasize that ICT diffusion lowers the need for supervision in a job. The rationale is twofold. Lindbeck and Snower (2000) indeed admit that supervision and management control remain important elements. They suggest, however, that that supervision should be less detailed and less tied to specific activities. One reason is that more decentralized organization and a corresponding increase in autonomy of employees impinges on the possibility of monitoring employees effectively. Besides that, other accounts (e.g. Thomas and Velthouse, 1990) argue that the decentralization of decision-making leads to a highly motivated and empowered workforce. This conjecture induced Arthur (1992) to hypothesize that the requirement for supervision is further reduced.

Summing up the preceding remarks, building on the theoretical arguments offered by the complementarity perspective (Milgrom & Roberts, 1990; 1995) and by its extended version supplied by Lindbeck and Snower (2000), a rich body of literature provides valuable line of thoughts on how the diffusion and application of ICT impacts work characteristics. In particular, consent in this literature is that ICT usage promotes perceived variety, job autonomy, skill use, and reduces the need for supervision. Essentially, these arguments align with the basic premise of the SBTC approach that work characteristics are modified in a way that high-skilled workers possess a comparative advantage (O'Mahony, Robinson, and Vecchi, 2008). However, these accounts building on the complementary framework depict a more nuanced view on how job characteristics change in view of ICT diffusion.

2.2.2 Technology and job content

Apart from changes in work characteristics, a more nuanced perspective of the SBTC approach requires an analysis of the relationship between computer usage and job content. The first theoretical framework that sheds light upon this nexus was developed by Autor et al. (2003).[10]

[10] See Acemoglu and Autor (2011) for a formal presentation of this model.

One of the central assumptions of this framework is the distinction between routine and non-routine job tasks. According to Autor et al. (2003), routine tasks are such activities in a job that both follow predefined procedures, and are programmable. On the contrary, non-routine tasks are those activities, whose execution does not follow predefined procedures and are, therefore, not programmable. Table 2 outlines the categorization according to Autor et al. (2003), and provides illustrative examples.

Table 2: Categorization of routine and non-routine tasks

	Analytic and interactive tasks	Manual tasks
Routine tasks	Bookkeeping or calculating	Picking, sorting or repetitive assembly
Non-routine tasks	Delegating work or preparation of a (medical) diagnosis	Janitorial services or driving of trucks

Source: Own compilation based on Autor et al. (2003: 1286).

One novelty of this model is that it directly links the relevance of both routine and non-routine tasks to the diffusion of ICT. In particular, the model predicts that certain routine tasks requiring few preconditions regarding cognitive and manual skills become less relevant, as machines can conduct them more efficiently. The argument for a task-replacing effect rests upon cost-saving considerations. Being more precise, the decline in prices for computer capital and the simultaneous increase in computer power (see Nordhaus, 2001 for a summary) makes it economically sensible to substitute IT capital for labor to cost-optimize production processes (Autor et al., 2003).

The task framework additionally predicts that non-routine activities cannot thoroughly be done by computers.[11] One rationale is that those activities necessitating complex cognitive requirements can hardly be substituted. However, the model goes one step further and predicts that the substitution of labor for IT capital is complementary to the relevance of such non-routine tasks as their execution is supported by ICT (Autor et al., 2003: 1285).

[11] Recent contributions (e.g. Frey and Osborne, 2017; Brynjolfsson and McAfee, 2014) argue that such tasks can nowadays partially be done by ICT. Specific developments such as the enormous progresses in autonomous driving blur the boundary between routine and non-routine tasks. Therefore, this routine/non-routine task construct might rather be interpreted as a flexible than a rigid classification.

In summary, the task framework predicts that in industries, whose production processes strongly depend on the execution of routine tasks, an increased utilization of IT capital is economically sensible. An additional implication is that the demand for employees (in either high-, middle- or low-paid occupations) capable of performing non-routine activities will increase. As such tasks can be found in both high-pay and low-pay occupations, the task approach can explain the documented increase in demand for employees in such occupations as well as the polarized wage growth (Autor, 2013).

Shortcomings and extensions of the task approach

Although the task literature emanating from the formulated model is a rather new field of research, critical voices have raised several issues typically inherent in task-based analyses.
The first major criticism centers on the used data and data collection method to gain insight into the relevance of conducted tasks in different occupations. In particular, using non-survey information such as the DOT data does not capture heterogeneity in job tasks among individuals within the same occupation (Autor et al., 2003: 1292–1293). Other methodological points of criticism typically encountered in task-based analyses are related to imprecise definitions of the measured tasks or emphasize that important job tasks has not been collected constantly throughout different years (Autor, 2013).
Another shortcoming regularly highlighted is concerned with the classification of certain tasks into a specific category. Autor et al. (2003: 1306) state that the classification of certain tasks into a predefined typology generates some noise. In more detail, assigning tasks into the proposed typology of routine- and non-routine tasks is based on subjective perception rather than on replicable rules. Autor (2013) elaborates this point in more depth and stresses that applying a rough taxonomy of the two distinct task groups suffers from the existence of certain overlaps. Therefore, the distinction between routine and non-routine tasks must be interpreted in a more dynamic way rather than presuming fixed demarcations. This circumstance is crucial as a correct measurement is "*the sine qua non of any scientific endeavor"* (Freeman, 2000: 12).
Another major criticism centers on the models mechanism. Specifically, the framework outlines a rather deterministic mechanism, which attributes ICT diffusion to be the unicausal source of changes in job content. As a result, most accounts address changes in job content through a technology lens and do not incorporate other aspects such as organizational design or managerial decision (Parker et al., 2017b: 291). Therefore, the framework provides a strong

foundation for the general effect of technology, though, it remains silent on other organizational or contextual factors being relevant (e.g. Green, 2012).

The ensuing analysis draws upon the task framework but distinguishes itself from it. For one, it departs from the classical non-routine/routine typology as proposed. In more detail, specific task domains are derived by applying exploratory factor analysis. This decision helps to group single tasks into general categories of generic tasks that go together in practice. Secondly, the ensuing elaboration outlines a broader theoretical framework, incorporating more factors influencing the relevance of tasks within a job.

2.3 Involvement practices and work design

This section reviews the literature that links specific HR practices with the design of work. Basically, a growing body of academic accounts in several research domains such as labor economics, industrial relations or strategic HRM contribute to the debate on the impact of high-performance work practices (HPWP) on firms and workers alike (Boxall & Macky, 2009: 3). In MacDuffie's (1995: 197ff) terms, such HR practices usually encompass bundles of interrelated and internally consistent measures and complementary employment policies. However, due to the difficulty of defining HPWS in view of the "*complex reality of the implementation and operation"* (Ramsay, Scholarios, & Harley, 2000: 521), this dissertation follows the suggestion made by Lepak, Liao, Chung, and Harden (2006) describing innovative HR practices in meaningful terms by focusing on their most dominant theme.

Therefore, this thesis draws upon the school of thought concerned with involvement practices originating from Lawlers' III (1986) work. The rationale is that involvement practices, such as the implementation of quality circles, team meetings, self-managing teams, and admitting autonomy are the principal theme that underpin observed changes in the way work is organized (Boxall & Macky, 2009: 7-9).[12] In accordance with Wood, van Veldhoven, Croon, & Menezes (2012) and Griffin, Patterson, and West (2001), this dissertation treats such involvement practices as organization-level practices aiming at reversing centralized decision-making or strict occupational barriers by encouraging pro-activity, flexibility, and direct involvement via

[12] Hence, other complementary HR practices that not directly are targeted to modify jobs (e.g extensive training, comprehensive recruitment or competitive compensation) are not regarded in this thesis. See Jiang, Lepak, Hu, and Baer (2012) for a comprehensive summary.

idea-capturing schemes.

Originating in the 1990s, much empirical research has been devoted to assessing the performance effect of such involvement practices. For example, the landmark study by MacDuffie (1995) demonstrates that their introduction in the automotive industry substantially decreases the hours of actual working effort to build a vehicle. For the UK, Guest, Michie, Conway, and Sheehan (2003) add evidence that these involvement practices enhance firms' productivity not only in the manufacturing industry, but also in the service sector. Similarly, Ramsay et al. (2000) detect that they are positively associated with management's perception about the firms' productivity. A more aggregate perspective is provided by Combs, Liu, Hall, and Ketchen (2006). Their meta-analysis offers a valuable baseline estimate on the positive productivity effect of such practices.

Although the empirical relationship is well researched, recent accounts call for more nuanced analyses of the processes and variables that mediate this relationship (e.g. Peccei, van de Voorde, van Veldhoven, Paauwe, Guest, & Wright, 2013). This claim concurs with Becker and Huselid's (2006) remarks on the theoretical challenge to link such work practices with plant performance. Some research, indeed, has been devoted to unfold the mechanism of why such practices promote organizational performance. Emphasis has been laid, for example, on measuring the effect of such practices on organizational commitment (e.g. Griffin, 1991), organizational citizenship behavior (e.g. Cappelli & Rogovsky, 1998), and on job satisfaction in particular (e.g. Mohr & Zoghi, 2008). However, Becker and Huselid (2010) observe that much more work needs to be done to link this body of literature with changes in the design of work. According to Piva, Santarelli, & Vivarelli, (2005), linking such research is compelling as it allows scholars to describe more sophisticatedly the skill-biasedness of organizational change (see e.g. Caroli & van Reenen, 2001 for a comprehensive summary of the skill-biased organizational change approach)

The next two sections reviews literature that offers insights into the nexus between involvement practices and work characteristics / job content.

2.3.1 Involvement practices and work characteristics

In extant literature, it is commonly suggested that the implementation of involvement practices alters and modifies work characteristics on multiple fronts. Based on the constitutive work supplied by Lawler III (1986), who provides in-depth reasoning on the impact of such practices on job autonomy or job variety, a rich body of literature has emerged that speculates on the impact of such practices on those work characteristics being in the focus of this thesis.
In particular, Boxall and Macky (2009), for example, emphasize that the new forms of work challenge traditional jobs by broadening the set of tasks employees have to conduct and by allowing them a greater degree of autonomy. Similarly, Bacon and Blyton (2001: 13) point to that such practices modify jobs in a way that the required repertoire of tasks employees need to conduct is broadened. This nexus is acknowledged even in earlier contributions (e.g. MacDuffie, 1995; Ichniowski, Shaw, & Prennushi, 1997) stressing that involvement practices entail flexible working methods, such as job rotation or flexible job assignments/ descriptions. Along parallel lines, Paré and Tremblay (2007: 329) suggest that through the blurring of occupational barriers and decentralization of decision-making, employees are allowed to hold several roles and responsibilities.

Besides an increase in variety and autonomy, scholars frequently point out that involvement practices ensure the development and application of skills. Lawler III (1986: 108), for instance, reasons that a participative management approach has a considerable impact on the knowledge utilization of employees as they are expected to learn and apply new knowledge. In a follow up-study, Lawler III (1994) comments on this nexus more precisely. He advocates that the shift towards involvement-based establishments transforms firms to competency-based rather than job-based firms. Consequentially, this entails that individuals add significant value to the product or service in self-managed work or in self-directed teams. As such, employees have to be developed and trained to be able to contribute (Lawler III, 1994: 68). In a similar fashion, Paré and Tremblay (2007) reason that the application of involvement practices is directly related to skill utilization, as organizations rely on employees to apply their skills to identify and resolve problems, to initiate new work methods, and to take responsibility for quality. Likewise, Butts, Vandenberg, DeJoy, Schaffer, and Wilson (2009) underline that employees must use their cognitive capabilities efficiently as organizations rely on employees to act under conditions of uncertainty (a claim that is akin to the remarks made by Guthrie, Spell, and

Nyamori (2002: 186)).

In terms of the absence of control, Lawler's III (1986: 110) elaboration suggests that supervision in an involvement-based organization is reduced. The rationale is that the role of e.g. team leaders is that of a facilitator and communication link rather than being a supervisor. Related research suggests that the implementation of involvement practices leads to lower supervision as such measures lead to an empowered workforce being intrinsically motivated (Arthur, 1994). Cappelli & Rogovsky (1998) further hypothesize that granting employees a broader authority and scope of decision-making is positively associated with organizational citizenship behavior, which diminishes the need for tight control.

In this research domain, Appelbaum et al. (2000) supply a landmark study. In particular, the authors' contribution adds substantive quantitative evidence for the relationship between involvement practices and specific work design outcomes. Although their main focus is on developing and testing a model concerning the relationship between involvement practices and plant performance, their analysis provides comprehensive numerical evidence for the relationship between involvement practices and the work characteristics under consideration.
Specifically, their multilevel research approach shows that the installment of measures like quality circles or suggestion schemes requires front-line employees to act autonomously as they have to make work-related decisions on a regular base (Appelbaum et al., 2000: 102). In a similar vein, the authors reveal that in the case of a reduction in the number of hierarchical levels, the range of horizontal and vertical tasks further increases, thus fostering the autonomy of the workforce (Appelbaum et al., 2000: 103).

2.3.2 Involvement practices and job content

Consent in extant literature is that the installment of such organizational-level practices brings along a multitude of changes in organizations and on the level of jobs. Employees are permitted a greater degree of discretion, hierarchical layers are reduced, and occupational barriers become blurred through increased job rotation.
However, some accounts (e.g. Felstead and Gallie, 2004) point out that many contributions end by speculating over the corresponding changes in the content of jobs. Exemplarily, MacDuffie

and Kochan (1995: 166) reason that in view of flexible production settings, more broadly applicable cognitive and interpersonal skills are required. In a similar fashion, Guthrie et al. (2002) hypothesize that those practices lead to a greater need for depth and breadth of employee skills as they have to conduct a broader set of tasks.

More theory guided arguments on the impact of these practices on job tasks is, again, supplied by Lawler III (1986) and by Appelbaum et al. (2000), who describe in-depth the impact of such practices in terms of work content.

Specifically, Lawler III (1986) indicates that the participative management approach requires employees to be actively engaged in problem-solving activities as an involvement-based organization relies on insights of their employees to obtain better work methods (Lawler III, 1986: 35). In a similar fashion, Appelbaum et al. (2000: 102) ascribe the participation in problem-solving groups to be an essential element of such practices. Furthermore, Lawler III (1986: 37) reasons that communication is an integral part of an involvement-based organization as the interdependence of different work units increases. A similar claim is made by Appelbaum et al. (2000: 102), who emphasize why communicating becomes an important part of the job not only in addressing problems, but also to communicate proposed solutions to other workers or managers.

Similarly, both accounts highlight that the relevance of vertical tasks formerly conducted by supervisors, technical or other support staff increases. The rationale is that tasks such as assigning jobs, deciding on work methods or scheduling time off are now made the responsibility of the team or of the individual employee (Appelbaum et al., 2000: 103; Lawler III, 1986: 108).

Both contributions are at the heart of more recent work making similar claims regarding the changing nature of job content due to the implementation of involvement measures. Wood and Menezes (2008), for instance, reason that in quality circles (or problem-solving groups) employees are regularly grouped together and meet in specific intervals to identify, discuss, analyze and solve work related problems. According to the authors, a common thread in those groups is that employees must spot problems or faults, analyze complex problems in depth and think of solutions to problems. Arguing along parallel lines, Felstead and Gallie (2004) suggest that giving employees the autonomy to organize their own work in teams requires them to solve problems instantly when they arise. Felstead and Ashton (2000) underscore that employees in involvement-based organizations are interrelated not only via pronounced team work but also

through their dependence on colleagues to work efficiently. As a consequence, they must communicate with each other on a regular base. A similar line of thought is provided by Felstead and Gallie (2004) who emphasize the need for enhanced peer communication and directive activities when work teams are installed.

Finally, such contributions acknowledge that the relevance of planning activities increases in an involvement-based organization. Felstead and Gallie (2004: 1297) stress that by giving employees a widespread decision authority regarding their own work tasks, employees need to plan their own activities extensively in advance. Ellis, Bell, Ployhart, Hollenbeck, and Ilgen (2005) concur by referring to the need for planning coordination in working teams. They suggest that planning activities become more relevant as individual members of teams must be able to synchronize their own activities with those of their colleagues to ensure efficient team collaboration. Analogously, Mathieu and Rapp (2009) outline the importance of early stage planning of work group activities as a prerequisite for future work group outcomes.

This short review is by no means an exhaustive summary of all contributions speculating on the nexus between involvement practices and work content. However, the reached consensus in this field is that those tasks become more relevant through the installment of involvement practices, which are considered in this thesis as being important in a holistic job.

2.4 Trade union presence and work design

This chapter summarizes key arguments from the IR and related bodies of literature, on which the ensuing argumentation concerning the link between union presence and the design of work builds upon.

Being at the core of the ensuing discussion is the contractual relationship between trade unions and employers. Although mentioned at best on a passing note, this feature of the union-management relationship is at the heart of scholars' analyses of the union effect on employment outcomes and work design in particular. Basically, similar to the contractual relationship between an employer and employee, the relationship between unions and management (or firms) is considered to be incomplete by nature (Bronars & Deere, 1993; Ulph & Ulph, 2001). Bronars and Deere (1993: 117), for instance, argue that the incompleteness is a result of future union members not being involved in current negotiations, and of the relative short time period

that is covered by the union-firm contract. This line of reasoning concurs with Lorenz (1999), who characterizes the link between both actors as being long-term by nature containing recurrent trading relations. Strongly tied to this argument, Creane and Davidson (2008) highlight the bounded rationality of the actors involved that shapes the management-union relationship.

The consequences arising from this incomplete relationship are studied by various accounts. These analyze, for instance, a firms' preference over different unionization structures (Stole & Zwiebel, 1996), the bargaining strategy of firms and unions (Ulph & Ulph, 2001) or strike incidences (Kuhn & Gu, 1999). Similarly, the incompleteness of the contractual relationship is subject in contributions hypothesizing over the effect of trade unions on work practices (e.g. Ichniowski, Kochan, Levine, Olson, & Strauss, 1996), management intention to curb union power (e.g. Verma, 2005), or union response and strategies (e.g. Shackleton, 1998).

This logic of incomplete union-management relationship underlines the ensuing elaboration that links union presence with the design of work.

2.4.1 Trade union presence, bargaining power, and work design

In this thesis, a line of thought is sketched that the sole presence of UK trade unions exerts an independent influence on the design of jobs. However, due to the fact that trade union strength and influence has declined since the 1980s, linking union presence to the design of work requires a more comprehensive approach. In particular, arguments are required emphasizing that the design of work depends on the state of industrial relations. Moreover, a train of though is required that UK unions remain an important actor in the British industrial relations. Besides that, a firm line of reasoning is needed that work design decisions are not necessarily the product of rational choices but depend on the interplay between management and other actors. Finally, to hypothesize on the effect of UK unions on the design of work, rationales are required offering an in-depth look into management reaction once unions are present at workplaces.

To address these issues, this thesis builds upon insights from contributions belonging to the British IR literature, accounts applying an institutional approaches, and literature combining strategic choice (with the main focus being laid on human resource management) and industrial relations. The main points made in the diverse fields are briefly reviewed in this section.

Overall, they provide grounds to assume that bargaining power and rent sharing considerations are important elements in the discussion on changes in work characteristics and job content.

Institutional context, the design of work, and relevance of UK trade unions

Substantive reasoning is supplied by accounts applying an institutional perspective that the design of work depends on the state of industrial relations. Fundamentally, this research stream acknowledges that decisions made by firms are conditioned by the general institutional environment in which they are embedded (see Meyer and Rowan, 1977). Hence, variations in the design of work are the outcome of "*distinct configurations"* (Jackson & Deeg, 2006: 6) of different institutions affecting management decisions (see Doellgast et al., 2009 for an in-depth discussion).

Substantial arguments on the nexus between work design and the institutional context in particular are presented by scholars building upon the Variety of Capitalism (VoC) approach introduced by Hall and Soskice (2001). Basically, the VoC-literature differentiates between two modes of coordination shaping the relationship between firms and other actors: coordinated market economies (CME) such as Germany, and liberal market economies (LME) such as the UK (Hall & Soskice, 2001). In the latter mode, firms rely heavily on markets to coordinate their endeavors (Hall & Soskice, 2001: 22). In particular, establishments in LME's build on markets to organize relations with the labor force, as there is no obligation to establish representative labor bodies such as work councils (Hall & Soskice, 2001: 27ff). Besides that, LME's are characterized by a highly fluid labor market that fosters the accumulation of general skills (Holman et al., 2009).

Scholars in this domain posit that UK management is less willing to coordinate training measures, and prefer developing their own training scheme. This leads to a less systematic training as compared to countries like Germany (Holman et al., 2009: 514). As concluded by Batt (2001), one outcome therefrom is a lower average skill level of employees. Going one step further, Holman et al. (2009) reason that the lack of national training standards in LME's favors a lower skilled workforce which, in turn, leads to less complex jobs with lower level of task discretion.

Emanating from these reflections, several quantitative cross-country studies have been

conducted to measure differences in work design or job quality. For instance, Holman et al. (2009) revealed that in countries with a coordinated market setting, employees report a higher level of autonomy and lower performance monitoring as compared to employees in the UK. Aycan, Kanungo, Mendonca, Yu, Deller, Stahl, and Kurshid (2000) demonstrate that the US country score in terms of autonomy and task variety is lower among employees of public and private sector business organizations as compared to Germany. On the contrary, the scores regarding supervision in a job are found to be higher in the US. Similarly, Lincoln and Kalleberg (1985) report differences in work design in terms of variety or autonomy in manufacturing plants in the US and Japan. More recently, using the European Working Condition Survey 2005, Holman (2013) unveil that employees in the UK report lower levels of autonomy and job complexity as compared to CME-countries.

Applying such an institutional lens, several explanations have been forwarded to explain work design differences across countries. Hamann and Kelly (2008: 135) point out that firms in LME's operate with lower skill levels compared to CME's as the institutional setting in the latter incentivizes employers to invest in the skills of their employees. According to the authors, this favors a more tayloristic production regime with lower levels of job autonomy or variety (Hamann and Kelly, 2008: 136). In addition to that, scholars assess that training of employees in LME's is less systematic and widespread, leading to a lower skill level among employees (Holman et al., 2009: 514). Another point being made by scholars from this domain emphasizes the prevalence of trust between management and labor as a prerequisite for granting employees autonomy (Gustavsen, 2007) as a further reason for lower levels of autonomy in LME's.

The latter point is crucial for this thesis, as it tentatively suggest the importance of trust between relevant actors in the employment relation, such as management and unions, as being one source for determining variations in the work design across countries. Being more precise, scholars from this field, such as Hall and Gingerich (2009: 452), conclude that UK firms in contrast to firms in CME's coordinate with trade unions primarily through competitive markets characterized by arms-length relations and formal contracting. This implies that "*management's room for manoeuvre*" depends on trade union strength and how management interacts with trade unions (representatives) (Hall & Thelen, 2009: 21). Consequentially, trust among the actors involved and the state of IR is assumed to be a crucial determinant for explaining specific employment outcomes (Jackson & Deeg, 2006).

In sum, the VoC literature emphasizes that cross-country differences in the design of work may stem from varying trust between the relevant actors. However, one crucial assumption is that the relevant actors possess some bargaining power (Hall & Thelen, 2009). Against the backdrop of decline in membership and influence of UK unions, one might question the relevance of UK trade unions. However, as outlined earlier in Chapter 1.2, trade unions in the UK remain a key party in the employment relation. This claim is supported by accounts that emphasize that management intention to curb union power remains prevalent in the UK (e.g. Cullinane & Dundon, 2014), and that *perceived* union influence in the workplace was resilient during the 1990s (Bryson and Green, 2015: 139–140).

Combining the main points of the VoC literature and of the British IR literature concerning the relevance of trade unions, it is assumed that the low trust relationship and the corresponding state of IR is one source explaining variations in the design of work.

However, what has not been unveiled so far is the link between union presence and work design decisions from a theoretical point of view. In this regard, a summary of literature combining line of thoughts from strategic choice and industrial relations with the focus on human resource management offers valuable additional insights.

Trade unions, strategic choice, and work design

Until the 1980s, the industrial relations system approach first introduced by Dunlop (1958) had been the dominant paradigm used to explain union influence on organizational and operational decision-making. Following Kaufman's (2010) in-depth description, this framework emphasizes the relevance of common but also opposed interests of the actors involved (such as management, trade unions, or government) in determining workplace rules.

This approach, however, had been challenged by the emergence of several patterns in the employment relations unaligned with the frameworks predictions, such as declining union membership rates, changes in managerial values / ideologies, or managerial initiatives to avoid unionization (Kochan et al., 1984). These unexplained patterns raised the call for a complementary model discarding the systems approach static framing, and allowing management a more proactive role in shaping the employment relation. Such a more dynamic framework of industrial relations was first introduced by Kochan et al. (1984). This work has received considerable attention since the mid-1980s (Godard, 1997), as the therein developed framework allows linking industrial relations strategies of employers with their respective

business strategy (Streeck, 1987: 284).

Basically, one of the main underlying assumptions of this model is that the choices made by management and trade unions are affected by their interdependence. Building upon this approach, Godard (1997: 206) expounds that variations in the choices made by management or labor representatives depend both on their valuation of and on their belief in the relationship with the other actor. Likewise, the approach provides fruitful grounds that the level of power ascribed to either management or union affects the strategic choices (Tapia, Ibsen, and Kochan, 2015). Correspondingly, this framework offers theoretical guidance to link external pressures to managerial choice, and to analyze existing barriers that limit the scope of strategic choices by either management or labor representatives (Ross & Bamber, 2009). Therefore, this framework emphasizes that external forces, such as union growth, are important parameters for managerial choice (Kochan and Dyer, 1993: 581). This reasoning implies that trade unions (presence) directly influence managerial choices or, at least passively, constrain and shape management choice concerning important workplace decisions. The very same argument is forwarded by Kochan, McKersie, and Chalykoff (1986) themselves as they ascribe trade unions as being an important capacity in forging management's choice of strategy.

Insights from this body of literature motivated a complementary field of research providing a more fine-grained perspective of the strategic choice framework in IR, with the focus being laid on the design of work. In particular, Schuler (1989) was the first to integrate the frameworks of competitive strategy and human resource management (SHRM) practices to the dynamic and proactive role of management in the employment relation.

In this widespread field, literature from a sub-domain emphasizing the importance of power relations when new forms of work are installed, produce valuable arguments into the link between the design or work and the presence of external actors. Specifically, the resource dependence model introduced by Pfeffer and Salancik (1978) is commonly referred to when hypothesizing over power considerations in the study of HRM practices (Wright & McMahan, 1992: 311). In contrast to standard approaches in this field[13] highlighting that management is rationally-motivated in work design decisions, literature applying this framework underlines the importance of a non-strategic, non-rational dimension (Wright & McMahan, 1992: 311).

Although originally developed to explain the existence of interorganizational arrangements

[13] Wright and McMahan (1992) outline a comprehensive overview of the different approaches applied regularly.

(e.g. Yin & Shanley, 2008; Barringer & Harrison, 2000), this approach is useful to link power considerations to the design of work (Wright and McMahan, 1992: 311). In particular, several empirical accounts draw upon this framework to assess more thoroughly how the scarcity of resources and the corresponding power of entities influences the design of work. For instance, Lu and Bjorkman (1997) applied this approach to explain the evolution of HRM practices in Sino-Western joint ventures. The authors reveal the significance of the MNC's relative power in determining HR practices as joint ventures were unlikely to integrate local practices. From another perspective, Sherer and Lee (2002) built upon this framework to explain why law firms depart from established ways of managing the workforce to more innovative practices.
Although critical voices suggest that the resource dependence theory is a rather powerful general metaphor instead of being a basis for empirical research (e.g. Casciaro & Piskorski, 2005), this thesis concurs with its main statement. Specifically, the resource dependence model highlights that work design is not necessarily *mechanistic* (i.e. rational), but that political and power aspects are pivotal elements affecting management decisions in terms of work design (Wright & McMahan, 1992).

Generally, as subsumed by Katz, Batt, and Keefe (2003: 574), applying a resource-dependence logic implies that management pursues strategies in terms of political action that aim at enhancing its own bargaining power. That means, resource dependence theory stresses that internal organizational decision-making is shaped by political motives to preserve one's own bargaining power when external actors are present (Aldrich and Pfeffer, 1976).
This notion is supported by empirical accounts such as Pfeffer and Cohen (1984), who offer evidence that trade union recognition is associated with a fractionating of the workforce that limits the ability to unionize (Pfeffer & Cohen, 1984: 569). Along parallel lines, Harney and Dundon (2006) provide case study evidence that trade union presence shapes the implementation of HR practices. More specifically, the authors found that jobs in Ireland have been designed in a way to reassert managerial prerogative and to diminish the power of unions.

To sum up, the main point in this sub-domain of SHRM research is that the design of work is not necessarily rationally motivated but that power aspects are important determinant as well as organizations seek to reduce they vulnerability to other competing actors. Building on this line of reasoning, the following sub-section reviews the relevant IR literature that offers insights into the direction of the impact of union presence on the design of work.

Trade union presence and tayloristic job design

Management intention to limit union bargaining power has been profoundly addressed in the UK industrial relations literature (e.g. Brown and Wadhwani, 1990). Rationales for this management approach include a low-trust union-management relationship, widespread decentralization of collective bargaining system, or the increased need for enhanced bargaining power as wages and other key conditions are *not* taken out of competition.

Theoretical justification for curbing union power builds upon the incompleteness of the union-management relationship as discussed earlier. Tirole (1999) states that in a setting, where quasi-rents are open for renegotiation and might be appropriated by the other party, underinvestment is generally pervasive. Building on this logic, formal models of underinvestment were developed in the 1980s (e.g. Baldwin, 1983; Grout, 1984) in the field of British IR that ascribe unions as being an institution that captures economic rents in case contracts are non-binding. Due to the absence of legally binding contracts, the models supply formal evidence that trade unions are likely to renegotiate wages once the firm has made a specific investment. Firms knowing ex ante of the existence of such non-binding contracts anticipate trade unions' behavior. In its final consequence, the model developed by Grout (1984) provides rationales that an increase in bargaining power of unions leads to a more pronounced appropriation of quasi-rents. This, in turn, attenuates firms' incentives to invest. In a similar vein, Baldwin (1983) adds formal evidence that investments will not be made if the profit stream of capital is vulnerable to being appropriated via higher wage demands. In this view, Machin and Wadhwani (1991) emphasize that higher levels of investment are likely to raise wage demands by trade unions. Bryson et al. (2011: 174) concur by emphasizing that rent sharing with trade unions appears most likely where firms have surplus rents and unions possess bargaining power.

Such underinvestment models have been primarily used to explain the monopoly face of unions emphasizing the inhibiting effect of trade unions in terms of productivity.[14] Empirical evidence for the UK backs the model's claims. Machin and Stewart (1996) reveal a negative association between union recognition and firms financial performance. Denny and Nickell (1991; 1992) show that firms that recognize unions invest less than firms without unions. Metcalf (2002)

[14] See Lommerud, Meland, and Straume (2009) for an alternate application of the models logic. More specifically, the authors reason that firms deter from offshoring activities in case unions are present due to the fear that the additionally generated rents gets appropriated in collective bargaining.

summarizes the UK evidence and found an overall negative effect of trade union presence on investment. More recent meta-analysis reveals little disagreement as the available evidence indicates that trade unions are associated with depressed levels of innovation in UK establishments (Doucouliagos & Laroche, 2013).

The logic of the model's underlying mechanism is compelling as it sheds light upon the influence of bargaining power on employment outcomes. The bottom line of these models suggest that employers in the UK are willing to alter the design of work in a way that limits their exposure to union activity. This claim concurs with Addison (2014: 5), who emphasizes that firms naturally try to limit their exposure to rent-capturing behavior. Previously it was reasoned and elaborated in more depth that employees in a more holistic environment possess a higher degree of bargaining power. This is partly due to higher (specific) skills needed in a more holistic environment, and due to the fact that employees gain the capacity to hold the firm hostage (Osterman, 2006: 190). Tentative numerical evidence for this claim is provided by Forth and Millward (2004), who demonstrate that workers in more involvement-based organizations with strong unions capture a higher share of economic rents.

Building upon the twin ideas of power considerations in work design and rent capturing originating from the IR literature, it is assumed that work characteristics and job content are modified in a way to increase firms' bargaining power in case trade unions are present. The concluding argument is that, in order to limit the exposure to rent-capturing, jobs in unionized workplaces score lower in holistic job attributes as compared to jobs in non-unionized establishments. This statement concurs with the remarks by Ashton, Loyd, and Warhurst (2017: 313), who emphasize that despite high quality product strategies or limited labor market regulations, employers may reduce skill levels and job autonomy as they have a firm incentive to limit their exposure to rent capturing. Hence, the main proposition to be tested is therefore:

Trade union presence is associated with more tayloristic work design

2.4.2 Trade union motives and influence on other posited determinants

Outlining a framework how union presence affects the design of work requires a summary of literature with respect to on unions' influence on the other posited determinants. Hence, this sub-section summarizes extant literature shedding light upon whether UK trade unions exert an influence over the way new technologies or involvement practices are adopted.

The discourse around unions' intentions regarding technical advancements and their implementation in UK workplaces has a long tradition. As stated by Lintner, Pokorny, Woods, and Blinkhorn (1987), the debate was fueled in the late 1970s by managements' fear that unionized workforces resist the introduction of new technologies such as computer-aided design (CAD) or CNC technologies.

The unions' response towards new technologies, however, has been the opposite. More specifically, with the advent of change in production technologies, unions followed a high-route with the overall objective of becoming a partner for consultation. Exemplarily, Manwaring (1981) outlines that the TUC had a positive attitude towards change as they hope that modifications in the production process bring along several benefits for employees. In a more comprehensive work, McLoughlin (1991: 303) summarizes that the TUC encouraged trade unions to become actively involved in the design of new technologies. Furthermore, the TUC advised unions not to resist change. This union approach culminated in the formulation of so called new technology "model agreements" containing demands in terms of better training provisions, lower degrees of supervision or increases in job autonomy (Manwaring, 1981).

In practice, however, there was a wide gap between unions' demands and their realization. Daniel (1987) supplies extensive numerical evidence regarding the implementation process of new technology and the way trade unions influenced it. Based on the first two waves of the WERS, he revealed that new technologies were introduced without prior consultations or specific agreements with labor representatives in the majority of establishments. More specifically, the management survey indicates that changes in technologies were negotiated in less than one out of every ten cases in establishments recognizing trade unions (Daniel, 1987: 123). Moreover, the data unveil that internal consultation and discussion over the introduction of new technologies had taken place with individual workers rather than with unions. Similar findings are provided by Dodgson and Martin (1987: 12-13). They show that negotiations

between unions and management in the period from 1980 to 1985 still centered on traditional issues of bargaining such as pay or redundancies, and that other crucial decisions regarding technology adoption had been "*removed from the bargaining area"*.

The failure of those model agreements was by no means a pattern of opportunistic management approach due to unfavorable legislation in that time as formulated by e.g. Kelly (1990).
In fact, more recent evidence suggests that *contemporary* union influence on technology adoption in UK workplaces remains limited, and that unions continue to struggle in affecting the agenda beyond traditional bargaining items. In a series of case studies (Taylor & Bain, 2001; Bain & Taylor, 2000) focusing on call centers in the financial industry, the authors found that unions' role remained confined to classical bargaining items, leaving other workplace issues largely at managements discretion. In a similar vein, Stewart and Wass (1998) demonstrate that unions in the automotive industry had little say in terms of technology implementation and that union's response has been strongly constrained by parameters set by the company. In a survey of workplace representatives from the Manufacturing, Science and Finance trade union (MSF), one of the UK's largest trade unions at that time, Martinez Lucio and Stuart (2002) found that the unions' involvement remained most prevalent in bargaining items such as pay or working conditions. Besides that, the results suggest that *no* negotiation did occur in terms of business investment decisions including the implementation of ICT, nor that the unions had been consulted.

Analogously, the implementation of HR practices is subject of critical discussions in the field of British industrial relations where no clear consent is reached. Many debates centered on the trade unions' motive and response to changes in workplace organization, and various arguments in the IR literature from different point of views have been formulated.
Some scholars point to the incompatibility of workplace reorganization and trade unions' interest, stressing the historical role and sympathy of UK trade unions in regulating employment relations (Godard, 2004). Similarly, Gill (2009) points to the fact that such practices might be interpreted as measures for union substitution. Likewise, Kizilos and Reshef (1997) stress that UK unions might oppose such new schemes of work as they fear an erosion of union solidarity. They refer to the fragmentation of the workforce within firms – culminating in a "*radicalization of differences"*(Hyman, 2007: 203) – leading to situations where union bargaining rarely involves matters that are relevant for the whole workforce.

On the contrary, more optimistic commentators speculate that the implementation of involvement practices is compatible with the core interest of unions, and that unions function as a supportive institution facilitating their implementation. Roche and Geary (2002) hypothesize that unions' supportive role is attributable to the fact that employees have become increasingly disenchanted with adversarial industrial relations. Others (e.g. Kochan, 1995) emphasize that unions need to support such practices as workers become increasingly interested in more extensive involvement or greater say in their job. This argument concurs with contributions emphasizing that trade unions have been the most visible institution attempting to improve job quality (Doellgast et al., 2009). This line of thought is at the heart of more recent contributions focusing on the nexus between UK unionism and job quality (e.g. Bryson & Green, 2015). Another argument made is that the shift towards an involvement-based organization offers trade unions the possibility to redefine their traditional role in the labor relationship. As suggested by Liu, Guthrie, Flood, and MacCurtain (2009: 111), reorganization within firms creates opportunities for union revival strategies as it facilitates a change in relationship patterns away from a more adversarial towards a more cooperative role. Hence, the implementation of innovative HR practices might be the best strategy not only for employers or employees, but also for trade unions (see Godard, 2004 for a critical assessment of this claim). This train of reasoning leads more enthusiastic accounts to conclude that their installment with union support leads to a virtuous circle of partnership and a high-trust union-management relationship (Lloyd and Payne, 2006).

Case study evidence and empirical analyses proffer in-depth insights into whether or not UK unions are actively engaged in the implementation of new forms of work, and how they respond to it. Ramirez, Guy, and Beale (2007), for instance, analyzed the response of the Communication Workers Union (CWU) at British Telecom when involvement practices had been introduced. The case indicates that the CWU ultimately dropped their opposition in return for management commitment for greater employment security, and that unions did little to support the implementation process (Ramirez et al., 2007: 510ff). In the UK steel industry, Bacon and Blyton (2000) demonstrate that more conflict has been prevalent in unionized establishments when new HR practices had been implemented. Danford, Richardson, Stewart, Tailby, and Upchurch (2004) found that recognized trade unions in the UK aerospace sector did not have a unitary response towards the implementation of HR practices. Similar findings are reported by Stevenson (2007), who revealed that in the educational sector, some teachers unions enhanced and welcomed new practices, whereas the powerful National Union of

Teachers (NUT) opposed such changes. Hall, Purcell, Terry, Hutchinson, and Parker (2015) conduct large scale case study analysis based on 25 UK companies that introduced information and consultation bodies. Their findings suggest that some bodies, such as the TUC, positively responded to such change. However, the reaction of those unions present at the workplace ranged from being cautious to hostility, and that unions had little say on these measures.
Fairbrother's (1996) extensive review of several cases in the manufacturing sector exhibits unions' scant involvement in the implementation of innovative HR practices. The author found that it was common to implement such practices without prior consultation or, in instances, the implementation even began without prior notification (Fairbrother, 1996: 16). Similar patterns are discovered in other sectors as well, albeit the width and scope of union ignorance has not been that pronounced as compared to the manufacturing sector (Fairbrother, 1996). Along parallel lines, Bacon and Blyton (2000) proffer survey evidence for the UK steel industry that involvement practices had sometimes been implemented without prior consultation. In certain instances unions were informed only after the decision had been made.

To conclude, the arguments and evidence presented in this sub-section suggest that – on average – trade unions in the UK neither shape the way technology is implemented nor influence managerial decision-making on how involvement practices are introduced. This conclusion aligns with earlier comments emphasizing that the relationship between trade unions and management is shaped by adversarialism, and by a lack of legislative support to influence managerial decisions.

This following chapter synthesizes the elaborations of this and of the preceding chapters 2.2 and 2.3, and testable hypotheses will be derived.

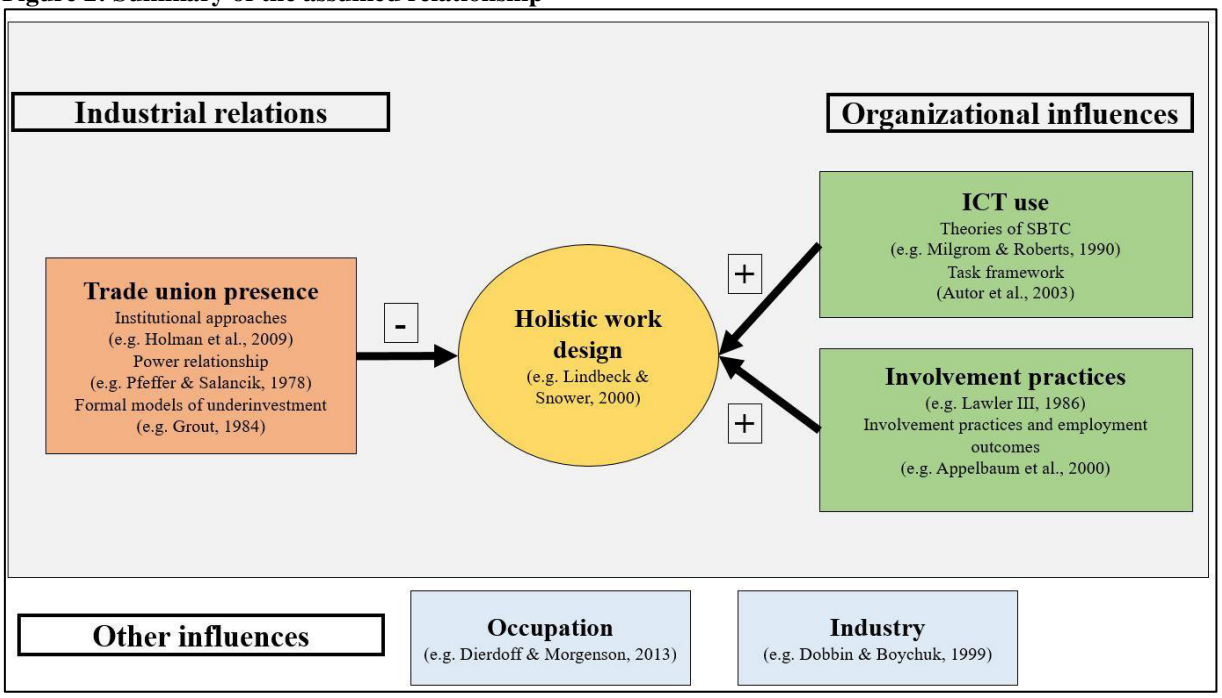
2.5 Synthesis of theory and deduction of hypotheses

> *"Theories, if accurate, fulfill the objectives of prediction (knowledge of the outcome) and understanding (knowledge of the process) regarding the relationships among the variables of interest. Thus, a good theory enables one to both predict what will happen […], and to understand why this predicted value should result"* (Wright & McMahan, 1992: 296).

Applying a multi-disciplinary perspective, the following empirical analysis tests the impact of organizational influences such as technology use and the implementation of involvement practices on the design of work. Additionally, union presence is examined to ascertain whether it is an independent and separate determinant.

Figure 2 compendiously outlines the underlying framework derived from literature.

Figure 2: Summary of the assumed relationship



Source: Own compilation

To evaluate the effect of ICT, involvement practices, and trade union presence on the design of work, two ideal types of jobs are derived: holistic and tayloristic jobs. One novel feature proposed in this thesis is that besides specific work characteristics, job tasks are also considered

to be important attributes. In particular, building on the work supplied by Lindbeck and Snower (2000), it is reasoned that a tayloristic job is one associated with a lower level of perceived variety, autonomy, skill utilization and absence of control. On the contrary, a holistic job scores higher in the respective job characteristics. Analogously, it is derived that the relevance of specific task domains such as problem-solving, directive, and planning is higher in a holistic and lower in a tayloristic job.

The relationship to be evaluated builds upon three partially strict assumptions that are, however, reasonable against the backdrop of the discussions in the presented fields of research.

For one, it is assumed that management in the UK takes an adversarial stance towards trade union representation. This assumption does not seem to be farfetched given the discourse in the IR and VoC literature assessing the nature of the management-union relationship in the UK. In particular, despite governmental efforts to amend the trade union/management relationship, the literature suggest a clear tendency that management perception of trade union presence is still marked by distrust. Although it is evidenced by literature that partnership principles are present occasionally (see Oxenbridge & Brown, 2002), it is proposed that adversarialism remains the dominant feature of union-management relationships in the UK.

Secondly, it is assumed that trade unions are equal in terms of their factual bargaining power. Again, this is a rather strict assumption given the many determinants that affect union bargaining power (Mishel, 1986; Disney, 1990). However, this assumption seems to be reasonable as nearly 90% of UK unions, once they are present at the workplace, are recognized by management as legimate parties to negotiate pay related issues (see section 3.3.2).

The final assumption is concerned with the interrelatedness between technology diffusion and the implementation of involvement practices. Scholars regularly emphasize that technology and organizational restructuring complement each other (see e.g. Milgrom & Roberts, 1995; Lindbeck & Snower, 2000; Bresnahan et al., 2002). Hence, one might reasonably state that the implementation of HR practices mediates the effect of ICT on the design of work. In the following, however, it is assumed that both determinants have an independent influence on the design of work. This assumption builds upon insights from accounts emphasizing that the decision to implement such practices is not necessarily contingent on new available technologies. Specifically, Green (2012) argues that the decision to implement involvement practices depends on technology-independent thinking, new management knowledge or the institutional environment. Analogously, Antonioli, Mazzanti, and Pini (2011) refer to

management willingness to cooperate with their employees being a crucial factor as well. A similar claim is made by Sung and Ashton (2002), who add case study evidence that the scope and spread of organizational change depends on specific firm characteristics that are independent from new technologies. Such arguments provide rationales why the shift towards a more holistic organizations varies across firms, even within narrowly defined industries (e.g. Pil and MacDuffie, 1996).

Building on this set of assumptions, the following sub-sections briefly summarize the main arguments connecting each determinant with the structure and content of work. To conclude each sub-section, two sets of testable hypotheses – one set for work characteristics and one set for job tasks – will be formulated separately. Additionally, empirical analyses are presented that underline the validity of the developed hypotheses.

2.5.1 Technology and work design

As outlined earlier, the SBTC-approach does not offer any theoretical guidance on how ICT diffusion alters work characteristics.

To address this issue, this this thesis builds upon work provided by Milgrom and Roberts (1990; 1995) and upon the related model supplied by Lindbeck and Snower (2000). The rationale includes that both approaches are the central theoretical frameworks applied to hypothesize over the impact of new technologies on work characteristics (e.g. Bayo-Moriones et al., 2017). The model developed by Milgrom and Roberts (1990) acknowledges that the organization structure of profit-maximizing firms implementing new technologies must ensure that employees are able to adjust quickly to their changing environment. Likewise, Milgrom and Roberts (1995: 195) add analytical evidence that investing in new and cheaper flexible manufacturing technologies will lead to a systematic response in terms of greater autonomy for workers and more varied jobs through the promotion of teamwork. Originally developed to explain revealed patterns in the organization of manufacturing firms, the line of thought presented in those models emphasizes that changes in the production system go hand in hand with changes in the organization structure, providing employees e.g. decision authority.

Whereas the focus of attention in the models supplied by Milgrom and Roberts (1990; 1995) is on changes in production technologies, Lindbeck and Snower (2000) developed a complementarity model that focusses on the impact of new information and communication

technologies on the nature of work. Addressing a firm's decision-making problem whether workers are to specialize or to perform multiple tasks, the authors offer a firm line of reasoning on how the introduction of computerized information and communication systems alters work characteristics. Moreover, the authors demonstrate analytically that the implementation of ICT favors a more holistic organization that includes job rotation or decentralization of decision-making (Lindbeck & Snower, 2000). Overall, the logic of both models suggests that employees expand their role in organizations and are assigned with more responsibilities in view of ICT diffusion, leading to increased autonomy and variety (van Yperen, Rietzschel, & de Jonge, 2014).

The literature review in section 2.2.1 also indicates that ICT use is positively associated with skill utilization. Morrison, Cordery, Girardi, and Payne (2005: 73) emphasize that modern manufacturing strategies places greater emphasis on skills and skill utilization. Other scholars, such as van den Hoff and de Ridder (2004), emphasize that computer-mediated-communication facilitates knowledge collection, exchange and donation which incentivizes employees to apply their own knowledge in the job.

Finally, Lindbeck and Snower (2000) further maintain that the diffusion of ICT corresponds with a lower extent to which managers monitor and evaluate employees within organizations.

To sum up, building upon the insights of accounts applying the complementarity framework developed by Milgrom and Roberts (1990; 1995), and the related model supplied by Lindbeck and Snower (2000), the first set of hypotheses is derived:

> Hypothesis 1: ***ICT use is positively associated with a) job variety; b) job autonomy; c) skill use; and d) absence of control***

Empirical accounts confirm the validity of the derived hypotheses. For one, Martin (2011) found that the usage of ICT is positively associated with perceived diversification in a job among a representative sample of individuals living in Luxembourg. Similarly, Venkatesh et al. (2010) unveil that the implementation of ICT is correlated with a higher perceived variety among employees in the finance sector.

However, findings from other accounts show that the relationship is not as clear cut as anticipated. Bayo-Moriones et al. (2017), for instance, could not support the hypothesis that ICT is – on average – positively associated with job breadth. Bayo-Moriones, Calleja-Blanco,

and Lera-López (2015) even detect an overall negative association between ICT use and task variety in their analysis of the fourth European Working Condition Survey. However, the authors unveil that the association between job variety and ICT is contingent on the respondents' occupations. Being more precise, the authors unveil two patterns. First, a negative relationship between ICT use and job variety exists for service workers and operators. Secondly, the relationship is more positive for clerks and for craft workers as compared to professionals (Bayo-Moriones et al., 2015: 1173). Such findings raise the question of the unidirectional association between ICT use and job variety.

On the contrary, the nexus between ICT and perceived autonomy is empirically well established. Cross-country evidence for Europe suggests that perceived job autonomy is higher in jobs using ICT (Eurofound, 2017). In their widely cited study, Bresnahan et al. (2002) found a positive correlation between the diffusion of ICT and management perception on worker autonomy. Along parallel lines, Rosholm, Røed, and Schøne (2013) detect a positive association between ICT and perceived autonomy using a linked employer-employee panel data set. More recently, Bayo-Moriones et al. (2015) supply further evidence for the positive relation. The findings of the latter study suggest that the positive relationship remains robust irrespective of the respondent's occupation.

Empirical evidence for the direct relationship between ICT usage and skill utilization in a job is scarce. Some evidence is provided by earlier studies that scrutinize the impact of advanced manufacturing technologies on skill utilization. Wall, Kemp, Jackson, and Clegg (1986), for instance, revealed that skill utilization is higher in jobs containing AMT applications. In a similar vein, Jackson and Martin (1996) show that skill utilization was higher when just-in-time production systems were installed. Green, Felstead, and Gallie's (2003) findings come closest to the developed hypotheses. In detail, the authors found a positive relationship among UK employees between computer use and their use of qualifications.
Finally, some empirical accounts (e.g. Rasel, 2016), proffer tentaive evidence that the diffusion of ICT at the workplace is positively associated with decentralized work systems, in which supervision and management control should be less detailed and less tied to specific activities.

As elaborated earlier, polarization patterns on labor markets raised the call for a more nuanced version of the SBTC-approach that describes the impact of ICT diffusion on the content of jobs.

The task approach introduced by Autor et al. (2003) offers such a framework. It asserts that ICT diffusion complements workers in performing e.g. non-routine analytical/interactive or non-routine manual tasks, and thus increases their relevance. On the contrary, routine programmable tasks should decrease in their relevance, as computers substitute for humans in conducting them. Building on this logic, it is assumed that those task domains become more relevant in a job that contains a higher share of non-routine activities. Hence, as problem-solving or planning tasks require intuition and are not foreseeable (Green, 2012), such tasks become more important in a job when ICTs are used. In a similar fashion, it is predicted that the relevance of directive tasks increases in a job. This leads to the derivation of the second set of hypotheses:

> Hypothesis 2: ***ICT use is positively associated with the relevance of a) problem-solving tasks, b) directive tasks, and c) planning tasks.***

The formulation of the task framework spurred empirical research (e.g. Autor et al., 2003; Spitz-Oener, 2006; Green, 2012) scrutinizing the effect of ICT on job content.

Autor et al. (2003) themselves tested the implications of their developed model. Using information supplied by the "*Dictionary of Occupational Titles (DOT)"*, their analysis reveals that industry computerization and the relevance of routine tasks are uniformly negatively associated during the 1970s, 1980s, and 1990s. Besides that, the authors discovered a positive association between industry computerization and both non-routine analytical and non-routine interactive tasks. They further detect that the absolute magnitude of the technology effect became larger with each passing decade. This finding concurs with a recent empirical analysis assessing the skill biasedness of ICT during the last decades (Michaels et al., 2014).

Spitz-Oener (2006) confirms the findings for the ICT-task nexus using a German micro-data set. She demonstrates that during the period from 1979 to 1998/1999, the conducted tasks at workplaces became more complex, and that the relevance of analytical/interactive tasks increased. On the other hand, she found that manual routine tasks became less important in view of ICT use. More specifically, she shows that an increase in ICT use increases the relevance of planning and analyzing activities or the relevance of non-routine interactive tasks such as managing personnel, coordinating or negotiating. On the contrary, she discloses that ICT is negatively associated with the relevance of routine cognitive tasks (e.g. calculating and bookkeeping) or with routine manual tasks (e.g. operating or equipping machines).

For the UK, Green (2012) confirmed the predictions of the task framework. In detail, he

presents evidence that, irrespective of whether ICT is used in a complex or moderate / simple way, it is positively associated with the relevance of non-routine cognitive activities such as problem-solving or planning.

To address the issue of reversed causality traditionally inherent in task-based analyses, Gaggl and Wright (2017) exploit a natural experiment to distill the causal effect of ICT use on job content. Against the backdrop of imposed legislation incentivizing smaller firms in the UK to promote investments in new ICT capital, the authors found that employment growth has been concentrated among managerial and professional employees that are typically engaged in non-routine, cognitive intensive tasks (Gaggl & Wright, 2017: 264).

2.5.2 Involvement practices and work design

To evaluate the impact of innovative HR practices on the design of work, this thesis focusses on involvement practices as it is one of the principal themes that underpin observed changes in HR systems (Boxall & Macky, 2009: 7).

The literature review in the preceding chapter summarizes contributions that consider the relationship between involvement practices on the structure and content of jobs. Building upon the work by Lawler III (1986) and subsequent contributions, it is reasoned that involvement practices discard traditional work system characterized by tightly defined jobs or clear lines of demarcations separating workers duties. Such practices are assumed to foster employee involvement via pronounced teamwork, participation in quality-circles and similar schemes, or direct organizational involvement. As pointed out by Wood and Menezes (2011: 1588), for instance, such involvement practices provide a greater degree of flexibility, proactivity and collaboration among employees.

To establish theoretically the link between involvement practices and work characteristics, this thesis builds upon the descriptive work by Lawler III (1986) and on the related, quantitative contribution by Appelbaum et al. (2000). Taken together, these works present in-depth reasoning about and offer numerical evidence for the relationship between involvement practices and the structure and content of work.

In particular, both contributions stress that the new form of work building upon involvement and participation changes the structure along the job dimensions variety and autonomy. They emphasize that the implementation of team work (either self-directed teams of quality circles) requires employees to become more autonomous as otherwise the benefits of teamwork may

not be accrued (Appelbaum et al., 2000: 103). Furthermore, the authors reason that reducing hierarchical levels within the organization increases the range of horizontal and vertical tasks, leading to an increase in job variety (Lawler III, 1986: 90f).
Additionally, both contributions emphasize that the implementation of self-directed teams or quality circles requires employees to develop and utilize skills (Appelbaum et al., 2000: 103; Lawler III, 1986: 38).
Similarly, this stream of research suggest that self-management and team work in involvement-based organizations reduce the need for close supervision (Lawler III, 1986: 38); an argument that finds support scholars applying an organizational psychology perspective (e.g. Thomas & Velthouse, 1990).

To conclude, it is assumed that involvement practices have implications for work characteristics that run parallel with the effect of ICT. That is, compared to organizations that adopt a more Taylorist command and control-principle, jobs in involvement-based organizations are hypothesized to score high in variety, degree of autonomy, skill utilization, and absence of control. This reasoning motivates the next set of hypotheses:

> Hypothesis 3: ***Involvement practices are positively associated with a) job variety; b) job autonomy; c) skill use; d) absence of control***

Overall, empirical accounts support the validity of the derived hypotheses. Van Mierlo, Rutte, Seinen, and Kompier (2001) demonstrate that autonomous teamwork is positively related with both perceived individual job variety and perceived job autonomy. In a study using a sample of 48 manufacturing companies in the UK comprising over 4000 employees, Griffin et al. (2001) show that teamwork is positively correlated with the degree of skill flexibility and with the extent of variety among shop floor workers. Furthermore, UK employees participating in quality circles document a higher perceived variety in their job (Delbridge & Whitfield, 2001). Along the same lines, participating in a job rotation scheme is found to be positively correlated with task variety (e.g. Campion, Cheraskin, & Stevens, 1994).
Concerning skill utilization, more recent empirical evidence support the validity of the derived hypothesis 3c. Felstead, Gallie, Green, and Zhou (2010) – using data from the 2006 Skill Survey – proffer evidence that employee involvement is associated with rising levels of skills used in a job. A similar finding is presented by Boxall, Hutchison, and Wassenaar (2015). Using survey

data from a large New Zealand organization providing distribution services, the authors unveil that an increase in discretion is positively correlated with skill utilization at shop floor level. Additional insights are given by Felstead, Gallie, Green, and Henseke (2016). The authors found in a longitudinal analysis that typical facets of employee involvement, such as individual discretion or direct participation, are positively linked to skill utilization.

Empirical evidence on the relationship between involvement practices and perceived absence of control is mixed. Wilkinson, Godfrey, and Marchington (1997), for instance, indeed supply case study evidence that in some companies in the UK, employees documented a higher degree of absence of control after involvement practices had been implemented. In fact they revealed that some employees report that they are freer to decide within their own work environment without being closely supervised (Wilkinson et al., 1997: 809). However, this relationship is not unconditionally supported (see Fenton-O'Creevy, 2001), raising the question whether this association is equally present across distinct occupations.

Similarly, the works supplied by Lawler III (1986) and Appelbaum et al. (2000) provide arguments on how the shift towards an involvement-based organization impacts the content of jobs. Specifically, the authors highlight that employees are required to be engaged in problem-solving activities as team-work requires employees to constantly find solutions to problems (Appelbaum et al., 2000: 102: Lawler III, 1986: 36). Analogously, the authors emphasize the increased need for peer communication regarding proposed solutions and for planning the activities of colleagues as additional tasks required in a more involvement-based surrounding (Appelbaum et al., 2000; Lawler III, 1986).

Building on this work and on arguments from related accounts as reviewed in the previous chapter, it is assumed that practices reversing the traditional Taylorist command- and control principle, raise the need for workers to communicate with each other as interdependency increases. Along parallel lines, it is assumed that employees get more engaged in planning activities, and in discussing, analyzing and solving work-related problems on a regular basis. In sum, this suggests the following set of hypotheses:

> Hypothesis 4: ***Involvement practices are positively associated with the relevance of a) problem-solving tasks, b) directive tasks, and c) planning tasks.***

Case study evidence supports for the validity of the hypotheses. In company studies conducted in multiple countries, Ashton and Sung (2002) demonstrate that the implementation of

involvement practices is associated with a higher degree of problem-solving as well as communication within the job. This finding aligns with more recent case study evidence (e.g. Litwin & Eaton, 2018). Specific to the UK context, Thompson, Wallace, Flecker, and Ahlstrand (1995) notice that the installment of quality-circles and teamwork increased the need for problem-solving activities among operators in the UK manufacturing sector. Correspondingly, Currie and Procter (2003) found that involvement practices implemented in the UK public sector are positively correlated with communication and planning activities.

Quantitative evidence for the UK also provides qualified support for the derived hypotheses. Felstead and Ashton (2000) disclose that the move from a "*traditional*" (tayloristic) organization to a *"modern"* (holistic) organization is positively related to the relevance of problem-solving and communication / social skills. Analogously, Felstead and Gallie (2004) analyze the impact of high-involvement work systems on the content of jobs. In their study, the authors derive an overall involvement index through summarizing numerous dimensions such as admitting discretion at work, implementation of teamwork or quality-circles, and tested its impact on the relevance of specific tasks. They observed that an increase in involvement is positively associated with the relevance of problem-solving, planning, and peer communication activities. More recently, Green (2012) analyzed the separate effects of organizational measures of involvement and discretion on job content. His study – which comes from a methodological point of view closest to this dissertation – reveals that both employee involvement and discretion on the job are positively correlated with the relevance of problem-solving, planning, and directive tasks. In line with previous studies, the author shows that participation in quality-circles, teamwork, or suggestion schemes is most strongly correlated with the relevance of problem-solving and directive tasks, whereas practices permitting decentralized decision-making are most strongly correlated with the relevance of planning activities.

2.5.3 Trade union presence and work design

One of the novel aspects in this dissertation is the empirical assessment whether or not trade union presence in UK establishments impacts the design of jobs. Against the backdrop of the idiosyncrasies of the British IR system, the main point of this work is that despite declines in membership levels or negotiation power, trade unions in the UK remain a relevant actor in the employment relationship, and influence both the structure and content of jobs. As indicated in

the literature review, insights from the IR literature and related bodies of research offer a firm line of reasoning on the direction of the unions' effect on work design.

First, building upon accounts applying an institutional perspective (Hall & Soskice, 2001; Holman et al., 2009) to explain cross country differences in the design of work, it is reasoned that the state of IR matters in terms of work design, and that trade unions are considered to be a competing interest group. The same conclusion of the rather adversarial relationship between management and trade unions in the UK is reached in the British IR literature. As outlined, despite governmental efforts to promote social partnership between management and unions in the UK since the 1990s, the outcomes of those partnership agreements suggest that the relationship between both actors remains tainted by limited cooperation and mistrust (e.g. Ackers & Payne, 1998).

Although the main arguments in these fields are valuable regarding the general relationship between the state of IR and the design of work, they do not offer a theoretical link between union presence and the design of work. Therefore, this work additionally draws upon literature combining strategic choice and industrial relations (e.g. Kochan et al., 1984), and on related models that incorporates strategic choice in terms of job design (e.g. Schuler, 1989). Specifically, a sub-field therein acknowledges the existence of non-strategic, non-rational dimensions when management makes decisions regarding the design of work. Thus, the design of work is then not necessarily *mechanistic* and the sole result of strategic choices, but is rather shaped by the willingness to reduce others power (Hillman, Withers, & Collins, 2009: 1404).

As the power of trade unions becomes relevant at the bargaining table when negotiating traditional items such as terms of pay and other working conditions, it was reasoned that management is willing to modify the design of jobs in order to shift the balance of power in their favor. The logic follows traditional rent-capturing models in case contracts are non-binding as developed in the IR literature (e.g. Grout, 1984). Originally, those models emphasize the monopoly face of unions as sketched in the seminal work supplied by Freeman and Medoff (1984). They had been developed to explain why management in the UK may withdraw from investments in new technologies or other productivity-enhancing measures when unions are present.

Whereas those models do not directly link union presence with job design, the model's logic provides rationales for management intentions to curb union power in order to avoid own vulnerability in collective bargaining. Building on models regarding the power distribution

among different stakeholders (Coff, 1999; Steigenberger, 2013), it was derived that a holistic work design is associated with enhanced bargaining power of employees and, on the contrary, a tayloristic job is associated with lower bargaining power.
This reasoning motivates the final set of hypotheses:

> Hypothesis 5: ***a) Job variety; b) Job autonomy; c) Skill use; d) Absence of control is lower in unionized compared to non-unionized workplaces***

> Hypothesis 6: ***The relevance of a) problem-solving tasks; b) directive tasks; c) planning tasks is lower in unionized compared to non-unionized workplaces.***

Overall, empirical accounts support the quality of the developed hypotheses, albeit the studies main foci are not necessarily being laid on bargaining power considerations nor on on-site labor representation.
Indirect evidence on the plausibility of the developed hypotheses is, for example, offered by studies that scrutinize the link between union membership and job satisfaction. Specifically, Hammer and Avgar (2005) summarize the findings of many empirical studies that evaluate the union-membership-job satisfaction link. Overall, those studies reveal that trade union members are less satisfied with supervision in job, job content, and with the freedom given to do their job compared to non-union members.
Critical voices assessing the nexus between union-membership and job satisfaction (e.g. Bryson, Cappellari, and Lucifora, 2004) highlight, though, the importance of selection into union-membership as an important objection when reasoning over a union-membership effect on job (dis-)satisfaction. Specifically, it is typically referred to that the most dissatisfied workers are attracted to join unions as a mean to improve working conditions. However, Petrescu and Simmons (2008) demonstrate that, even after controlling for a large number of personal, job, and firm-related characteristics, the implementation of certain involvement practices raises job satisfaction for non-union workers but not for comparable union-workers in the UK. In a similar vein, Green and Heywood (2015) use longitudinal data from the British Household Panel Survey, holding worker fixed effects constant. Their results imply that the reported dissatisfaction among union workers is not necessarily the result of sorting among workers nor that of union status across jobs (Green & Heywood, 2015: 597).

Overall, those studies evaluating the link between union membership and job satisfaction only add suggestive evidence for a union's effect on work design. Other studies focusing on on-site labor representation / union membership, and its link with specific work characteristics offer a more in-depth insight on this matter.

Green (2008) uses matched employee-employer data from the WERS 2004 to identify determinants of decentralized decision-making. He found that trade union membership is negatively associated with the level of discretion at workplaces even after controlling for establishment-wide unobserved factors. In correspondence with the line of thought developed in this thesis, the author reasons that designing jobs that offer workers less control over their action may be attributable to employers' fear that UK union members prefer to behave in the interest of unions instead of theirs (Green, 2008: 22). Gallie, Felstead, and Green (2004) use data supplied by the Skills Surveys conducted in 1992, 1997, and 2001 to assess the impact of several determinants on the degree of discretion at a job. Concerning union presence, the conducted analysis reveals that despite union decline in the 1990s, union presence at the workplace is negatively associated with the degree of admitted discretion at the job. Along parallel lines, they explain this result by referring to the reluctance to decentralize decision-making to employees "*where they have organizational resources to contest management"* (Gallie et al., 2004: 257). Further evidence is also presented by Green and Whitfield (2009). The authors show that, other things being equal, employees in UK workplaces with recognized unions report more negative experiences at work in terms of influence over their pace of work (Green & Whitfield, 2009: 228). Finally, in a more recent study that focusses on trade union's effect on job quality, Bryson and Green (2015) found that the level of both discretion and opportunity of skill use is set significantly lower in union covered sectors in the UK than in uncovered ones.

To conclude, the research hypotheses to be tested in the ensuing analysis are compendiously summarized in Table 3.

Table 3: Summary of research hypotheses

H1a: ICT use is ***positively*** associated with job variety.
H1b: ICT use is ***positively*** associated with job autonomy.
H1c: ICT use is ***positively*** associated with skill use.
H1d: ICT use is ***positively*** associated with absence of control.
H2a: ICT use is ***positively*** associated with the relevance of problem-solving tasks.
H2b: ICT use is ***positively*** associated with the relevance of directive tasks.
H2c: ICT use is ***positively*** associated with the relevance of planning tasks.
H3a: Involvement practices are ***positively*** associated with job variety.
H3b: Involvement practices are ***positively*** associated with job autonomy.
H3c: Involvement practices are ***positively*** associated with skill use.
H3d: Involvement practices are ***positively*** associated with absence of control.
H4a: Involvement practices are ***positively*** associated with the relevance of problem-solving tasks.
H4b: Involvement practices are ***positively*** associated with the relevance of directive tasks.
H4c: Involvement practices are ***positively*** associated with the relevance of planning tasks.
H5a: Job variety is ***lower*** in unionized compared to non-unionized workplaces.
H5b: Job autonomy is ***lower*** in unionized compared to non-unionized workplaces.
H5c: Skill use is ***lower*** in unionized compared to non-unionized workplaces.
H5d: Absence of control is ***lower*** in unionized compared to non-unionized workplaces.
H6a: The relevance of problem-solving tasks is ***lower*** in unionized compared to non-unionized workplaces.
H6b: The relevance of directive tasks is ***lower*** in unionized compared to non-unionized workplaces.
H6c: The relevance of planning tasks is ***lower*** in unionized compared to non-unionized workplaces.

3 Data, operationalization, descriptive statistics, and methods

After reviewing the relevant fields of literature and developing testable hypotheses in Chapter 2, this part of the work initiates the empirical assessment of the main research questions to be analyzed.

The first sub-section introduces the Skills and Employment Survey Series, the data source for the empirical analysis. Section 3.2 outlines the operationalization of the dependent variables. In addition, this sub-section entails a brief description of the factor analysis used to derive distinct task domains, and presents some descriptive statistics of the dependent variables. The operationalization of the main explanatory factors (ICT use, involvement practices, and union presence) and some descriptive statistics are outlined in section 3.3. Chapter 3.4 offers some tentative evidence on the association between the work design variables paid wages. This chapter concludes by describing the empirical approach used to test the validity of the developed hypotheses.

3.1 The SES and its use in research

The information used in the empirical analysis is supplied by the Skills and Employment Survey Series (SES). The SES[15] combines data from six independently conducted *Skills Surveys* that took place in the years 1986, 1992, 1997, 2001, 2006, and 2012. Initially, the first survey in 1986, the *Social Change and Economic Life Initiative Survey,* was carried out to find valid measures of the skill requirements within jobs, and to quantify the distribution of broad skills among the British workforce (Felstead, Gallie, Green, & Zhou, 2007: 2). The very first *Skill Survey* administered in 1997 was designed to extend knowledge about trends in broad skills over time. Most notably, this *Skill Survey* was the first gathering rich information about the wide range of tasks carried out in the job (Felstead et al., 2007: 2). The 2001 *Skills Survey* conducted four years later has been a partial repeat survey with the overall aim to update extant knowledge on the distribution and trends of skill requirements. Additionally, this *Skill Survey* extended the 1997 survey by introducing a richer set of measures for job quality (Felstead et

[15] For a detailed summary with regard to the method of data collection, sampling and weighting procedure (and more), see Felstead et al. (2007).

al., 2007: 2). The 2006 *Skill Survey* extends this time series data and ads insights into work preferences and work motivation of the employed persons. One of the main goals was to update knowledge concerning the association of skill utilization with indicators of employee well-being (BMRB, 2007: 3). The latest survey in this tradition, the *Skills and Employment Survey 2012*, further complements the time series.

The overall objective of the SES is to combine the various data on skills and employment experience of the British workforce and on the performed tasks at work (BMRB, 2007: 1). Thus, it provides fertile ground to assess changes in skill and job requirements in the British economy, and their effect on several employment outcomes. Therefore it does not come as a surprise that the SES is widely used in academia. For instance, many empirical studies used the information to outline determinants for employee well-being (e.g. Felstead, Gallie, Green, & Inanc, 2015) or quality of work (Gallie, Felstead, & Green, 2012).

The unit of analysis in the various *Skill Surveys* is the individual employee in the workplace. This implies that the sample contains more accurate measures of respondents experience in the job rather than relying on managements estimates on job content or work characteristics.

It must be noted, though, that the SES is not a longitudinal study that involves repeated observations of the same entity over the different years. Instead, it is a pooled cross-section data series that combines the independently conducted Skills Surveys. Notwithstanding, the dataset is to that effect compelling as it contains a staple set of questions that do not change in the respective years. Along the same lines, the used scales and wording in the respective questions remain constant throughout the years.

In principle, representative micro-data that allow analyses of the task composition of jobs combined with work characteristics are scarce. In fact, besides the SES, there are currently only two more sources publicly available that allow such analyses. Autor (2013) presents an excellent overview of the respective data sets, and outlines both advantages and disadvantages that go hand in hand with the respective samples.

The German IAB/BIBB labor force survey, for instance, contains self-reported data on primary activities of the German workforce at their current jobs, covering the period from 1979 until 2012. During that period, numerous independent cross-section samples have, indeed, been compiled but the surveys have not been carried out to measure economic-wide and over time changes in job tasks. This is mirrored through the inconsistencies concerning the questions asked across the different survey years. That is, various job task items have only been collected

once, and the wording (and scale) of items has changed during the period covered. In addition to that, with regard to the research question to be analyzed in this thesis, the data does not contain information on the presence of labor representation bodies.

For the US, the DOT and its successor O*NET offer in-depth statistics about the tasks performed in particular jobs and how they have evolved over time (Autor et al., 2003: 1291). One feature of this data set is that it reduces the subjectivity in the task categorization as it relies on so-called standardized job descriptors to each of the over 1000 occupations. This implies that classifying tasks is due to external supplied job content measures that can be validated carefully.

Despite being rich in content and dimensions, the US data suffers from three particular pitfalls. First, as the data source incorporates externally supplied job content measures by experts, it may suffer from overlooking heterogeneity in job tasks among individuals within an occupation (Autor, 2013: 190). Besides that, the vast number of occupations incorporated makes it impossible to refresh the entire database regularly. Hence, it only offers a more static view about the tasks performed at the workplace. Thirdly, the O*NET data does not supply information with regard to ICT use at the workplace nor about the application of certain organizational practices (Green, 2012: 44). This problem can admittedly be overcome by combining this source with external data as it is done, for example, by Autor et al. (2003). However, such a procedure is likely to create some noise (Spitz-Oener, 2006: 236).

According to Autor (2013: 191), the SES overcomes many of the problems inherent in other sources. It was explicitly developed to measure economic-wide and over-time changes in job tasks. It also contains rich and consistent information on the posited work design determinants. Therefore, the SES is especially suited for the empirical assessment of the developed hypotheses.

For the ensuing analysis, the information supplied by the *Skills Surveys* from 1997 onwards is used. The rationale is that the respective cross sections homogeneously assess the degree to which tasks within a job are relevant.

In total, the particular waves consist of 2.467 (1997), 4.470 (2001), 7.787 (2006), and 3.200 (2012) respondents, providing a representative sample of the employed population in the UK.

In order to accommodate the various pooled cross-section data, the following analysis relies on information provided by the employed population aged 20 to 60.

In addition to that, observations from Northern Ireland and Highlands / Islands regions are excluded as those parts of the UK were only covered in the year 2006. Furthermore, respondents

that did not give information about their current industry and occupation they work in were not included. Finally, the sample only considers employees and excludes self-employed respondents as the main focus in the analysis is laid on the employer-employee and on the trade union-employer relationship.
In summary, the analysis uses data from 14.270 respondents (2.181 (1997), 3.983 (2001), 5.573 (2006), and 2.533 (2012)).

3.2 Operationalizing tayloristic and holistic jobs

In this section, the operationalization of the dependent variables used in the empirical analysis is described. The choice of job indicators used aligns with the elaboration sketched in section 2, in which specific attributes of tayloristic/holistic jobs are derived. In a first step, the indicators used for work characteristics are presented, including a short description of operationalization issues typically associated with them. Then, the exploratory factor analysis conducted to derive the specific task domains is briefly described, and the three task domains retrieved are presented. The last section outlines some descriptive statistics for the dependent variables.

3.2.1 Work characteristics

As elaborated earlier, the choice of work characteristic indicators draws upon the seminal work provided by Lindbeck and Snower (2000). Building on their logic and on insights from related research, a job with a lower (higher) degree of autonomy, lower (higher) variety, lower (higher) skill utilization and tight (low) control is considered to be a taylorisitc (holistic) job. For such work characteristics, the SES contains rich information.

To operationalize perceived variety in a job, an indicator is used that collects information on the question "*how often does your work involve carrying out short, repetitive tasks"* (SES, 2012: 19) . Here, respondents can specify the degree of repetitiveness in their job on a likert-scale ranging from 1 (never) to 5 (always). For the analysis, a reversed indicator is constructed so that an ascending value of this indicator stands for a higher perceived job variety.

For perceived job autonomy, the analysis uses information supplied by respondents who were

constantly asked during the periods under investigation: "*How much choice do you have over the way in which you do your job"* (SES, 2012: 19). The persons interviewed indicate on a likert-scale ranging from 1 (a great deal of choice) to 4 (no choice at all) how much autonomy they possess. Principally, measuring job autonomy raises some issues as there are conceptually distinct facets of autonomy. For example, Breaugh (1985) distinguishes between "Work Method Autonomy", "Work Scheduling Autonomy", and "Work Criteria Autonomy". The proxy used in the ensuing analysis comes closest to work method autonomy, which captures the degree of individual choice one has over the procedures utilized in one's job (Breaugh, 1985: 566).

As outlined in the previous chapter, skill utilization is considered as well being an important indicator for a more holistic environment. One rationale is that a more holistic organization aims at seeking to incorporate worker suggestion and employee involvement at a regular base, and thus, depends on the skill utilization and the willingness of employees to enhance their knowledge.
The measure for skill use stems from the following question: "*In my current job I have enough opportunity to use the knowledge and skills that I have*". Here, respondents assess on a likert-scale ranging from 1 to 4 whether they strongly agree (1) to strongly disagree (4) (SES, 2012: 12). Unlike the other work design variables, the information on skill use in a job has been collected only for the years 2001, 2006, and 2012.

The final item to be used as dependent variable is an indicator for the absence of control in a job. To capture the level of absence of control, information by respondents is used who state how closely supervised they are in their job on a likert-scale ranging from 1 (Very closely) to 4 (Not at all closely) (SES, 2012: 20).

The four indicators used (variety, autonomy, skill utilization, and absence of control) are all single-item measures. When operationalizing such indicators, it is quite common in empirical accounts that multi-items measures are applied instead. As an example, Morgeson, Delaney-Klinger, and Hemingway (2005: 401) construct a summary indicator for job autonomy with three distinct items. Others again use five items to calculate an indicator for skill utilization in a job (de Witte, de Cuyper, Handaja, Sverke, Näswall, & Hellgren, 2010).
Basically, no clear consent in the extant literature is reached whether using multi-item indicators is better or worse than single-item scales. Kwon and Trail (2005), for instance, present evidence

that single-item measures do not necessarily perform better than multi-items scales of the same construct (the same is true for the other way round, see Gardner, Cummings, Dunham, & Pierce, 1998). Some accounts reason that multi-item scales are more reliable than single-item scales because they enable computation of correlation that can be used to validate the underlying attributes (Churchill Jr, 1979). Another advantage is that multiple indicators used adjust for random error as it is assumed that the combination of numerous items corrects for those (Sarstedt & Wilczynski, 2009: 214).

Despite those advantages, the ensuing analysis sticks to the single-item approach. The motivation is twofold. First of all, the variables provided by the SES indeed proffer global proxies for job autonomy and the like, but it does not contain all the required items necessary for multi-item scale development. Following therefrom, as pointed out by Rossiter (2002: 313), when an attribute is judged to be concrete, there is no need to use more than a single item to measure it. The final argument emphasizes that although multi-item scales adjust for random-errors, using a single-item avoids the common methods bias that occurs when the correlation between two or more constructs is present (Bergkvist & Rossiter, 2007).

3.2.2 Task domains

The uniqueness of the SES stems from that in addition to the rich information concerning work characteristics, it supplies fine measures on activities performed in a job over a reasonable time period.

In total, 31 task items are available that have been gathered in every wave. More specifically, respondents of the survey have been asked consistently which activities are or are not part of their job. The questions were posed as follows: "*In your job, how important is … [each task]"*. Respondents might answer: "1. *essential", "2. very important", "3. fairly important", "4. not very important",* and *"5. not at all/does not apply"*. An example would be: *"In your job, how important is dealing with people?"* (SES, 2012: 29).

To transform the items into task variables, this work follows the methodology proposed by Felstead et al. (2007: 27), and converts the "*ordinal scale of 'importance' for each variable into an increasing cardinal scale"* that ranges from 0 "Not at all/does not apply" to 4 "Essential".

Appendix 1 outlines the 31 task items available and presents some descriptive statistics. Those

results suggest that – on average – occupations in the UK have become more complex. For instance, the relevance for certain non-routine analytic tasks such as "*analyzing complex problems in depth*" or "*planning own activities"* increased in the period under investigation as well as the relevance for non-routine interactive tasks such as "*making speeches/presentations*". Those 31 items lay the foundation for classifying specific task domains. The use of such domains is motivated to counter posited critics, who stress the high degree of subjectivity that is involved when assigning certain tasks items into a specific task classification (Handel, 2017). Moreover, using such domains decreases the complexity as several items are likely to exist that share the same underlying domain. Besides reducing complexity, this approach leads to a conservation of the degrees of freedom and improves the power against type II errors (Thompson, 2004: 5).

By conducting a factor analysis, such issues are addressed. In particular, building on the intercorrelation of the task items, this technique is used to summarize highly correlated items into underlying task domains. The cohesive items are subsumed in additive (and rescaled) indices. To derive task domains, exploratory factor analysis (EFA) is conducted as a priori no expectation is formulated concerning the number and content of the factors, and the sole aim is to reduce the number of task items. Several tests are run (based on the description by Backhaus, Erichson, Plinke, & Weiber, 2008: 333ff)) to confirm the usability of the 31 items for this analytical procedure. [16]

For the extraction of task domains, principal component factoring is applied. Two arguments support this decision. First, the difference between the two most common applied factor extraction methods is rather small, especially in case the score reliability of the measured items is given (Thompson, 2004: 55–56). This is ensured as the SES is built upon "*concrete, behaviourally-anchored"* developed items that ascertain a reduction of a *"social-desirability"* effect (Ashton, Davies, Felstead, & Green, 2000: 28) when answering questions concerning job content.

Secondly, the extraction of factors is only an intermediate step for further analyses as the rather limited intention of the EFA is to reduce the numbers of items and to subsume them under a collective term. In this case, a principal component analysis should be preferred (Backhaus et

[16] In detail, the correlation matrix has been analysed. Additionally, the anti-image covariance matrix is inspected. This meets the criteria formulated by Dziuban and Shirkey (1974). Finally, the KMO criterion for sampling adequacy is highly met as its value exceeds 0.9.

al., 2008: 350–351).

To determine the numbers of task domains to be extracted, numerous criteria and methods are applied, as there is not any deterministic retention rule (Henson & Roberts, 2006: 398).[17] The robust findings from the various tests suggest that, in total, seven domains should be extracted. To facilitate the interpretation of the factors, oblique rotation technique is applied as there is no ground to suppose that different task domains are *not* correlated with each other. To load the items to a factor, a minimum factor loading of 0.41 is demanded (see Bortz, 2006: 511ff). The rotated factor loadings are outlined in Appendix 2. The results show that all but three items (listen, special, and orgwork) can be assigned unequivocally. Consequently, these items are excluded from the analysis.[18]

In total, seven task domains are extracted. However, only three of them (see Table 4) are suitable for the ensuing analysis as only those align with the theoretical model. Cronbach's α for each domain exceeds at least 0.8, thus indicating a strong internal consistency of the respective task domains. The labeling of the generated task domains is in line with Green (2012), who reaches similar conclusions regarding the assignment of task items to job domains.

To generate the task domains, additive indices are calculated. By doing so, it is assumed that all items are equally weighted by 1 whereas using factor scores instead would weight each item by its correlation with the respective factor (Langbein, 2006: 232). Using factor scores is usually preferred on theoretical terms (Langbein, 2006: 232). However, for the subsequent analysis, additive indices are used. The motivation is threefold. For one, additive indices are more easily and intuitively interpretable than the factor scores. Secondly, using average scores may be useful to foster comparisons between factors with differing amounts of items (DiStefano, Zhu, & Mindrila, 2009: 3). Finally, the correlation between factor scores and the additive indices generated exceeds at least 0.92 (see Table 4), indicating that both measures are rather equal.

[17] Both, subjective and mathematical methods have been applied. The EV-criterion suggests the extraction of seven factors. Due to inconsistencies of the EV rule (Henson and Roberts, 2006) and to further validate the findings, mathematical procedures such as parallel analysis (Zwick and Velicer, 1986) or the minimum-average partial tests have been conducted. All methods reach the same conclusion.

[18] Using alternative techniques (e.g. principal factoring) and other rotation methods yields similar results regarding the numbers of factors to be extracted and the factor loadings.

Table 4: Overview of task domains used

Task items by domain	**Correlation with factor scores** (loading with task domain)
Problem-solving	**0.96**
Spotting problems or faults	(0.9050)
Working out the cause of problems or faults	(0.9557)
Thinking of solutions to problems	(0.8105)
Analyzing complex problems in depth	(0.4758)
Communication: Direction	**0.92**
Instructing, training, or teaching people	(0.6403)
Making speeches or presentations	(0.7850)
Persuade or influence others	(0.6442)
Planning the activities of others	(0.6018)
Planning	**0.97**
Planning your own activities	(0.8752)
Organizing your own time	(0.8959)
Thinking ahead	(0.7431)

Notes: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012.

3.2.3 Descriptive statistics of dependent variables

Table 5 outlines several summary statistics of the work design variables. In the period covered, the relevance of all task domains (problem-solving, direction, and planning) has increased. This pattern is in line with accounts that point to shifts in the employment in the UK towards services which has been extensively documented since the 1980s (e.g. Goos & Manning, 2007; Fernández-Macías, 2012). This development is not UK specific as evidenced by other contributions that reveal a consistent shift in task profiles within jobs across various countries in Europe. In particular, a universal shift away from routine tasks towards more non-routine interpersonal and non-routine analytical tasks has also been documented in Germany, Spain or Sweden (Eurofound, 2016: 75).

Conversely, the summary statistics of the work characteristic variables indicate that during the period under investigation, perceived job variety, autonomy, and absence of control decreased. Some of those findings are in line with earlier research. Gallie et al. (2004), for example, showed that the level of task discretion in the UK decreased during the period from 1992 to

2001 and levelled off afterwards.

Table 5: Summary statistics of work design variables

Task domains / holistic job indicator	Cronbach's alpha	1997	2012	1997-2012	s.d. of pooled data	r with required education$^{\upsilon}$
Problem-solving	0.85	2.716	2.780	0.064**	1.00	0.340
Direction	0.81	1.825	2.104	0.279***	1.08	0.406
Planning	0.85	2.822	3.025	0.203***	0.99	0.397
Job variety	-	1.749	1.572	-0.177***	1.181	0.283
Autonomy	-	2.219	2.036	-0.183***	0.861	0.218
Skill Use	-	2.101$^{\mu}$	2.247	0.146***	0.789	0.236
Absence of control	-	1.847	1.621	-0.226***	0.864	0.091

Notes: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Scale of the task domains ranges from 0 (not at all important) to 4 (essential). Scale of the job variety indicator (reverse indicator for perceived repetition) ranges from 0 (Never) to 4 (Always). Scale of the perceived autonomy indicator ranges from 0 (no choice at all) to 3 (a great deal of choice). Scale of the skill use indicator ranges from 0 (strongly disagree) to 3 (strongly agree). Scale of absence of control indicator ranges from 0 (very closely supervised) to 3 (not at all supervised).
μ: Only period 2001 until 2012 is covered. Therefore, the number 2.101 indicates the mean value in 2001.
υ Correlation of each skill index with the job's required education level scaled to six points: 0=no required educational qualification in job; level 1= below GSCE or equivalent; level 2 at GSCE level or equivalent; level 3 = A level or equivalent; level 4 = tertiary diplomas and qualifications below degree level; level 5 = bachelor's degree or above (in accordance with Green (2012)).
*** Changes in the mean value of the respective indices are statistically significant at the 1%-level ($p<0.01$, two-tailed test), ** statistically significant at the 5%-level.

Similarly, perceived absence of control and perceived variety decreased in the period covered. Although studies on call centers in the UK offer similar evidence (e.g. Taylor, Mulvey, Hyman, & Bain, 2002), it was not expected a priori to discern this pattern across the whole sample. Unsurprisingly, the correlation coefficients with the required education suggest that those aspects of work design associated with a more holistic job are associated with a higher needed level of education. The sole exception is the indicator for absence of control as only a weak positive correlation is found.

Table 6 lists the pairwise correlation of the work design variables. As continuous (problem-solving, direction, planning) and discrete variables (job variety, autonomy, skill use, and

absence of control) are used, both Spearman rank correlation and Pearson's correlation coefficients have been calculated. As both approaches yield similar results, Table 6 only presents Pearson's correlation coefficients.

Table 6: Pairwise correlation of dependent variables

	Variable	Mean (SD)	1	2	3	4	5	6	7
1	Problem-solving	2.81 (0.96)	1						
2	Direction	2.03 (1.06)	0.52	1					
3	Planning	3.01 (0.95)	0.50	0.58	1				
4	Job variety	1.67 (1.15)	0.12	0.19	0.18	1			
5	Autonomy	2.10 (0.86)	0.23	0.27	0.36	0.18	1		
6	Skill use	2.18 (0.80)	0.22	0.28	0.27	0.17	0.26	1	
7	Absence of control	1.72 (0.87)	0.01	-0.02	0.08	0.12	0.20	-0.01	1

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The numbers in the table show the pairwise correlation coefficients, the mean value, and standard deviation of the work design variables using survey data from 2001 onwards. All correlation coefficients are statistically significant at the one-percent level. The only exceptions are the correlation coefficient for absence of control and problem-solving (significant at the ten-percent level), absence of control and direction (five-percent level) and absence of control and skill use (no significance).

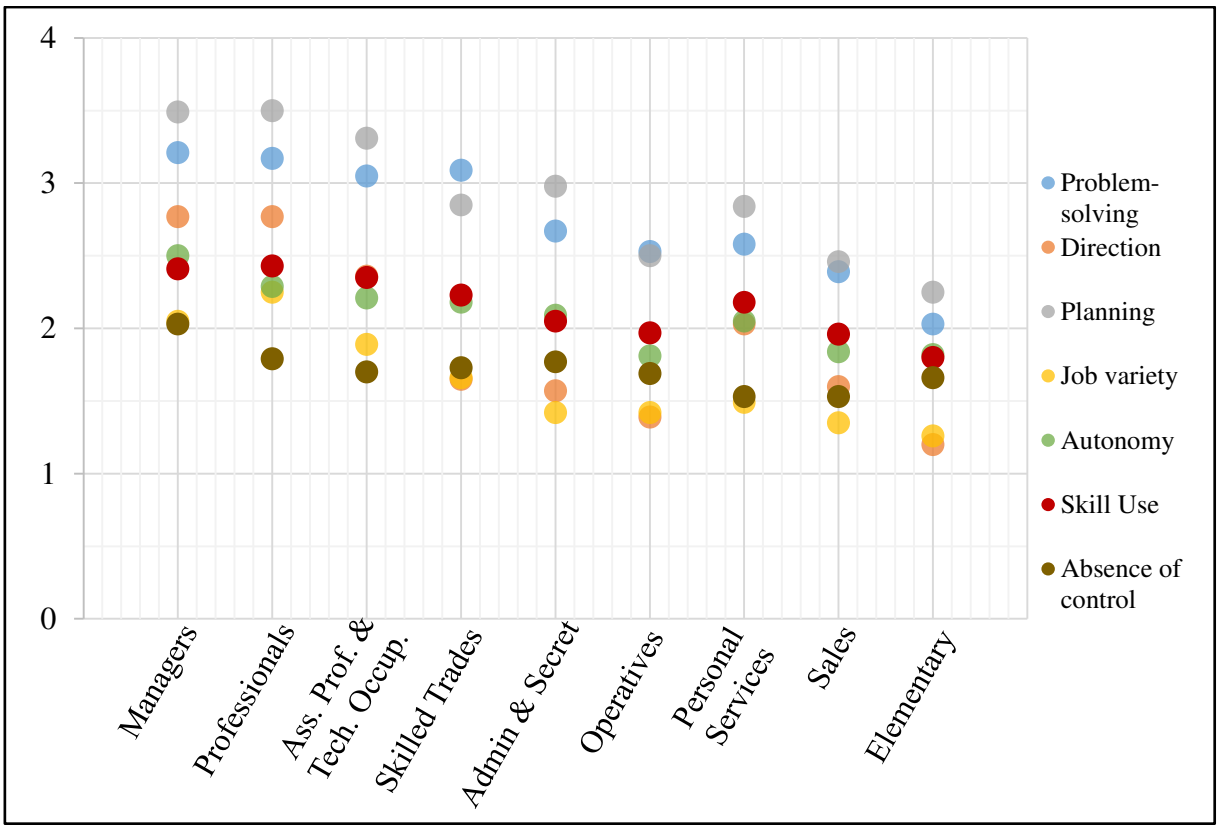
Overall, the revealed associations do not come as a surprise. For instance, coefficients for the task variables are positively correlated (moderate to strong) with each other. In addition to that, a moderate correlation is detected between the indicator for perceived job variety and the relevance of abstract tasks. This finding is similar to accounts using different data sources (e.g. Kalleberg, 2011).

The only coefficient showing different patterns is for absence of control as no or only weak correlations are found with other work design variables. The exception is the correlation with perceived autonomy. As anticipated, both indicators are positively (although modestly) correlated with each other.

One claim that needs to be addressed is that the correlation of the work design variables are arguably too weak against the backdrop of the differentiation between holistic and tayloristic job. However, it was not expected a priori that all of the work design variables used in the analysis are positively correlated (moderate to strong) with each other. This view reflects the

line of thought proposed by Hughes and Sharrock (2007: 84), who emphasize that the definition of ideal types is rather an analytical tool for empirical inquiries to reduce the complexity of the real world, and is not an end in itself.

Figure 3: Work characteristic bundles (occupational level)



Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The main groups (1-digit level) are derived from the Standard Occupational Classification 2000 (SOC 2000). The occupations are arranged according to the mean hourly wage.

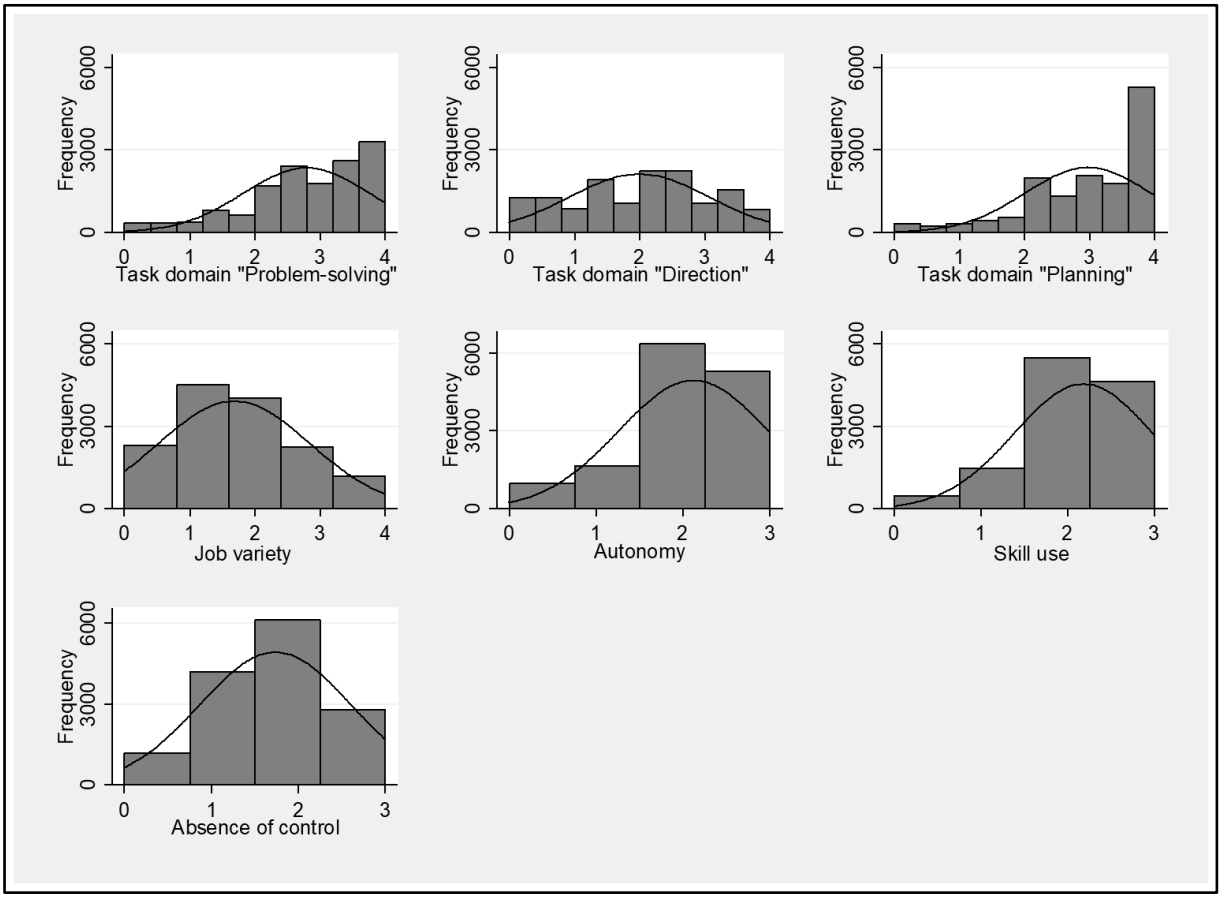
Interesting insights are retrieved when linking work design variables with the respective occupation. Figure 3 overviews several work design variables as bundles within occupations. The occupations are ranged according to mean hourly pay in the respective job. Therefore, the highest paid occupation (Managers) is on the left whereas the lowest paid occupation (Elementary) is on the right hand side.

As expected, work design characteristics associated with a more holistic environment are found in high paid jobs, such as management or professional positions. Conversely, a more tayloristic job design is detected in low paid occupations, such as elementary or sales positions. One striking pattern is that the bundle of work design characteristics moves towards a more

tayloristic combination the lower the occupational pay level. This pattern for UK jobs is also observable across Europe (Eurofound, 2016), and provides tentative evidence for that the scores of the work characteristic items are correlated with the skill and pay level of occupations.

Finally, Figure 4 displays the distributions of work characteristic variables together with a normal density plot. For all items, the full range of possible answers is found. However, the distributional plots emphasize the tendency of respondents to answer on the top point of the scale (with the exception being job variety). In other words, the negative skewness is a signal for the presence of a minority of respondents answering low on the respective work characteristics.

Figure 4: Distribution of dependent variables



Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. More details regarding the distribution is presented in Appendices 3-4. In detail Appendix 3 outlines the distribution of the specific task items that constitute the task domains. To further corroborate the validity of the dependent variables, Appendix 4 graphically reveals that respondents with managerial and/or supervisory duties score higher in holistic work design variables compared to respondents without such duties. The overall differences between those groups are all statistically significant at the 1%-level.

This finding concurs with other studies reporting a negative skewness of work design characteristics (e.g. Green, 2010; Liu, Spector, & Jex, 2005).

3.3 Operationalization of independent variables

This section outlines the operationalization of the posited work design determinants technology, involvement practices and union presence, and concludes by presenting combined descriptive statistics.

3.3.1 Technology and involvement practices

To capture the degree of ICT use within a job, information is used that respondents supply by answering the question how important it is to use "*a computer, 'PC', or other types of computerized equipment"* in their job (SES, 2012: 33). The respondents may indicate their assessment on the overall relevance on a five-point likert-scale ranging from 1 "Essential" to 5 "Not at all important". Similar to the task items, the scale is reordered (0 "Not at all important" to 4 "Essential").

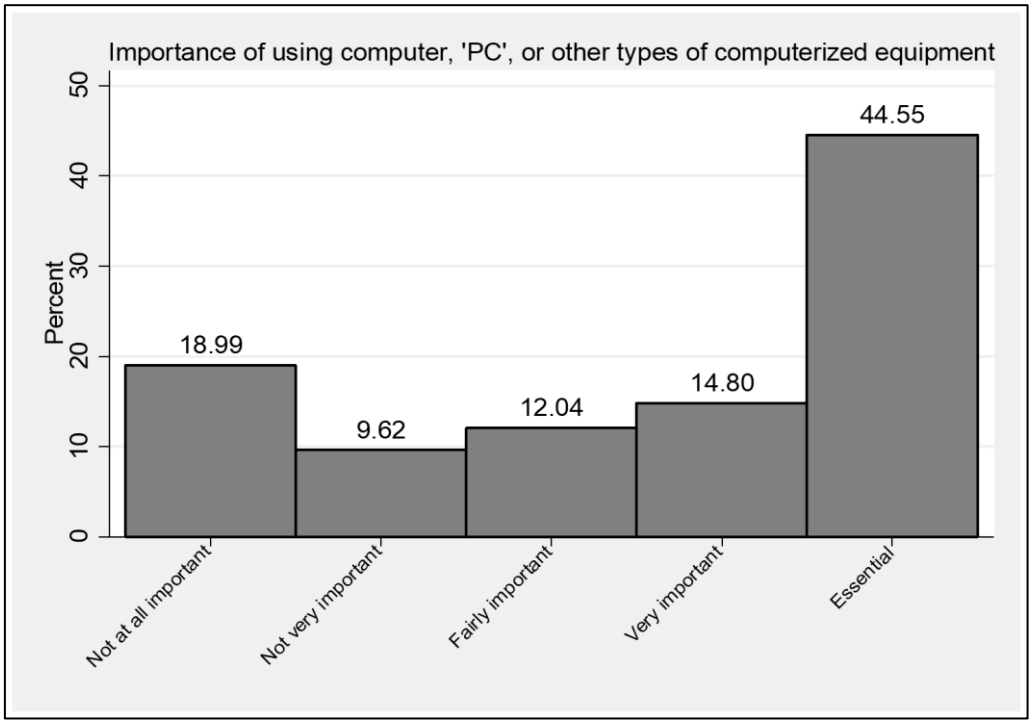
Generally, the SES contains several proxies for ICT diffusion/usage. For instance, one proxy captures whether new computerized, automated, or communication equipment has been implemented at the respondents' place of employment in the last three to five years. Besides that, information is given about the *way* respondents use computers or computerized equipment in their job (using computers for complex operations or for moderate/simple tasks such as word processing).

The motivation for using this proxy instead is twofold. First, by incorporating the relevance of computer use at the job as a proxy for ICT, the empirical analysis is in line with studies that measure the impact of ICT on job content. To capture the impact of ICT, Autor et al. (2003: 1324), for instance, use the percentage point change in industry computer use measured as the fraction of industry workers using a computer on their job. In a similar vein, Spitz-Oener (2006: 243) creates a dummy variable indicating whether or not employees use either computers, terminals, or electronic data-processing machines in their job. Thus, by using this proxy for ICT use, the empirical analysis in this dissertation follows common practice. Secondly, content and practical aspects also justify the decision. Besides not having the respective data for each

specific wave, the other proxies do not adequately capture the diffusion of technology at the workplace. For example, information on the installment of new computerized or automated equipment remains silent on its factual usage. Similarly, using information on how respondents use computers at their job allows to assess how certain *kinds* of computer utilization affect e.g. the evolution of tasks. Although this provides interesting insights, it is not a suitable proxy for the ensuing analysis as the main focus is being laid on ICT diffusion.

Figure 5 outlines the distribution of respondents answering to the importance of computer/technology use at the job.

Figure 5: Relevance of ICT use



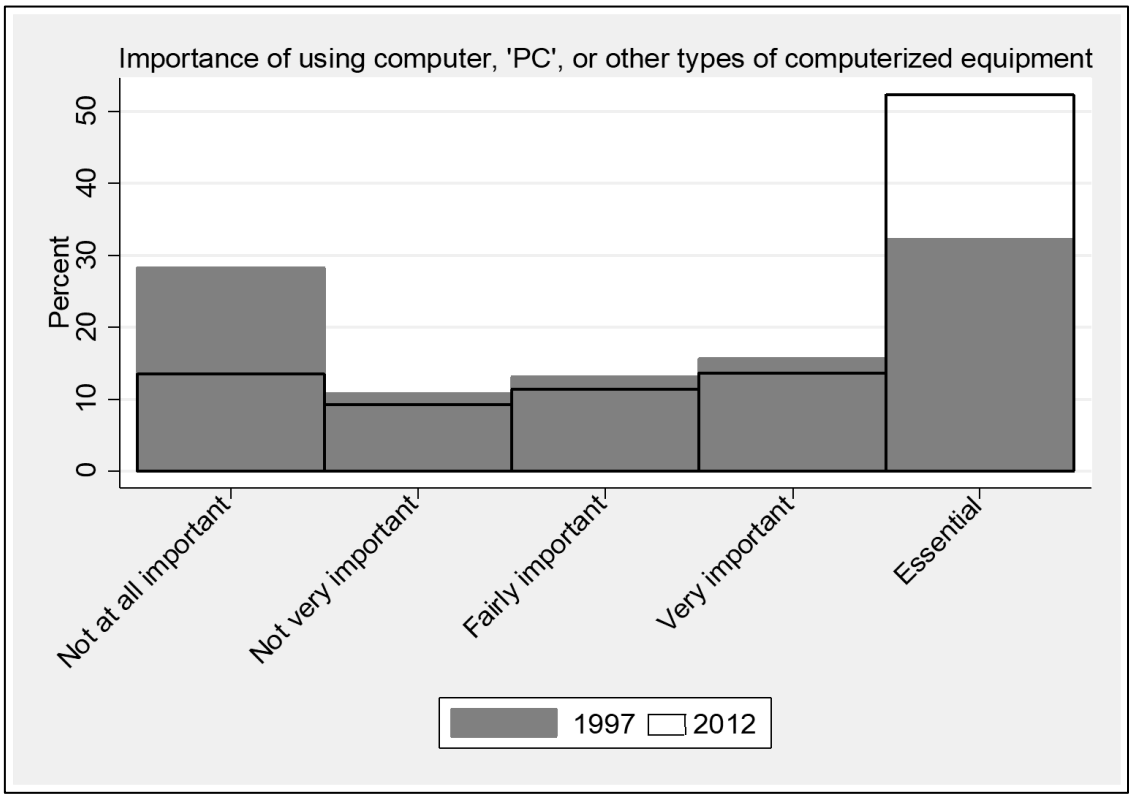
Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012.

As expected, the majority of respondents answered on the top point of the scale, indicating a vast diffusion of technology at workplaces. In particular, for nearly 45% of the 14.270 respondents, ICT use is essential in their job. Moreover, over 70% respond that the use of technology is at least fairly important.

Along the same lines, Figure 6 unveils – rather unsurprising – that the relevance of ICT use in jobs increased from 1997 to 2012. Being more precise, approximately 28% of the respondents in 1997 indicate that ICTs are not at all important in their job. The share of respondents

answering on the lowest point of the scale fell gradually to 20% in 2001, 17% in 2006, and finally to 13% in 2012. On the contrary, the share of respondents answering on the top point of the scale increased substantially during the covered period. Whereas 32% of respondents in 1997 assess that ICT is essential in their work, the share increased to 41% in 2001, to 48% in 2006, and finally to 52% in 2012 respectively.

Figure 6: Relevance of ICT use (1997 & 2012)



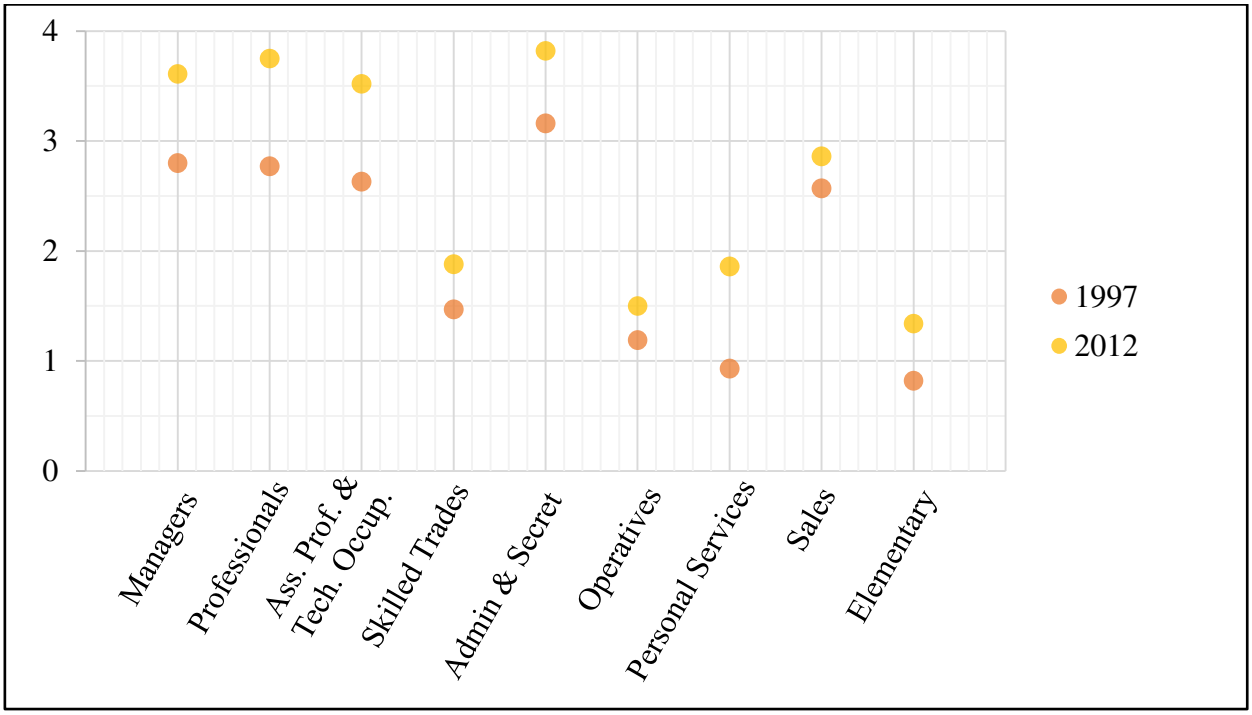
Note: Own compilation. Distributions based on own calculations using the SES (waves 1997, 2001, 2006, and 2012)

Due to the fact that the share of the respondents' occupations remain on a steady level in the respective cross-sections, it can be deduced that the increase in ICT use is not the result of a shift towards jobs requiring a higher level of ICT, but rather being the result of within-occupation changes regarding the use of computers.

This claim finds support through the data. Figure 7 overviews changes in the mean value of ICT use in each occupation (1-digit level) for the years 1997 and 2012. It becomes apparent that within each occupation, the mean value of ICT use increased in the period covered. Specifically, the mean value in managerial occupations increased from 2.8 in 1997 to 3.6 in

2012. Along the same lines, even respondents that document a comparatively high level of ICT use in 1997 experienced an increase in relevance. For instance, respondents employed in administrative and secretary occupations document an increase from 3.2 in 1997 to 3.8 in 2012. The same development is observable in occupations that score comparatively low concerning the level of ICT use. For example, respondents employed in operative (e.g. process, plant, and machine operatives) or elementary occupations (i.e. waiters/waitresses or postal workers) also document an increase, ranging from 0.31 (operatives) to 0.52 (elementary). For each occupation, all differences in the mean value are statistically significant at least at the 10%-level.

Figure 7: Relevance of ICT through time (mean, occupation)



Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The main groups (1-digit level) are derived from the Standard Occupational Classification 2000 (SOC 2000). The occupations are arranged according to the mean hourly wage. All differences are statistically significant at least at the 10%-level.

Overall, the diverse findings for ICT use across occupations in the UK concur with more recent surveys (e.g. Menon, Salvatori, & Zwysen, 2018) that analyze cross-country trends within EU workplaces. This indicates that the trend is not only confined to one specific country, but rather that there is a broad pattern across different countries emphasizing that ICT use has increased substantially in the last decades, even within the same occupations.

Involvement practices

To operationalize involvement practices, two indicators are used that measure distinct features of organizational involvement: employee involvement and task discretion.
Generally, operationalizing involvement practices is a challenging task. As outlined by Paauwe (2009: 136), one rationale is that accounts are influenced by their respective research backgrounds and possess distinct perceptions of how to define and operationalize such practices. Thus, a coherent consent on the nature of HR practices is lacking in extant literature (Boxall & Macky, 2009). The review by Boselie, Dietz, and Boon (2005) spanning the period 1994 to 2003, for example, reveals that in empirical analyses assessing the impact of HR practices on employment outcomes, 26 different HR practices have been operationalized.

In operationalizing involvement practices, this work follows the suggestion by Pil and MacDuffie (1996) and Green (2012). More specifically, Pil and MacDuffie (1996) created a composite index to operationalize involvement practices that includes certain work practices such as team-working, quality circles, job rotation, suggestion programs, and decentralization of quality-related activities. In addition to that, Green (2012: 42) suggests including task discretion as an additional proxy, as this facet is recognized as a key part of high-involvement work systems. Being more precise, incorporating both indicators acknowledges that role-based involvement via higher discretion and organizational involvement entailing worker participation are two distinct features of involvement practices (Felstead et al., 2016: 4).

Finally, by incorporating both indicators, two crucial points are made. For one, this study departs from other accounts. More specifically, some (e.g. Guthrie, 2001) delineate a much broader involvement index by adding elements such as internal promotions or employee stock ownership. Such practices are, however, widely assumed as *complementary* HR policies (Pil & MacDuffie, 1996). Secondly, by using information on employee involvement and task discretion, it is assumed that *organizational level indicators* governing employee activities to stimulate involvement in decision-making are captured (see Griffin et al., 2001; Pil and MacDuffie, 1996). The latter assumption is important as, prima facie, the use of the task discretion indicator seems problematic due to its proximity to the dependent variable perceived

job autonomy.[19]

Table 7 lists both indicators with its constituents. Overall, the employee involvement index used consists of six items. The items "involvement in quality circles", "participation in appraisals in last 12 months", "suggestions made in the last 12 months", "possibility of expressing own opinions", and "management informs employees" are dummy variables indicating whether these practices are in place (1) or not (0). The scale of the item "importance of teamwork" is discrete and ranges from 0 (Not at all important) to 4 (Essential). This item is transformed into a dummy-variable taking the value 1 if teamwork is essential and 0 if not. The index is averaged from the six constituents elements.

Table 7: High-involvement indices and descriptive statistics

	Mean				Δ Mean
	1997	**2001**	**2006**	**2012**	**1997-2012**
Employee involvement	0.57	0.58	0.63	0.64	0.07***
Constituents					
Involved in Quality Circle	0.31	0.37	0.42	0.40	
Importance of Teamwork	0.45	0.46	0.52	0.53	
Participation in Appraisal	0.68	0.70	0.75	0.78	
Make Suggestions for Improving Efficiency	0.72	0.70	0.75	0.73	
Expression of Views	0.66	0.66	0.71	0.73	
Management informs Employees	0.73	0.71	0.75	0.78	
Task Discretion Index	2.26	2.18	2.18	2.19	-0.07***
Constituents					
Personal influence: How hard to work	2.57	2.38	2.40	2.40	
Personal influence: What task to do	1.94	1.84	1.85	1.90	
Personal influence: How to do task	2.30	2.20	2.21	2.20	
Personal influence: Quality standards	2.24	2.29	2.28	2.30	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The employee involvement index is averaged from the six constituent elements and the responses are combined in a scale ranging from 0 to 1.The task discretion index is averaged from its four constituent elements and the responses are combined in a scale ranging from 0 (Not at all) to 3 (A great deal). Changes in the mean are statistically significant at the * 0.10 level, ** 0.05 level, and ***0.01 level (two-tailed test).

[19] The assumed conceptual difference between this indicator and the job-level measure for autonomy shows up in the correlation coefficient outlined in section 3.3.3. Being more precise, the correlation of r = 0.54 indicates that a rather strong positive correlation. However, the size of the coefficient does not support the objection that both indications measure the same.

The task discretion index is given by the SES and involves four constituents. In detail, on a scale ranging from 0 (Not at all) to 3 (A great deal), respondents assess how much influence they ***personally*** have on deciding how hard to work, which tasks to do, how to do tasks, and on the quality standards. Similarly, the task discretion index is averaged from its four constituents.

A closer inspection of the employee involvement index and its constituents lays bare that they all, in total, have been higher in 2012 than in 1997. For some items, this rise, however, levelled off between 1997 and 2001. The pattern of moderately rising involvement is also found in other data sources for the UK (Kersley, Alpin, Forth, Bryson, Bewley, Dix, & Oxenbridge, 2013). On the other hand, it is revealed that the level of discretion moderately decreased between 1997 and 2012. The data also shows that this development levelled off between 2001 and 2012. Similar findings for the UK are provided by Gallie et al. (2004).

3.3.2 Trade union presence and other control variables

Trade union presence is a binary variable taking the value 1 if respondents indicate that trade unions are present at their workplaces and 0 if a trade union is *not* present.
The chief advantage in using this binary variable is that it facilitates the interpretation of results. Nevertheless, potential problems arise as it is only a broad indicator that masks certain variations among trade unions that are present at distinct workplaces. For instance, this indicator remains silent on possible variations in trade union strategies at UK workplaces (e.g. Wallis, Stuart, & Greenwood, 2005), trade unions cooperation with management or ideologies (e.g. Heery, Williams, & Abbott, 2012), or simply variations in the degree of influence unions factually have.
However, the motivation to use this binary variable as the main explanatory variable is twofold. First, using available information on trade union influence at workplaces would bias the findings as the analysis would be restricted to unionized workplaces. This would be misleading in terms of the underlying research question as the main focus is laid on the difference between unionized and non-unionized settings. Secondly, as outlined by Bryson and Green (2015), information retrieved by employee interviews regarding the perception of union characteristics might be biased due to the limited awareness of what unions may be achieving or of the management-trade union relationship.

Table 8 presents some descriptive statistics regarding the spread of trade union presence across workplaces.

Table 8: Union presence at workplaces (1997-2012)

Variable	1997	2001	2006	2012
Union presence at workplaces (in %)	54.25	54.83	56.73	56.88
(% recognized for negotiating pay)	(92.64)	(86.08)	(88.98)	(84.26)

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012.

The statistics indicate that trade union presence in firms remained stable in the covered period. This finding concurs with remarks by Bryson and Green (2015), who maintain that trade unions preserved their organizational strength on the ground, despite continuing decrease in membership. Further, the data shows that it is quite likely that unions are recognized for negotiating pay once they are present at a workplace.

Other control variables

In view of appropriate parsimony, the ensuing empirical analysis only includes control variables for occupation and industry, which are recognized being important predictors for the dependent and independent variables. This approach allows testing the very same model while only changing the dependent variables.

The importance of occupational influences in work design research has long been recognized. Dierdorff and Morgeson (2007) provide an in-depth reasoning on how occupational influences affect the design of work, and reveal several mechanisms that are at work. Dierdorff and Morgeson (2013) corroborate this reasoning by calculating that 16% of the variation in work characteristics is attributable to occupational influences. Correspondingly, occupations are recognized as important predictors for the diffusion of involvement practices or for ICT use (Green, 2012). Against this backdrop, 345 occupational dummy variables enter the main model. In a similar vein, accounts suggest to include industry dummy variables as additional controls. Dobbin and Boychuk (1999), for instance, reason that industries differ in terms of predictability of the work processes. Hence, in industries in which work processes are unpredictable, autonomy, for example, should be higher. Including sector dummies also capture some of the effect of technology on work characteristics as industrial variations exist regarding the scope

and the way new technology is implemented. Hence, 56 industry dummy variables are included in the main model.

3.3.3 Combined summary statistics

In the final step, this sub-section outlines descriptive statistics combining the work design with the main explanatory variables of interest. In Table 9, Pearsons correlation coefficients are presented.

As stated earlier, the correlation between task discretion and perceived job autonomy (r=0.54) indicates a strong correlation between both items. This comes as no surprise. However, the size of the correlation coefficient demonstrates that both variables do not measure the same construct. As previously outlined, it is assumed that the indicator for perceived job autonomy measures the autonomy within a specific job, whereas the task discretion index and employee involvement index respectively represent indicators for organizational measures that govern job activities and foster worker involvement. The size of the correlation coefficient backs this conclusion.

The found correlation between ICT use and task domains are moderately positive, a finding which overlaps with the prediction of the task framework.

Furthermore, a moderate positive correlation is detected between employee involvement and ICT (r=0.35), a result that concurs with studies emphasizing the complementarity between technology adoption and such HR practices (e.g. Bresnahan et al., 2002).

Table 9: Pearson correlation coefficient (main variables)

	Variable	Mean (SD)	1	2	3	4	5	6	7	8	9	10
1	Problem-solving	2.81 (0.96)	1									
2	Direction	2.03 (1.06)	0.52	1								
3	Planning	3.01 (0.95)	0.50	0.58	1							
4	Job variety	1.67 (1.15)	0.12	0.19	0.18	1						
5	Autonomy	2.11 (0.86)	0.23	0.27	0.36	0.18	1					
6	Skill use	2.18 (0.80)	0.22	0.28	0.27	0.17	0.26	1				
7	Absence of control	1.72 (0.87)	0.01	-0.02	0.08	0.12	0.20	-0.01	1			
8	Employee involvement	0.62 (0.29)	0.36	0.51	0.38	0.10	0.18	0.24	-0.09	1		
9	Task discretion	2.19 (0.66)	0.29	0.35	0.45	0.14	0.54	0.26	0.20	0.22	1	
10	ICT use	2.64 (1.54)	0.36	0.35	0.36	0.12	0.13	0.16	0.02	0.35	0.16	1

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The numbers in the table show the pairwise correlation coefficients, the mean value, and standard deviation of the work design variables using survey data from 2001 onwards. All correlation coefficients are statistically significant at least at the 5%- level. Only the correlation coefficient between absence of control and problem-solving and skill use, respectively is not significant at the 5%-level.

Multiple calculations are conducted to assess the relationship between the binary variable "union presence" and the other main variables of interest. First, both Spearmen correlation coefficients and Pearsons product-moment correlations are computed when the other variable of interest is categorical. Since the approaches yield similar results, only Pearson's correlation

coefficients are presented. Further, point-biserial correlations are calculated in case the other variable is continuous. Table 10 breaks down the results.

Table 10: Correlation with union presence

Item	Trade union presence
Problem-solving	**0.04*** **
Direction	**0.13*** **
Planning	**0.06*** **
Job variety	0.01
Autonomy	-0.07***
Skill use	0.02**
Absence of control	-0.1***
Employee involvement	**0.24*** **
Task discretion	**-0.06*** **
ICT use	0.12***

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The numbers in bold are calculated using point biserial correlation. The correlation coefficients outlined normally show the pairwise correlation coefficient. The coefficients in bold document the point-biserial correlation coefficient** indicates a statistical significance at the 5%-level, *** indicates a statistical significance at the 1%-level.

Overall, a weak but positive correlation was found between trade union presence and the respective task domain variables. This finding stands in contrast to the theoretical argument that union presence is negatively correlated with such tasks typically prevalent in a more holistic environment.

Regarding the work characteristic variables, mixed results are retrieved. A negative correlation is disclosed for both absence of control and perceived autonomy. Contrarily, a positive correlation for skill use in a job is detected. Finally, the point-biserial correlation coefficient reveals a positive correlation between union presence and both employee involvement and ICT, and a negative association with task discretion.

Table 11 presents respondents assessment of work characteristics, technology usage, and high-involvement work practices contingent on whether they work in a unionized firm or not. Additionally, information regarding the profile of respondents working in a unionized or non-unionized firm is shown.

Table 11: Assessment on work design and respondents' profiles (union vs. non-union)

	Union present	Union not present	Difference
Problem-solving	2.84	2.75	***
Direction	2.13	1.85	***
Planning	3.04	2.92	***
Job variety	1.69	1.67	*
Autonomy	2.07	2.19	***
Skill use	2.20	2.17	**
Absence of control	1.66	1.84	***
Employee involvement	0.67	0.54	***
Task discretion	2.17	2.25	***
ICT use	2.74	2.35	***
Age	41.35	39.33	***
Qualification	2.19	1.69	***
Male	0.46	0.52	***
Wage	10.74	9.86	***

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Numbers in the respective cells represent the mean values. As described earlier, the scales of the work characteristic variables range from 0 to 4 or 0 to 3, respectively. Employee involvement is averaged from its constituents and the responses are combined in a scale ranging from 0 to 1.The task discretion index is averaged from its four constituent elements and the responses are combined in a scale ranging from 0 (Not at all) to 3 (A great deal). The scale of "ICT use" ranges from 0 (Not at all important) to 4 (Essential). Qualification is an indicator for the required education level in a job. The scale ranges from 0 (no required educational qualification in job); level 1 (below GSCE or equivalent); level 2 (GSCE level or equivalent); level 3 (A level or equivalent); level 4 (tertiary diplomas and qualifications below degree level) to level 5 (bachelor's degree or above). Male is a dichotomous variable taking the value 1 for male and 0 for female. Wage is the respondents' gross hourly earnings. *** indicates that the differences are statistically significant at the 1%-level, ** at the 5%-level. * at the 10%-level.

The marked differences suggest a certain dissimilarity of the assessment of work design among respondents working in a unionized or non-unionized firm. However, those stand in contrast to the formulated expectation. For one, respondents working in unionized firms indicate a higher relevance of abstract tasks. Similarly, the employee involvement index and ICT use is – on average – higher for those respondents. In line with the presupposed pattern, autonomy and absence of control is lower for respondents in unionized firms. The indicator for task discretion is also lower.

A closer inspection of the respondents' profile shows that employees in a unionized firm tend to receive a higher general level of pay. This is in line with accounts demonstrating a union-wage premium in the UK (see Blanchflower and Bryson, 2010 for comprehensive empirical analyses for the wage effect of British trade unions). Interestingly, required qualification is higher in unionized than in non-unionized workplaces. Moreover, the share of female employees working in a unionized workplace is higher.

Whereas the results do not allow to deduce predictive effects of trade union presence, the summary statistics provide some insights that need to be considered in the ensuing discussion. First, it can cautiously be deduced that a close relationship between trade union presence and poorer working conditions is not as obvious as commonly assumed (see Hoque et al., 2017 for a literature review). This conclusion concurs with more recent contributions adding evidence that contemporary union recognition in the UK takes place in hard to reach, low unionized sectors (Blanden, Machin, & van Reenen, 2006).
Secondly, it must be noted that those general findings are biased, as they are the result of a specific industry effect. Specifically, 35% of the respondents in the sample work in the public administration, education, and health sector. As the diffusion of unions in this sector is rather high (and respondents in this sector score high on holistic work design variables as well), the ensuing analysis needs to pay attention to sectoral idiosyncrasies.

When averaging the respondents' assessment by sector, the raw mean values align with the presupposed pattern regarding union presence and work design. Table 12 gives a representation of the assessment of respondents working in different industries. Only the raw mean values are reported, in which the differences in the work design variables are statistically significant.
Exemplarily, respondents (in unionized firms) working in the manufacturing, distribution/hotels, transport/communication or banking sector score lower in perceived variety as compared to those respondents working in a union-free setting. Similar trends are found in terms of relevance of planning activities or skill use. Notably, the raw mean value for perceived absence of control is comparatively lower for respondents working in the manufacturing, distribution/hotels, transport/communication, or banking sector with a union being present compared to those respondents working in a firm without labor representation. Besides that, it becomes apparent that respondents employed in the public sector score higher on each work design variable in cases where unions are present in the establishments.

Table 12: Assessment on work characteristics (industry)

	Union present	No union present
Problem-solving		
Transport & Communication	2.58	2.71
Public Admin, etc.	2.88	2.65
Direction		
Distribution & Hotels	1.82	1.7
Banking, Finance, etc.	2.08	1.99
Public Admin, etc.	2.38	2.06
Planning		
Manufacturing	2.72	2.87
Transport & Communication	2.67	2.96
Public Admin, etc.	3.26	3
Job variety		
Manufacturing	1.54	1.69
Distribution & Hotels	1.35	1.49
Transport & Communication	1.45	1.71
Banking, Finance, etc.	1.77	1.89
Public Admin, etc.	1.83	1.62
Autonomy		
Manufacturing	2.04	2.23
Distribution & Hotels	2.11	2.19
Transport & Communication	1.94	2.19
Banking, Finance, etc.	2.14	2.29
Skill use		
Transport & Communication	2.01	2.14
Banking, Finance, etc.	2.19	2.27
Public Admin, etc.	2.29	2.21
Absence of control		
Manufacturing	1.71	1.85
Distribution & Hotels	1.56	1.84
Transport & Communication	1.64	1.89
Banking, Finance, etc.	1.65	1.85

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Numbers in the respective cells represent the mean values. All differences are statistically significant at least at the 10%-level.

These findings are to that effect interesting as institutional explanations of organizational structure and management practices highlight the supposed similarity among firms operating in the same industry within the context of a single country (Gooderham, Nordhaug, & Ringdal, 1999).

The comparison of the raw mean values offers two valuable insights. First, the findings show that a positive association between trade union presence in the public sector and holistic work design does indeed exist. This finding concurs with contributions that emphasize the marked differences between trade unions in the public, healthcare, and education sector in terms of characteristics, strategies, or power compared to those in other sectors (e.g. Hoque and Bacon, 2015; Blanchflower & Bryson, 2010).
Secondly, apart from the public sector, the descriptive results reveal that there is a tendency of those respondents working in a unionized setting to report a lower level of holistic work design compared to respondents working in non-unionized workplaces. This finding is in line with the theoretical argumentation presented earlier.

3.4 Work design and wages

This section addresses the link between paid wages and the work design variables. As previously outlined, the relationship between specific work characteristics such as job autonomy or job variety, and employment outcomes such as job satisfaction is well-established both from theoretical and empirical accounts (e.g. Hackman & Oldham, 1975; Mohr & Zoghi, 2008). This sub-section proffers an additional perspective into this matter by examining whether variations in work design actually matter in terms of pay.
From a theoretical perspective, linking work design variables with wages paid is not straightforward and might provide misleading results (Autor, 2013; Rinawi & Backes-Gellner, 2015). Autor and Handel (2013: S64) elaborate on this issue and emphasize that it is not possible to interpret the coefficients for e.g. problem-solving in a wage regression as the economy-wide price for this job task. The rationale is that work characteristics, and job tasks in particular, are a mirror of personal skill endowments. This indicates that employees modify task inputs as job requirements change (Autor & Handel, 2013: S64). Consequentially, this leads to self-selection among employees into job tasks or work characteristics as implied by comparative advantage models (Autor, 2013: 194). This, in turn, makes the identification of the return to work design variables more complicated (Autor & Handel, 2013: S66).

Yet, despite the difficulties to establish the link between work design variables and pay, this work follows the approach proposed by Autor and Handel (2013) to make tentative inferences

on this relationship. Therefore, the first step includes demonstrating sorting tendencies among employees. To do so, OLS-regressions will be conducted in which the different work design variables are regressed on human capital measures for education and work experience, on demographic characteristics such as race (with the reference category being white), gender (with the reference category being male), and whether one is working full-time (reference category being not). Additionally, in order to control for occupational and industrial characteristics that may be correlated with the variables of interest, a vector of 345 occupation and 56 industry dummies is included. As pooled cross-sectional data is used, it is controlled for the year in each specification (with the year 1997 (2001 for skill use) defining the reference category).

The results of the various OLS regressions of work design on demographic and human capital variables are fully outlined in Appendix 5. Models with odd numbers (1, 3, 5, 7, 9, 11, and 13) do not control for occupation and industry. Generally, the posited determinants in those models explain 3% to 14 % of the variations in work characteristics and job content. Controlling for occupation and industry (even numbers) increases the explanatory power to 12% to 40%, indicating that occupations and industry are important predictors for both work characteristics and job content.

Conditioning on occupation and industry, the effects of qualification (measured as years of education), experience (measured as years in paid work), race, gender, or working full-time on the work design variables are attenuated substantially in most specifications. Sometimes, even the statistical significance of the predictors gets eliminated.

Notwithstanding, the results of the different models controlling for occupation and industry provide important arguments. Figure 8 summarizes the most important findings. For one, the positive relationship between the qualification of employees and the work design variables remains statistically significant (with skill use and planning being the only exception).

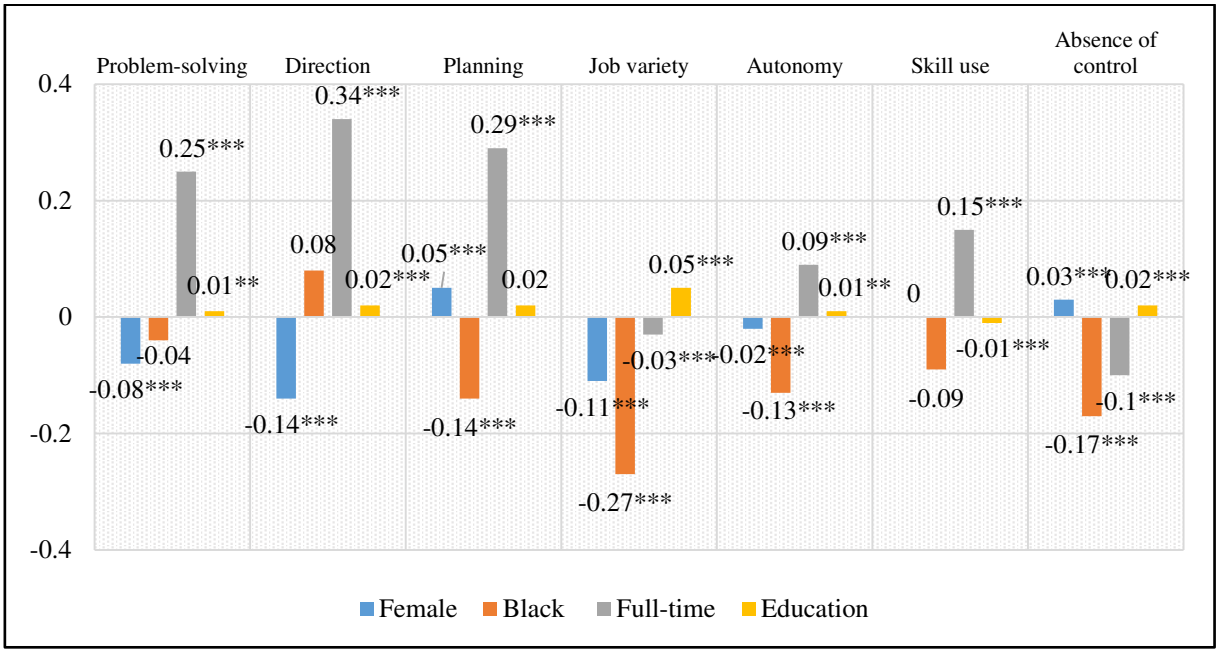
Most notably, the coefficients for the gender variable indicates a female-male gap for certain work characteristics and job tasks even within the same occupation and industry. Being more precise, female employees have a lower relevance for problem-solving and direction tasks in the same job compared to men. Besides that, female employees have lower perceived variety and autonomy in their job compared to men, assuming other factors remain equal.

Moreover, black employees have lower levels of job variety, autonomy, absence of control, and a lower relevance of planning tasks as compared to white employees.

Overall, the estimates suggest that even within occupations in the same industry, systematic

differences exist among employees that differ in human capital, race or gender.

Figure 8: Pooled OLS regression of work design variables on HC variables



Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The respective work design variables are the dependent variable. *** indicates significance at the 1%-level, ** 5%-level, * 10%-level.

Basically, such findings can be explained using different theoretical perspectives such as gender roles (Eagly & Steffen, 1986), gender stereotyping (for a summary, see Abele, 2000), or by employing sociological work on the reasons for occupational segregation and sorting (e.g. Penner, 2008; Cotter, Hermsen, & Vanneman, 2003). The obtained differences across genders align with findings of a comprehensive meta-analysis that reveals that job aspects such as authority, leadership or intellectual stimulation are more important for men than for women (Konrad, Ritchie Jr, Lieb, & Corrigall, 2000).

The sorting tendencies found are important because they "*directly imply*" that both work characteristics and job tasks must be predictive of wages themselves, as education, gender, and race are, in turn, important determinants for wages (Autor & Handel, 2013: S83-S84).
Building upon this line of thought, the relationship between work design variables and paid wages is tested by regressing the log hourly wages on work design, and human capital variables, full-time employment, and trade union presence. The results from the various specifications are fully outlined in Appendix 6.

Model 1 functions as a benchmark regression and represents an augmented version of the Mincerian wage regression including year dummies, standard human capital variables (age, work experience), demographic background variables (gender, race), and a binary indicator whether one is a full-time employee. The coefficients in the model display the expected signs and are all statistical significant. Overall, the included variables explain 40% of the variation in paid wages. Replacing the human capital variables, demographic variables, and the indicator for full-time employment with occupation and industry dummy variables (Model 2) shows that occupation and industry are strong predictor for wages paid. Stated more precisely, the set of indicators accounts for 60% of the variation in the dependent variable.

Model 3 combines both set of variables. As expected, the inclusion of occupation and industry attenuates the size of the other estimates. Nevertheless, nearly all variables remain statistically significant (with the exception being the coefficient for black employees). The results suggest that within the same occupation and industry, female employees earn 10% less compared to men. The size of the estimate aligns with comparable studies evaluating the gender wage gap in the UK (e.g. Machin & Puhani, 2003).

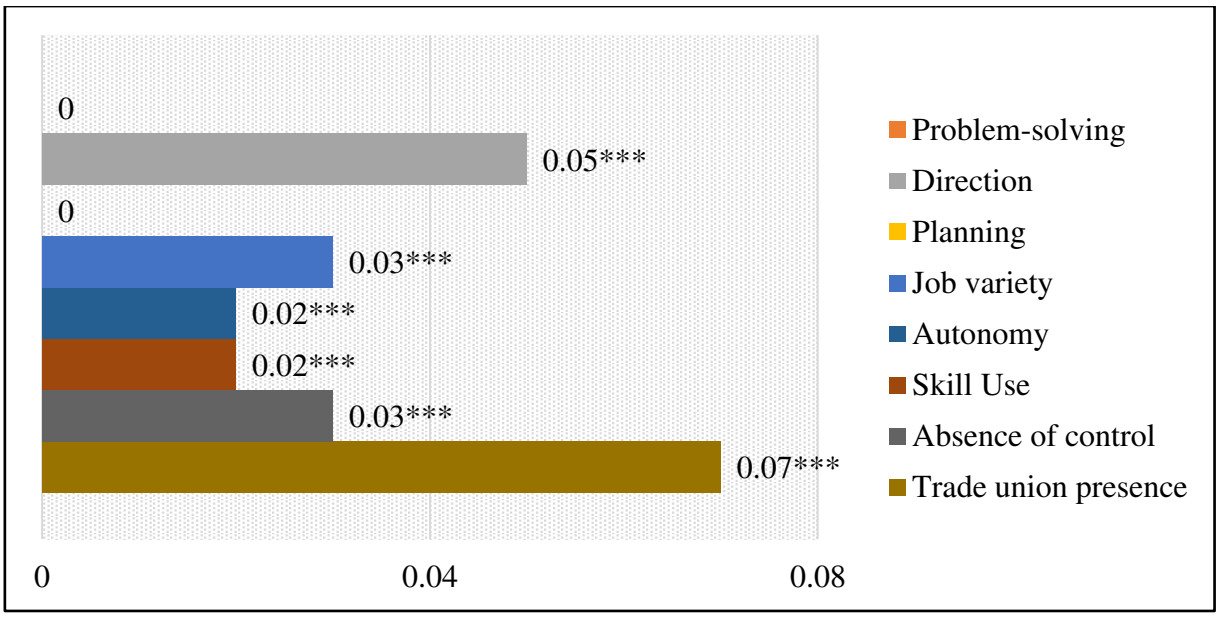
Model 4 introduces the work design variables and the binary variable for trade union presence. The size of the coefficients is as expected and all coefficients are statistically significant at the 1%-level. Overall, the findings align with the descriptive statistics outlined in section 3.2.3. In more detail, they provide tentative reasoning that a higher score in the work design variables is positively associated with the hourly wage. For instance, an increase in the relevance of direction activities is associated with a 11% wage premium, and an increase in skill use in a job is associated with a 4% pay hike. Besides that, job variety and autonomy are found to be positively related to wages paid (8% and 3% wage premium, respectively). Overall, those variables account for 34% of the variation in wages, thus having a similar explanatory power compared to the human capital, and demographic variables.

As expected, conditioning on occupation and industry (Model 5), attenuates the size of the coefficients, and the statistical significance is eliminated for problem-solving and planning tasks. Nevertheless, most of the coefficient retain their explanatory power. For example, the results imply that even within the same occupation an increase in the relevance of direction activities is associated with a 6% wage premium. Arguing along parallel lines, an increase in job variety (job autonomy) is associated with a 4% (2%) pay hike.

What is not known so far is whether the relationship between the work design variables and wages remains when it is jointly controlled for education, gender, race, full-time employment, occupation, and industry. Model 6 sheds light upon whether the association between work characteristics, job tasks, and wages remain robust when including all sets of variables simultaneously. The results are outlined in Figure 9.

The results imply that within occupation and industry, an increase in the relevance of direction tasks is associated with a 5% wage premium. In a similar vein, an increase in skill use and absence of control is associated with a 2% and 3% wage premium, respectively. Furthermore, an increase in job variety (3%) and autonomy (2%) is positively related to paid wages, c.p. The size of the estimates and the statistical significances correspond to the findings supplied by Autor and Handel (2013) who test the association between job tasks and wages using a US sample.

Figure 9: OLS regressions of log hourly wages on work design / trade union presence



Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The log hourly wage is the dependent variable. The work design variables are included simultaneously as explanatory variables. Additionally, it is also controlled for standard human capital variables (gender, education, work experience, squared work experience, race). Also, a binary variable taking the value 1 if respondent works full-time and 0 if not is included as well as a binary indicator taking the value 1 if a union is present at the workplace and 0 if not. N=10,251. R^2=0.64. *** indicates significance at the 1%-level, ** 5%-level, * 10%-level.

Finally, the regression results point to a union wage premium. The results suggest that trade union presence at workplaces is associated with a 7% pay hike. This finding concurs with more comprehensive analysis on the union wage premium in the U.K. (e.g. Blanchflower & Bryson,

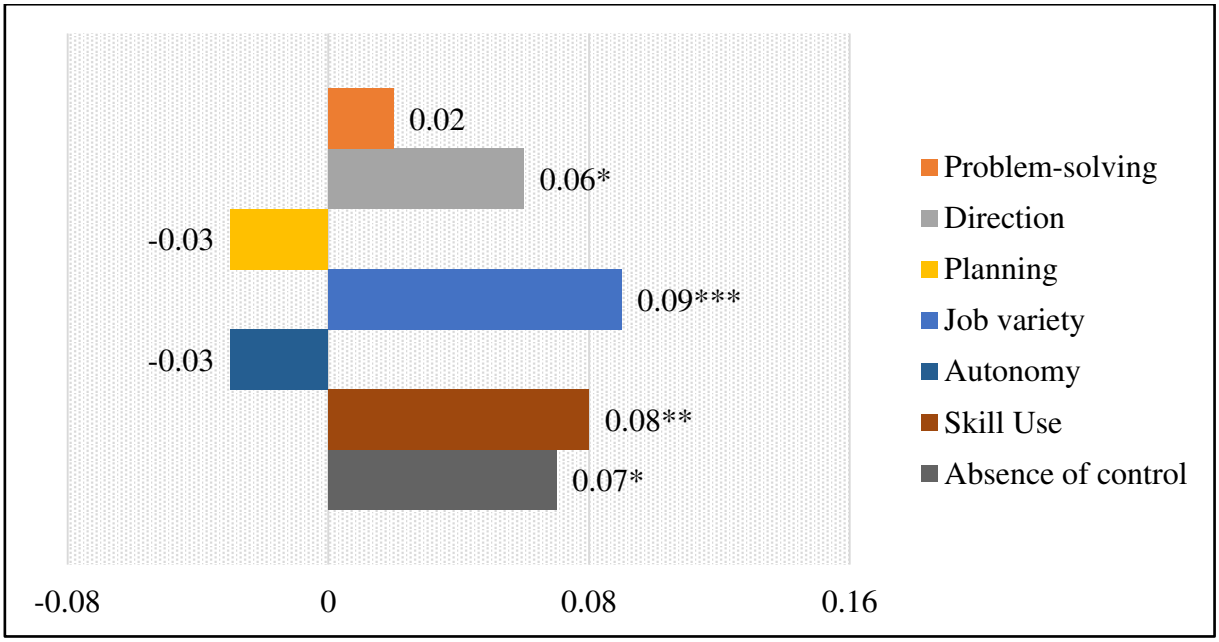
2010).

As most of the coefficients for the human capital and demographic background variables also remain statistically significant, it can be deduced that each set of variables captures distinct sources of wage variations and are all important predictors in their own right. Interestingly, when comparing Wald tests for the joint significance, it is found that the *F*-statistic for the work design variables (74.22) are larger than those for the occupation (46.89) or industry dummies (5.18) alone, but lower when comparing it with the human capital and demographic background variables (92.52).

There might be an issue with unobserved heterogeneity across occupations when regressing wages on work design variables. In accordance with Green (2012), a panel at the 4-digit occupation level is constructed to control for time invariant fixed-effects within occupations. This approach relies on the assumptions that neither the unobserved factors in each occupation, nor the "price" of each work characteristics and job task varies across time (Green, 2012: 48).[20] To construct a panel, average raw values of the main variables are calculated for each occupational cell for each period. For the analysis, all occupations with fewer than five observations are excluded, yielding an average cell size of about 20. Besides that, the coefficients are weighted according to the occupational cell size in 2006.
The results of this fixed-effects model are presented in Figure 10. Overall, the direction and statistical significance of the point estimators align with those of the pooled OLS regression. In particular, the results reveal that the estimates for direction tasks, skill use and absence of control are even higher (and statistically significant) in this specification compared to the pooled OLS estimation. Correspondingly, the point estimate for perceived variety in a job is higher compared to the OLS-specification and remains statistically significant.
The coefficients for problem-solving, planning and perceived job autonomy are statistically insignificant.

[20] Running separate cross-sectional regressions for each year, no evidence is found for significant changes over time in the coefficient estimates attached to the work design variables, union presence, or human capital variables.

Figure 10: Fixed-effects regression of log hourly wages on work design variables



Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The dependent variable is the log mean value of the hourly pay for each occupation. N=540. R^2=0.97. *** indicates significance at the 1%-level, ** 5%-level, * 10%-level.

The minor deviations and the size of the coefficients in the fixed-effects specification might be the consequence of a much lower precision in the fixed-effects estimates compared to the pooled OLS estimates due to the small n in the panel sample.[21]

Building on such insights, Green (2012) goes one step further. Following his approach, the trends in the work design variables are linked with the magnitude of the estimates to assess whether changes in work design are a modest source of the changing pay distribution. Accordingly, the 2001-2012 rise in the relevance of directive tasks by 0.183 is then associated with a rise in hourly wage by approximately 1.1 % (0.183*0.06 log points). The decrease in perceived variety on the other hand is associated with a 1.1 % wage penalty (-0.127*0.09 log points), and the increase in skill use in a job is associated with a 1.2 % increase (0.146* 0.08 log points) in the hourly pay, respectively. Additionally, the decrease by 0.097 in absence of control is associated with a 0.7% (-0.097*0.07 log points) wage penalty.

Although none of the presented findings regarding the work design-pay nexus can be utilized to draw causal inferences, the results proffer tentative evidence for that changes in work design

[21] The results outlined in the fixed-effect specification rely on information for the cross-sections 2001, 2006, and 2012 as the variable “Skill use” has been collected only since 2001.

are, at least modest, significant in terms of pay.

3.5 Estimation strategy

To test the association between the design of work and its posited determinants, the following model is estimated:

$$(1)\ WD_{iotz} = \beta_0 + \beta_{year01}Year01 + \beta_{year06}Year06 + \beta_{year12}Year12 + \beta_{EI}EI_{iotz} + \beta_{DI}DI_{iotz} + \beta_{CU}ICT_{iotz} + \beta_{union}union_{iotz} + \sum_j \beta_{occup}OCC_o + \sum_z \beta_{ind}Ind_z + u_{ioz} + \varepsilon_{iotz}$$

WD stands for the several work design variables presented earlier. The subscripts refer to individual i in occupation o and industry z at time t. As the underlying SES data pools independent cross sections over time, year dummies ($Year01, Year06, Year12$) for all but one year are included. According to Wooldridge (2012: 449), it is common to use the earliest year in the sample as the reference year to account for that the underlying population may have different distributions in different time periods. [22]

EI stands for the employee involvement index and DI for the task discretion index. The variable ICT captures the relevance of ICT use in a job. The variable for trade union presence ($union$) is a simple dummy variable that takes the value 1 if a union is present at the workplace and 0 if no union is present. OCC comprise 345 4-digit occupation dummy variables to control for occupation characteristics. Ind comprise 56 2-digit industry dummy variables. u captures unobserved time-invariant components that might be correlated with the main variables of interest. ε is a random error term, which is assumed to be normally distributed conditioned on the predictor variables.

To validate the impact of involvement practices, technology, and union presence on the design of work, the ensuing analysis applies several estimation strategies.

First, a pooled OLS-regression is conducted to calculate the average effect of technology, involvement practices, and union presence on the design of work across all occupations and industries. The main advantage of this approach is that – compared to using cross-sectional data

[22] For the variable skill use, the year 2001 functions as the reference category as information for skill use in a job has been collected only since 2001.

– the sample size increases substantially. This leads to more precise estimators and test statistics with more power (Wooldridge, 2012: 449). Another advantage is that the same regression diagnostics for detecting violations of regression assumptions can be used (Wooldridge, 2010: 129).

In addition to the pooled OLS estimation, several robustness checks at the individual level are made to further corroborate the findings. In a first step, regressions are calculated including more control variables for personal or workplace characteristics. Furthermore, sub-sample analyses are conducted to assess whether the general findings remain robust when confining the sample to specific industries.

To address the issue of selection on observables, propensity-score matching is applied (see Rosenbaum and Rubin, 1983 for a more comprehensive (technical) summary of this method). This approach has become accepted more recently to estimate causal effects of a specific treatment (Caliendo & Kopeinig, 2008: 31). One potential source of bias inherent in the OLS estimation approach is that respondents in unionized firms differ systematically from employees in non-unionized firms in a way that affect their evaluation of e.g. job characteristics. Propensity score matching pairs similar respondents working in similar firms but only differ in the treatment variable (trade union presence).

Another challenge for the reliability of the estimates is the presence of unobserved components correlating with both the dependent and explanatory variables. The OLS approach and matching rely on the strong assumption of strict exogeneity. Hence, none of the approaches can eliminate potential sources of bias caused by the correlation of the estimates with the error term due to unobserved heterogeneity. In the case of union presence, Lee and Mas (2012: 335) make the case in point that the endogeneity of unionization makes it difficult to separate causal effects from other unobserved, confounding factors.

To address this issue, a panel at industry level consistently defined over the four cross-sections is constructed. By calculating a fixed-effects model, the time-invariant error term u capturing the influence of unobserved components within industries is canceled out. This enhances the efficiency of the estimators, making them more reliable than in pooled cross-sectional analyses.

4 Empirical results

This section summarizes the outcomes of the empirical analyses. The tables and figures presented in this chapter compactly sum up and accentuate the most important results. In section 4.1, the results are structured following the order of the hypotheses. As some of the independent variables vary in their respective scale, in each of the tables in section 4.1, the standardized beta coefficients are outlined to facilitate the comparison of the coefficients.[23]
The tables with the full regression results including unstandardized coefficients are outlined in Appendices 7-13.

4.1 Pooled OLS estimation

Appendices 7 to 13 summarize the regression results of the several pooled OLS estimations. Breusch-Pagan tests suggest that white-corrected standard errors should be used for nearly all specifications. Otherwise, p-values are given in squared brackets.
For each work design variable, column (1) in Appendices 7 to 13 outlines the raw time changes with no additional variables added. The estimates for the 2012 dummy variable are identical to the average change during the covered period as shown in the previous chapter (Table 5). In column (2), 4-digit occupation and 2-digit industry dummy variables are included. For every work design variable, occupation and industry characteristics explain a substantial part of the variation. In detail, ΔR^2 ranges from 0.09 (absence of control) to 0.36 (direction). Unsurprisingly, occupations account for a greater proportion of the variance in work design as indicated by the F-statistics.

As expected, industrial, and most notably occupational characteristics, account for some proportion of the time trends as well. In particular, conditioning on occupation and industry attenuates the time coefficients for problem-solving, direction, planning, and skill use. This

[23] Several objections have been raised in extant literature that emphasize the fallacies of using standardized coefficients to compare the coefficients of distinct explanatory variables. Exemplarily, Cain and Watts (1970) demonstrate that the efficiency of standardized coefficients is contingent on the joint distribution and intercorrelation of the regressors. Other scholars point to the difficulty to interpret the coefficients or that they are no measures of changes in the independent variable (see Bring (1994) for a more comprehensive summary).

implies that the rise of those tasks and skill use is partly associated with the changing occupational and industrial structure (see Green, 2012 for a more detailed summary).

Column (3) presents the results when the indicators for employee involvement, task discretion and ICT use enter the model without controlling for occupation and industry. As expected, these variables explain a high share of the variation in the work design variables (ΔR^2 ranges from 0.04 (job variety) to 0.34 (direction)) compared to the baseline model (column 1). The proportion of explained variance in the dependent variables also exceeds the proportion explained by the standard human capital and demographic background variables combined (see Appendix 5).
Column (4) introduces the occupation and industry dummies again in addition to the involvement and technology variables. Persistently, both occupation and industry explain some of the variance in the work design variables, however, their share decreases. More specifically, occupation and industry additionally explain 4% (autonomy) to 16% (direction) of the total variation in the dependent variables, indicating that a large proportion of the variance is already explained by the involvement and technology variables. Moreover, the results highlight that, depending on the specific work characteristics, once it is controlled for involvement and technology, occupational and industrial variations barely have additional explanatory power. The F-statistics reveal that employee involvement remains the variable with the highest explanatory power.
Column (5) presents the results when trade union presence is included and column (6) outlines the results when the full set of variables enters the model. The results reported in column (6) provide first evidence for the conformity of the derived hypotheses.

4.1.1 Technology and work characteristics

Hypotheses **1a** to **1d** predict the relationship between ICT use and specific work characteristics. The empirical findings of the pooled OLS regression are compendiously outlined in Table 13, which is an excerpt of the full regression results presented in column (6) in the Appendices 10-13.

Table 13: Pooled OLS regression (Hypotheses 1a, 1b, 1c, and 1d)

	Job variety		Autonomy		Skill use	
	beta-coefficient	(p-value)	beta-coefficient	(p-value)	beta-coefficient	(p-value)
ICT use	0.01	[0.278]	0.01	(0.605)	0.05***	(0.000)
Occupation	YES		YES		YES	
Industry	YES		YES		YES	
R^2	0.15		0.34		0.17	
Observation	13,902		13,905		11,750	

	Absence of control	
	beta-coefficient	(p-value)
ICT use	-0.03**	(0.025)
Occupation	YES	
Industry	YES	
R^2	0.14	
Observation	13,888	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with the respective work characteristic variable as dependent variable. The table is an excerpt from the full model outlined in column (6) in Appendices 10-13. The effect of ICT is controlled for multiple variables (year, involvement practices, trade union presence, occupation, and industry). The dependent variables job variety ranges from 0 (Never) to 4 (Always). The variable skill use ranges from 0 (Strongly disagree) to 4 (Strongly agree). The variables autonomy ranges from 0 (No choice at all) to 3 (A great deal of choice) and absence of control ranges from 0 (Very closely supervised) to 3 (Not at all supervised). The independent variable ICT use ranges from 0 (Not at all important) to 4 (Essential). White-corrected standard errors are used in every specification except for variety. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Hypothesis **1a,** which predicts that ICT use is positively associated with perceived job variety is not supported. In fact, the obtained coefficient with the corresponding p-value of 0.278 misses the conventional significance level. This result indicates that there is a neutral effect on job variety, assuming other factors are held constant. The finding for variety is somewhat surprising given extant empirical evidence documenting a negative relationship with the relevance of repetitive physical tasks (e.g. Green, 2012; Spitz-Oener, 2006).

Contrary to the expected connection, no statistically significant association is found between ICT and perceived autonomy. Therefore, hypothesis **1b** cannot be accepted at the conventional 10%-level.

The neutral relationship between ICT and perceived autonomy stands, at first sight, in contrast to more recent accounts (e.g. Menon et al., 2018) which demonstrate a positive link between ICT and autonomy within a job. The divergence of the results is partly attributable to differences in the underlying model specification. As noted by Gallie et al. (2004), ICT use is highly

associated with the skill level and other workplace factors. Hence, controlling for these factors should account for a substantial part of the variation in autonomy. The results obtained in the main model specification are, thus, in line with empirical work that accounts for such influences (e.g. Chesley, 2014 or Gallie et al., 2004) that similarly detected a neutral association between ICT and perceived autonomy. In this debate, Gerten, Beckmann, and Bellmann (2018) make a convincing point. Using unique German linked employer-employee data, the authors disclose that employees are affected differently in terms of autonomy induced by technology diffusion. In fact, they reveal that the association is contingent on employees' hierarchical position. This emphasizes the importance of assessing the impact of ICT separately for distinct occupations.

Hypothesis **1c**, predicting a positive association between ICT use and skill use in jobs, is supported at the 1%-level. This standardized coefficient of 0.05 indicates that within the same occupation and industry, skill use across the employed population in the sample increases by 0.05 standard deviations with every increase of one standard deviation in ICT use, assuming all other factors being held constant.

Finally, hypothesis **1e,** predicting a positive association between absence of control and ICT use, cannot be accepted. In fact, the estimation suggests that the there is a reversed, negative relationship that is statistically significant at the 5%-level. The standardized coefficient of -0.03 implies that absence of control decreases by 0.03 standard deviations with every increase of one standard deviation in the relevance of ICT (c.p.), pointing to a *positive* relationship – on average – between ICT and the *perception of supervision* in a job across all occupations and industries.

To play off the strength of the pooled sample, it was evaluated whether the estimate for ICT use has changed over time. The rationale is that changes in the nature of technology might alter the effect of technology usage on work characteristics. In Appendix 14, the coefficients of the various interaction terms (years multiplied with the explanatory variables) are outlined. Concerning the variable ICT use, the results suggest that its association with the respective work characteristic has not changed compared to the base year 1997 (indicated through the insignificant interaction terms).

Overall, the results found so far specify the average association between the variables of interest

across all occupations and industries. As implied by earlier remarks however, several studies highlight that the relation between ICT use and changes in work characteristics is contingent on the occupation of the respondent (e.g. Gibbs, 2017, Bayo-Moriones et al., 2015, Gerten et al., 2018)

To address this claim, a complementary analysis is conducted that tests the interaction between the occupation of the respondents and ICT use. In this specification, the same explanatory factors enter the model (e.g. employee involvement, industry). To ease interpretation, the 4-digit occupation dummies have been replaced by 1-digit occupation dummies (based on the Standard Occupational Classification 1992). Table 14 presents the statistically significant standardized coefficients for the interaction terms. In all specification, the occupational group "*Operatives*" is the reference category.

Investigating the association between ICT use and work characteristics by occupation unveils some interesting patterns. One outcome is that a marked difference does not exist in the association between ICT and perceived autonomy or skill use across different occupations compared to the reference category "*Operatives*". The sole exception are "*Elementary*" occupations. For perceived autonomy, the coefficient for the interaction term is negative and statistically significant, indicating that for "*Elementary"* occupations the association between autonomy and ICT is weaker compared to the reference category.

Concerning perceived variety, the interaction terms reveal that its association with ICT is much more pronounced and statistically significant for occupations that require a higher educational level ("*Managers*", "*Professional*", "*Skilled Trade*", and "*Personal Service*") compared to the reference occupation "*Operatives*". On the contrary, the association is weaker for "*Sales"* occupations compared to the reference occupation.

Finally, the positive and statistically significant coefficients in the various interaction terms for "*Managers"*, "*Associate Professionals"*, and "*Skilled trade*" occupations regarding absence of control implies that this relationship is stronger compared to the "*Operative*" group.

Table 14: Pooled OLS regression (ICT use*occupations) – work characteristics

	Job variety		Autonomy		Skill use	
	beta-coefficient	(p-value)	beta-coefficient	(p-value)	beta-coefficient	(p-value)
Man*ICT	0.10***	[0.002]				
Prof* ICT	0.07*	[0.052]				
Admin* ICT	-0.07*	[0.078]				
Skilltr* ICT	0.05***	[0.006]				
Perser* ICT	0.04**	[0.025]				
Sales* ICT	-0.05**	[0.025]				
Elem* ICT			-0.03**	(0.026)	-0.02	(0.338)
Industry	YES		YES		YES	
R^2	0.11		0.31		0.14	
Observation	13,902		13,905		11,750	

	Absence of control	
	beta-coefficient	(p-value)
Man* ICT	0.07**	(0.039)
Assprof* ICT	0.09***	(0.007)
Admin* ICT	0.13***	(0.001)
Skilltr* ICT	0.09***	(0.000)
Industry	YES	
R^2	0.10	
Observation	13,888	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The work characteristics variables are the dependent variables. "Man" stands for "Managerial Occupations", "Prof" stands for "Professional Occupations", "Admin" for "Administrative and Secretary Occupations", "SkillTr" stands for "Skilled Trade" occupations, "PerSer" stands for "Personal Services", and "Element" stands for "Elementary" occupations. The variable ICT use ranges from 0 (Not at all important) to 4 (Essential). White-corrected standard errors are used in every specification except for variety. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

In sum, these results provide indication for that the association between ICT and work characteristics is contingent on respondents' occupation. The obtained results align with other studies that demonstrate that high-skilled occupation benefit more from ICT use in terms of changing work characteristics as compared to lower-skilled occupations (e.g. Bayo-Moriones et al., 2015).

4.1.2 Technology and job tasks

Hypotheses **2a-2c** predict a positive relationship between ICT and the relevance of problem-solving, directive, and planning tasks.

The reasoning is motivated by the prognosis of the task framework that there is a positive association between ICT and the relevance of non-routine analytical/interactive tasks. Table 15 outlines the results of the pooled OLS estimation with each of the different task domains being the dependent variable.

Overall, the findings are in line with the theoretical prediction and all three hypotheses (**2a-2c)** can be accepted at the 1%-level. That is, a positive association between ICT use and the relevance of non-routine analytical/interactive tasks such as problem-solving, directive, and planning is found.

In particular, the standardized coefficient of 0.25 indicates that the relevance of problem-solving increases by 0.25 standard deviations with every increase of one standard deviation in the relevance of ICT, assuming all other factors being held constant. In a similar vein, the standardized coefficient of 0.16 (0.19) implies that the relevance of direction (planning) tasks increases by 0.16 (0.19) standard deviations with every increase of one standard deviation in the relevance of ICT, c.p. Overall, the results suggest that an increase in technology usage is associated with an increase in the relevance of those task domains even among respondents within the same occupation and industry.

Table 15: Pooled OLS regression (Hypotheses 2a, 2b, and 2c)

	Problem-solving		Direction		Planning	
	beta-coefficient	(p-value)	beta-coefficient	(p-value)	beta-coefficient	(p-value)
ICT use	0.25***	(0.000)	0.16***	(0.000)	0.19***	(0.000)
Occupation	YES		YES		YES	
Industry	YES		YES		YES	
R^2	0.35		0.51		0.43	
Observation	13,907		13,908		13,907	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with the respective job content variable as dependent variable. The table is an excerpt from the full model outlined in column (6) in Appendices 7-9. The effect of ICT is controlled for multiple variables (year, involvement policies, trade union presence, occupation, and industry). The dependent variables range from 0 (Not at all important) to 4 (Essential). The independent variable ICT use ranges from 0 (Not at all important) to 4 (Essential). White-corrected standard errors are used in every specification. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Overall, the findings obtained are in line with empirical accounts testing the prediction of the task framework (e.g. Spitz-Oener, 2006; Autor et al., 2003; Green, 2012).

The reported beta coefficients in Table 15 suggest that the relationship between ICT use and job content is more pronounced compared to its association with work characteristics. This finding is not surprising, however, given the conceptual difference between work characteristics and job content (Oldham & Hackman, 2010). In particular, some line of thought emphasizes that work characteristics depend more strongly on the social organisation of production. Therefore, work characteristics are more historically and institutionally contingent. On the other hand, the content of jobs is considered to be more sensitive regarding changes in technology use within a job (Eurofound, 2017: 37).

Along parallel lines, it was evaluated whether the ICT-work characteristic nexus is contingent on the respective occupation. The results presented in Table 16 present the statistical significant standardized coefficients.

Table 16: Pooled OLS regression (ICT use*occupations) – job content

	Problem-solving		Direction		Planning	
	beta-coefficient	(p-value)	beta-coefficient	(p-value)	beta-coefficient	(p-value)
Man*ICT	-0.10***	(0.000)	-0.11***	(0.000)		
Prof* ICT			-0.15***	(0.000)		
Assprof* ICT	-0.06**	(0.041)	-0.17***	(0.000)		
Admin* ICT	-0.10***	(0.008)	-0.26***	(0.000)		
Skilltr* ICT			-0.03**	(0.027)		
Perser* ICT	-0.03*	(0.061)	-0.03**	(0.044)	0.03*	(0.056)
Sales* ICT			-0.06***	(0.000)		
Elem* ICT	0.04***	(0.007)			0.04***	(0.005)
Industry	YES		YES		YES	
R^2	0.31		0.547		0.39	
Observation	13,907		13,908		13,907	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The task domain variables are the dependent variables. "Man" stands for "Managerial Occupations", "Prof" stands for "Professional Occupations", "Admin" for "Administrative and Secretary Occupations", "SkillTr" stands for "Skilled Trade" occupations, "PerSer" stands for "Personal Services", and "Element" stands for "Elementary" occupations. The variable ICT use ranges from 0 (Not at all important) to 4 (Essential). White-corrected standard errors are used in every specification. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

The statistically significant interaction term suggest that the relationship between ICT and relevance of problem-solving tasks is much more pronounced in the reference category "*Operatives*" than in high-skilled occupations such as "*Managers*" or "*Associate Professionals*". Furthermore, the relationship is even more pronounced in "*Elementary"* occupations compared to "*Operative"* occupations. Besides that, the association between the

relevance of directive tasks and ICT use is more marked in "*Operative*" occupations compared to high-skilled occupations.
This finding aligns with contemporary studies linking the diffusion of technology at the workplace with occupational upgrading (e.g. Oesch, 2013). Being more precise, this argument emphasizes that that occupations located at the lower end of skill requirement experience – as a consequence of ICT diffusion – a relatively more pronounced job upgrade in terms of content compared to high-skilled occupations that already require higher levels of non-routine tasks (see Gibbs, 2017 for a more in-depth elaboration).

Finally, the statistical significance of the coefficients for the respective interaction terms (outlined in Appendix 14) suggests that the relation between ICT and job tasks is about the same in 2001, 2006, and 2012 compared to 1997.

4.1.3 Involvement practices and work characteristics

Table 17 presents the results of the analysis testing the relationship between the indicators for involvement practices and work characteristics.
In hypotheses **3a, 3b, 3c, and 3d**, an overall positive association is predicted between the involvement variables and perceived variety, autonomy, skill-use, and absence of control.

Overall, most of the hypotheses are supported. Hypotheses **3b** and **3c**, predicting a positive relationship with autonomy and skill use, can be accepted at the 1%-level for both involvement indicators. More specifically, the standardized coefficient of 0.07 (0.47) implies that the perceived job autonomy increases by 0.07 (0.47) standard deviations with every increase of one standard deviation in employee involvement (task discretion) assuming all other factors being held constant. Analogously, the standardized coefficient of 0.14 (0.18) implies that the perceived skill use in a job increases by 0.14 (0.18) standard deviations with every increase of one standard deviation in employee involvement (task discretion).
Mixed results are obtained regarding the association between involvement practices and job variety (Hypothesis **3a**). As anticipated, a positive association between admitted discretion and perceived variety is found (statistically significant at the 1%-level). However, a neutral relationship is revealed for employee involvement, leading to a partial rejection of the hypothesis.

Table 17: Pooled OLS regression (Hypotheses 3a, 3b, 3c, and 3d)

	Job variety		Autonomy		Skill use	
	beta-coefficient	(p-value)	beta-coefficient	(p-value)	beta-coefficient	(p-value)
Employee involvement	-0.00	[0.942]	0.07***	(0.000)	0.14***	(0.000)
Task Discretion	0.07***	[0.000]	0.47***	(0.000)	0.18***	(0.000)
Occupation	YES		YES		YES	
Industry	YES		YES		YES	
R^2	0.15		0.34		0.17	
Observation	13,902		13,905		11,750	

	Absence of control	
	beta-coefficient	(p-value)
Employee involvement	-0.14***	(0.000)
Task discretion	0.19***	(0.000)
Occupation	YES	
Industry	YES	
R^2	0.14	
Observation	13,888	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with the respective work characteristic variable as dependent variable. The table is an excerpt from the full model outlined in column (6) in Appendices 10-13. The effect of involvement policies is controlled for multiple variables (year, ICT use, trade union presence, occupation, and industry). The dependent variables job variety ranges from 0 (Never) to 4 (Always). The variable skill use ranges from 0 (Strongly disagree) to 4 (Strongly agree). The variables autonomy ranges from 0 (No choice at all) to 3 (A great deal of choice) and absence of control ranges from 0 (Very closely supervised) to 3 (Not at all supervised). The independent variable employee involvement is a summary indicator calculated from the arithmetic mean of all variables included and ranges from 0 to 1. The variable task discretion is a summary indicator ranges from 0 (Not at all) to 3 (A great deal). White-corrected standard errors are used in every specification except for variety. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

In addition, ambiguous results are found for absence of control (Hypothesis **3d)**. In accordance with the developed hypothesis, the results suggest that discretion at workplaces is positively linked to perceived absence of control in a job (statistically significant at the 1%-level). Specifically, the standardized coefficient of 0.19 implies that perceived absence of control increases by 0.19 standard deviations with every increase of one standard deviation in task discretion assuming all other factors being held constant.

Contrary to expectations, the results indicate that employee involvement is negatively associated (statistically significant at the 1%-level) with absence of control. This result suggest that employees' perception over supervision is positively linked to this form of involvement. Although this finding contradicts the presupposed relationship, it is in line with (critical)

accounts that point to work intensification in terms of "concertive" control mechanisms by adopting specific involvement practices (Barker, 1993; Sewell, 1998).

Additionally, a closer inspection of the standardized coefficients suggests that the association between task discretion and work characteristics is more pronounced compared to employee involvement. Unsurprisingly, the strongest relationship is found between discretion and perceived job autonomy.
Overall, this pattern underscores the importance of addressing the association between work characteristics and both set of indicators for involvement practices separately because the relationship is not unidirectional and of comparable magnitude.
Moreover, the findings imply that the link between such involvement practices and work characteristics is more pronounced compared with ICT use. Specifically, the results suggest that organizational measures to increase involvement of employees are more strongly related to changes in work characteristics compared to the use of ICT.

In a related manner, it was tested whether the relationship between involvement practices and work characteristic variables is contingent on the occupation of the respondents. Table 18 presents the standardized coefficients of the interaction terms. Again the occupational group "*Operatives"* is the reference category. For reasons of clarity, only those interaction terms being statistically significant are outlined.

The coefficients retrieved tentatively suggest that little differences in the relationship between involvement/task discretion and perceived autonomy/skill use exists in the different occupations. Regarding perceived variety, the results of the interaction terms are ambiguous. On the one hand, the coefficients reveal that the relationship between employee involvement and variety is more pronounced in nearly all other occupational groups compared to the occupational group "*Operatives*". On the other hand, the nexus between task discretion and perceived job variety is weaker in nearly all other occupational groups as compared to "*Operatives"*.

Table 18: Pooled OLS regression (involvement*occupations) – work characteristics

	Job variety		Autonomy		Skill use	
	beta-coefficient	(p-value)	beta-coefficient	(p-value)	beta-coefficient	(p-value)
Man*EI	0.08**	[0.026]				
Prof*EI	0.09**	[0.012]	-0.09***	(0.009)		
Assprof* EI	0.06*	[0.079]				
Admin* EI	0.09***	[0.001]				
Skilltr* EI	0.05**	[0.035]			-0.04*	(0.074)
Perser* EI			-0.05*	(0.076)		
Sales* EI	0.05**	[0.039]				
Elem* EI	0.05**	[0.030]	-0.04*	(0.067)		
Man*TD			-0.14***	(0.004)		
Prof*TD	-0.12***	[0.006]	-0.14***	(0.000)		
Assprof*TD	-0.11**	[0.012]	-0.09**	(0.041)		
Admin*TD	-0.14***	[0.000]				
Skilltr*TD	-0.10**	[0.014]				
Perser*TD	-0.08**	[0.046]	-0.07*	(0.051)		
Elem*TD	-0.14***	[0.000]			-0.09**	(0.027)
Industry	YES		YES		YES	
R^2	0.11		0.31		0.14	
Observation	13,902		13,905		11,750	

	Absence of control	
	beta-coefficient	(p-value)
Man*EI	-0.13***	(0.000)
Perser* EI	-0.08***	(0.007)
Elem* EI	-0.06**	(0.014)
Man*TD	0.16***	(0.004)
Prof*TD	0.17***	(0.000)
Assprof*TD	0.12**	(0.014)
Admin*TD	0.15***	(0.001)
Skilltr*TD	0.14***	(0.002)
Industry	YES	
R^2	0.10	
Observation	13,888	

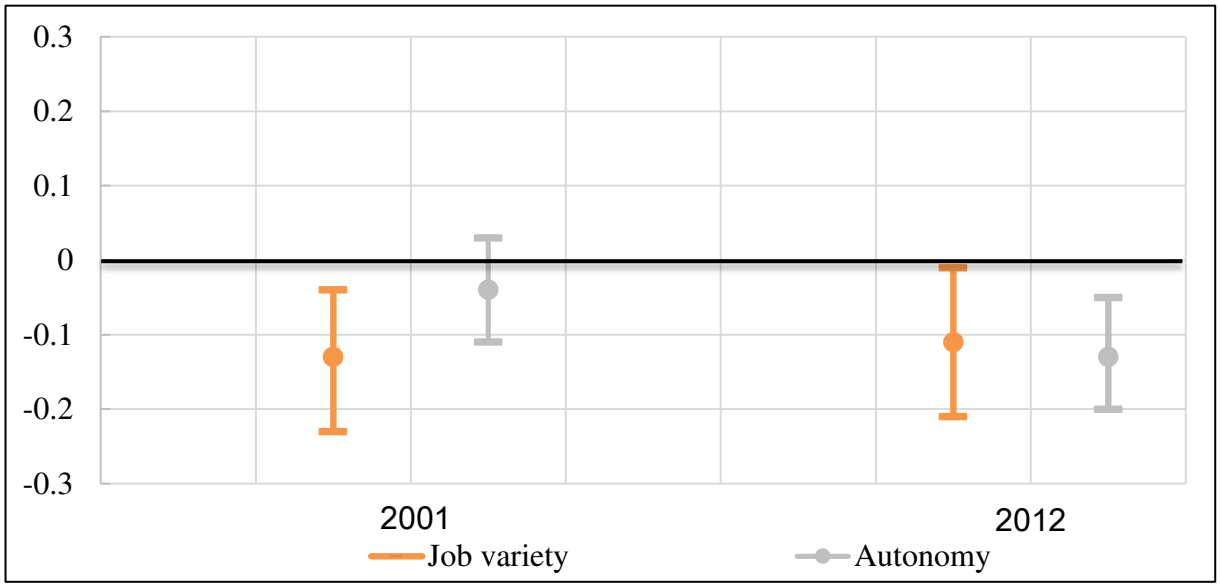
Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The work characteristic variables are the dependent variables. "Man" stands for "Managerial Occupations", "Prof" stands for "Professional Occupations", "Admin" for "Administrative and Secretary Occupations", "SkillTr" stands for "Skilled Trade" occupations, "PerSer" stands for "Personal Services", and "Element" stands for "Elementary" occupations. The independent variable employee involvement is a summary indicator calculated from the arithmetic mean of all variables included and ranges from 0 to 1. The variable task discretion is a summary indicator ranges from 0 (Not at all) to 3 (A great deal). White-corrected standard errors are used in every specification except for variety. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

A similar pattern is retrieved (although with different directions of the estimates) when testing the association between involvement practices and absence of control by occupation. Here, the

coefficients of the interaction terms suggest that the association between employee involvement and absence of control is more negative for e.g. respondents in managerial compared to operative occupations. This findings indicates that employees in managerial occupations perceive this form of involvement more adversely compared to operatives in terms of supervision. On the other hand, an increase task discretion is more positively associated with absence of control for nearly all other occupational groups.

Overall, these results hint to that the nexus between those practices and the considered work characteristics is far more complex than previously anticipated. This train of thought concurs with studies that focus on the changes in job characteristics in distinct occupational classes in the UK (Gallie et al., 2004), which reveal that the evolution in job characteristics is not uniform across occupations.

Figure 11: Task discretion and variety/autonomy (compared to 1997; 95%-CI)



Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with the respective job content variable as dependent variable. The table is an excerpt from Appendix 14.

Finally, it was evaluated whether the estimates differ for the years 2001, 2006, and 2012 compared to 1997. Only for the task discretion index, the slope of the coefficient differed for some work characteristics (summarized in Figure 11). That is, the overall positive relationship between task discretion and variety was lower in 2001 and 2012 compared to 1997. Similarly, the positive relationship between discretion and both job autonomy and job variety was lower in 2012 compared to 1997.

This finding offers tentative indication for more recent claims pointing to that management in the UK returned to command and control principles during the period from 2000 to 2010 (Green et al., 2016).

4.1.4 Involvement practices and job tasks

Table 19 compendiously outlines the standardized coefficients of the empirical analysis testing hypotheses **4a-4c** that speculate on the relationship between involvement practices and work content.

Table 19: Pooled OLS regression (Hypotheses 4a, 4b, and 4c):

	Problem-solving		Direction		Planning	
	beta-coefficient	(p-value)	beta-coefficient	(p-value)	beta-coefficient	(p-value)
Employee involvement	0.21***	(0.000)	0.30***	(0.000)	0.17***	(0.000)
Task discretion	0.17***	(0.000)	0.18***	(0.000)	0.30***	(0.000)
Occupation	YES		YES		YES	
Industry	YES		YES		YES	
R^2	0.35		0.51		0.43	
Observation	13,907		13,908		13,907	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with the respective job content variable as dependent variables. The table is an excerpt from the full model outlined in column (6) in Appendices 7-9. The effect of involvement practices is controlled for multiple variables (year, ICT use, trade union presence, occupation, and industry). The dependent variables range from 0 (Not at all important) to 4 (Essential). The independent variable employee involvement is a summary indicator calculated from the arithmetic mean of all variables included and ranges from 0 to 1. The variable task discretion is a summary indicator ranges from 0 (Not at all) to 3 (A great deal). White-corrected standard errors are used in every specification. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

In summary, all hypotheses can be accepted at the 1%-level. That is, irrespective of the occupation and industry, an increase in either employee involvement or task discretion is positively associated with the relevance of problem-solving, directive, and planning tasks. In particular, the standardized coefficient of 0.21 (0.17) implies that the relevance of problem-solving tasks in a job increases by 0.21 (0.17) standard deviations with every increase of one standard deviation in employee involvement (task discretion), assuming all other factors being held constant. Along parallel lines, the standardized coefficient of 0.30 (0.18) implies that the relevance of directive tasks increases by 0.30 (0.18) standard deviations with every increase of

one standard deviation in employee involvement (task discretion), and the standardized coefficient of 0.17 (0.30) implies that the relevance of planning tasks increases by 0.17 (0.30) standard deviations with every increase of one standard deviation in employee involvement (task discretion), c.p.

The similar coefficients for employee involvement and task discretion for problem-solving suggest that the relationship for both indicators is equal. On the contrary, the results indicate that the association between employee involvement and directive tasks is more pronounced compared to the relation with admitted discretion. This pattern concurs with the line of argumentation suggested by Felstead and Gallie (2004), who emphasize that engagement in teamwork, quality circles as well as in suggestion schemes leads to more pronounced interrelations among employees, and a higher need for peer communication. The standardized coefficients also suggest that the relationship between planning and discretion is much more pronounced compared to its relation with employee involvement. This finding does not come as a surprise and reflects arguments emphasizing that planning activities are prerequisites for efficient autonomous work (e.g. Ellis et al., 2005).

Besides that, a closer inspection of the standardized coefficients unveils that the size of the coefficient for the used involvement indicators is comparable to the coefficient that specifies the relationship with ICT. In particular, the association between employee involvement (0.21) and problem-solving tasks is comparable to that with ICT use (0.25). In a similar vein, the relationship between discretion (0.18) and direction activities is similar to that of ICT (0.16). Besides that, the standardized coefficients implies that admitted discretion (0.30) is more strongly related to the relevance of planning tasks compared to ICT (0.19), whereas the relationship with employee involvement (0.17) is rather equal.
The bottom line of these finding is that the development towards involvement-based organizations provides an additional, "*orthogonal"* (Green et al., 2016: 126) source of changes in task requirements within jobs. These results underscore the importance of more recent contributions (e.g. Green, 2012) evaluating the impact of such practices on the content of jobs.

Of particular interest, again, is the direction of the interaction terms for different occupations. The results of the corresponding regression are outlined in Table 20. Again, for reasons of clarity, only those interaction terms are outlined that are statistically significant. The occupational group "*Operatives"* is the reference category.

Table 20: Pooled OLS regression (involvement*occupations) – job content

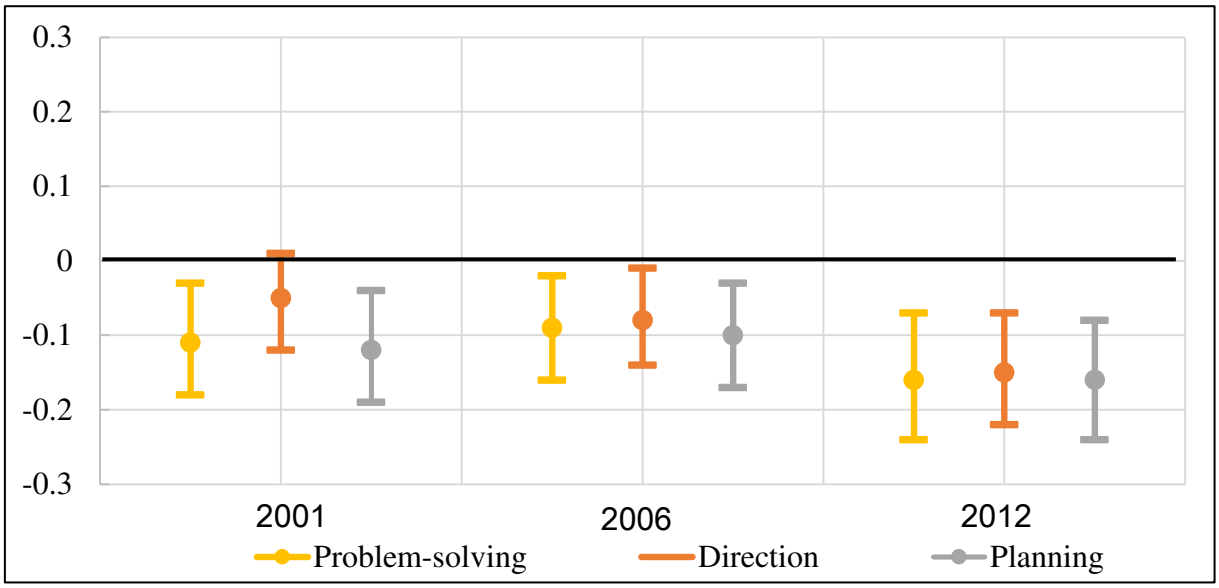
	Problem-solving		Direction		Planning	
	beta-coefficient	(p-value)	beta-coefficient	(p-value)	beta-coefficient	(p-value)
Man*EI	-0.10***	(0.001)				
Prof*EI	-0.14***	(0.000)	-0.05*	(0.094)		
Assprof*EI	-0.10**	(0.001)	-0.05*	(0.074)		
Admin*EI					0.05*	(0.087)
Skilltr*EI	-0.08***	(0.000)	-0.07***	(0.000)		
Perser*EI					0.04*	(0.087)
Sales*EI					0.07***	(0.002)
Elem*EI	0.05**	(0.011)			0.04*	(0.076)
Man*TD	-0.09**	(0.045)			-0.29***	(0.000)
Prof*TD	-0.13***	(0.002)	-0.06*	(0.092)	-0.29***	(0.000)
Assprof*TD	-0.10**	(0.016)			-0.17***	(0.000)
Admin*TD					-0.07*	(0.078)
Skilltr*TD			0.07**	(0.029)		
Perser*TD					-0.09**	(0.025)
Industry	YES		YES		YES	
R^2	0.31		0.46		0.39	
Observation	13,907		13,908		13,907	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The task domain variables are the dependent variables. "Man" stands for "Managerial Occupations", "Prof" stands for "Professional Occupations", "Admin" for "Administrative and Secretary Occupations", "SkillTr" stands for "Skilled Trade" occupations, "PerSer" stands for "Personal Services", and "Element" stands for "Elementary" occupations. The independent variable employee involvement is a summary indicator calculated from the arithmetic mean of all variables included and ranges from 0 to 1. The variable task discretion is a summary indicator ranges from 0 (Not at all) to 3 (A great deal). White-corrected standard errors are used in every specification. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Overall, the results for the interaction terms reveal that the association between employee involvement and problem-solving/directive tasks is more pronounced in the reference category "*Operatives"* compared to e.g. the occupational group "*Professionals*" or "*Skilled Trade*". Focussing on admitted discretion, the results highlight that the relationship with e.g. problem-solving and planning is less pronounced for the occupational groups "*Managers"* or "*Professional*" compared to "*Operatives*".

Based on these results, one preliminary conclusion is that the impact of involvement practices on the relevance of job tasks is contingent on distinct occupational groups. The direction of the coefficients indicates that the overall impact of involvement schemes on some task domains is attenuated for high-skill occupations such as "*Managers*" or "*Professionals*" that already score high on such task domains, and more pronounced for lower-skilled occupations. Again, these findings provide tentative evidence for a job upgrade in lower skilled occupations when involvement practices are introduced.

Figure 12: Task discretion and task domains (compared to 1997; 95%-CI)



Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with the respective job content variable as dependent variable. The table is an excerpt from Appendix 15.

Finally, the relationship between involvement practices and task domains was assessed more thoroughly to see whether it differed in the period under consideration. For employee involvement, no difference in the slope of the coefficient compared to 1997 is found (see Appendix 15).

For task discretion, it is detected that the relationship with the task domains under consideration has become weaker compared to 1997 (see Figure 12). More specifically, whereas the increase in the relevance of problem-solving tasks is estimated to be 0.34 with a unit increase in discretion in 1997, the predicted impact is about 0.16 units lower in 2012. Likewise, whereas the increase in the relevance of planning tasks is estimated to be 0.54 with a unit increase in discretion in 1997, the predicted influence is about 0.10 units lower in 2006. Accordingly, whereas a one unit increase in task discretion is associated with a 0.34 rise in the relevance of direction tasks in 1997, this relationship becomes weaker by 0.08 units in 2006.

This finding further supports earlier remarks on changes in the *nature* of admitted discretion in UK workplaces. Not only is the level of discretion falling in overall terms. The results presented also suggest that the impact of admitted discretion on work content has changed throughout the last decade, pointing to a more complex relationship between admitted discretion and work design.

4.1.5 Trade union presence and work characteristics

Hypotheses **5a-5d** summarize the assumed relationship between union presence and work characteristics. In section 2.4, it was reasoned that trade union presence is associated with more tayloristic work design which goes hand in hand with a lower degree of variety, autonomy, skill use and absence of control. The standardized coefficients retrieved from the empirical analysis testing the relationship are presented in Table 21.

Overall, the findings of the pooled OLS regression are in accordance with the developed hypotheses.

Table 21: Pooled OLS regression (Hypotheses 5a, 5b, 5c, and 5d)

	Job variety		Autonomy		Skill use	
	beta-coefficient	(p-value)	beta-coefficient	(p-value)	beta-coefficient	(p-value)
Trade union presence	-0.02*	[0.068]	-0.05***	(0.000)	-0.03**	(0.011)
Occupation	YES		YES		YES	
Industry	YES		YES		YES	
R^2	0.15		0.34		0.17	
Observation	13,902		13,905		11,750	

	Absence of control	
	beta-coefficient	(p-value)
Trade union presence	-0.04***	(0.000)
Occupation	YES	
Industry	YES	
R^2	0.14	
Observation	13,888	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with the respective work characteristic variable as dependent variable. The table is an excerpt from the full model outlined in column (6) in Appendices 10-13. The effect of involvement policies is controlled for multiple variables (year, ICT use, involvement policies, occupation, and industry). The dependent variables job variety ranges from 0 (Never) to 4 (Always). The variable skill use ranges from 0 (Strongly disagree) to 4 (Strongly agree). The variables autonomy ranges from 0 (No choice at all) to 3 (A great deal of choice) and absence of control ranges from 0 (Very closely supervised) to 3 (Not at all supervised). The independent variable trade union presence is a dummy variable taking the value 1 if a trade union is present and 0 if no union is present at the workplace. White-corrected standard errors are used in every specification except for variety. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

In particular, hypothesis **5a** predicting a negative association between union presence and

perceived job variety can be accepted at the 10%-level. The coefficient of -0.04 [24] indicates that – on average – perceived job variety is 0.04 units lower in unionized workplaces compared to non-unionized workplaces.

Hypothesis **5b** (**5d),** predicting a negative association between union presence and job autonomy (absence of control) can be accepted at the 1%-level. The coefficient of -0.08 (-0.08) implies that – on average – perceived autonomy (absence of control) is estimated to be 0.08 (0.08) units lower in unionized compared to non-unionized workplaces, holding all else to be constant.
In a similar vein, hypothesis **5c** can be accepted at the 5%-level. The coefficient of -0.04 specifies that – on average – perceived skill use in a job is estimated to be 0.04 units lower in unionized compared to non-unionized workplaces, c.p.

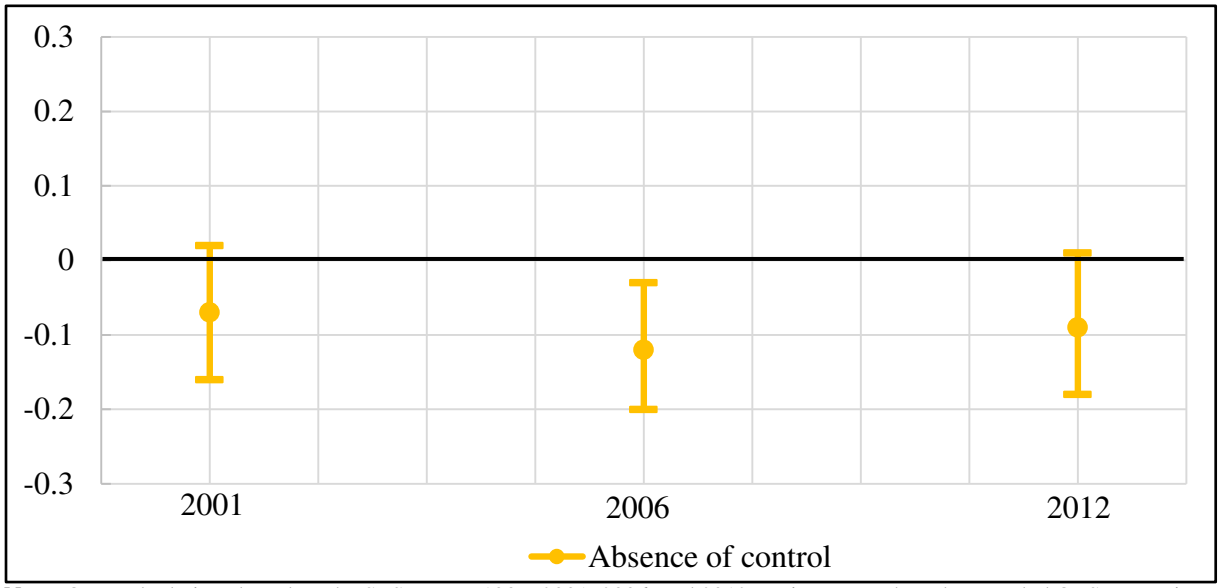
Comparing the standardized beta-coefficients between the posited determinants yields additional insights. For one, the results suggest that the association between union presence and work characteristics is less pronounced compared to the relationship with involvement practices. This finding does not come as a surprise, as organizational level practices aiming to foster involvement are expected to have a stronger relationship with work characteristics compared to contextual factors such as union presence. However, the findings suggest that the negative relationship of trade union presence and autonomy is – in terms of magnitude – similar to the positive link between employee involvement and autonomy. Comparing the association between ICT use and work characteristics with that of trade union presence unveils a similar pattern. In fact, the standardized coefficients for absence of control and skill use are similar for union presence in terms of magnitude compared to the coefficient for ICT. This finding was not anticipated a priori and further supports the claim that trade union presence should be considered as an important indicator of work characteristics in its own right.

Finally, complementary calculations were conducted to see whether the relationship between trade union presence and work characteristics changed throughout the covered period. One rationale justifying this thought is that the partnership principles in the 2000s may have changed the association between trade union presence at workplaces and job characteristics.

[24] For ease of interpretation, the unstandardized coefficients outlined in Appendices 7-13 are used as the transformation of dichotomous variables into standardized variables makes the interpretation of the coefficient less intuitive.

The results outlined in Appendix 14 suggest, however, that a difference in the relationship between union presence and most work characteristics compared to 1997 is not to be found, with the sole exception being the association with perceived absence of control. This finding is highly interesting.

Figure 13: Union presence and absence of control (compared to 1997; 95%-CI)



Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with absence of control being the dependent variable. The table is an excerpt from the interacted model in which it is assumed that the relationship between ICT and employee involvement does not change compared to 1997.

In detail, Figure 13 outlines the estimate of the interaction term. The numbers indicate that the negative relationship between union presence and absence of control is more pronounced in 2006 and 2012 compared to 1997 (interaction terms are statistically significant at least at the 10%-level). In other words, the finding suggests that perceived supervision in a job *increased* in unionized workplaces compared to non-unionized workplaces despite political efforts to establish a cooperative union-management relation in the UK.

This finding highlights two aspects. First, the *overall* negative relation found between union presence and absence of control is mainly attributable to the development in the 2000s. In other words, the association had not been constant during the covered period. The second tentative conclusion is that the more pronounced relation between union presence and perceived supervision coincides with the attempts to establish a relationship between trade unions and management that relies more on trust than on repudiation. Hence, this finding also supports the previous line of thought emphasizing that adversarialism remains a marked feature of the industrial relations in the UK.

4.1.6 Trade union presence and job tasks

The developed hypotheses **6a**-**6c** link trade unions presence with the generic task domains conducted in a job. More specifically, based on the main proposition to be tested, a negative association between union presence and the relevance of problem-solving (**6a)**, directive (**6b**), and planning tasks (**6c**) is hypothesized.
Table 22 presents the standardized beta coefficients of the pooled OLS estimation.

Hypothesis **6a** can be accepted at the 10%-level. The coefficient of -0.03[25] implies that – on average – the relevance of problem-solving activities is 0.03 units lower in unionized compared to non-unionized workplaces, c.p.
Furthermore, hypothesis **6c** can be accepted at the 10%-level. That is, the relevance of planning tasks is estimated 0.03 units lower in unionized workplaces compared to non-unionized workplaces, c.p.
Contrary to the expected pattern, a neutral association between trade union presence and discretion activities is detected. This leads to a rejection of hypothesis **6b**.

Table 22: Pooled OLS regression (Hypotheses 6a, 6b, and 6c)

	Problem-solving		Direction		Planning	
	beta-coefficient	(p-value)	beta-coefficient	(p-value)	beta-coefficient	(p-value)
Trade union presence	-0.02*	(0.076)	-0.00	(0.905)	-0.03*	(0.051)
Occupation	YES		YES		YES	
Industry	YES		YES		YES	
R^2	0.35		0.51		0.43	
Observation	13,907		13,908		13,907	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with the respective job content variable as dependent variable. The table is an excerpt from the full model outlined in column (6) in Appendices 7-9. The dependent variables range from 0 (Not at all important) to 4 (Essential). The independent variable trade union presence is a dummy variable taking the value 1 if a trade union is present and 0 if no union is present at the workplace. White-corrected standard errors are used in every specification. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Comparing the standardized beta-coefficients unveils that the relationship between job tasks and trade union presence is much lower compared to the nexus with involvement practices and

[25] Again, for ease of interpretation, the unstandardized coefficients outlined in Appendices 7-9 are used.

ICT. In particular, whereas the standardized coefficients for involvement practices and ICT are at least above 0.16, the standardized coefficients for trade union presence are rather modest in comparison (-0.02 and -0.03, respectively). Notwithstanding, the results suggest that union presence is an important explanatory factor in its own right. One rationale is that the estimates found for union presence represent the average association with job content (and work characteristics) across the whole sample. It might be the case that the relationship is more marked for specific sub-samples (e.g. for distinct industries). Being more precise, the sample used also contains information from respondents working in the public administration, educational, and health sector in which trade union diffusion is high and respondents score higher on the different items for holistic jobs. Therefore, confining the sample to specific industries might unveil a more pronounced relationship with union presence.
Secondly, the importance of the union effect is emphasized by empirical studies (e.g. Nguyen, Taylor, & Bradley, 2003; Scott & Bruce, 1994; Ayres & Malouff, 2007) highlighting that only minor changes in the work design variables under consideration have a strong impact on outcomes such as job satisfaction or innovativeness. Hence, the results of the main model provide tentative evidence that despite the relative small effect size, trade union presence is a relevant indicator.

To conclude, it was tested whether the association between trade union presence and task domains is different for the respective cross-sections. The results obtained in the regression model including interaction terms for years and union presence (Appendix 15) suggest, however, that the relationship has not changed during the covered period. In other words, no difference is disclosed regarding the association between union presence and job content compared to 1997.

As a final note, additional robustness checks are run (results not reported) to tackle specific issues regarding the pooled OLS-estimation.
First, as information on skill use has only been collected since 2001, one might object that the retrieved coefficients for the other indicators are due to the larger sample size in the respective regressions. However, running regressions on a confined sample only including information from the years 2001, 2006, and 2012 reveals no difference in the coefficients nor their statistical significance.
Second, seemingly unrelated regressions (Zellner, 1962) have been conducted, which allows

the error terms in the respective equations to be correlated. The findings of this additional test indicate that the results remain robust under this assumption.
Thirdly, running separate regressions for each year does not alter the main conclusion, as nearly all coefficients remain statistically significant as compared to the pooled sample.

4.2 Additional analyses

To corroborate the findings of the pooled OLS regression presented in section 4.1, additional analyses are conducted to address specific objections that undermine the validity of the retrieved results.
In a first step, an extended version of the main model incorporating more control variables is tested. In detail, it is evaluated whether the retrieved results from the main model remain robust when additionally controlling for workplace and individual-level factors.

To obtain a more nuanced insight into the unions' effect on work design, the second step includes additional analyses for specific industries. The overall aim of this approach is to assess whether the size (and direction) of the coefficient for union presence varies across distinct industries. Moreover, these findings also shed light upon whether the link between union presence and the design of work is similar to that of the other posited determinants in different industries.

To address the issue of selection on observables, propensity score matching is conducted. This technique is used to control for differences among the respondents that work in unionized or non-unionized workplaces; making the groups of individuals comparable. In doing so, workplace characteristics are controlled, which themselves are important predictors for union presence at the workplace.

Finally, to deal with the concern of unobserved heterogeneity, a fixed-effects panel estimation at industry-level is conducted to control for unobserved factors within industries that correlate with the variable of interest.

4.2.1 Additional controls

To ensure appropriate parsimony, the main model only includes such controls that are identified to be sufficient to explain a substantial part of the variations in the work design variables. One possible objection, however, is that the main model might be underspecified as variables capturing specific firm characteristics are not included. This claim is backed by scholars pointing to that firm size is an important determinant in explaining variations in computer-use (e.g. DeLone, 1981), or that firm size affects working conditions such as the degree of participation (García-Serrano, 2011).
Another claim made is that employees with specific characteristics, such as being a part-time employee, are in low skilled positions that score lower on holistic job attributes (e.g. Felstead & Gallie, 2004). Tentative evidence for this line of reasoning was presented earlier in section 3.4, as marked differences in the work design variables are revealed between e.g. men and women.

To address the objection that important variables have been omitted in the main model, an additional model is tested controlling for a battery of workplace and individual level attributes. In detail, following the work of Felstead and Gallie (2004), a range of workplace controls, such as establishment size or workplace gender composition, and individual controls, such as a gender dummy variable, age, age squared or employment status (taking the value 1 if the respondent works full-time and taking the value 0 if not) enter the model.

Column (7) in Appendices 7-13 presents the estimates of this extended version of the main model. The findings (standardized beta coefficients) for the variables of interest are compendiously outlined in Table 23.

Table 23: Pooled OLS regression (additional controls, standardized)

	Dependent variables						
	Job variety	Autonomy	Skill use	Absence of control	Problem-solving	Direction	Planning
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Employee involvement	-0.01 [0.541]	0.07*** (0.000)	0.14*** (0.000)	-0.13*** (0.000)	0.20*** (0.000)	0.18*** (0.000)	0.17*** (0.000)
Task discretion	0.07*** [0.000]	0.46*** (0.000)	0.18*** (0.000)	0.18*** (0.000)	0.17*** (0.004)	0.14*** (0.000)	0.30*** (0.000)
ICT use	0.01 [0.506]	0.00 (0.671)	0.05*** (0.000)	-0.02 (0.235)	0.25*** (0.000)	0.14*** (0.000)	0.18*** (0.000)
Trade union presence	-0.03*** [0.008]	-0.04*** (0.000)	-0.03*** (0.002)	-0.06*** (0.000)	-0.02** (0.047)	-0.01 (0.525)	-0.01 (0.129)
R^2	0.16	0.34	0.18	0.17	0.35	0.52	0.43
N	13,477	13,480	11,392	13,463	13,482	13,483	13,482

Note: Calculations based on the SES, waves 1997, 2001, 2006, and 2012. The respective work design variables are the dependent variables. The coefficients present the average effect of employee involvement, task discretion, ICT use, and trade union presence on the respective dependent variables (ceteris paribus). White-corrected standard errors are used in every specification except for variety. The outlined coefficients are the standardized beta-coefficients. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Concerning the variable employee involvement, the size of the coefficients and its statistical significance aligns with the results of the main model. Specifically, the revealed negative linkage between employee involvement and absence of control remains negative and statistically significant. Besides that, the neutral relation between employee involvement and perceived variety remains robust.

Similar to the main model, the associations between the indicator for task discretion and all work design variables remain unchanged.
For ICT use, the size of the coefficients do not change much, and they remain statistically significant. The only exception is the association between ICT and absence of control. The negative association detected in the main model becomes statistically insignificant at the conventional levels after taking account for the additional control variables.

The coefficients retrieved for the variable union presence suggest that the associations found in the main model maintain their validity when controlling for multiple workplace and individual-level variables. Overall, the size of nearly all coefficients remain on similar levels in the augmented version, and retain their statistical significance at conventional levels. The only exception is the coefficient for planning tasks. Here, the association cannot be accepted at the 10%-level with a p-value of 0.129. Notwithstanding this result, the corresponding 95%-CI [-0.06; 0.01] underscores the tendency of a negative relationship between union presence and the relevance of planning tasks in a job.
Overall, the findings from the augmented model demonstrate that the joint inclusion of indicators for workplace characteristics and personal characteristics does not alter the findings retrieved from the main model.

4.2.2 Sub-sample analyses

In the following, the results of sub-sample analyses are presented. In particular, a model is tested using a sample that is confined to specific industries. As indicated earlier, the results from the pooled OLS estimation presented in 4.1 represent the average association between trade union presence and the respective work design variables across the whole sample. Hence, one might reasonably state that the association with union presence is contingent on the

characteristics of specific industries that may differ in terms of bargaining power or adversarial stance towards management.

The results of the analysis are reported in Table 24. For reasons of clarity, only the standardized coefficients of those models are outlined in which the coefficients for union presence are statistically significant at the conventional 10%-level. Although it is acknowledged that the reported results need to be interpreted rather cautiously due to causality considerations, they do reveal interesting patterns.

Exemplarily, the coefficients retrieved for the sample confined to the *manufacturing sector* unveil that the size of coefficient for trade union presence is in terms of autonomy or job variety comparable to that of ICT (and, as expected, in an opposite direction).

Observing the results in more detail, the standardized coefficient of 0.04 implies that the perceived job variety increases by 0.04 standard deviations with every increase of one standard deviation in ICT use among respondents working in the manufacturing sector. The negative coefficient for union presence, on the contrary, implies that perceived job variety among respondents working in a unionized workplace in the manufacturing sector is lower compared to respondents working in a non-unionized workplace in the same industry (c.p.).

Comparing the results for the sample of respondents working in the distribution and hotel sector reveals that the association between union presence and autonomy is on a similar level (and in different direction) compared to the association between employee involvement and autonomy. Interestingly, the hypothesized negative association between union presence and autonomy, skill use, and absence of control is also found in the banking, and finance industry; a sector in which employees tend to report higher scores for the holistic work design items. In particular, the standardized coefficients outlined in Table 24 suggest that the negative relationship between autonomy and union presence is comparable in terms of magnitude to the positive association between involvement and autonomy.

Table 24: Pooled OLS regression for specific industries (standardized)

	Manufacturing			Distribution, Hotels, etc.		
	Planning	Job variety	Autonomy	Job variety	Autonomy	Absence of control
	(1)	(2)	(3)	(1)	(2)	(3)
Employee involvement	0.16***	0.03	0.05***	-0.01	0.08***	-0.16***
	(0.000)	(0.251)	(0.004)	(0.685)	(0.000)	(0.000)
Task discretion	0.40***	0.14***	0.53***	0.06***	0.46***	0.17***
	(0.000)	(0.000)	(0.000)	(0.006)	(0.000)	(0.000)
ICT use	0.16***	0.04*	0.04*	-0.04	-0.01	-0.03
	(0.000)	(0.098)	(0.077)	(0.134)	(0.708)	(0.282)
Trade union presence	-0.04**	-0.04*	-0.03*	-0.04*	-0.09***	-0.10***
	(0.016)	(0.068)	(0.064)	(0.074)	(0.000)	(0.000)
R^2	0.45	0.14	0.38	0.05	0.47	0.09
N	2,272	2,272	2,272	2,335	2,336	2,233

	Banking, Finance, etc.			Transport & Communication				
	Autonomy	Skill use	Absence of control	Problem-solving	Planning	Job variety	Autonomy	Skill use
	(1)	(2)	(3)	(1)	(2)	(3)	(4)	
Employee involvement	0.05**	0.14***	-0.12***	0.23***	0.16***	-0.04	0.09***	0.17***
	(0.038)	(0.000)	(0.000)	(0.000)	(0.000)	(0.320)	(0.005)	(0.000)
Task discretion	0.50***	0.19***	0.27***	0.15***	0.32***	0.08**	0.49***	0.21***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.021)	(0.000)	(0.000)
ICT use	0.01***	0.07**	-0.02	0.29***	0.17***	0.02	0.02	0.01
	(0.751)	(0.032)	(0.559)	(0.000)	(0.000)	(0.628)	(0.624)	(0.791)
Trade union presence	-0.08***	-0.04*	-0.05*	-0.11***	-0.11***	-0.08**	-0.09***	-0.08**
	(0.016)	(0.055)	(0.025)	(0.000)	(0.000)	(0.017)	(0.002)	(0.046)
R^2	0.34	0.15	0.11	0.38	0.30	0.09	0.36	0.17
N	2,123	1,826	2,122	905	905	904	905	744

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. In addition, 345 occupation dummies are included in each regression. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

The results for the transportation and communication sector are highly interesting as well. For nearly all work design variables, a statistically significant negative relationship is detected with union presence. The association is – in terms of coefficient size – substantially larger compared to the average effect found for union presence in the main model. One rationale for this finding includes that the working conditions in this sector are per se worse compared to other branches. Indirect evidence for this claim is supplied by Gazioglu and Tansel (2006), who demonstrate that employees working in the transportation sector are less satisfied with influence over job, amount of pay, or with sense of achievement. Another tentative interpretation of this finding draws upon a line of thought provided by Brown, Bryson, and Forth (2008), and concurs with the theoretical arguments outlined in this thesis. In particular, the authors emphasize that industrial relations in this sector are not only shaped by long bargaining traditions or by lower union retreat during the 2000s, but also by the fact that workplaces in this sector are most likely to use collective bargaining.

Additionally, it was evaluated whether the relationship between union presence and the work design variables remains robust when confining the sample to respondents that have no managerial duties or to respondents with specific jobs. The results of these complementary analyses align with the patterns retrieved.
Being more precise, a negative association is revealed between trade union presence and the relevance of problem-solving and planning tasks, as well between union presence and all work characteristic indicators among non-managerial respondents. Along parallel lines, a statistically significant negative relationship between union presence and autonomy was found among respondents in "*Professionals"*, "*Associate Professionals*, and "*Skilled Trade"* occupations. Furthermore, a statistically significant negative correlation with job variety (absence of control) is detected for respondents employed in "*Skilled Trades"* and "*Operative"* ("*Skilled Trades"*, "*Sales"*, and "*Operative*") occupations. Finally, a negative association between skill use and union presence is retrieved for respondents working as "*Professionals"* or "*Skilled Trades"*.

In sum, although the findings of this sub-section need to be interpreted rather cautiously due to causality issues, restricting the whole sample to specific sub-samples leads to the same outcomes as in the pooled OLS estimation presented in 4.1.

4.2.3 Propensity score matching

Propensity score matching has been conducted as an additional robustness check as well. One motive for this approach is to address the problem of selection on observable characteristics which typically goes hand in hand with OLS estimations. In the case of trade union presence, it might be reasoned that respondents working in unionized firms are different from workers in non-unionized firms, and that differences in unionized compared to non-unionized firms stain on respondents assessment of work characteristics and job content.
Without relying on parametric assumptions,[26] the propensity score method allows one to preprocess data in a way that pairs observations in treated groups (employees in unionized firms) and control groups (employees in non-unionized firms). Thus, this approach eliminates the bias due to confounding variables (Ho, Imai, King, & Stuart, 2007).
Overall, the results obtained through this method complements the findings of the pooled OLS estimation (Imbens, 2015).

In principle, this method entails several strict and partly untestable conjectures. For one, an important assumption entails that the treatment variable satisfies some form of exogeneity, (Caliendo & Kopeinig, 2008: 35). This assumption is commonly referred to as unconfoundedness (Rosenbaum & Rubin, 1983) or conditional independence assumption (e.g. Blundell, Dearden, & Sianesi, 2005). It emphasizes that all variables influencing the treatment assignment and outcome have to be observed (Caliendo & Kopeinig, 2008: 35).
A second important assumption is that of common support. Common support ensures that treatment observations have a similar counterpart in the control group (Heckman, LaLonde, & Smith, 1999: 2000). That means, respondents having the same observable covariates have the same probability to either belong to the treatment or control group.

To address these issues, several aspects are considered. In a first step, this work follows Belloni, Chernozhukov, and Hansen (2014) who advocate a "*double selection"* of variables to calculate propensity scores. That is, all variables enter the model that are relevant for both the outcome and treatment equation (union presence). To select determinants of union presence at

[26] The main advantage of the matching method compared to the OLS method is that the latter entails strict functional form restrictions that makes it inadequate to calculate average treatment effects, whereas the matching approach is a non-parametric technique which does not require the assumption of linearity (Imbens, 2015: 373).

workplaces, this work concurs with Cullinane (2001), and adds – besides the relevant variables in the outcome equation (occupation, industry, employee involvement, task discretion, and ICT use) – dummy variables for organizational size, sector, and gender composition. In addition, regional dummies are included. Moreover, an indicator containing external data for unemployment in the respective region to control for local labor market conditions is included, as well as workplace information for computerization. All indicators are considered to affect workplace-level unionization (Bryson et al., 2004).
To ensure comparability between the treatment and control group, observations are excluded that are outside of common support. Therefore, those observations are discarded whose propensity scores lie outside the range of the other groups (see Stuart (2010) for a comprehensive summary). In addition, observations are deleted that have extreme propensity scores. Following the recommendation by Crump, Hotz, Imbens, and Mitnik (2009), observations are withdrawn whose score lies outside the interval [0.1; 0.9]. After trimming the data, propensity scores are re-estimated.

For the ensuing matching approach, radius caliper and kernel matching are applied. There is no general consent on which algorithms should be used in specific situations, as the trade-off between bias and efficiency casts constant doubt on the efficiency of either method. Hence, multiple approaches should be used to assess whether differences in the results exist. When similar results are yield, the choice of algorithm is not of importance (Caliendo & Kopeinig, 2008: 45).

Common support is imposed, and 20% of the treatment observations at which propensity score density is lowest, are dropped. The results outlined in Appendix 15 show that differences in the matched sample in the controls included are then not statistically distinguishable (see Appendix 15).
Overall, the quality of the matched sample is ensured. Appendix 15 lists several numerical diagnostics. For instance, the standardized bias does not exceed 5% in any of the covariates after matching (see Caliendo and Kopeinig, 2008 for a discussion on the critical value), and the absolute standardized differences in means do not exceed 0.25. Additionally, the variance ratio is 1.18. Both measures fulfill the guidelines set up by Rubin (2001). Again, similar results are obtained when using the kernel matching technique (see Appendix 16).

Table 25 presents the results of the propensity score matching using the radius caliper (0.08)

technique. Different values for the caliper are used but the results remain robust through the different specifications.

Table 25: Comparison of treatment and control group after PSM (radius caliper)

	Union present (Treated)	*Average Treatment Effect on the treated (ATT)*	*|T-value|*	*Union not present (Not treated)*
Problem-solving	2.83	-0.05*	1.93	2.88
Direction	1.98	-0.03	1.13	2.02
Planning	2.92	-0.07**	2.45	2.99
Job variety	1.60	-0.06*	1.94	1.66
Autonomy	2.04	-0.08***	3.03	2.12
Skill use	2.13	-0.04*	1.86	2.17
Absence of control	1.67	-0.08***	3.13	1.74

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The matching algorithm is radius caliper (0.08). Difference between treated (union present) and control group (no union present) represents the average treatment effect on the treated. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Overall, the results are in line with the findings from the pooled OLS estimation. Statistically significant differences between the treatment group and control group are revealed, and the differences have the expected sign.

As advocated by Imbens (2015), propensity score matching and linear regression should not be conducted independently. After propensity score matching, a regression on the matched sample should be run instead. The rationale is that regression on the matched sample offers a "*double robustness"* of the obtained results as such a regression controls for small residual covariate imbalances between groups (Stuart, 2010: 15). Table 26 outlines the standardized beta coefficients of the regression on the matched sample for work characteristics. Table 27 documents the results for the job content variables.

Overall, the results for the variable trade union presence – compared to the main model – are of the same order of magnitude and the statistical significance is ensured. That is, except for direction tasks, the sign of the estimates is as hypothesized and the results are statistically significant at least at the 10%-level.

Table 26: Regression on matched sample (work characteristics, radius caliper)

	Job variety		Autonomy		Skill use	
	beta-coefficient	(p-value)	beta-coefficient	(p-value)	beta-coefficient	(p-value)
Trade union presence	-0.03*	(0.06)	-0.04***	(0.001)	-0.03**	(0.021)
Occupation	YES		YES		YES	
Industry	YES		YES		YES	
R^2	0.20		0.38		0.22	
Observation	7,362		7,362		7,357	

	Absence of control	
	beta-coefficient	(p-value)
Trade union presence	-0.04***	(0.005)
Occupation	YES	
Industry	YES	
R^2	0.17	
Observation	7,352	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The matching algorithm is radius caliper (0.08). Respective work characteristic variables are the dependent variables. The coefficients present the average effect of trade union presence on the respective dependent variables (ceteris paribus) on the matched sample. White-corrected standard errors are used in every specification. The coefficients are standardized beta-coefficients. 4-digit occupation and 2-digit industry dummies are included. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table 27: Regression on matched sample (job content, radius caliper)

	Problem-solving		Direction		Planning	
	beta-coefficient	(p-value)	beta-coefficient	(p-value)	beta-coefficient	(p-value)
Trade union presence	-0.03**	(0.019)	-0.01	(0.548)	-0.03**	(0.032)
Occupation	YES		YES		YES	
Industry	YES		YES		YES	
R^2	0.38		0.50		0.44	
Observation	7,363		7,363		7,363	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The matching algorithm is radius caliper (0.08). Job content variables are the dependent variables. The coefficients present the average effect of trade union presence on the respective dependent variables (ceteris paribus) on the matched sample. White-corrected standard errors are used in every specification. The coefficients are standardized beta-coefficients. 4-digit occupation and 2-digit industry dummies are included. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

As an additional robustness check, the same approach has been conducted when more individual level variables such as gender, age, and years of education enter the model to calculate propensity scores. Again, the results obtained correspond to those presented in Table 26 and Table 27.

Although propensity score matching corroborates the results of the main model, the retrieved results cannot be interpreted as a causal effect of union presence on work design. The rationale is that in the presence of unobserved factors, propensity score matching is not capable of isolating the causal effect of trade union presence. Nevertheless, the results make a strong case in point that selection on observables is not an issue of major concern.

4.2.4 Fixed-effect panel estimation

The final robustness check addresses the potential bias resulting from unobserved heterogeneity. It might be that some industries that score high on certain work design variables also score high on other unobserved factors, such as specific production processes or change of employed workforce that affects both ICT diffusion and trade union presence. The advantage of the fixed-effect estimation is that the unobserved factors – under the assumption of being time-invariant – are canceled out.

To control for time-invariant unobserved factors within industries, a panel at the level of industry is constructed. As the SES does not contain a natural panel structure, a *pseudo*-panel was created. The unit for analysis is the two-digit standard industrial classification (1992) (SIC 1992) being consistently defined over the four independent cross-sections. The two-digit classification differentiates between 59 industries (n=59). Therefore, 236 observations (N=236) are available for the analysis.

To generate the pseudo-panel, the raw mean value for each posited determinant is calculated for each industry in the respective year. To capture trade union presence, externally supplied data provided by the Department for Business, Energy & Industrial Strategy for union density in each sector in the respective year is used. The external data on trade union density in different sectors is matched to the used industrial classification (see Appendix 17 for descriptive statistics). To account for the disparity of respondents in different sectors in each wave, the estimates are weighted by the number of observations.
In the analysis, the minimum industry cell size is set to be at least 5. This reduces the total observations used for the analysis to 191. However, it increases the average size to 48 respondents for each industry. The standard deviation of 24.72 suggests that there is still

substantial variation around the mean. Raising the minimum cell size, though, would further reduce the overall low number of industry cells, which adversely affects the precision of the estimates.

Table 28 reports the results of the fixed-effect estimation using white-corrected standard errors (see Abadie, Athey, Imbens, & Wooldridge (2017) for a more recent discussion on the appropriate choice regarding standard errors). Overall, the findings align with those of the main model. For instance, a positive correlation between involvement practices and the task domains is revealed after controlling for unobserved heterogeneity at industry level.
In terms of work characteristics, the results are mixed. The sign of the estimator for task discretion is in line with the theoretical prediction and statistically significant through every specification (the fixed-effect estimation for skill use is a unique case due to the low overall number of observations and the resulting imprecision of the estimate).
Regarding the perceived absence of control, the size of the coefficient suggests a negative relationship with employee involvement (as in the pooled OLS estimation). Moreover, no association between employee involvement and job variety / job autonomy was found.

Concerning the variable ICT use, the findings of the fixed-effect model are consistent with those of the pooled OLS estimation in terms of job content. That is, a positive (and statistically significant) relationship is unveiled with each task domain. Regarding the work characteristics, a positive relationship is detected with perceived autonomy but no association with job variety and absence of control.

Most notably, the findings for trade union density are, overall, in line with that of the main model. More specifically, it is revealed that a 10-percentage point increase in union density within a sector decreases the relevance for problem-solving activities by 0.135 units and the relevance for direction tasks by 0.073 units. Besides that, it is found that a 10-percentage point increase in trade union density decreases the perceived variety by 0.13 units, c.p. Similarly, a 10 percentage point increase in union density decreases autonomy by 0.06 units, c.p.

Overall, the results remain robust when changing the base year for weighting. Given the limited explanatory power of the model for skill use, the only two exceptions are the findings for absence of control and relevance of planning tasks. In both cases, no association is revealed, suggesting a neutral effect of trade union density.

Table 28: Fixed-effect panel estimation (robust s.e., w2012)

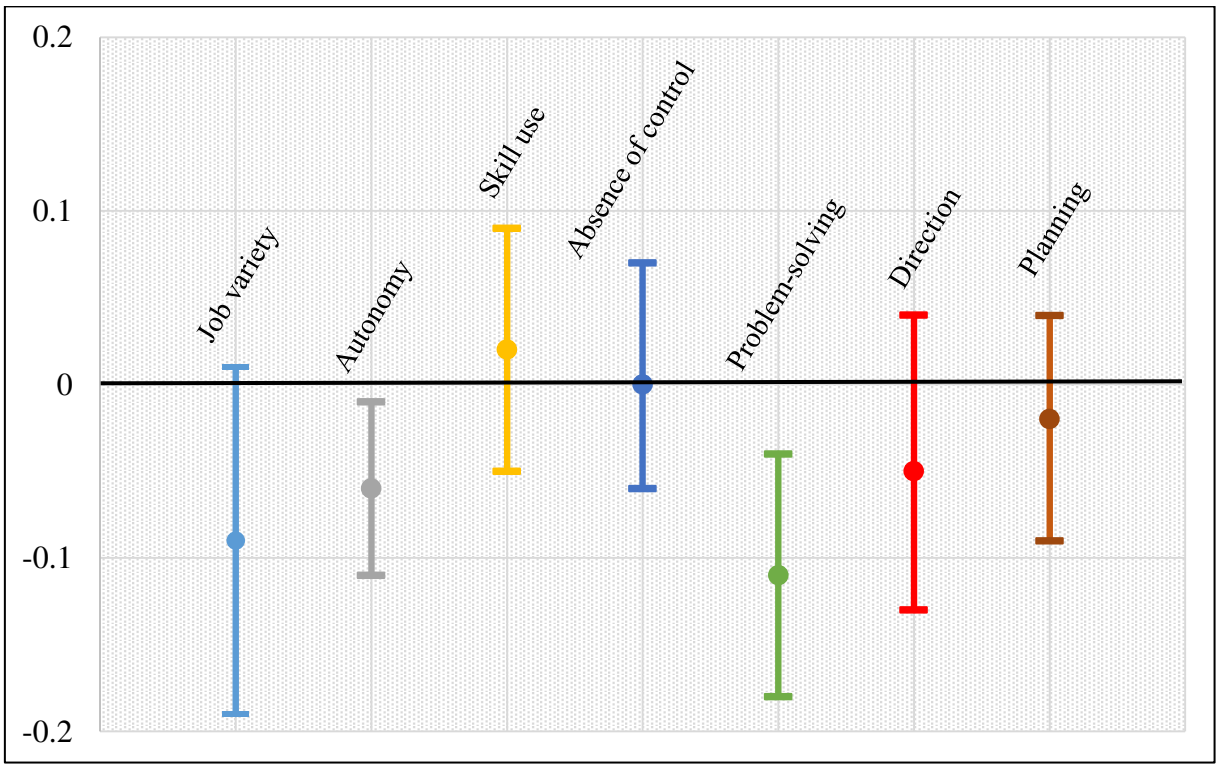
	Dependent variables						
	Job variety	Autonomy	Skill use	Absence of control	Problem-solving	Direction	Planning
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Employee involvement	-0.39	-0.22	0.25	-0.45	0.54*	1.13***	0.41
	(0.349)	(0.292)	(0.442)	(0.126)	(0.058)	(0.000)	(0.127)
Task discretion	0.53***	0.84***	0.17	0.40***	0.43***	0.54***	0.64***
	(0.005)	(0.000)	(0.212)	(0.005)	(0.004)	(0.001)	(0.000)
ICT use	-0.01	0.08***	0.03	-0.02	0.17***	0.15***	0.26***
	(0.857)	(0.006)	(0.605)	(0.756)	(0.001)	(0.006)	(0.000)
Trade union density	-1.27**	-0.57*	0.32	-0.13	-1.35***	-0.73*	-0.32
	(0.016)	(0.067)	(0.467)	(0.727)	(0.001)	(0.093)	(0.418)
R^2	0.81	0.86	0.83	0.74	0.91	0.94	0.92
N	186	186	140	186	186	186	186

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Respective work design variables are the dependent variables. The coefficients present the average effect of trade union density on the respective dependent variables (ceteris paribus) across industries. All industries with n < 5 are dropped. Estimates are weighted according to the cell size of the specific industries in 2012. White-corrected standard errors are used in every specification. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

In addition to that, additional fixed-effect estimations are tested using clustered standard errors at industry level. However, as it becomes evident from Appendix 18, the overall pattern remains unchanged.

As a final step, lagged values for union density are used. In particular, data for union density in the respective industry in year 1996 are used for the year 1997, etc. Figure 14 compendiously outlines the 95%-CI for each coefficient. Overall, the pattern is in line with the previous panel estimation. A statistically significant negative relationship is detected between trade union density and the relevance of problem-solving tasks. Similarly, statistical significant negative relationships are found for perceived variety as well as perceived job autonomy.

Figure 14: Trade unions and work design (fixed-effects, lagged values)



Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The 95%-CI are presents after estimating the panel with lagged value for union density (divided by 10). Estimates are weighted according to the cell size in 2012. White-corrected standard errors are used in every specification.

4.3 Summarizing assessment of empirical findings

Before integrating the results of the analysis within the extant literature, this sub-section concludes by summarizing and critically appraising the empirical findings.

Technology

Overall, the hypothesized relationships between ICT use and specific work characteristics are only partly confirmed. As predicted, the results from the pooled OLS estimation suggest that ICT use is positively correlated with skill use in a job. However, a neutral association between ICT and job variety and autonomy is revealed. Especially the neutral effect on variety is surprising against the backdrop of extant empirical literature that unveils a negative link between e.g. computer use and the relevance of repetitive tasks (e.g. Green, 2012). One tentative explanation is that the indicator used for perceived job variety rather reflects the degree of workplace procedures and prescribed work steps being shaped by organization history and/or culture as elaborated earlier. In this light, Becker and Muendler (2015), for instance, demonstrate that for Germany during the period of 1979 to 2006, work enrichment indeed took place in form of an accumulation of additional activities. These changes, though, did not necessarily affect the degree of repeated work steps or the prevalence of prescribed work procedures.

Besides that, the neutral effect might be attributable to that the association is contingent on respondents' occupation. In other words, the *average* effect found across the whole sample might masks statistically significant correlations for distinct occupations. As shown by additional calculations, the relationship differs across distinct occupations. In particular, positive associations are observed in the "*Managerial*", "*Professional*" or "*Skilled Trades*" occupational groups, whereas negative relationships are retrieved within "*Secretarial and Administrative*" or "*Sales*" occupations. Generally, these findings shed light upon the difficulty to derive *absolute* statements on the effect of ICT on work characteristics.

Contrary to the anticipated pattern, a negative relationship between ICT use and absence of control has been discovered in the pooled OLS estimation. This outcome aligns, though, with more recent accounts demonstrating that new technologies at the workplace increase the perceived supervision among lower-skilled employees (Gerten et al., 2018), and with other empirical accounts for the UK documenting such a relationship (e.g. Taylor & Bain, 2001).

Several explanations for this finding are forwarded in the extant literature. For one, some scholars point to the low cost for management associated with monitoring the activity of employees (Eivazi, 2011). Others stress that ICT enables employers to easily collect, store, and analyze information regarding employees' performance (Alge, 2001). Still other scholars

(Gerten et al., 2018) reason that supervision of employees is likely to increase in view of ICT diffusion as employees are required to carry out a larger number of specific tasks that need to be controlled.
Again, the negative *average* association likely masks differences for some subset of employees. The complementary calculations conducted provide tentative results for that respondents in low-skilled occupational groups ("*Operatives*", "*Sales*") are likely to be adversely affected by ICT use in terms of absence of control compared to respondents in higher skilled occupations (e.g. "*Managers*").

Regarding the job content variables, the findings of the main model are straightforward. Positive associations between ICT and the relevance of problem-solving, direction, and planning tasks are found. The standardized coefficients suggest that the nexus between technology and job content is much more pronounced compared to the relation with work characteristics. One reading of these results is that ICT diffusion within workplaces is more closely correlated with job tasks than with work characteristics in general. One punchline might be that work characteristics are partly contingent on general management attitudes or workplace tradition, whereas the implementation and use of new technology directly alters requirements within jobs.
Moreover, the results of the complementary calculations indicate that lower skilled occupations experience a job upgrade in terms of content.

Most of the main model's findings remain robust in the fixed-effect estimation, though, some of the coefficients become insignificant. In detail, the association with skill use disappears. However, this does not come as a surprise as the estimator in the fixed-effects model is imprecise due to the small overall N. The explanatory power in this specification is – at best – questionable. A neutral association with variety is disclosed, whereas the correlation with autonomy becomes positive (and statistically significant). For each task domain, the fixed-effects estimation reveals positive associations.

Overall, the results for ICT use provide two insights. First, the diffusion of technology indeed affects work characteristics, however, the effect may not be overestimated. In fact, robust results are detected for the task variables but not for all work characteristics. This implies that technology diffusion rather exerts an influence on the content of jobs.
Second, the findings suggest that the relationship between ICT and specific work characteristics

is contingent on distinct occupational groups, and that the average relationship must be cautiously interpreted. In particular, the numbers presented imply that respondents in different occupations experience different outcomes. In particular, the results add tentative evidence that employees in higher-skilled occupational groups benefit more from technology usage in terms of variety, autonomy or absence of control whereas the association between ICT and job tasks is more pronounced in lower-skilled occupational groups.

Involvement practices

The third and fourth set of hypotheses speculate on the impact of involvement practices on work characteristics and job content.

Overall, the findings for task discretion are straightforward. In particular, the results of the pooled OLS estimation suggest that admitted discretion is positively associated with perceived autonomy, variety, skill use, and absence of control.

However, no clear pattern is retrieved for the employee involvement indicator. In particular, a positive relationship is found with perceived autonomy and skill use (as expected). On the contrary, no association with perceived variety could be detected. Most notably, a negative association is detected for perceived absence of control.

The latter result corresponds with arguments in extant literature stressing peer pressure and peer surveillance being prevalent in involvement-based organizations. Sewell (1998), for instance, emphasizes that peer control in autonomous teams shapes the social relation among team members. Furthermore, as reiterated by Godard (2001: 778), those new forms of work represent a new form of control that is invisible to employees. The results of the main model tentatively add to such contributions by revealing that some forms of involvement might adversely impact specific work characteristics.

Concerning the job content variables, the findings are in line with the hypothesized positive relationship. Both involvement practice indicators are positively associated with the task domains under consideration. The size of the estimates corroborates the significance of the results.

The findings of the pooled OLS estimation are supported by the results of the fixed-effects model. In particular, the retrieved coefficients support the positive association between both indicators for involvement and the respective task domains. Similarly, the positive link between

discretion and variety, autonomy, and absence of control remains robust.
For employee involvement, both the positive association with job autonomy and the negative association with absence of control become statistically insignificant. However, the 95%-CI for absence of control suggests that the negative relationship is quite likely once it is controlled for time-invariant, unobserved factors.

Overall, the findings suggest that the differentiation between two forms of involvement is crucial. The rationale is that both are correlated distinctively with specific work characteristics.

Trade union presence

The findings regarding the relationship between union presence and the respective work design variables align with the anticipated pattern. In particular, the pooled OLS estimation suggests a negative relationship between all work characteristic variables (variety, autonomy, skill use, and absence of control) and trade union presence. The size of the coefficients indicates that the relation is – compared to the other posited determinants – weaker. However, it is argued that the unions' effect is far from being negligible. Sub-sample analyses show that the correlation of union presence with specific work characteristics is comparable to other workplace determinants in specific circumstances.
The estimates of the pooled OLS estimation also suggest that trade union presence and job content are correlated in expected ways. The only statistically insignificant coefficient is the one for direction tasks.

To corroborate the findings for union presence, several topics are addressed in the empirical analysis, ranging from omitted variables bias, selection on observables or unobserved heterogeneity. Overall, the conducted robustness checks support the validity of the main model's findings. For one, propensity score matching suggests that selection on observables is not an issue of major concern. Being more precise, the differences in the assessment of work design remain valid when comparing similar respondents working in similar workplaces.
Moreover, the fixed effect analysis provides evidence that, after controlling for unobserved time-invariant factors within industries, union density is negatively associated with perceived job variety, autonomy, problem-solving, and direction activities. Those results are mostly confirmed, when lagged values for union density are used.

In sum, the various robustness checks confirm the validity of the main proposition that trade union presence in UK workplaces is associated with tayloristic jobs, and that union presence should be considered as an important determinant in its own right.

One unresolved issue that needs to be addressed is that of reversed causation. The various methodological approaches conducted cannot rule out the possibility of alternative interpretations. For instance, it might be that changes in work characteristics and job content are driven by e.g. market competition, leading to changes in technology usage (Green, 2012). Concerning trade union presence, one objection is that employee representation is more likely to be present at workplaces with inferior working conditions. In other words, it is unlikely that labor representation is randomly distributed among UK workplaces (Hoque et al., 2017: 32). In consequence, this would imply that the associations found are not attributable to a union effect but rather reflect poorer working conditions among unionized workplaces. There is a substantial body of research in the IR literature supporting this claim (see e.g. Bryson et al., 2004 for a discussion), and other research shows that poor working conditions correspond with the demand for on-site union representation (e.g. Bryson & Freeman, 2013).

One valid objection against the reversed causation claim, however, comes from more recent accounts analyzing the implementation of HR practices or improvements in job quality among unionized workplaces. Overall, extant empirical evidence suggests that union presence is not necessarily confined to workplaces with poor working conditions. In detail, Bryson, Forth, and Kirby (2005) found that the implementation of involvement practices in the UK promoting job quality does not stand in contrast to the unionization of workplaces but rather goes hand in hand with it. Along the same lines, Hoque et al. (2017) disclose a positive relationship between on-site union representatives at workplaces in the UK finance sector and summary indicators for job quality.

Similar numbers have been presented earlier in Table 11, indicating that e.g. the degree of employee involvement is – on average – higher in unionized compared to non-unionized workplaces. Those studies and the numbers presented in the descriptive statistics underscore that contemporary unionized workplaces in the UK do not necessarily reflect traditional work organizations characterized by strict work rules, tight job demarcations, and inferior working conditions.

As a final note, the findings of the empirical analysis should not be interpreted in a normative statement that trade union presence in UK workplaces is per se bad. The results of the empirical analysis instead should be interpreted that the adversarial relationship between trade unions and management in the UK not only expresses itself in the general investment levels of firms (Doucouliagos & Laroche, 2013) but also influences the design of work within workplaces.

To conclude the assessment of the empirical findings, Table 29 provides an overview of the several hypotheses tested. "Supported" means that the coefficients are statistically significant at least at the 10%-level or (concerning planning tasks) the 95%-CI strongly suggests that the hypothesized direction is quite likely. "-" implies that the found estimates are not statistically significant at the conventional levels. "Mixed" indicates that the statistically significant estimates for the involvement indicators go in opposite directions, or at least one indicator is statistically insignificant. "Reversed" means that the coefficient is in opposite direction (and statistically significant) to the formulated hypothesis.

Table 29: Summary assessment of developed hypotheses

	Pooled OLS	Matching	Fixed-Effect
H1a: ICT use is positively associated with perceived variety.	**-**		**-**
H1b: ICT use is positively associated with perceived autonomy.	**-**		**Supported**
H1c: ICT use is positively associated with skill use.	**Supported**		**-**
H1d: ICT use is positively associated with absence of control.	**Reversed**		**-**
H2a: ICT use is ***positively*** associated with the relevance of problem-solving tasks.	**Supported**		**Supported**
H2b: ICT use is ***positively*** associated with the relevance of directive tasks.	**Supported**		**Supported**
H2c: ICT use is ***positively*** associated with the relevance of planning tasks.	**Supported**		**Supported**
H3a: Involvement practices are positively associated with perceived variety.	**Mixed**		**Mixed**
H3b: Involvement practices are positively associated with perceived autonomy.	**Supported**		**Mixed**
H3c: Involvement practices are positively associated with skill use.	**Supported**		**-**
H3d: Involvement practices are positively associated with absence of control.	**Mixed**		**Mixed**

Table 29: Summary assessment of developed hypotheses (continued).

H4a: Involvement practices are positively associated with the relevance of problem-solving tasks.	**Supported**		**Supported**
H4b: Involvement practices are positively associated with the relevance of directive tasks.	**Supported**		**Supported**
H4c: Involvement practices are positively associated with the relevance of planning tasks.	**Supported**		**Supported**
H5a: Job variety is lower in unionized compared to non-unionized workplaces.	**Supported**	**Supported**	**Supported**
H5b: Job autonomy is lower in unionized compared to non-unionized workplaces.	**Supported**	**Supported**	**Supported**
H5c: Skill use is lower in unionized compared to non-unionized workplaces.	**Supported**	**Supported**	**-**
H5d: Absence of control is lower in unionized compared to non-unionized workplaces.	**Supported**	**Supported**	**-**
H6a: The relevance of problem-solving tasks is lower in unionized compared to non-unionized workplaces.	**Supported**	**Supported**	**Supported**
H6b: The relevance of directive tasks is lower in unionized compared to non-unionized workplaces.	**-**	**-**	**Supported**
H6c: The relevance of planning tasks is lower in unionized compared to non-unionized workplaces.	**Supported**	**Supported**	**-**

Source: Own compilation.

5 Conclusion

The chief motivation of this dissertation is to introduce again the field of British industrial relations and the presence of trade unions in particular to the discussion on the design of work. Additionally, this thesis pursues a nuanced empirical assessment whether union presence exerts an independent influence on work characteristics and job content. By doing so, more recent calls are addressed, as outlined in the introductory quote, for a more evidence-based understanding of "*where work design comes from and how it is constrained or enabled"* (Parker et al., 2017b: 267).

The omission of work characteristics and job content as outcome variables seems rather at odds at first sight. For one, in the last 50 years, few topics in organizational research have attracted as much attention as work design related issues (Oldham & Fried, 2016). Secondly, as indicated in this work, the importance of work design research is highlighted by multiple accounts shedding light upon the impact of work design on important employment outcomes such as job satisfaction or employee productivity.

One tentative explanation for this lack of comprehensive knowledge over work design determinants is that different research fields have mostly remained within their own discipline. As a consequence, only a coarse understanding of the interaction of different explanatory factors explaining variations in the design of work is present. Exemplarily, Parker et al., (2017b) emphasize that little progress has been made to link organizational with contextual determinants that affect managerial choices and actions in terms of job design. Such limited perspectives become crucial when scholars seek to explain extant variations in work design across countries, particularly against the backdrop that main drivers, such as ICT diffusion, are considered to be rather universal (Green et al., 2016). This dissertation is motivated by such calls in work design and in the IR literature emphasizing the need for context sensitive approaches to study work design-related issues (Edwards, 2005; Parker et al., 2017b).

The main conclusion of the empirical analysis is that besides technology or installment of involvement practices, union presence should be considered as a distinct source relevant for the design of work, at least in the UK context. In particular, the findings suggest that trade union presence is associated with a more tayloristic work design whereas indicators for technology

usage and involvement practices are – with some notable exceptions – associated with a more holistic work design.

The outlined relationship between union presence and work design is important for a number of different reasons, and the insights presented in this dissertation pave the way for future research. Both issues will be presented in two steps. First, implications will be discussed. In the final section, some limitations of the work are addressed, and avenues for future research are outlined.

5.1 Implications

First, the results of the empirical analysis demonstrate that contemporary IR scholars should evaluate the impact of trade unions on work design more thoroughly. In the period before 1980, extensive discussions in the British IR literature have centered on the linkage between trade unions' motives and restrictive work practices (e.g. Addison, 1984). In previous years, though, contributions analyzing specific determinants of work design addressed the impact of trade unions, at best, on a passing note. However, this thesis proffers some rationales that despite the vast changes in the IR landscape in the UK and the corresponding decline in union power, the presence of unions still exerts an influence on such employment terms. The results in this dissertation lay bare that contemporary (IR) scholars should not neglect but rather (re-)consider unionism as an additional trigger for work design issues, at least for the UK context.

Along the same lines, this work contributes to more recent claims in work design literature calling for more nuanced and comprehensive understanding of the forces that affect work characteristics and job content (Parker et al., 2017b). Overall, the results presented in this work suggest that context matters. In particular, IR accounts (e.g. Furåker & Bengtsson, 2013) typically emphasize that unions – by increasing collective power – are more likely to push for enriched jobs or to resist poor quality jobs. Although not denying this claim in its essence, this work provides some rationales that the context determines trade unions' effect on work design. Being more precise, when labor representation bodies are considered as a partnering institution, and beyond, possess some statutory bargaining power to influence managerial decision making, the claim formulated by Furåker and Bengtsson (2013) is likely to be more prevalent in practice

compared to settings, in which such bodies are considered as competing interest groups. The sketched framework and the revealed findings suggest that idiosyncrasies in the union-management relationship need to be addressed carefully when reasoning over trade unions' effect on work design.

Besides that, the findings suggest that the popular task framework in contemporary economic analyses gets enriched when contextual factors are considered. More specifically, the assumed unidirectional relationship between ICT and job content is too narrowly defined as other determinants outside of the organization are crucial as well in determining the allocation of skills to tasks. Hence, the model developed in this work stands in line with more recent works (e.g. Green, 2012), and offers a richer and more comprehensive approach in assessing influences on job content.

Finally, this work adds to a long-standing discussion in the field of British IR. In particular, much research has been centered on the unions' effect on firms' productivity. Building on the seminal account by Freeman and Medoff (1984), numerous contributions have hypothesized over and empirically tested the claim that trade unions either enhance or lower firms' performance. Without summarizing the extant literature here, the findings in this dissertation complement this discussion by proposing an alternative mechanism of how unionization of workplaces may influence firms' performance. Although this conjecture needs to stand empirical investigation, it is an interesting and promising topic for further inquiry.

From a societal point of view, the results are important for a number of issues. For one, the initiated discussion in this work connects to contemporary debates concerning trade union strategy and job quality. As evidenced by recent policy proposals written by the TUC (Trade Union Congress, 2017a), enhancing job quality in UK workplaces is among the top priorities of trade unions. This shift in paradigm away from mere pay related questions towards job quality aspects may have important implications for the reassertion of trade union power. Some scholars even claim that increasing job quality could be *the* basis for union renewal and collective action, especially among well-educated young workers with high job expectations (Lowe, 1998).

The empirical analysis demonstrates, though, that union presence is linked to a work design being associated with inferior job quality. In particular, the findings in this work suggest that albeit innovative HR practices are on a higher level in unionized establishments compared to

non-unionized firms, those measures do not translate into more variety or autonomy. Admittedly, this claim is highly contestable. However, the revealed findings may provide some glimpse over the success trade unions had in terms of job quality, and that the link between job quality and union presence is far more multi-faceted than commonly considered.

Related to this line of reasoning, the results offer some tentative insights into the success of the social partnership agenda driven by new Labor Government starting in the late 1990s. One of the main motives for these agreements was to establish a mutual trust relationship between both actors and to offer trade unions again a central role in the workplace and beyond. However, the found results in this work further support critical voices predicting the limited success of those agreements (e.g. Kelly, 2004), and that both parties – management and trade unions – remain two actors following a low-trust route.

5.2 Limitations and avenues for future research

To conclude this work, some limitations need to be addressed. As previously stated, none of the findings regarding the association between technology, involvement practices, or trade union presence with work characteristics and job content is immune from the issue of reversed causality. Due to the absence of suitable instruments (e.g. for trade union presence), no reliable claims regarding the causal effect of union presence or the other posited determinants can be made. Future research may address this limitation by exploiting potential exogenous shocks (e.g. in specific industries) or by using validated instruments for e.g. union presence, to outline whether the posited determinants have causal implications.

Another limitation of this study is its level of generalizability. This work primarily focuses on the UK context with its specific IR system. Therefore, the line of thought and the formulated research model is geared to the specificities of the British context. When focusing on other countries with different institutional and statutory settings, it becomes apparent that the elaborated line of thought over a trade unions' effect is not universally applicable. Exemplarily, the German case would require a more sophisticated analysis of the effect of work councils as this body of labor representation negotiates with management over work design issues. Hence, the propositions made in this work are context sensitive. This implies that evaluating the impact

of trade unions or other employee representation bodies on work design in a different setting calls for a different conceptual approach.

Additionally, some loose ends remain that might be picked up in future work. For one, complementary analyses may be conducted using firm-level data. The Workplace and Employment Relation Survey (WERS), for instance, contains fine-grained information concerning management perception over trade unions that are present at their workplaces, and supplements information on management perception over employees' degree of autonomy or variety. One advantage of this data source is that it contains rich information on firm characteristics that can be utilized to control for important firm differences. Moreover, the data can be used to analyze whether managements' perception of union presence moderates the effect of unionization on work design outcomes. Along parallel lines, using this data source creates the opportunity to incorporate the factual bargaining power of trade unions more sophisticatedly, and to analyze how this bargaining power moderates the union effect on work design outcomes

Secondly, as the developed model makes several strict but reasonable assumptions, their relaxation offers fruitful avenues for future research. Exemplarily, the developed framework assumes that technology and the installment of involvement practices are independent from each other. This claim was justified by referring to accounts indicating that management intention to implement such practices is not necessarily contingent on the adoption of new technologies and vice versa. However, research also suggests that complementarities between ICT diffusion and spread of HR practices exist (e.g. Bresnahan et al., 2002). One possible path for research would be the formulation of a more nuanced model that recognizes the interaction of both work design determinants; implying that their association with work characteristics and job content is contingent on the level of the other determinants. Such an approach would extend knowledge on the mechanics how ICT and involvement practices influence work characteristics and job content.

Another assumption made is that unions have no direct influence on the way technology is implemented or on the installment of involvement practices. This assumption was justified by emphasizing the managerial prerogative in those terms. However, factual union influence is strongly shaped by differences in the history of the respective trade union in establishments or by workplace traditions and other organizational factors (e.g. Martinez-Lucio & Weston, 1992). Considering this dissimilarity of unions' role in workplaces would enrich extant knowledge on

the mechanics at work of how union presence influences the design of work.

In addition, the developed framework builds upon the assumption that UK management takes a rather adversarial route towards trade unions. Although research in the field of partnership agreement justifies this conclusion, there are occasions where management and unions in the UK have a rather cooperative relationship. Hence, a starting point for further inquiry are case study analyses that assess whether a more cooperative management-union relationship would bring work design related questions on the consultation table, and thus, whether unions' effect might differ under specific circumstances.

Finally, the research question in this work has been formulated against the backdrop of differences in work design across countries. The main point is that the *nature* of differences in work design across countries may be attributable to the distinct systems of industrial relations, and to the relationship with unions and other bodies of labor representation in particular. To extend our knowledge of the impact of bodies of employee representation, cross-country analyses are required to draw a more precise picture in this area.

To conclude, this thesis advocates that research in the field of industrial relations retains its viability. After hitting a low point in the 1990s (see Hyman, 1995 for a more comprehensive discussion), this research domain seems to have rebounded. As summarized by Kaufman (2014: 24), though, the field is exposed to several challenges:

> "*In terms of attention given to study of all dimensions of the employment relationship, the British IR field resembles an hourglass, with the narrow neck in the 1950s and work of the Oxford School. The challenge for IR today is use ideas from the Webbs (and others) to create a broader and more integrative theoretical framework that binds together and explains the major parts of the employment relationship*"

This dissertation represents an attempt to serve this challenge by conducting research on an important aspect of the employment relationship: the design of work.

References

Abadie, A., Athey, S., Imbens, G., & Wooldridge, J. 2017. ***When should you adjust standard errors for clustering?*** NBER Working Paper No. w24003. Cambridge, MA. Available at http://www.nber.org/papers/w24003. Accessed April 11, 2018.

Abele, A. E. 2000. A dual-impact model of gender and career-related processes. In T. Eckes & H. M. Trautner (Eds.), ***The developmental social psychology of gender***: 361–388. New York: Psychology Press.

Acemoglu, D. 1998. Why do new technologies complement skills? Directed technical change and wage inequality. ***The Quarterly Journal of Economics***, 113(4): 1055–1089.

Acemoglu, D. 2002. Technical change, inequality, and the labor market. ***Journal of Economic Literature***, 40(1): 7–72.

Acemoglu, D., & Autor, D. H. 2011. Skills, tasks and technologies: Implications for employment and earnings. In O. Ashenfelter (Ed.), ***Handbook of labor economics***: 1043–1171. Amsterdam: Elsevier.

Acemoglu, D., & Autor, D. H. 2012. What does human capital do? A review of Goldin and Katz's The race between education and technology. ***Journal of Economic Literature***, 50(2): 426–463.

Ackers, P., & Payne, J. 1998. British trade unions and social partnership: Rhetoric, reality and strategy. ***The International Journal of Human Resource Management***, 9(3): 529–550.

Ackers, P., & Wilkinson, A. 2003. Introduction: The British industrial relations tradition. In P. Ackers & A. Wilkinson (Eds.), ***Understanding work and employment. Industrial relations in transition***: 1–27. Oxford: Oxford University Press.

Addison, J. 2014. ***The consequences of trade union power erosion.*** IZA World of Labor No. 68. Available at https://wol.iza.org/articles/consequences-of-trade-union-power-erosion/long. Accessed April 25, 2018.

Addison, J. T. 1984. Trade unions and restrictive practices. In J. J. Rosa (Ed.), ***The economics of trade unions. New directions***: 83–119. Dordrecht: Springer.

Afonso, O., Albuquerque, A. L., & Almeida, A. 2013. Wage inequality determinants in European Union countries. ***Applied Economics Letters***, 20(12): 1170–1173.

Aghion, P., & Tirole, J. 1997. Formal and real authority in organizations. ***Journal of Political Economy***, 105(1): 1–29.

Aldrich, H. E., & Pfeffer, J. 1976. Environments of organizations. ***Annual Review of Sociology***, 2(1): 79–105.

Alge, B. J. 2001. Effects of computer surveillance on perceptions of privacy and procedural justice. ***Journal of Applied Psychology***, 86(4): 797–804.

Antonioli, D., Mazzanti, M., & Pini, P. 2011. Innovation, industrial relations and employee outcomes: Evidence from Italy. ***Journal of Economic Studies***, 38(1): 66–90.

Appelbaum, E. 2002. The impact of new forms of work organization on workers. In G. Murray, J. Bélanger, A. Giles & P. A. Lapointe (Eds.), ***Work and employment relations in the high performance workplace***: 120–149. London: continuum.

Appelbaum, E., Bailey, T., Berg, P. B., Kalleberg, A. L., & Bailey, T. A. 2000. ***Manufacturing advantage***: ***Why high-performance work systems pay off***. Ithaca, NY: Cornell University Press.

Arthur, J. B. 1992. The link between business strategy and industrial relations systems in American steel minimills. ***ILR Review***, 45(3): 488–506.

Arthur, J. B. 1994. Effects of human resource systems on manufacturing performance and turnover. ***Academy of Management Journal***, 37(3): 670–687.

Ashton, D., Davies, B., Felstead, A., & Green, F. 2000. ***Work skills in Britain.*** ESRC Centre on Skills, Knowledge and Organisational Performance. Universities of Oxford/Warwick. Available at http://www.voced.edu.au/content/ngv:20174. Accessed April 26, 2018.

Ashton, D. N., Loyd, C., & Warhurst, C. 2017. Business strategies and skills. In C. Warhurst, K. Mayhew, D. Finegold & J. Buchanan (Eds.), ***The Oxford handbook of skills and training***: 301–320. New York: Oxford University Press.

Ashton, D. N., & Sung, J. 2002. ***Supporting workplace learning for high performance working***. Geneva: International Labour Organization.

Autor, D. H. 2013. The 'task approach'to labor markets: An overview. ***Journal for Labour Market Research***, 46(3): 185–199.

Autor, D. H., & Dorn, D. 2013. The growth of low-skill service jobs and the polarization of the US labor market. ***American Economic Review***, 103(5): 1553–1597.

Autor, D. H., & Handel, M. J. 2013. Putting tasks to the test: Human capital, job tasks, and wages. ***Journal of Labor Economics***, 31(2): S59-S96.

Autor, D. H., Katz, L. F., & Kearney, M. S. 2006. The polarization of the US labor market. ***American Economic Review***, 96(2): 189–194.

Autor, D. H., Levy, F., & Murnane, R. J. 2003. The skill content of recent technological change: An empirical exploration. ***The Quarterly Journal of Economics***, 118(4): 1279–1333.

Aycan, Z., Kanungo, R., Mendonca, M., Yu, K., Deller, J., Stahl, G., & Kurshid, A. 2000. Impact of culture on human resource management practices: A 10-country comparison. ***Applied Psychology***, 49(1): 192–221.

Ayres, J., & Malouff, J. M. 2007. Problem-solving training to help workers increase positive affect, job satisfaction, and life satisfaction. ***European Journal of Work and Organizational Psychology***, 16(3): 279–294.

Babbage, C. 1832. ***On the economy of machinery and manufactures***. London: Charles Knight.

Backhaus, K., Erichson, B., Plinke, W., & Weiber, R. 2008. ***Multivariate Analysemethoden***: ***Eine anwendungsorientierte Einführung*** (12th ed.). Berlin: Springer.

Bacon, N., & Blyton, P. 2000. Industrial relations and the diffusion of teamworking: Survey evidence from the UK steel industry. ***International Journal of Operations & Production Management***, 20(8): 911–931.

Bacon, N., & Blyton, P. 2001. High involvement work systems and job insecurity in the international iron and steel industry. ***Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration***, 18(1): 5–16.

Bacon, N., Blyton, P., & Morris, J. 1996. Among the ashes: Trade union strategies in the UK and German steel industries. ***British Journal of Industrial Relations***, 34(1): 25–50.

Bain, P., & Taylor, P. 2000. Entrapped by the 'electronic panopticon'? Worker resistance in the call centre. ***New Technology, Work and Employment***, 15(1): 2–18.

Baldwin, C. Y. 1983. Productivity and labor unions: An application of the theory of self-enforcing contracts. ***Journal of Business***, 56(2): 155–185.

Baldwin, R. E. 1971. Determinants of the commodity structure of US trade. ***American***

Economic Review, 61(1): 126–146.

Barker, J. R. 1993. Tightening the iron cage: Concertive control in self-managing teams. ***Administrative Science Quarterly***, 38(3): 408–437.

Barringer, B. R., & Harrison, J. S. 2000. Walking a tightrope: Creating value through interorganizational relationships. ***Journal of Management***, 26(3): 367–403.

Bartel, A. P., & Lichtenberg, F. R. 1987. The comparative advantage of educated workers in implementing new technology. ***The Review of Economics and Statistics***, 69(1): 1–11.

Bayo-Moriones, A., Billon, M., & Lera-López, F. 2017. Are new work practices applied together with ICT and AMT? ***The International Journal of Human Resource Management***, 28(4): 553–580.

Bayo-Moriones, A., Calleja-Blanco, J., & Lera-López, F. 2015. The relationship between ICTs and HPWPs across occupations. ***International Journal of Manpower***, 36(8): 1164–1180.

Becker, B., & Gerhart, B. 1996. The impact of human resource management on organizational performance: Progress and prospects. ***Academy of Management Journal***, 39(4): 779–801.

Becker, B. E., & Huselid, M. A. 2006. Strategic human resources management: Where do we go from here? ***Journal of Management***, 32(6): 898–925.

Becker, B. E., & Huselid, M. A. 2010. SHRM and job design: Narrowing the divide. ***Journal of Organizational Behavior***, 31(2/3): 379–388.

Becker, S. O., & Muendler, M.-A. 2015. Trade and tasks: An exploration over three decades in Germany. ***Economic Policy***, 30(84): 589–641.

Belloni, A., Chernozhukov, V., & Hansen, C. 2014. Inference on treatment effects after selection among high-dimensional controls. ***The Review of Economic Studies***, 81(2): 608–650.

Bennett, J. T., & Kaufman, B. E. 2004. What do unions do? A twenty-year perspective. ***Journal of Labor Research***, 25(3): 339–349.

Bergkvist, L., & Rossiter, J. R. 2007. The predictive validity of multiple-item versus single-item measures of the same constructs. ***Journal of Marketing Research***, 44(2): 175–184.

Berman, E., Bound, J., & Machin, S. 1998. Implications of skill-biased technological change: International evidence. ***The Quarterly Journal of Economics***, 113(4): 1245–1279.

Bernard, A. B., & Jensen, J.B. 1997. Exporters, skill upgrading, and the wage gap. ***Journal of International Economics***, 42(1/2): 3–31.

Blanchflower, D. G., & Bryson, A. 2010. The wage impact of trade unions in the UK public and private sectors. ***Economica***, 77(305): 92–109.

Blanden, J., Machin, S., & van Reenen, J. 2006. Have unions turned the corner? New evidence on recent trends in union recognition in UK firms. ***British Journal of Industrial Relations***, 44(2): 169–190.

Blaug, M. 1993. Education and the employment contract. ***Education Economics***, 1(1): 21–33.

Blundell, R., Dearden, L., & Sianesi, B. 2005. Evaluating the effect of education on earnings: Models, methods and results from the National Child Development Survey. ***Journal of the Royal Statistical Society: Series A (Statistics in Society)***, 168(3): 473–512.

BMRB 2007. ***2006 Skills Survey***: ***Technical report.*** The University of Kent. Available at https://sp.ukdataservice.ac.uk/doc/6004/mrdoc/pdf/6004userguide.pdf. Accessed April 26, 2018.

Böheim, R., & Booth, A. L. 2004. Trade Union presence and employer-provided training in Great Britain. ***Industrial Relations: A Journal of Economy and Society***, 43(3): 520–545.

Bolton, P., & Dewatripont, M. 2005. ***Contract theory***. Cambridge, MA: MIT Press.

Bortz, J. 2006. ***Statistik***: ***Für Human-und Sozialwissenschaftler*** (6th ed.). Heidelberg: Springer.

Boselie, P., Dietz, G., & Boon, C. 2005. Commonalities and contradictions in HRM and performance research. ***Human Resource Management Journal***, 15(3): 67–94.

Boxall, P. 2008. Trade union strategy. In P. Blyton, E. Heery, N. Bacon & J. Fiorito (Eds.), ***The SAGE handbook of industrial relations***: 209–224. London: Sage.

Boxall, P., & Haynes, P. 1997. Strategy and trade union effectiveness in a neo-liberal environment. ***British Journal of Industrial Relations***, 35(4): 567–591.

Boxall, P., Hutchison, A., & Wassenaar, B. 2015. How do high-involvement work processes influence employee outcomes? An examination of the mediating roles of skill utilisation and intrinsic motivation. ***The International Journal of Human Resource Management***, 26(13): 1737–1752.

Boxall, P., & Macky, K. 2009. Research and theory on high-performance work systems: Progressing the high-involvement stream. ***Human Resource Management Journal***, 19(1): 3–23.

Boxall, P., & Macky, K. 2014. High-involvement work processes, work intensification and employee well-being. ***Work, Employment and Society***, 28(6): 963–984.

Braverman, H. 1974. ***Labor and monopoly capital***: ***The degradation of work in the twentieth century***. New York NY: Monthly Review Press.

Breaugh, J. A. 1985. The measurement of work autonomy. ***Human Relations***, 38(6): 551–570.

Bresnahan, T., & Yin, P.-L. 2017. Adoption of new information and communications technologies in the workplace today. ***Innovation Policy and the Economy***, 17(1): 95–124.

Bresnahan, T. F., Brynjolfsson, E., & Hitt, L. M. 2002. Information technology, workplace organization, and the demand for skilled labor: Firm-level evidence. ***The Quarterly Journal of Economics***, 117(1): 339–376.

Bring, J. 1994. How to standardize regression coefficients. ***The American Statistician***, 48(3): 209–213.

Bronars, S. G., & Deere, D. R. 1993. Unionization, incomplete contracting, and capital investment. ***Journal of Business***, 66(1): 117–132.

Brown, W., Bryson, A., & Forth, J. 2008. ***Competition and the retreat from collective bargaining.*** NIESR Discussion Paper No. 318. Available at http://westminsterresearch.wmin.ac.uk/20885/. Accessed April 27, 2018.

Brown, W., & Oxenbridge, S. 2004. The development of co-operative employer/trade union relationships in Britain. ***Industrielle Beziehungen/The German Journal of Industrial Relations***, 11(1/2): 143–158.

Brown, W., & Rea, D. 1995. The changing nature of the employment contract. ***Scottish Journal of Political Economy***, 42(3): 363–377.

Brown, W., & Wadhwani, S. 1990. The economic effects of industrial relations legislation since 1979. ***National Institute Economic Review***, 131(1): 57–70.

Brynjolfsson, E., & McAfee, A. 2014. ***The second machine age***: ***Work, progress, and prosperity in a time of brilliant technologies***. New York: WW Norton & Company.

Bryson, A., Cappellari, L., & Lucifora, C. 2004. Does union membership really reduce job satisfaction? ***British Journal of Industrial Relations***, 42(3): 439–459.

Bryson, A., Ebbinghaus, B., Visser, J., Forth, J., & Laroche, P. 2011. Evolution or revolution? The impact of unions on workplace performance in Britain and France. ***European Journal of Industrial Relations***, 17(2): 171–187.

Bryson, A., Forth, J., & Kirby, S. 2005. High-involvement management practices, trade union representation and workplace performance in Britain. ***Scottish Journal of Political Economy***, 52(3): 451–491.

Bryson, A., & Freeman, R. B. 2013. Employee perceptions of working conditions and the desire for worker representation in Britain and the US. ***Journal of Labor Research***, 34(1): 1–29.

Bryson, A., & Green, F. 2015. Unions and job quality. In A. Felstead, D. Gallie & F. Green (Eds.), ***Unequal Britain at work***: 130–146. Oxford: Oxford University Press.

Butts, M. M., Vandenberg, R. J., DeJoy, D. M., Schaffer, B. S., & Wilson, M. G. 2009. Individual reactions to high involvement work processes: Investigating the role of empowerment and perceived organizational support. ***Journal of Occupational Health Psychology***, 14(2): 122–136.

Cain, G. G., & Watts, H. W. 1970. Problems in making policy inferences from the Coleman Report. ***American Sociological Review***, 35(2): 228–242.

Caliendo, M., & Kopeinig, S. 2008. Some practical guidance for the implementation of propensity score matching. ***Journal of Economic Surveys***, 22(1): 31–72.

Campion, M. A., Cheraskin, L., & Stevens, M. J. 1994. Career-related antecedents and outcomes of job rotation. ***Academy of Management Journal***, 37(6): 1518–1542.

Cappelli, P., & Rogovsky, N. 1998. Employee involvement and organizational citizenship: Implications for labor law reform and “lean production". ***ILR Review***, 51(4): 633–653.

Card, D., & DiNardo, J. E. 2002. Skill-biased technological change and rising wage inequality: Some problems and puzzles. ***Journal of Labor Economics***, 20(4): 733–783.

Caroli, E., & van Reenen, J. 2001. Skill-biased organizational change? Evidence from a panel of British and French establishments. ***The Quarterly Journal of Economics***, 116(4): 1449–1492.

Casciaro, T., & Piskorski, M. J. 2005. Power imbalance, mutual dependence, and constraint absorption: A closer look at resource dependence theory. ***Administrative Science Quarterly***, 50(2): 167–199.

Chesley, N. 2014. Information and communication technology use, work intensification and employee strain and distress. ***Work, Employment and Society***, 28(4): 589–610.

Churchill Jr, G. A. 1979. A paradigm for developing better measures of marketing constructs. ***Journal of Marketing Research***, 16(1): 64–73.

Clegg, H. A. 1979. ***The changing system of industrial relations in Great Britain***. Oxford: Basil Blackwell.

Coff, R. W. 1999. When competitive advantage doesn't lead to performance: The resource-based view and stakeholder bargaining power. ***Organization Science***, 10(2): 119–133.

Combs, J., Liu, Y., Hall, A., & Ketchen, D. 2006. How much do high-performance work practices matter? A meta-analysis of their effects on organizational performance. ***Personnel Psychology***, 59(3): 501–528.

Cotter, D. A., Hermsen, J. M., & Vanneman, R. 2003. The effects of occupational gender segregation across race. ***The Sociological Quarterly***, 44(1): 17–36.

Creane, A., & Davidson, C. 2008. Information sharing in union-firm relationships. ***International Economic Review***, 49(4): 1331–1363.

Crump, R. K., Hotz, V. J., Imbens, G. W., & Mitnik, O. A. 2009. Dealing with limited overlap in estimation of average treatment effects. ***Biometrika***, 96(1): 187–199.

Cullinane, J. 2001. Workplace determinants of union presence in New Zealand organisations. ***International Journal of Manpower***, 22(4): 380–392.

Cullinane, N., & Dundon, T. 2014. Unitarism and employer resistance to trade unionism. ***The International Journal of Human Resource Management***, 25(18): 2573–2590.

Currie, G., & Procter, S. 2003. The interaction of human resource policies and practices with the implementation of teamworking: Evidence from the UK public sector. ***The International Journal of Human Resource Management***, 14(4): 581–599.

Danford, A., Richardson, M., Stewart, P., Tailby, S., & Upchurch, M. 2004. High performance work systems and workplace partnership: A case study of aerospace workers. ***New Technology, Work and Employment***, 19(1): 14–29.

Daniel, W. W. 1987. ***Workplace industrial relations and technical change***. Longmead: Blackmore Press.

de Witte, H., de Cuyper, N., Handaja, Y., Sverke, M., Näswall, K., & Hellgren, J. 2010. Associations between quantitative and qualitative job insecurity and well-being. ***International Studies of Management and Organization***, 40(1): 40–56.

Dean, J. W., & Snell, S. A. 1991. Integrated manufacturing and job design: Moderating effects of organizational inertia. ***Academy of Management Journal***, 34(4): 776–804.

Delbridge, R., & Whitfield, K. 2001. Employee perceptions of job influence and organizational participation employee perceptions. ***Industrial Relations: A Journal of Economy and Society***, 40(3): 472–489.

DeLone, W. H. 1981. Firm size and the characteristics of computer use. ***MIS Quarterly***, 5(4): 65–77.

Denny, K., & Nickell, S. 1991. Unions and investment in British manufacturing industry. ***British Journal of Industrial Relations***, 29(1): 113–121.

Denny, K., & Nickell, S. J. 1992. Unions and investment in British industry. ***The Economic Journal***, 102(413): 874–887.

Department for Business, Energy & Industrial Strategy 2017. ***Trade union membership 2016***: ***Statistical bulletin. Available at*** https://www.gov.uk/government/statistics/trade-union-statistics-2016. Accessed April 18, 2018.

Devereux, P. J., & Hart, R. A. 2011. A good time to stay out? Strikes and the business cycle. ***British Journal of Industrial Relations***, 49(S1): S70–S92.

Dewett, T., & Jones, G. R. 2001. The role of information technology in the organization: A review, model, and assessment. ***Journal of Management***, 27(3): 313–346.

Dierdorff, E. C., & Morgeson, F. P. 2007. Consensus in work role requirements: The influence of discrete occupational context on role expectations. ***The Journal of Applied Psychology***, 92(5): 1228–1241.

Dierdorff, E. C., & Morgeson, F. P. 2013. Getting what the occupation gives: Exploring multilevel links between work design and occupational values. ***Personnel Psychology***, 66(3): 687–721.

Disney, R. 1990. Explanations of the decline in trade union density in Britain: An appraisal.

British Journal of Industrial Relations, 28(2): 165–177.

DiStefano, C., Zhu, M., & Mindrila, D. 2009. Understanding and using factor scores: Considerations for the applied researcher. ***Practical Assessment, Research & Evaluation***, 14(20): 2–11.

Dobbin, F., & Boychuk, T. 1999. National employment systems and job autonomy: Why job autonomy is high in the Nordic countries and low in the United States, Canada, and Australia. ***Organization Studies***, 20(2): 257–291.

Dobson, J. R. 1997. The effects of multi-unionism: A survey of large manufacturing establishments. ***British Journal of Industrial Relations***, 35(4): 547–566.

Dodgson, M., & Martin, R. 1987. Trade union policies on new technology: Facing the challenges of the 1980s. ***New Technology, Work and Employment***, 2(1): 9–17.

Doellgast, V., Holtgrewe, U., & Deery, S. 2009. The effects of national institutions and collective bargaining arrangements on job quality in front-line service workplaces. ***ILR Review***, 62(4): 489–509.

Dosi, G. 1982. Technological paradigms and technological trajectories: A suggested interpretation of the determinants and directions of technical change. ***Research Policy***, 11(3): 147–162.

Doty, D. H., & Glick, W. H. 1994. Typologies as a unique form of theory building: Toward improved understanding and modeling. ***Academy of Management Review***, 19(2): 230–251.

Doucouliagos, H., & Laroche, P. 2013. Unions and Innovation: New Insights From the Cross-Country Evidence. ***Industrial Relations: A Journal of Economy and Society***, 52(2): 467–491.

Dubois, P. 1982. Manning levels and wage hierarchies the case of French and English maintenance workers in serial (batch) industry. ***British Journal of Industrial Relations***, 20(1): 76–82.

Dundon, T. 2002. Employer opposition and union avoidance in the UK. ***Industrial Relations Journal***, 33(3): 234–245.

Dunlop, J. T. 1958. ***Industrial relations systems***. New York: Holt.

Dunn, S., & Wright, M. 1994. Maintaining the ‘Status Quo’? An analysis of the contents of

British collective agreements, 1979–1990. ***British Journal of Industrial Relations***, 32(1): 23–46.

Dziuban, C. D., & Shirkey, E. C. 1974. When is a correlation matrix appropriate for factor analysis? Some decision rules. ***Psychological Bulletin***, 81(6): 358.

Eagly, A. H., & Steffen, V. J. 1986. Gender and aggressive behavior: A meta-analytic review of the social psychological literature. ***Psychological Bulletin***, 100(3): 309.

Economist. 2018. A study finds nearly half of jobs are vulnerable to automation. Available at https://www.economist.com/graphic-detail/2018/04/24/a-study-finds-nearly-half-of-jobs-are-vulnerable-to-automation. Accessed September 26, 2018.

Edwards, P. 2005. The challenging but promising future of industrial relations: Developing theory and method in context-sensitive research. ***Industrial Relations Journal***, 36(4): 264–282.

Edwards, P., & Wright, M. 2001. High-involvement work systems and performance outcomes: The strength of variable, contingent and context-bound relationships. ***The International Journal of Human Resource Management***, 12(4): 568–585.

Eivazi, K. 2011. Computer use monitoring and privacy at work. ***Computer Law & Security Review***, 27(5): 516–523.

Ellis, A. P. J., Bell, B. S., Ployhart, R. E., Hollenbeck, J. R., & Ilgen, D. R. 2005. An evaluation of generic teamwork skills training with action teams: Effects on cognitive and skill-based outcomes. ***Personnel Psychology***, 58(3): 641–672.

Englehardt, S. J. 2009. The evolution of skill-biased effects on American wages in the 1980s and 1990s. ***Journal of Labor Research***, 30(2): 135–148.

Eurofound 2009. ***Working conditions in the European Union***: ***Work organisation.*** Publications Office of the European Union. Luxembourg. Available at https://www.eurofound.europa.eu/de/publications/report/2009/working-conditions/working-conditions-in-the-european-union-work-organisation. Accessed April 27, 2018.

Eurofound 2016. ***What do Europeans do at work? A task-based analysis.*** Publications Office of the European Union. Luxembourg. Available at https://www.eurofound.europa.eu/de/publications/report/2016/labour-market/what-do-

europeans-do-at-work-a-task-based-analysis-european-jobs-monitor-2016. Accessed April 27, 2018.

Eurofound 2017. ***Sixth European Working Conditions Survey - Overview report.*** Publications Office of the European Union. Luxembourg. Available at https://www.eurofound.europa.eu/surveys/2015/ewcs-2015-research-reports. Accessed April 27, 2018.

Fairbrother, P. 1996. Trade unions and human resource management in Britain: Case study evidence from the public sector, utilities and manufacturing. ***Employee Relations***, 18(6): 10–27.

Felstead, A., & Ashton, D. 2000. Tracing the link: Organisational structures and skill demands. ***Human Resource Management Journal***, 10(3): 5–21.

Felstead, A., & Gallie, D. 2004. For better or worse? Non-standard jobs and high involvement work systems. ***The International Journal of Human Resource Management***, 15(7): 1293–1316.

Felstead, A., Gallie, D., Green, F., & Henseke, G. 2016. The determinants of skills use and work pressure: A longitudinal analysis. ***Economic and Industrial Democracy***, 43(4): 1-25.

Felstead, A., Gallie, D., Green, F., & Inanc, H. 2015. Fits, misfits and interactions: Learning at work, job satisfaction and job-related well-being. ***Human Resource Management Journal***, 25(3): 294–310.

Felstead, A., Gallie, D., Green, F., & Zhou, Y. 2007. ***Skills at work in Britain***: ***1986 to 2006.*** ESRC Centre on Skills, Knowledge and Organisational Performance. Universities of Oxford/Cardiff. Available at http://epubs.surrey.ac.uk/186045/. Accessed April 26, 2018.

Felstead, A., Gallie, D., Green, F., & Zhou, Y. 2010. Employee involvement, the quality of training and the learning environment: An individual level analysis. ***The International Journal of Human Resource Management***, 21(10): 1667–1688.

Fenton-O'Creevy, M. 2001. Employee involvement and the middle manager: Saboteur or scapegoat? ***Human Resource Management Journal***, 11(1): 24–40.

Fernandez, R. M. 2001. Skill-biased technological change and wage inequality: Evidence from a plant retooling. ***American Journal of Sociology***, 107(2): 273–320.

Fernández-Macías, E. 2012. Job polarization in Europe? Changes in the employment structure and job quality, 1995-2007. ***Work and Occupations***, 39(2): 157–182.

Fiorito, J., & Jarley, P. 2008. Trade union morphology. In P. Blyton, E. Heery, N. Bacon & J. Fiorito (Eds.), ***The SAGE handbook of industrial relations***: 189–208. Thousand Oaks, CA.: Sage.

Fiss, P. C. 2011. Building better causal theories: A fuzzy set approach to typologies in organization research. ***Academy of Management Journal***, 54(2): 393–420.

Flanders, A. D. 1975. ***Management and unions***: ***The theory and reform of industrial relations***. London: Faber and Faber.

Forth, J., & Millward, N. 2004. High-involvement management and pay in Britain. ***Industrial Relations: A Journal of Economy and Society***, 43(1): 98–119.

Fraser, D. 2010. Deskilling: A New Discourse and Some New Evidence. ***The Economic and Labour Relations Review***, 21(2): 51–73.

Freeman, R., & Pelletier, J. 1990. The impact of industrial relations legislation on British union density. ***British Journal of Industrial Relations***, 28(2): 141–164.

Freeman, R. B. 2000. ***Single peaked vs. diversified capitalism***: ***The relation between economic institutions and outcomes.*** NBER Working Paper No. 7556. National Bureau of Economic Research. Available at http://www.nber.org/papers/w7556. Accessed April 20, 2018.

Freeman, R. B., & Medoff, J. L. 1984. ***What do unions do?*** New York: Basic Books, Inc.

Frey, C. B., & Osborne, M. A. 2017. The future of employment: How susceptible are jobs to computerisation? ***Technological Forecasting and Social Change***, 114(January): 254–280.

Friedberg, L. 2003. The impact of technological change on older workers: Evidence from data on computer use. ***ILR Review***, 56(3): 511–529.

Furåker, B., & Bengtsson, M. 2013. Collective and individual benefits of trade unions: A multi-level analysis of 21 European countries. ***Industrial Relations Journal***, 44(5/6): 548–565.

Gaggl, P., & Wright, G. C. 2017. A short-run view of what computers do: Evidence from a UK tax incentive. ***American Economic Journal: Applied Economics***, 9(3): 262–294.

Gall, G. 2008. Multi-unionism and the representation of sectional interests in British workplaces. ***Industrielle Beziehungen/The German Journal of Industrial Relations***, 15(4): 356–375.

Gallie, D., Felstead, A., & Green, F. 2004. Changing patterns of task discretion in Britain. ***Work, Employment and Society***, 18(2): 243–266.

Gallie, D., Felstead, A., & Green, F. 2012. Job preferences and the intrinsic quality of work: The changing attitudes of British employees 1992–2006. ***Work, Employment and Society***, 26(5): 806–821.

García-Serrano, C. 2011. Does size matter? The influence of firm size on working conditions, job satisfaction and quit intentions. ***Scottish Journal of Political Economy***, 58(2): 221–247.

Gardner, D. G., Cummings, L. L., Dunham, R. B., & Pierce, J. L. 1998. Single-item versus multiple-item measurement scales: An empirical comparison. ***Educational and Psychological Measurement***, 58(6): 898–915.

Gazioglu, S., & Tansel, A. 2006. Job satisfaction in Britain: Individual and job related factors. ***Applied Economics***, 38(10): 1163–1171.

Gerten, E., Beckmann, M., & Bellmann, L. 2018. ***Controlling working crowds***: ***The impact of digitalization on worker autonomy and monitoring across hierarchical levels.*** Working Papers No. 2018/09. Available at https://ideas.repec.org/p/bsl/wpaper/2018-09.html. Accessed April 26, 2018.

Gibbs, M. 2017. ***How is new technology changing job design?*** IZA World of Labor No. 344. Available at https://wol.iza.org/uploads/articles/344/pdfs/how-is-new-technology-changing-job-design.pdf. Accessed April 27, 2018.

Gill, C. 2009. Union impact on the effective adoption of high performance work practices. ***Human Resource Management Review***, 19(1): 39–50.

Giordano, L. 1992. ***Beyond Taylorism***: ***Computerization and the new industrial relations***. New York: St. Martins Press.

Gittleman, M., & Pierce, B. 2011. Inter-industry wage differentials job content and unobserved ability. ***ILR Review***, 64(2): 356–374.

Godard, J. 1997. Whither strategic choice: Do managerial IR ideologies matter? ***Industrial***

Relations: A Journal of Economy and Society, 36(2): 206–228.

Godard, J. 2001. High performance and the transformation of work? The implications of alternative work practices for the experience and outcomes of work. ***ILR Review***, 54(4): 776–805.

Godard, J. 2004. A critical assessment of the high-performance paradigm. ***British Journal of Industrial Relations***, 42(2): 349–378.

Goldin, C., & Katz, L. F. 1998. The origins of technology-skill complementarity. ***The Quarterly Journal of Economics***, 113(3): 693–732.

Goldthorpe, J. H. 1974. Industrial relations in Great Britain: A critique of reformism. ***Politics & Society***, 4(4): 419–452.

Gooderham, P. N., Nordhaug, O., & Ringdal, K. 1999. Institutional and rational determinants of organizational practices: Human resource management in European firms. ***Administrative Science Quarterly***, 44(3): 507–531.

Goos, M., & Manning, A. 2007. Lousy and lovely jobs: The rising polarization of work in Britain. ***Review of Economics and Statistics***, 89(1): 118–133.

Goos, M., Manning, A., & Salomons, A. 2009. Job polarization in Europe. ***American Economic Review***, 99(2): 58–63.

Grant, A. M., Fried, Y., Parker, S. K., & Frese, M. 2010. Putting job design in context: Introduction to the special issue. ***Journal of Organizational Behavior***, 31(2/3): 145–157.

Grant, A. M., & Parker, S. K. 2009. 7 redesigning work design theories: The rise of relational and proactive perspectives. ***Academy of Management Annals***, 3(1): 317–375.

Green, C. P., & Heywood, J. S. 2015. Dissatisfied union workers: Sorting revisited. ***British Journal of Industrial Relations***, 53(3): 580–600.

Green, F. 2008. Leeway for the loyal: A model of employee discretion. ***British Journal of Industrial Relations***, 46(1): 1–32.

Green, F. 2010. Well-being, job satisfaction and labour mobility. ***Labour Economics***, 17(6): 897–903.

Green, F. 2012. Employee involvement, technology and evolution in job skills: A task-based analysis. ***ILR Review***, 65(1): 36–67.

Green, F., Felstead, A., & Gallie, D. 2003. Computers and the changing skill-intensity of jobs. ***Applied Economics***, 35(14): 1561–1576.

Green, F., Felstead, A., Gallie, D., & Henseke, G. 2016. Skills and work organisation in Britain: A quarter century of change. ***Journal for Labour Market Research***, 49(2): 121–132.

Green, F., Mostafa, T., Parent-Thirion, A., Vermeylen, G., van Houten, G., Biletta, I., & Lyly-Yrjanainen, M. 2013. Is job quality becoming more unequal? ***ILR Review***, 66(4): 753–784.

Green, F., & Whitfield, K. 2009. Employees' experience of work. In W. Brown, A. Bryson, J. Forth & K. Whitfield (Eds.), ***The evolution of the modern workplace***: 201–229. Cambridge: Cambridge University Press.

Griffin, M. A., Patterson, M. G., & West, M. A. 2001. Job satisfaction and teamwork: The role of supervisor support. ***Journal of Organizational Behavior***, 22(5): 537–550.

Griffin, R. W. 1991. Effects of work redesign on employee perceptions, attitudes, and behaviors: A long-term investigation. ***Academy of Management Journal***, 34(2): 425–435.

Griliches, Z. 1969. Capital-skill complementarity. ***The Review of Economics and Statistics***, 51(4): 465–468.

Grossman, S. J., & Hart, O. D. 1986. The costs and benefits of ownership: A theory of vertical and lateral integration. ***Journal of Political Economy***, 94(4): 691–719.

Grout, P. A. 1984. Investment and wages in the absence of binding contracts: A Nash bargaining approach. ***Econometrica: Journal of the Econometric Society***, 52(2): 449–460.

Guest, D. E., Michie, J., Conway, N., & Sheehan, M. 2003. Human resource management and corporate performance in the UK. ***British Journal of Industrial Relations***, 41(2): 291–314.

Guest, D. E., & Peccei, R. 2001. Partnership at work: Mutuality and the balance of advantage. ***British Journal of Industrial Relations***, 39(2): 207–236.

Gustavsen, B. 2007. Work Organization and the Scandinavian Model. ***Economic and Industrial Democracy***, 28(4): 650–671.

Guthrie, J. P. 2001. High-involvement work practices, turnover, and productivity: Evidence

from New Zealand. ***Academy of Management Journal***, 44(1): 180–190.

Guthrie, J. P., Spell, C. S., & Nyamori, R. O. 2002. Correlates and consequences of high involvement work practices: The role of competitive strategy. ***The International Journal of Human Resource Management***, 13(1): 183–197.

Guy, F. 2003. High-involvement work practices and employee bargaining power. ***Employee Relations***, 25(5): 455–471.

Hackman, J. R., & Oldham, G. R. 1975. Development of the job diagnostic survey. ***Journal of Applied Psychology***, 60(2): 159.

Hackman, J. R., & Oldham, G. R. 1976. Motivation through the design of work: Test of a theory. ***Organizational Behavior and Human Performance***, 16(2): 250–279.

Hall, M., Purcell, J., Terry, M., Hutchinson, S., & Parker, J. 2015. Trade union approaches towards the ICE Regulations: Defensive realism or missed opportunity? ***British Journal of Industrial Relations***, 53(2): 350–375.

Hall, P. A., & Gingerich, D. W. 2009. Varieties of capitalism and institutional complementarities in the political economy: An empirical analysis. ***British Journal of Political Science***, 39(3): 449–482.

Hall, P. A., & Soskice, D. W. 2001. An introduction to varieties of capitalism. In D. W. Soskice & P. A. Hall (Eds.), ***Varieties of capitalism. The institutional foundations of comparative advantage***: 1–70. Oxford: Oxford University Press.

Hall, P. A., & Thelen, K. 2009. Institutional change in varieties of capitalism. ***Socio-Economic Review***, 7(1): 7–34.

Hamann, K., & Kelly, J. 2008. Varieties of capitalism and industrial relations. In P. Blyton, E. Heery, N. Bacon & J. Fiorito (Eds.), ***The SAGE handbook of industrial relations***: 129–148. London: Sage.

Hammer, T. H., & Avgar, A. 2005. The impact of unions on job satisfaction, organizational commitment, and turnover. ***Journal of Labor Research***, 26(2): 241–266.

Handel, M. J. 2017. Measuring job content: Skills, technology, and management practices. In C. Warhurst, K. Mayhew, D. Finegold & J. Buchanan (Eds.), ***The Oxford handbook of skills and training***: 92–123. New York: Oxford University Press.

Harcourt, M., Lam, H., & Croucher, R. 2015. The right-to-manage default rule. ***Industrial***

Relations Journal, 46(3): 222–235.

Harney, B., & Dundon, T. 2006. Capturing complexity: Developing an integrated approach to analysing HRM in SMEs. ***Human Resource Management Journal***, 16(1): 48–73.

Hart, O., & Moore, J. 1990. Property rights and the nature of the firm. ***Journal of Political Economy***, 98(6): 1119–1158.

Heckman, J. J., LaLonde, R. J., & Smith, J. A. 1999. The economics and econometrics of active labor market programs. In O. Ashenfelter & D. Card (Eds.), ***Handbook of labor economics***, vol. 3: 1865–2097. New York: Elsevier.

Heery, E., Williams, S., & Abbott, B. 2012. Civil society organizations and trade unions: Cooperation, conflict, indifference. ***Work, Employment and Society***, 26(1): 145–160.

Henson, R. K., & Roberts, J. K. 2006. Use of exploratory factor analysis in published research: Common errors and some comment on improved practice. ***Educational and Psychological Measurement***, 66(3): 393–416.

Herzberg, F. 1966. ***Work and the nature of man***. Cleveland: World Publishers.

Hickson, D. J., Hinings, C. R., Lee, C. A., Schneck, R. E., & Pennings, J. M. 1971. A strategic contingencies' theory of intraorganizational power. ***Administrative Science Quarterly***, 16(2): 216–229.

Hillman, A. J., Withers, M. C., & Collins, B. J. 2009. Resource dependence theory: A review. ***Journal of Management***, 35(6): 1404–1427.

Hinings, C. R., Hickson, D. J., Pennings, J. M., & Schneck, R. E. 1974. Structural conditions of intraorganizational power. ***Administrative Science Quarterly***: 22–44.

Ho, D. E., Imai, K., King, G., & Stuart, E. A. 2007. Matching as nonparametric preprocessing for reducing model dependence in parametric causal inference. ***Political Analysis***, 15(3): 199–236.

Holman, D. 2013. Job types and job quality in Europe. ***Human Relations***, 66(4): 475–502.

Holman, D., Frenkel, S., Sørensen, O., & Wood, S. 2009. Work design variation and outcomes in call centers: Strategic choice and institutional explanations. ***ILR Review***, 62(4): 510–532.

Holmstrom, B., & Milgrom, P. 1991. Multitask principal-agent analyses: Incentive contracts, asset ownership, and job design. ***Journal of Law, Economics, and Organization***,

7(Special issue): 24–52.

Hoogervorst, J. A.P., Koopman, P. L., & van der Flier, H. 2002. Human resource strategy for the new ICT-driven business context. ***The International Journal of Human Resource Management***, 13(8): 1245–1265.

Hoque, K., & Bacon, N. 2015. ***Workplace union representation in the British public sector***: ***Evidence from the 2011 Workplace Employment Relations Survey.*** Warwick Papers in Industrial Relations No. 101. Available at https://www.econstor.eu/handle/10419/119757. Accessed April 27, 2018.

Hoque, K., Earls, J., Conway, N., & Bacon, N. 2017. Union representation, collective voice and job quality: An analysis of a survey of union members in the UK finance sector. ***Economic and Industrial Democracy***, 38(1): 27–50.

Hughes, J., & Sharrock, W. 2007. ***Theory and methods in sociology***: ***An introduction to sociological thinking and practice***. New York: Palgrave Macmillan.

Humphrey, S. E., Nahrgang, J. D., & Morgeson, F. P. 2007. Integrating motivational, social, and contextual work design features: A meta-analytic summary and theoretical extension of the work design literature. ***The Journal of Applied Psychology***, 92(5): 1332–1356.

Hunt, S. T. 2002. On the virtues of staying 'inside of the box': Does organizational citizenship behavior detract from performance in Taylorist jobs? ***International Journal of Selection and Assessment***, 10(1/2): 152–159.

Huselid, M. A. 1995. The impact of human resource management practices on turnover, productivity, and corporate financial performance. ***Academy of Management Journal***, 38(3): 635–672.

Hyman, R. 1989. ***The political economy of industrial relations***. London: Macmillan.

Hyman, R. 1995. Industrial relations in Europe: Theory and practice. ***European Journal of Industrial Relations***, 1(1): 17–46.

Hyman, R. 1997. The future of employee representation. ***British Journal of Industrial Relations***, 35(3): 309–336.

Hyman, R. 2007. How can trade unions act strategically? ***European Review of Labour and Research***, 13(2): 193–210.

Ichniowski, C., Kochan, T. A., Levine, D., Olson, C., & Strauss, G. 1996. What works at

work: Overview and assessment. ***Industrial Relations: A Journal of Economy and Society***, 35(3): 299–333.

Ichniowski, C., Shaw, K., & Prennushi, G. 1997. The effects of human resource management practices on productivity: A study of steel finishing lines. ***American Economic Review***, 87(3): 291–313.

Imbens, G. W. 2015. Matching methods in practice: Three examples. ***Journal of Human Resources***, 50(2): 373–419.

Jackson, G., & Deeg, R. 2006. ***How many varieties of capitalism? Comparing the Comparative Institutional Analyses of Capitalist Diversity.*** MPIfG Discussion Paper No. 06/2. Available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.526.160&rep=rep1&type=pdf. Accessed October 10, 2018.

Jackson, P. R., & Martin, R. 1996. Impact of just-in-time on job content, employee attitudes and well-being: A longitudinal study. ***Ergonomics***, 39(1): 1–16.

Jiang, K., Lepak, D. P., Hu, J., & Baer, J. C. 2012. How does human resource management influence organizational outcomes? A meta-analytic investigation of mediating mechanisms. ***Academy of Management Journal***, 55(6): 1264–1294.

Johnson, G. E. 1997. Changes in earnings inequality: The role of demand shifts. ***Journal of Economic Perspectives***, 11(2): 41–54.

Kalleberg, A. L. 2011. ***Good jobs, bad jobs***: ***The rise of polarized and precarious employment systems in the United States, 1970s to 2000s***. New York: Russell Sage Foundation.

Katz, H. C. 1993. The decentralization of collective bargaining: A literature review and comparative analysis. ***ILR Review***, 47(1): 3–22.

Katz, H. C., Batt, R., & Keefe, J. H. 2003. The revitalization of the CWA: Integrating collective bargaining, political action, and organizing. ***ILR Review***, 56(4): 573–589.

Kaufman, B. E. 2010. The theoretical foundation of industrial relations and its implications for labor economics and human resource management. ***ILR Review***, 64(1): 74–108.

Kaufman, B. E. 2014. History of the British industrial relations field reconsidered: Getting from the Webbs to the new employment relations paradigm. ***British Journal of Industrial***

Relations, 52(1): 1–31.

Kelly, J. 1990. British trade unionism 1979-89: Change, continuity and contradictions. ***Work, Employment and Society***, 4(5): 29–65.

Kelly, J. 2001. Social partnership agreements in Britain: Union revitalization or employer counter-mobilisation. In M. Martinez-Lucio & M. Stuart (Eds.), ***The prospects for and challenges of "modernization"***: 79–86. Leeds, UK: Leeds University Business School.

Kelly, J. 2004. Social partnership agreements in Britain: Labor cooperation and compliance. ***Industrial Relations: A Journal of Economy and Society***, 43(1): 267–292.

Kersley, B., Alpin, C., Forth, J., Bryson, A., Bewley, H., Dix, G., & Oxenbridge, S. 2013. ***Inside the workplace***: ***Findings from the 2004 Workplace Employment Relations Survey***. New York: Routledge.

Kizilos, M., & Reshef, Y. 1997. The effects of workplace unionization on worker responses to HRM innovation. ***Journal of Labor Research***, 18(4): 641–656.

Klein, B., Crawford, R. G., & Alchian, A. A. 1978. Vertical integration, appropriable rents, and the competitive contracting process. ***The Journal of Law and Economics***, 21(2): 297–326.

Kochan, T. A. 1995. Using the Dunlop report to achieve mutual gains. ***Industrial Relations: A Journal of Economy and Society***, 34(3): 350–366.

Kochan, T. A., & Dyer, L. 1993. Managing transformational change: The role of human resource professionals. ***The International Journal of Human Resource Management***, 4(3): 569–590.

Kochan, T. A., McKersie, R. B., & Cappelli, P. 1984. Strategic choice and industrial relations theory. ***Industrial Relations: A Journal of Economy and Society***, 23(1): 16–39.

Kochan, T. A., McKersie, R. B., & Chalykoff, J. 1986. The effects of corporate strategy and workplace innovations on union representation. ***ILR Review***, 39(4): 487–501.

Konrad, A. M., Ritchie Jr, J. E., Lieb, P., & Corrigall, E. 2000. Sex differences and similarities in job attribute preferences: A meta-analysis. ***Psychological Bulletin***, 126(4): 593–641.

Kristal, T. 2013. The capitalist machine: Computerization, workers' power, and the decline in labor's share within US industries. ***American Sociological Review***, 78(3): 361–389.

Krugman, P. R. 2000. Technology, trade and factor prices. ***Journal of International Economics***, 50(1): 51–71.

Kuhn, P., & Gu, W. 1999. Learning in sequential wage negotiations: Theory and evidence. ***Journal of Labor Economics***, 17(1): 109–140.

Kwon, H., & Trail, G. 2005. The feasibility of single-item measures in sport loyalty research. ***Sport Management Review***, 8(1): 69–88.

Langbein, L. 2006. ***Public program evaluation***: ***A statistical guide***. New York: Routledge.

Lawler III, E. E. 1986. ***High-involvement management. Participative strategies for improving organizational performance***. San Francisco: Jossey-Bass, Inc.

Lawler III, E. E. 1994. Total quality management and employee involvement: Are they compatible? ***The Academy of Management Executive***, 8(1): 68–76.

Lawrence, P. R. 2010. The key job design problem is still Taylorism. ***Journal of Organizational Behavior***, 31(2/3): 412–421.

Lazear, E. P. 2009. Firm-specific human capital: A skill-weights approach. ***Journal of Political Economy***, 117(5): 914–940.

Lee, D. S., & Mas, A. 2012. Long-run impacts of unions on firms: New evidence from financial markets, 1961–1999. ***The Quarterly Journal of Economics***, 127(1): 333–378.

Lepak, D. P., Liao, H., Chung, Y., & Harden, E. E. 2006. A conceptual review of human resource management systems in strategic human resource management research. ***Research in Personnel and Human Resources Management***, 25: 217–271.

Lin, H.-F. 2007. Knowledge sharing and firm innovation capability: An empirical study. ***International Journal of Manpower***, 28(3/4): 315–332.

Lincoln, J. R., & Kalleberg, A. L. 1985. Work organization and workforce commitment: A study of plants and employees in the US and Japan. ***American Sociological Review***, 50(6): 738–760.

Lindbeck, A., & Snower, D. J. 2000. Multitask learning and the reorganization of work: From tayloristic to holistic organization. ***Journal of Labor Economics***, 18(3): 353–376.

Lintner, V. G., Pokorny, M. J., Woods, M. M., & Blinkhorn, M. R. 1987. Trade unions and technological change in the UK mechanical engineering industry. ***British Journal of Industrial Relations***, 25(1): 19–29.

Littler, C. R. 1978. Understanding taylorism. ***British Journal of Sociology***, 29(2): 185–202.

Litwin, A. S., & Eaton, A. E. 2018. Complementary or conflictual? Formal participation, informal participation, and organizational performance. ***Human Resource Management***, 57(1): 307–325.

Liu, C., Spector, P., & Jex, S. 2005. The relation of job control with job strains: A comparison of multiple data sources. ***Journal of Occupational and Organizational Psychology***, 78(3): 325–336.

Liu, W., Guthrie, J. P., Flood, P. C., & MacCurtain, S. 2009. Unions and the adoption of high performance work systems: Does employment security play a role? ***ILR Review***, 63(1): 109–127.

Lloyd, C., & Payne, J. 2006. Goodbye to all that? A critical re-evaluation of the role of the high performance work organization within the UK skills debate. ***Work, Employment and Society***, 20(1): 151–165.

Lommerud, K. E., Meland, F., & Straume, O. R. 2009. Can deunionization lead to international outsourcing? ***Journal of International Economics***, 77(1): 109–119.

Lopez-Nicolas, C., & Soto-Acosta, P. 2010. Analyzing ICT adoption and use effects on knowledge creation: An empirical investigation in SMEs. ***International Journal of Information Management***, 30(6): 521–528.

Lorenz, E. 1999. Trust, contract and economic cooperation. ***Cambridge Journal of Economics***, 23(3): 301–315.

Lorenz, E., & Valeyre, A. 2005. Organisational innovation, human resource management and labour market structure: A comparison of the EU-15. ***Journal of Industrial Relations***, 47(4): 424–442.

Lowe, G. S. 1998. The future of work: Implications for unions. ***Relations Industrielles/Industrial Relations***, 53(2): 235–257.

Lu, Y., & Bjorkman, I. 1997. HRM practices in China-Western joint ventures: MNC standardization versus localization. ***The International Journal of Human Resource Management***, 8(5): 614–628.

MacDuffie, J. P. 1995. Human resource bundles and manufacturing performance: Organizational logic and flexible production systems in the world auto industry. ***ILR***

Review, 48(2): 197–221.

MacDuffie, J. P., & Kochan, T. A. 1995. Do US firms invest less in human resources? Training in the world auto industry. ***Industrial Relations: A Journal of Economy and Society***, 34(2): 147–168.

Machin, S., & Puhani, P. A. 2003. Subject of degree and the gender wage differential: Evidence from the UK and Germany. ***Economics Letters***, 79(3): 393–400.

Machin, S., & Stewart, M. 1996. Trade unions and financial performance. ***Oxford Economic Papers***, 48(2): 213–241.

Machin, S., & van Reenen, J. 1998. Technology and changes in skill structure: Evidence from seven OECD countries. ***The Quarterly Journal of Economics***, 113(4): 1215–1244.

Machin, S., & Wadhwani, S. 1991. The effects of unions on organisational change and employment. ***The Economic Journal***, 101(407): 835–854.

Manwaring, T. 1981. The trade union response to new technology. ***Industrial Relations Journal***, 12(4): 7–26.

Marchington, M., Waddington, J., & Timming, A. 2011. Employment relations in Britain. In G. J. Bamber, R. D. Lansbury & N. Wailes (Eds.), ***International and comparative employment relations***: 36–61. Los Angeles, CA.: Sage.

Marsden, D. 1995. ***The impact of industrial relations practices on employment and unemployment.*** Disussion Paper No. 240. Centre for Economic Performance (LSE). London. Available at http://cep.lse.ac.uk/pubs/download/DP0240.pdf. Accessed April 18, 2018.

Marsden, D. 2000. A theory of job regulation, the employment relationship, and the organisation of labour institutions. ***Industrielle Beziehungen/The German Journal of Industrial Relations***, 7(4): 320–347.

Marsden, D., & Thompson, M. 1990. Flexibility agreements and their significance in the increase in productivity in British manufacturing since 1980. ***Work, Employment and Society***, 4(1): 83–104.

Martin, L. 2011. The effects of ICT use on employee's motivations: An empirical evaluation. ***Economics Bulletin***, 31(2): 1592–1605.

Martinez Lucio, M., & Stuart, M. 2002. Assessing the principles of partnership: Workplace

trade union representatives' attitudes and experiences. ***Employee Relations***, 24(3): 305–320.

Martinez-Lucio, M., & Weston, S. 1992. The politics and complexity of trade union responses to new management practices. ***Human Resource Management Journal***, 2(4): 77–91.

Mathieu, J. E., & Rapp, T. L. 2009. Laying the foundation for successful team performance trajectories: The roles of team charters and performance strategies. ***Journal of Applied Psychology***, 94(1): 90–103.

McGoldrick, J. 1983. Industrial relations and the division of labour in the shipbuilding industry since the war. ***British Journal of Industrial Relations***, 21(2): 197–220.

McKinney, J. C. 1969. Typification, typologies, and sociological theory. ***Social Forces***, 48(1): 1–12.

McLoughlin, I. 1991. Human-centred by design? The adoption of CAD in the UK. ***AI & society***, 5(4): 296–307.

Menon, S., Salvatori, A., & Zwysen, W. 2018. ***The effect of computer use on job quality***: ***Evidence from Europe.*** Disussion Paper Series No. 11298. Institute for the Study of Labor (IZA). Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3117302. Accessed April 26, 2018.

Metcalf, D. 1989. Water notes dry up: The impact of the Donovan reform proposals and Thatcherism at work on labour productivity in British manufacturing industry. ***British Journal of Industrial Relations***, 27(1): 1–31.

Metcalf, D. 2002. ***Unions and productivity, financial performance and investment***: ***International evidence.*** CEPDP No. 530. London School of Economics and Political Science (United Kingdom). Available at http://eprints.lse.ac.uk/20072/. Accessed April 25, 2018.

Meyer, A. D., Tsui, A. S., & Hinings, C. R. 1993. Configurational approaches to organizational analysis. ***Academy of Management Journal***, 36(6): 1175–1195.

Meyer, J. W., & Rowan, B. 1977. Institutionalized organizations: Formal structure as myth and ceremony. ***American Journal of Sociology***, 83(2): 340–363.

Michaels, G., Natraj, A., & van Reenen, J. 2014. Has ICT polarized skill demand? Evidence from eleven countries over twenty-five years. ***Review of Economics and Statistics***, 96(1):

60–77.

Milgrom, P., & Roberts, J. 1990. The economics of modern manufacturing: Technology, strategy, and organization. ***American Economic Review***, 80(3): 511–528.

Milgrom, P., & Roberts, J. 1995. Complementarities and fit strategy, structure, and organizational change in manufacturing. ***Journal of Accounting and Economics***, 19(2-3): 179–208.

Mishel, L. 1986. The structural determinants of union bargaining power. ***ILR Review***, 40(1): 90–104.

Mohr, R. D., & Zoghi, C. 2008. High-involvement work design and job satisfaction. ***ILR Review***, 61(3): 275–296.

Morgeson, F. P., Delaney-Klinger, K., & Hemingway, M. A. 2005. The importance of job autonomy, cognitive ability, and job-related skill for predicting role breadth and job performance. ***The Journal of Applied Psychology***, 90(2): 399–406.

Morgeson, F. P., & Humphrey, S. E. 2008. Job and team design: Toward a more integrative conceptualization of work design. ***Research in Personnel and Human Resource Management***, 27: 39–91.

Morrison, D., Cordery, J., Girardi, A., & Payne, R. 2005. Job design, opportunities for skill utilization, and intrinsic job satisfaction. ***European Journal of Work and Organizational Psychology***, 14(1): 59–79.

Nguyen, A. N., Taylor, J., & Bradley, S. 2003. ***Job autonomy and job satisfaction***: ***New evidence.*** Working Paper No. 50. Lancaster University Management School. Available at http://eprints.lancs.ac.uk/48658/. Accessed April 27, 2018.

Nickell, S., & Nicolitsas, D. 1997. Wages, restrictive practices and productivity. ***Labour Economics***, 4(3): 201–221.

Nordhaus, W. 2001. ***The progress of computing.*** Cowles Foundation Discussion Paper No. 1324. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=285168. Accessed April 20, 2018.

Oesch, D. 2013. ***Occupational change in Europe***: ***How technology and education transform the job structure***. Oxford: Oxford University Press.

Oldham, G. R., & Fried, Y. 2016. Job design research and theory: Past, present and future.

Organizational Behavior and Human Decision Processes, 136(September 2016): 20–35.

Oldham, G. R., & Hackman, J. R. 2010. Not what it was and not what it will be: The future of job design research. ***Journal of Organizational Behavior***, 31(2/3): 463–479.

Olsen, K. M. 2016. The power of workers: Knowledge work and the power balance in Scandinavian countries. ***Employee Relations***, 38(3): 390–405.

O'Mahony, M., Robinson, C., & Vecchi, M. 2008. The impact of ICT on the demand for skilled labour: A cross-country comparison. ***Labour Economics***, 15(6): 1435–1450.

Osterman, P. 2006. The wage effects of high performance work organization in manufacturing. ***ILR Review***, 59(2): 187–204.

Oswald, A. J. 1993. Efficient contracts are on the labour demand curve: Theory and facts. ***Labour Economics***, 1(1): 85–113.

Oxenbridge, S., & Brown, W. 2002. The two faces of partnership? ***Employee Relations***, 24(3): 262–276.

Paauwe, J. 2009. HRM and performance: Achievements, methodological issues and prospects. ***Journal of Management Studies***, 46(1): 129–142.

Paré, G., & Tremblay, M. 2007. The influence of high-involvement human resources practices, procedural justice, organizational commitment, and citizenship behaviors on information technology professionals' turnover intentions. ***Group & Organization Management***, 32(3): 326–357.

Parker, S. K. 2003. Longitudinal effects of lean production on employee outcomes and the mediating role of work characteristics. ***Journal of Applied Psychology***, 88(4): 620–634.

Parker, S. K., Morgeson, F. P., & Johns, G. 2017a. One hundred years of work design research: Looking back and looking forward. ***The Journal of Applied Psychology***, 102(3): 403–420.

Parker, S. K., van den Broeck, A., & Holman, D. 2017b. Work design influences: A synthesis of multilevel factors that affect the design of jobs. ***Academy of Management Annals***, 11(1): 267–308.

Peccei, R. E., van de Voorde, F. C., van Veldhoven, M., Paauwe, J., Guest, D. E., & Wright, P. M. 2013. HRM, well-being and performance: A theoretical and empirical review. In D. E. Guest, J. Paauwe & P. Wright (Eds.), ***HRM and performance. Achievements and***

challenges: 15–46. Chichester: John Wiley & Sons.

Pendleton, A. 1997. The evolution of industrial relations in UK nationalized industries. ***British Journal of Industrial Relations***, 35(2): 145–172.

Penner, A. M. 2008. Race and gender differences in wages: The role of occupational sorting at the point of hire. ***The Sociological Quarterly***, 49(3): 597–614.

Petrescu, A. I., & Simmons, R. 2008. Human resource management practices and workers' job satisfaction. ***International Journal of Manpower***, 29(7): 651–667.

Pfeffer, J., & Cohen, Y. 1984. Determinants of internal labor markets in organizations. ***Administrative Science Quarterly***, 29(4): 550–572.

Pfeffer, J., & Salancik, G. R. 1978. ***The external control of organizations***: ***A resource dependence approach***. New York: Harper and Row Publishers.

Pil, F. K., & MacDuffie, J. P. 1996. The adoption of high-involvement work practices. ***Industrial Relations: A Journal of Economy and Society***, 35(3): 423–455.

Piva, M., Santarelli, E., & Vivarelli, M. 2005. The skill bias effect of technological and organisational change: Evidence and policy implications. ***Research Policy***, 34(2): 141–157.

Price, R., & Bain, G. S. 1983. Union growth in Britain: Retrospect and prospect. ***British Journal of Industrial Relations***, 21(1): 46–68.

Ramirez, M., Guy, F., & Beale, D. 2007. Contested resources: Unions, employers, and the adoption of new work practices in US and UK telecommunications. ***British Journal of Industrial Relations***, 45(3): 495–517.

Ramsay, H., Scholarios, D., & Harley, B. 2000. Employees and high-performance work systems: Testing inside the black box. ***British Journal of Industrial Relations***, 38(4): 501–531.

Rasel, F. 2016. Combining information technology and decentralized workplace organization: SMEs versus larger firms. ***International Journal of the Economics of Business***, 23(2): 199–241.

Rinawi, M., & Backes-Gellner, U. 2015. ***Skill prices, skill composition, and the structure of wages.*** Working Paper No. 112. Swiss Leading House. Available at https://edudoc.ch/record/122519/files/16062_Rinawi_Backes-Gellner.pdf. Accessed April

17, 2018.

Rocha, R. 2009. Changing the (im)balance of power: High-performance work systems in Brazil. ***Employee Relations***, 32(1): 74–88.

Roche, W. K., & Geary, J. F. 2002. Advocates, critics and union involvement in workplace partnership: Irish airports. ***British Journal of Industrial Relations***, 40(4): 659–688.

Rönnmar, M. 2004. The managerial prerogative and the employee's duty to work: A comparative study of functional flexibility in working life. ***The International Journal of Human Resource Management***, 15(3): 451–458.

Rosenbaum, P. R., & Rubin, D. B. 1983. The central role of the propensity score in observational studies for causal effects. ***Biometrika***, 70(1): 41–55.

Rosholm, M., Røed, M., & Schøne, P. 2013. Are new work practices and new technologies biased against immigrant workers? ***International Journal of Manpower***, 34(8): 995–1014.

Ross, E. W. 2010. Exploring Taylorism and its continued influence on work and schooling. In E. E. Heilman, R. F. Amthor & M. T. Missias (Eds.), ***Social studies and diversity education. What we do and why we do it***: 33–37. New York: Routledge.

Ross, P., & Bamber, G. J. 2009. Strategic choices in pluralist and unitarist employment relations regimes: A study of Australian telecommunications. ***ILR Review***, 63(1): 24–41.

Rossiter, J. R. 2002. The C-OAR-SE procedure for scale development in marketing. ***International Journal of Research in Marketing***, 19(4): 305–335.

Rubery, J., & Grimshaw, D. 2001. ICTs and employment: The problem of job quality. ***International Labour Review***, 140(2): 165–192.

Rubin, D. B. 2001. Using propensity scores to help design observational studies: Application to the tobacco litigation. ***Health Services and Outcomes Research Methodology***, 2(3/4): 169–188.

Samuel, P., & Bacon, N. 2010. The contents of partnership agreements in Britain 1990-2007. ***Work, Employment and Society***, 24(3): 430–448.

Sarstedt, M., & Wilczynski, P. 2009. More for less? A comparison of single-item and multi-item measures. ***Die Betriebswirtschaft***, 69(2): 211.

Schuler, R. S. 1989. Strategic human resource management and industrial relations. ***Human Relations***, 42(2): 157–184.

Scott, S. G., & Bruce, R. A. 1994. Determinants of innovative behavior: A path model of individual innovation in the workplace. ***Academy of Management Journal***, 37(3): 580–607.

SES 2012. ***Skill and Employment Survey Series***: ***Questionnaire.*** UK Data Archive. Available at http://doc.ukdataservice.ac.uk/doc/7467/mrdoc/pdf/7467_ses_2012_questionnaire.pdf. Accessed April 26, 2018.

Sewell, G. 1998. The discipline of teams: The control of team-based industrial work through electronic and peer surveillance. ***Administrative Science Quarterly***, 43(2): 397–428.

Shackleton, J. R. 1998. Industrial relations reform in Britain since 1979. ***Journal of Labor Research***, 19(3): 581–605.

Sherer, P. D., & Lee, K. 2002. Institutional change in large law firms: A resource dependency and institutional perspective. ***Academy of Management Journal***, 45(1): 102–119.

Simms, M. 2017. Unions and job quality in the UK: Extending interest representation within regulation institutions. ***Work and Occupations***, 44(1): 47–67.

Simon, H. A. 1951. A formal theory of the employment relationship. ***Econometrica: Journal of the Econometric Society***, 19(3): 293–305.

Smith, A. 1976. ***An inquiry into the nature and causes of the wealth of nations***. Oxford: Oxford University Press.

Smith, C., & Thompson, P. 1998. Re-evaluating the labour process debate. ***Economic and Industrial Democracy***, 19(4): 551–577.

Spitz-Oener, A. 2006. Technical change, job tasks, and rising educational demands: Looking outside the wage structure. ***Journal of Labor Economics***, 24(2): 235–270.

Steigenberger, N. 2013. Power shifts in organizations: The role of high-performance work systems. ***The International Journal of Human Resource Management***, 24(6): 1165–1185.

Stevenson, H. 2007. Restructuring teachers' work and trade union responses in England: Bargaining for change? ***American Educational Research Journal***, 44(2): 224–251.

Stewart, P., & Wass, V. 1998. From ‘embrace and change’to ‘engage and change’: Trade union renewal and new management strategies in the UK automotive industry? ***New Technology, Work and Employment***, 13(2): 77–93.

Stole, L. A., & Zwiebel, J. 1996. Organizational design and technology choice under intrafirm bargaining. ***American Economic Review***, 86(1): 195–222.

Streeck, W. 1987. The uncertainties of management in the management of uncertainty: Employers, labor relations and industrial adjustment in the 1980s. ***Work, Employment and Society***, 1(3): 281–308.

Stuart, E. A. 2010. Matching methods for causal inference: A review and a look forward. ***Statistical Science***, 25(1): 1–21.

Sung, J., & Ashton, D. N. ***High performance work practices***: ***Linking strategy and skills to performance outcomes.*** Department of Trade and Industry. London. Available at https://www.researchgate.net/publication/258829103_High_Performance_Work_Practices_linking_strategy_and_skills_to_performance_outcomes. Accessed August 30, 2018.

Takahashi, S. 2011. How multi-tasking job designs affect productivity: Evidence from the Australian coal mining industry. ***ILR Review***, 64(5): 841–862.

Tapia, M., Ibsen, C. L., & Kochan, T. A. 2015. Mapping the frontier of theory in industrial relations: The contested role of worker representation. ***Socio-Economic Review***, 13(1): 157–184.

Taylor, F. 1911. ***The principles of scientific management***. New York: Harper Bros.

Taylor, P., & Bain, P. 2001. Trade unions, workers' rights and the frontier of control in UK call centres. ***Economic and Industrial Democracy***, 22(1): 39–66.

Taylor, P., Mulvey, G., Hyman, J., & Bain, P. 2002. Work organization, control and the experience of work in call centres. ***Work, Employment and Society***, 16(1): 133–150.

The Guardian. 2015. Five ways work will change in the future. Available at https://www.theguardian.com/society/2015/nov/29/five-ways-work-will-change-future-of-workplace-ai-cloud-retirement-remote. Accessed October 16, 2018.

Thomas, K. W., & Velthouse, B. A. 1990. Cognitive elements of empowerment: An “interpretive” model of intrinsic task motivation. ***Academy of Management Review***, 15(4): 666–681.

Thompson, B. 2004. ***Exploratory and confirmatory factor analysis***: ***Understanding concepts and applications***. Washington, DC, US: American Psychological Association.

Thompson, P., Wallace, T., Flecker, J., & Ahlstrand, R. 1995. It ain't what you do, it's the way that you do it: Production organisation and skill utilisation in commercial vehicles. ***Work, Employment and Society***, 9(4): 719–742.

Tinbergen, J. 1974. Substitution of graduate by other labour. ***Kyklos***, 27(2): 217–226.

Tirole, J. 1999. Incomplete contracts: Where do we stand? ***Econometrica***, 67(4): 741–781.

Townley, B. 1993. Foucault, power/knowledge, and its relevance for human resource management. ***Academy of Management Review***, 18(3): 518–545.

Trade Union Congress 2017a. ***Great jobs in great places***: ***How industrial strategy can create great work everywhere. Available at*** https://www.tuc.org.uk/research-analysis/reports/national/great-jobs-great-places. Accessed April 27, 2018.

Trade Union Congress 2017b. ***Shaping our digital future***: ***A TUC discussion paper. Available at*** https://www.tuc.org.uk/research-analysis/reports/shaping-our-digital-future. Accessed April 12, 2018.

Trist, E. L., & Bamforth, K. W. 1951. Some social and psychological consequences of the Longwall Method of coal-getting: An examination of the psychological situation and defences of a work group in relation to the social structure and technological content of the work system. ***Human Relations***, 4(1): 3–38.

Turner, A. N., & Lawrence, P. R. 1965. ***Industrial jobs and the worker***: ***An investigation of response to task attributes***. Cambridge, MA: Harvard University.

Ulph, A., & Ulph, D. 2001. Strategic innovation with complete and incomplete labour market contracts. ***The Scandinavian Journal of Economics***, 103(2): 265–282.

van den Hoff, B., & deRidder, J. 2004. Knowledge sharing in context: The influence of organizational commitment, communication climate and CMC use on knowledge sharing. ***Journal of Knowledge Management***, 8(6): 117–130.

van Mierlo, H., Rutte, C. G., Seinen, B., & Kompier, M. 2001. Autonomous teamwork and psychological well-being. ***European Journal of Work and Organizational Psychology***, 10(3): 291–301.

van Yperen, N. W., Rietzschel, E. F., & de Jonge, K. 2014. Blended working: For whom it

may (not) work. ***PloS one***, 9(7): 1-8.

Venkatesh, V., Bala, H., & Sykes, T. A. 2010. Impacts of information and communication technology implementations on employees' jobs in service organizations in India: A multi-method longitudinal field study. ***Production and Operations Management***, 19(5): 591–613.

Verma, A. 2005. What do unions do to the workplace? Union effects on management and HRM policies. ***Journal of Labor Research***, 26(3): 415–449.

Visser, J. 2016. ***ICTWSS Database***: ***Version 5.1.*** Amsterdam Institute for Advanced Labour Statistics (AIAS). Amsterdam. Available at http://www.uva-aias.net/en/ictwss. Accessed April 18, 2018.

Wall, T. D., Kemp, N. J., Jackson, P. R., & Clegg, C. W. 1986. Outcomes of autonomous workgroups: A long-term field experiment. ***Academy of Management Journal***, 29(2): 280–304.

Wallis, E., Stuart, M., & Greenwood, I. 2005. 'Learners of the workplace unite!' An empirical examination of the UK trade union learning representative initiative. ***Work, Employment and Society***, 19(2): 283–304.

Webb, S., & Webb, B. 1894. ***History of trade unionism***. London: Longmans, Green.

Webb, S., & Webb, B. 1897. ***Industrial democracy***. London: Longmans, Green.

Weber, M. 1949. ***Methodology of social sciences***. Glencoe: Free Press.

Wilkinson, A., Godfrey, G., & Marchington, M. 1997. Bouquets, brickbats and blinkers: Total quality management and employee involvement in practice. ***Organization Studies***, 18(5): 799–819.

Wood, S. 1987. The deskilling debate, new technology and work organization. ***Acta Sociologica***, 30(1): 3–24.

Wood, S., & Menezes, L. M. de 2008. Comparing perspectives on high involvement management and organizational performance across the British economy. ***The International Journal of Human Resource Management***, 19(4): 639–683.

Wood, S., & Menezes, L. M. de 2011. High involvement management, high-performance work systems and well-being. ***The International Journal of Human Resource Management***, 22(7): 1586–1610.

Wood, S., van Veldhoven, M., Croon, M., & Menezes, L. M. de 2012. Enriched job design, high involvement management and organizational performance: The mediating roles of job satisfaction and well-being. ***Human Relations***, 65(4): 419–445.

Wooldridge, J. M. 2010. ***Econometric analysis of cross section and panel data***. Cambridge, MA: MIT Press.

Wooldridge, J. M. 2012. ***Introductory econometrics***: ***A modern approach*** (5th ed.). Mason: South-Western.

Wright, P. M., & McMahan, G. C. 1992. Theoretical perspectives for strategic human resource management. ***Journal of Management***, 18(2): 295–320.

Yin, X., & Shanley, M. 2008. Industry determinants of the "merger versus alliance" decision. ***Academy of Management Review***, 33(2): 473–491.

Zellner, A. 1962. An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. ***Journal of the American Statistical Association***, 57(298): 348–368.

Zwick, W. R., & Velicer, W. F. 1986. Comparison of five rules for determining the number of components to retain. ***Psychological Bulletin***, 99(3): 1–59.

Appendix

Appendix 1: Evolution of the relevance of tasks in Britain (1997-2012)

Task items	% for whom task is "essential **1997**	% for whom task is "essential" **2012**	Change in the mean relevance of tasks **1997-2012**
Dealing with people	60.61	72.17	0.237***
Counseling, advising or caring for customers or clients	36.59	40.66	0.251***
Selling a product or service	23.98	20.81	-0.023
Knowledge of a particular product or service	35.44	39.56	0.182***
Listening carefully to colleagues	38.70	46.59	0.190***
Instructing, training, or teaching people	25.91	35.25	0.378***
Making speeches or presentations	7.38	11.73	0.330***
Persuade or influencing others	17.15	21.48	0.248***
Planning the activities of others	14.21	16.15	0.160***
Specialist knowledge or understanding	40.76	49.62	0.273***
Knowledge of how your organization works	25.13	37.47	0.375***
Physical strength e.g. carry, push, or pull heavy objects	14.26	15.24	0.084**
Work for long periods on physical activity	15.54	16.86	0.036
Skill or accuracy in using your hands or fingers	23.38	20.92	-0.041
Use or operate tools, equipment or machinery	34.53	29.89	-0.205***
Spotting problems or faults	46.54	42.72	-0.073**
Working out the cause of problems or faults	37.02	33.12	-0.068*
Thinking of solution to problems	35.35	35.49	0.112***
Analyzing complex problems in depth	19.94	24.44	0.284***
Reading written information e.g., forms, notices, or signs	42.46	45.40	0.111***
Reading short documents e.g., letters, or memos	34.98	43.62	0.227***
Reading long documents e.g., long reports, manuals	22.01	29.30	0.315***
Writing material e.g., forms, notices, or signs	26.13	30.12	0.153***
Writing short documents, e.g., letters, or memos	25.17	33.04	0.303***
Writing long documents with correct spelling/grammar	15.13	22.80	0.472***
Adding, subtracting, multiplying or dividing numbers	32.83	31.86	0.032
Calculations using decimals, percentage or fractions	24.25	24.48	0.114**
More advanced mathematical or statistical procedures	10.55	15.34	0.474***
Planning your own activities	32.46	36.87	0.144***
Organizing your own time	35.73	44.41	0.237***
Thinking ahead	38.19	44.97	0.229***

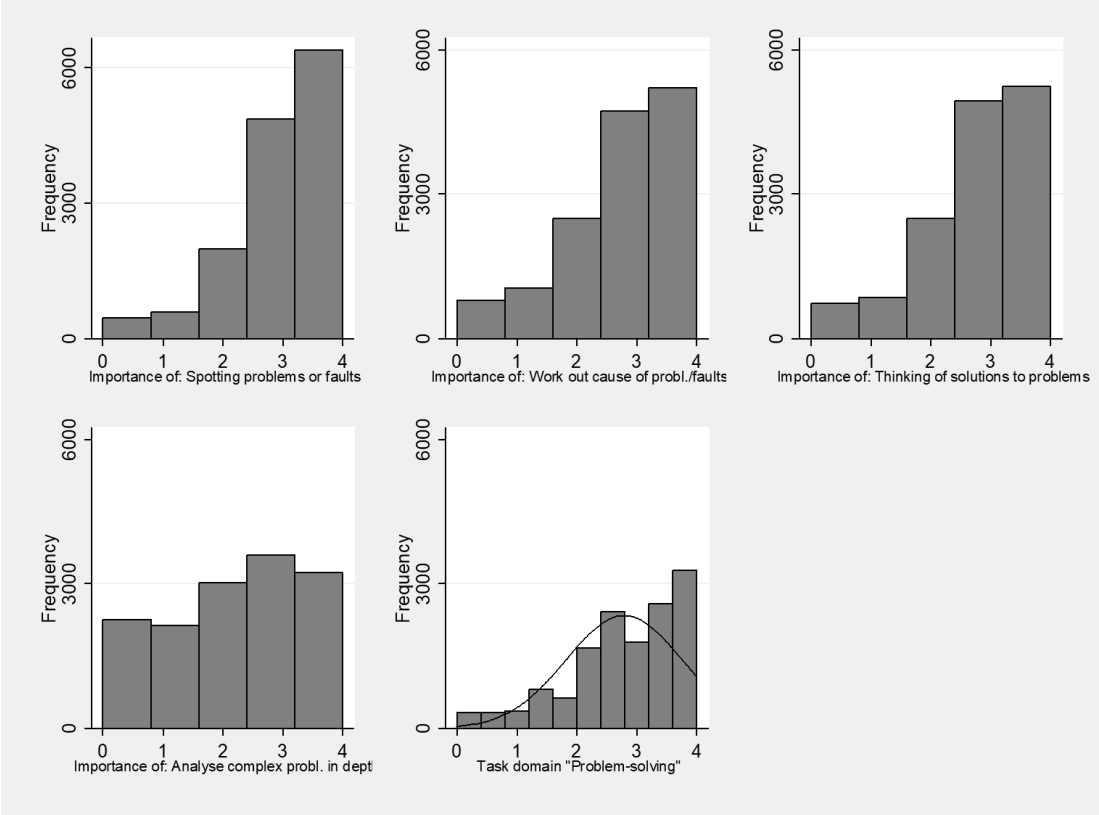
Notes: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. All task items have been recoded into an increasing cardinal scale that ranges from 0 "Not at all/does not apply" to 4 "Essential". Changes in the mean is statistically significant at the * 0.10 level, ** 0.05 level, and ***0.01 level (two-tailed test).

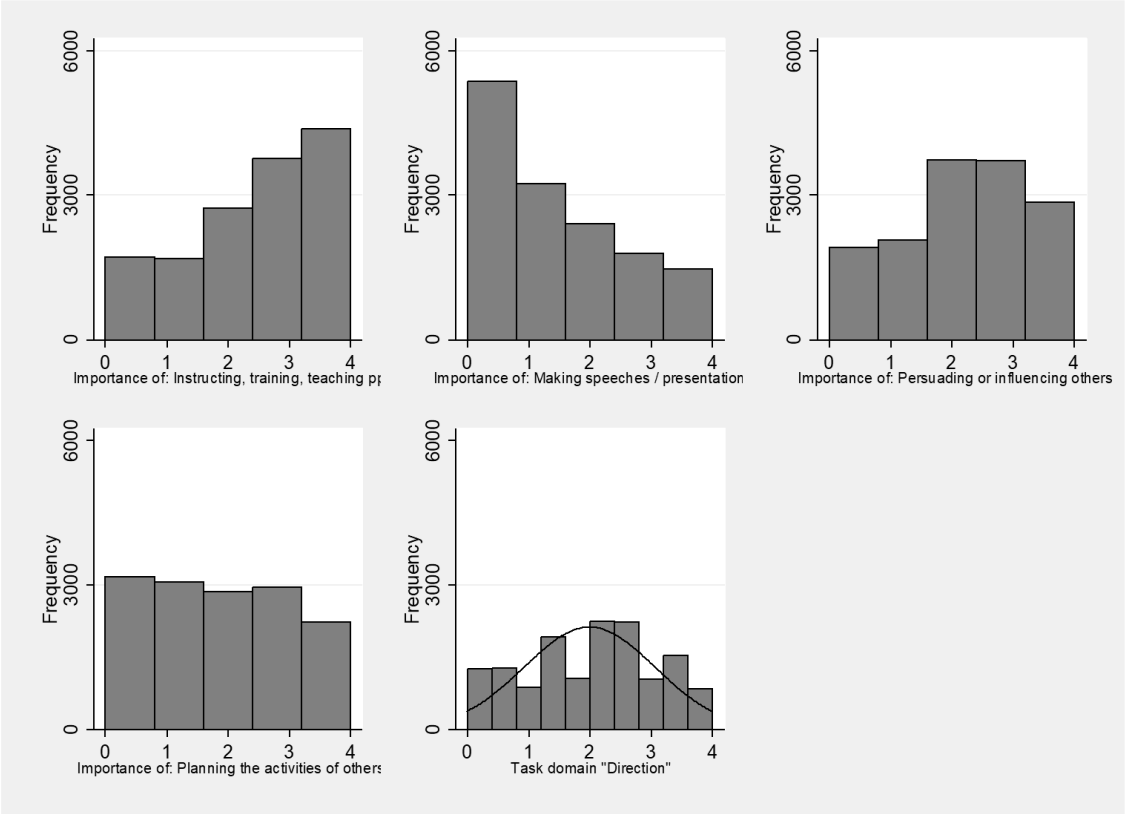
Appendix 2: Principal-component factoring (oblique rotation)

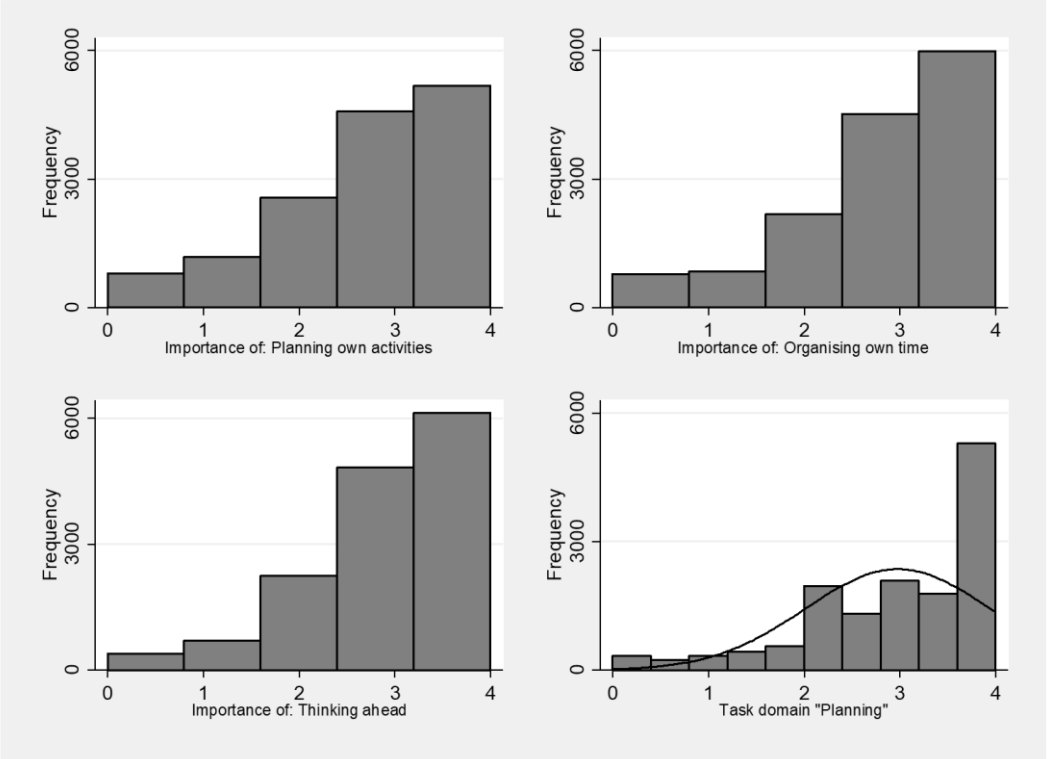
Variable	**Factor I**	**Factor II**	**Factor III**	**Factor IV**	**Factor V**	**Factor VI**	**Factor VII**	Uniqueness
people					0.6020			0.4403
teach			0.6403					0.4539
speech			0.7850					0.3231
persuade			0.6442					0.3495
selling					0.8159			0.3943
caring					0.6642			0.4035
listen								0.6234
strengt							0.8925	0.2460
stamina							0.8984	0.2609
hands							0.7307	0.3651
tools							0.6188	0.4259
product					0.6023			0.4349
special								0.5413
orgwork								0.5473
faults				0.9050				0.2905
cause				0.9557				0.2012
solutn				0.8105				0.2446
analyse				0.4758				0.3740
planme		08752						0.2354
planoth			0.6018					0.4030
mytime		0.8959						0.2373
ahead		0.7431						0.3033
read	0.8528							0.3225
readshort	0.8364							0.2563
readlong	0.7378							0.2865
write	0.8666							0.3425
writeshort	0.6957							0.2789
writelong	0.5489			0.4846				0.3252
calca						0.8399		0.2571
percent						0.8799		0.1658
stats						0.7731		0.2890

Notes: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Blanks represent abs(loadings) <.41 which is in line with Bortz and Schuster (2010).

Appendix 3: Distribution of items

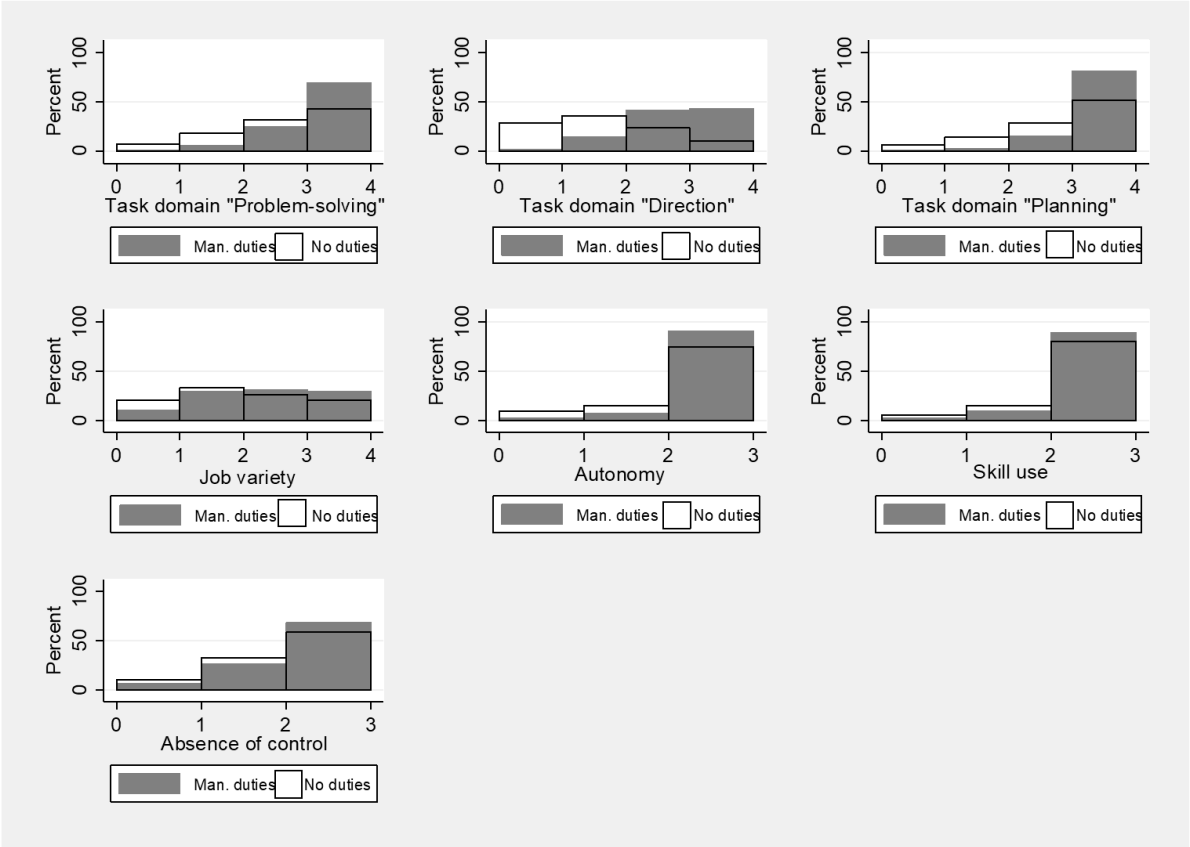






Note: Own compilation. Distributions based on own calculations using the SES (waves 1997, 2001, 2006, and 2012).

Appendix 4: Distribution managerial / supervisory duties vs. none



Note: Own compilation. Distributions based on own calculations using the SES (waves 1997, 2001, 2006, and 2012).

Appendix 5: OLS regressions of work design variables on HC variables

	Dependent Variables							
	Problem-solving		Direction		Planning		Job variety	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Education	0.06***	0.01**	0.12***	0.02***	0. 90***	0.02***	0.10***	0.05***
	(0.000)	(0.031)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Experience	0.03***	0.02***	0.05***	0.02***	0.04***	0.02***	0.04***	0.03***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Experience²/100	-0.06***	-0.03***	-0.010***	-0.05***	-0.07***	-0.03***	-0.07***	-0.05***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female	-0.12***	-0.08***	0.06***	-0.14***	0.15***	0.05***	-0.16***	-0.11***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.004)	(0.000)	(0.000)
Full-time	0.47***	0.25***	0.46***	0.34***	0.48***	0.29***	0.07**	-0.03
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.011)	(0.239)
Black	-0.11*	-0.04	-0.04	0.08	-0.23***	-0.14***	-0.36***	-0.27***
	(0.095)	(0.541)	(0.583)	(0.196)	(0.000)	(0.007)	(0.000)	(0.000)
Asian	-0.19***	-0.15***	-0.10*	0.01	-0.22***	-0.12***	-0.25***	-0.16***
	(0.000)	(0.002)	(0.070)	(0.793)	(0.000)	(0.009)	(0.000)	(0.007)
Other	-0.17**	-0.09	0.07	0.17***	-0.01	0.09	-0.35***	-0.27***
	(0.016)	(0.147)	(0.411)	(0.005)	(0.904)	(0.127)	(0.000)	(0.000)
Occupation	No	Yes	No	Yes	No	Yes	No	Yes
Industry	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.09	0.25	0.14	0.40	0.12	0.30	0.07	0.16
F(Education & Experience)	146.91	12.40	535.47	36.86	388.53	25.80	274.83	49.64
F(Gender & Race)	17.66	6.77	3.96	14.73	27.55	6.20	30.05	12.40
N	13,957		13,958		13,957		13,951	

Appendix 5: Pooled OLS regressions of work design variables on HC variables (continued)

	Dependent variables					
	Autonomy		Skill use		Absence of control	
	(9)	(10)	(11)	(12)	(13)	(14)
Education	0.04***	0.01**	0.03***	-0.01***	0.03***	0.02***
	(0.000)	(0.027)	(0.000)	(0.002)	(0.000)	(0.000)
Experience	0.02***	0.01***	0.02***	0.01***	0.03***	0.03***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Experience²/100	-0.03***	-0.02***	-0.03***	-0.01	-0.04***	-0.04***
	(0.000)	(0.010)	(0.000)	(0.124)	(0.000)	(0.000)
Female	-0.03	-0.02	0.04**	0.00	-0.05***	0.03
	(0.107)	(0.187)	(0.020)	(0.847)	(0.002)	(0.164)
Full-time	0.15***	0.09***	0.22***	0.15***	-0.05***	-0.10***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.000)
Black	-0.22***	-0.13**	-0.15***	-0.09	-0.24***	-0.17***
	(0.000)	(0.024)	(0.009)	(0.134)	(0.000)	(0.006)
Asian	-0.18***	-0.11**	-0.02	0.02	-0.21***	-0.19***
	(0.000)	(0.016)	(0.663)	(0.666)	(0.000)	(0.000)
Other	-0.05	-0.01	-0.02	0.04	-0.14***	-0.13**
	(0.369)	(0.861)	(0.793)	(0.554)	(0.033)	(0.041)
Occupation	No	Yes	No	Yes	No	Yes
Industry	No	Yes	No	Yes	No	Yes
R^2	0.03	0.14	0.03	0.13	0.04	0.12
F(Education & Experience)	87.39	19.48	53.35	25.13	158.44	114.53
F(Gender & Race)	7.71	3.02	3.07	0.73	11.93	6.79
N	13,956		11,804		13,937	

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. *** indicates significance at the 1%-level, ** 5%-level, * 10%-level.

Appendix 6: OLS regressions of log hourly pay on posited determinants

	Log hourly pay						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Education	0.09***		0.04***			0.03***	
	(0.000)		(0.000)			(0.000)	
Experience	0.04***		0.03***			0.02***	
	(0.000)		(0.000)			(0.000)	
Experience²/100	-0.07***		-0.04***			-0.04***	
	(0.000)		(0.000)			(0.000)	
Female	-0.13***		-0.10***			-0.09***	
	(0.000)		(0.000)			(0.000)	
Full-time	0.21***		0.04***			0.01*	
	(0.000)		(0.000)			(0.091)	
Black	-0.09***		0.01			0.01	
	(0.000)		(0.636)			(0.508)	
Asian	-0.09***		-0.05**			-0.05**	
	(0.000)		(0.016)			(0.039)	
Other	-0.11***		-0.03			-0.03	
	(0.000)		(0.193)			(0.231)	
Problem-solving				0.06***	0.01	0.00	0.02
				(0.000)	(0.139)	(0.352)	(0.882)
Direction				0.11***	0.06***	0.05***	0.06*
				(0.000)	(0.000)	(0.000)	(0.086)
Planning				0.04***	0.00	0.00	-0.03
				(0.000)	(0.335)	(0.324)	(0.422)
Job variety				0.08***	0.04***	0.03***	0.09**
				(0.000)	(0.000)	(0.000)	(0.001)
Autonomy				0.03***	0.02***	0.02***	-0.03
				(0.000)	(0.000)	(0.000)	(0.535)
Skill use				0.04***	0.02***	0.02***	0.08*
				(0.000)	(0.000)	(0.000)	(0.053)
Absence of control				0.07***	0.04***	0.03***	0.07**
				(0.000)	(0.000)	(0.000)	(0.051)
Union presence				0.12***	0.08***	0.07***	
				(0.000)	(0.000)	(0.000)	
Occupation	No	Yes	Yes	No	Yes	Yes	-
Industry	No	Yes	Yes	No	Yes	Yes	-
R^2	0.40	0.60	0.64	0.33	0.61	0.64	0.97
N	12,483	12,746	12,483	10,469	10,469	10,252	540

Note: Estimates are based on pooled OLS regressions with log hourly pay being the dependent variable. Column 7 presents the results of the fixed-effects panel estimation. P-values in parentheses. *** indicates significance at the 1%-level, ** 5%-level, * 10%-level.

Appendix 7: OLS regressions of problem-solving on posited determinants

	Problem-solving						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2001	0.08***	0.06**	0.05**	0.05**	0.05**	0.05**	0.06**
	(0.003)	(0.019)	(0.042)	(0.034)	(0.034)	(0.028)	(0.017)
2006	0.11***	0.08***	-0.01	-0.01	-0.01	-0.01	0.00
	(0.000)	(0.002)	(0.676)	(0.740)	(0.724)	(0.766)	(0.877)
2012	0.06***	0.05*	-0.08***	-0.07***	-0.08***	-0.07***	-0.05**
	(0.030)	(0.065)	(0.002)	(0.004)	(0.000)	(0.010)	(0.041)
Employee involvement			0.79***	0.68***	0.80***	0.69***	0.66***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Task discretion			0.29***	0.25***	0.29***	0.25***	0.25***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ICT use			0.16***	0.16***	0.15***	0.16***	0.15***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Union presence					-0.06***	-0.03*	-0.04**
					(0.000)	(0.076)	(0.047)
Occupation	No	Yes	No	Yes	No	Yes	Yes
Industry	No	Yes	No	Yes	No	Yes	Yes
R^2	0.00	0.24	0.23	0.35	0.23	0.35	0.35
F(Year)	5.75	3.22	11.65	11.65	10.89	10.81	9.03
F(Involvement)			829.46	580.67	812.33	567.38	516.23
F(Occupation)		13.07		8.02		7.70	5.54
F(Industry)		1.41		1.46		1.37	1.32
N	14,269	14,269	14,235	14,235	13,907	13,907	13,482

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with the relevance of problem-solving being the dependent variable. The dependent variable ranges from 0 (Not at all important) to 4 (Essential). The independent variable employee involvement is a summary indicator ranging from 0 to 1. The variable task discretion is a summary indicator ranging from 0 (Not at all) to 3 (A great deal). The variable ICT use ranges from 0 (Not at all important) to 4 (Essential) and trade union presence is a dummy variable taking the value 1 if a trade union is present and 0 if no union is present at the workplace. White-corrected standard errors are used in every specification. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Appendix 8: OLS regressions of direction on posited determinants

	Direction						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2001	0.10***	0.03	0.08***	0.04*	0.08***	0.04*	0.06***
	(0.001)	(0.249)	[0.001]	(0.076)	[0.000]	(0.073)	(0.010)
2006	0.24***	0.13***	0.11***	0.06***	0.11***	0.06***	0.08***
	(0.000)	(0.000)	[0.000]	(0.003)	[0.000]	(0.003)	(0.000)
2012	0.28***	0.16***	0.12***	0.05**	0.13***	0.06**	0.08***
	(0.000)	(0.000)	[0.000]	(0.026)	[0.000]	(0.019)	(0.003)
Employee involvement			1.47***	1.09***	1.44***	1.09***	1.04***
			[0.000]	(0.000)	[0.000]	(0.000)	(0.000)
Task discretion			0.38***	0.29***	0.39***	0.29***	0.29***
			[0.000]	(0.000)	[0.000]	(0.000)	(0.000)
ICT use			0.12***	0.11***	0.12***	0.11***	0.10***
			[0.000]	(0.000)	[0.000]	(0.000)	(0.000)
Union presence					0.06***	0.00	-0.01
					[0.000]	(0.905)	(0.525)
Occupation	No	Yes	No	Yes	No	Yes	Yes
Industry	No	Yes	No	Yes	No	Yes	Yes
R^2	0.01	0.37	0.35	0.51	0.35	0.51	0.52
F(Year)	40.05	22.27	9.51	3.04	9.97	3.07	4.29
F(Involvement)			2412.60	1357.32	2296.79	1319.21	1215.60
F(Occupation)		33.14		20.72		18.58	15.71
F(Industry)		1.74		1.34		1.23	1.31
N	14,270	14,270	14,236	14,236	13,908	13,908	13,483

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with the relevance of directive tasks being the dependent variable. The dependent variable ranges from 0 (Not at all important) to 4 (Essential). The independent variable employee involvement is a summary indicator ranging from 0 to 1. The variable task discretion is a summary indicator ranging from 0 (Not at all) to 3 (A great deal). The variable ICT use ranges from 0 (Not at all important) to 4 (Essential) and trade union presence is a dummy variable taking the value 1 if a trade union is present and 0 if no union is present at the workplace. White-corrected standard errors are used in every specification except of (3) and (5) (squared brackets). P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Appendix 9: OLS regressions of planning on posited determinants

	Planning						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2001	0.13***	0.07***	0.13***	0.09***	0.13***	0.09***	0.09***
	(0.000)	(0.008)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2006	0.21***	0.12***	0.13***	0.08***	0.13***	0.08***	0.08***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2012	0.20***	0.11***	0.09***	0.05**	0.10***	0.05**	0.06**
	(0.000)	(0.000)	(0.000)	(0.026)	(0.000)	(0.027)	(0.019)
Employee involvement			0.72***	0.56***	0.71***	0.56***	0.55***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Task discretion			0.54***	0.44***	0.54***	0.44***	0.43***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ICT use			0.14***	0.11***	0.13***	0.11***	0.11***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Union presence					0.01	-0.03*	-0.03
					(0.467)	(0.051)	(0.129)
Occupation	No	Yes	No	Yes	No	Yes	Yes
Industry	No	Yes	No	Yes	No	Yes	Yes
R^2	0.01	0.29	0.33	0.43	0.33	0.43	0.43
F(Year)	24.80	8.98	15.17	6.93	14.19	6.03	6.10
F(Involvement)			1664.00	1030.14	1602.89	996.83	924.40
F(Occupation)		21.86		13.62		12.50	10.49
F(Industry)		1.55		1.53		1.62	1.61
N	14,269	14,269	14,235	14,235	13,907	13,907	13,482

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with the relevance of planning tasks being the dependent variable. The dependent variable ranges from 0 (Not at all important) to 4 (Essential). The independent variable employee involvement is a summary indicator ranging from 0 to 1. The variable task discretion is a summary indicator ranging from 0 (Not at all) to 3 (A great deal). The variable ICT use ranges from 0 (Not at all important) to 4 (Essential) and trade union presence is a dummy variable taking the value 1 if a trade union is present and 0 if no union is present at the workplace. White-corrected standard errors are used in every specification. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Appendix 10: OLS regressions of job variety on posited determinants

	Job variety						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2001	-0.05	-0.11***	-0.06*	-0.10***	-0.06*	-0.10***	-0.11***
	(0.114)	[0.000]	(0.066)	[0.001]	(0.054)	[0.001]	[0.000]
2006	-0.06*	-0.13***	-0.09***	-0.12***	-0.10***	-0.12***	-0.16***
	(0.064)	[0.000]	(0.002)	[0.000]	(0.001)	[0.000]	[0.000]
2012	-0.18***	-0.25***	-0.23***	-0.25***	-0.23***	-0.246***	-0.30***
	[0.000]	[0.000]	(0.000)	[0.000]	(0.000)	[0.000]	[0.000]
Employee involvement			0.17***	-0.02	0.18***	-0.00	-0.02
			(0.000)	[0.661]	(0.000)	[0.942]	[0.541]
Task discretion			0.21***	0.12***	0.21***	0.12***	0.12***
			(0.000)	[0.000]	(0.000)	[0.000]	[0.000]
ICT use			0.07***	0.01	0.07***	0.01	-0.01
			(0.000)	[0.295]	(0.000)	[0.278]	[0.506]
Union presence					-0.01	-0.04*	-0.06***
					(0.782)	[0.068]	[0.008]
Occupation	No	Yes	No	Yes	No	Yes	Yes
Industry	No	Yes	No	Yes	No	Yes	Yes
R^2	0.00	0.15	0.04	0.15	0.04	0.15	0.16
F(Year)	10.48	19.19	17.22	18.10	16.18	17.09	23.89
F(Involvement)			118.34	31.17	114.39	29.75	28.62
F(Occupation)		5.17		4.34		4.26	2.92
F(Industry)		1.62		1.65		1.59	1.47
N	14,263	14,263	14,230	14,230	13,902	13,902	13,477

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with perceived job variety being the dependent variable. The dependent variable ranges from 0 (Never) to 4 (Always). The independent variable employee involvement is a summary indicator ranging from 0 to 1. The variable task discretion is a summary indicator ranging from 0 (Not at all) to 3 (A great deal). The variable ICT use ranges from 0 (Not at all important) to 4 (Essential) and trade union presence is a dummy variable taking the value 1 if a trade union is present and 0 if no union is present at the workplace. Normal standard errors are used in every specification except of (3) and (5). P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Appendix 11: OLS regressions of autonomy on posited determinants

	Autonomy						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2001	-0.07***	-0.10***	-0.02	-0.03	-0.03	-0.03	-0.03
	[0.002]	(0.000)	(0.236)	(0.204)	(0.177)	(0.169)	(0.109)
2006	-0.12***	-0.16***	-0.09***	-0.09***	-0.09***	-0.09***	-0.10***
	[0.000]	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
2012	-0.18***	-0.22***	-0.16***	-0.16***	-0.17***	-0.16***	-0.17***
	[0.000]	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Employee involvement			0.18***	0.18***	0.21***	0.20***	0.20***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Task discretion			0.67***	0.62***	0.66***	0.61***	0.60***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ICT use			0.02***	0.000	0.02***	0.00	0.00
			(0.000)	(0.995)	(0.000)	(0.605)	(0.671)
Union presence					-0.10***	-0.08***	-0.07***
					(0.000)	(0.000)	(0.000)
Occupation	No	Yes	No	Yes	No	Yes	Yes
Industry	No	Yes	No	Yes	No	Yes	Yes
R^2	0.00	0.14	0.30	0.34	0.30	0.34	0.34
F(Year)	19.73	27.83	26.55	22.56	26.10	21.72	21.77
F(Involvement)			2356.60	1699.82	2250.55	1638.20	1519.16
F(Occupation)		14.24		6.33		6.12	5.03
F(Industry)		2.26		2.12		2.14	1.95
N	14,267	14,267	14,233	14,233	13,905	13,905	13,480

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with perceived job autonomy being the dependent variable. The dependent variable ranges from 0 (No choice at all) to 3 (A great deal of choice). The independent variable employee involvement is a summary indicator ranging from 0 to 1. The variable task discretion is a summary indicator ranging from 0 (Not at all) to 3 (A great deal). The variable ICT use ranges from 0 (Not at all important) to 4 (Essential) and trade union presence is a dummy variable taking the value 1 if a trade union is present and 0 if no union is present at the workplace. White-corrected standard errors are used in every specification except of (1) (squared brackets). P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%- level, * indicates significance at the 10%-level.

Appendix 12: OLS regressions of skill use on posited determinants

	Skill use						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2006	0.11*** [0.000]	0.09*** (0.000)	0.07*** (0.000)	0.07*** (0.000)	0.07*** (0.001)	0.07*** (0.000)	0.08*** (0.000)
2012	0.15*** [0.000]	0.13*** (0.000)	0.10*** (0.000)	0.10*** (0.000)	0.10*** (0.000)	0.10*** (0.000)	0.10*** (0.000)
Employee involvement			0.46*** (0.000)	0.37*** (0.000)	0.47*** (0.000)	0.38*** (0.000)	0.37*** (0.000)
Task discretion			0.25*** (0.000)	0.22*** (0.000)	0.25*** (0.000)	0.22*** (0.000)	0.22*** (0.000)
ICT use			0.03*** (0.000)	0.02*** (0.001)	0.03*** (0.000)	0.02*** (0.001)	0.03*** (0.000)
Union presence					-0.03* (0.069)	-0.04** (0.011)	-0.05*** (0.002)
Occupation	No	Yes	No	Yes	No	Yes	Yes
Industry	No	Yes	No	Yes	No	Yes	Yes
R^2	0.01	0.12	0.11	0.17	0.11	0.17	0.18
F(Year)	32.47	26.45	16.24	14.93	15.45	14.38	13.86
F(Involvement)			465.54	289.86	465.41	293.80	266.68
F(Occupation)		-		8.55		7.15	6.29
F(Industry)		1.12		1.06		1.06	1.05
N	12,074	12,074	12,048	12,048	11,750	11,750	11,392

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with skill use in job being the dependent variable. The dependent variable ranges from 0 (Strongly disagree) to 3 (Strongly agree). The independent variable employee involvement is a summary indicator ranging from 0 to 1. The variable task discretion is a summary indicator ranging from 0 (Not at all) to 3 (A great deal). The variable ICT use ranges from 0 (Not at all important) to 4 (Essential) and trade union presence is a dummy variable taking the value 1 if a trade union is present and 0 if no union is present at the workplace. White-corrected standard errors are used in every specification except of (1) (squared brackets). P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Appendix 13: OLS regressions of absence of control on posited determinants

	Absence of control						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2001	-0.13***	-0.13***	-0.11	-0.10***	-0.11***	-0.11***	-0.13***
	[0.002]	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2006	-0.09***	-0.10***	-0.06***	-0.05**	-0.06***	-0.05**	-0.09***
	[0.000]	(0.000)	(0.009)	(0.041)	(0.010)	(0.040)	(0.000)
2012	-0.23***	-0.23***	-0.19***	-0.17***	-0.19***	-0.16***	-0.22***
	[0.000]	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Employee involvement			-0.47***	-0.45***	-0.43***	-0.43***	-0.40***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Task discretion			0.30***	0.25***	0.29***	0.25***	0.23***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ICT use			0.02***	-0.02***	0.03***	-0.02**	-0.01
			(0.000)	(0.010)	(0.000)	(0.025)	(0.235)
Union presence					-0.10***	-0.08***	-0.10***
					(0.000)	(0.000)	(0.000)
Occupation	No	Yes	No	Yes	No	Yes	Yes
Industry	No	Yes	No	Yes	No	Yes	Yes
R^2	0.01	0.10	0.07	0.14	0.07	0.14	0.17
F(Year)	28.88	26.38	24.84	18.21	23.83	17.07	23.94
F(Involvement)			437.49	293.42	372.91	269.27	232.96
F(Occupation)		35.78		19.69		20.01	12.73
F(Industry)		2.64		2.13		2.06	1.81
N	14,249	14,249	14,215	14,215	13,888	13,905	13,463

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Estimates are based on pooled OLS regressions with perceived absence of control in job being the dependent variable. The dependent variable ranges from 0 (Very closely supervised) to 3 (Not at all supervised). The independent variable employee involvement is a summary indicator ranging from 0 to 1. The variable task discretion is a summary indicator ranging from 0 (Not at all) to 3 (A great deal). The variable ICT use ranges from 0 (Not at all important) to 4 (Essential) and trade union presence is a dummy variable taking the value 1 if a trade union is present and 0 if no union is present at the workplace. White-corrected standard errors are used in every specification except of (1) (squared brackets). P-values are reported within parentheses. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Appendix 14: OLS regressions of work design variables on fully interacted model

	Dependent variables						
	Job variety	Autonomy	Skill use	Absence of control	Problem-solving	Direction	Planning
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Employee involvement	0.02	0.13**	0.32***	-0.43***	0.73***	1.10***	0.58***
	(0.853)	(0.031)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Task discretion	0.19***	0.64***	0.19***	0.25***	0.34***	0.36***	0.54***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ICT use	0.00	0.00	0.02***	-0.01	0.17***	0.12***	0.12***
	(0.935)	(0.710)	(0.009)	(0.673)	(0.000)	(0.000)	(0.000)
Union presence	-0.09*	-0.06*	-0.05**	-0.00	0.02	-0.00	-0.04
	(0.091)	(0.067)	(0.050)	(0.934)	(0.524)	(0.902)	(0.298)
EI*Year01	0.02	0.04	-	0.02	-0.03	0.02	0.01
	(0.868)	(0.647)		(0.842)	(0.698)	(0.846)	(0.878)
EI*Year06	-0.01	0.07	0.10	-0.01	-0.08	-0.02	-0.08
	(0.927)	(0.338)	(0.101)	(0.867)	(0.337)	(0.783)	(0.336)
EI*Year12	-0.13	0.14	0.11	-0.05	-0.02	-0.05	0.06
	(0.320)	(0.103)	(0.157)	(0.580)	(0.825)	(0.627)	(0.534)
TD*Year01	-0.13***	-0.04	-	0.03	-0.11***	-0.05	-0.12***
	(0.005)	(0.260)		(0.413)	(0.005)	(0.123)	(0.002)
TD*Year06	-0.04	0.02	0.05**	-0.03	-0.09**	-0.08**	-0.10***
	(0.374)	(0.623)	(0.043)	(0.445)	(0.016)	(0.023)	(0.006)
TD*Year12	-0.11**	-0.13***	0.01	-0.03	-0.16***	-0.15***	-0.16***
	(0.034)	(0.001)	(0.656)	(0.530)	(0.000)	(0.000)	(0.000)
CU*Year01	-0.00	-0.00	-	-0.00	-0.04***	-0.03*	-0.03*
	(0.983)	(0.787)		(0.970)	(0.006)	(0.076)	(0.053)
CU*Year06	0.01	0.00	-0.00	-0.02	0.00	-0.01	-0.00
	(0.695)	(0.989)	(0.799)	(0.270)	(0.900)	(0.619)	(0.886)
CU*Year12	0.03	-0.00	-0.00	-0.02	-0.01	0.00	0.00
	(0.134)	(0.826)	(0.819)	(0.236)	(0.453)	(0.999)	(0.942)
TU*Year01	0.03	-0.05	-	-0.07	-0.04	-0.02	0.01
	(0.661)	(0.208)		(0.126)	(0.335)	(0.657)	(0.810)
TU*Year06	0.06	-0.00	0.01	-0.11**	-0.09**	-0.01	0.01
	(0.301)	(0.965)	(0.732)	(0.017)	(0.037)	(0.886)	(0.724)
TU*Year12	0.08	0.008	0.02	-0.03	-0.04	0.07	-0.01
	(0.228)	(0.860)	(0.604)	(0.182)	(0.441)	(0.170)	(0.831)
R^2	0.15	0.34	0.17	0.14	0.35	0.51	0.43
N	13,902	13,905	11,750	13,888	13,907	13,908	13,907

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. P-values are reported within parentheses. *** indicates significance at the 1%-level, ** 5%-level, * 10%-level.

Appendix 15: Comparison of treatment and control group (before/after matching)

	Sample	Mean Treated	Mean Control	%bias	p>|t|
Employee Involvement	Unmatched	0.65	0.58	24.5	0.000
	Matched	0.64	0.65	-4.0	0.105
Task Discretion	Unmatched	2.15	2.23	-10.5	0.000
	Matched	2.16	2.16	-0.1	0.954
ICT use	Unmatched	2.69	2.52	10.8	0.000
	Matched	2.69	2.74	-3.1	0.215
Unemployment	Unmatched	0.06	0.06	2.7	0.220
	Matched	0.06	0.06	1.9	0.451
Absolute standard differences of mean	17.4				
Variance ratio	1.18				

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. Mean values are raw mean values for selected variables before and after propensity score matching (algorithm radius caliper (0.08). A full set of additional dummy variables is included (e.g. gender composition, region, etc.). p>|t| indicates whether the difference in the mean is statistically significant. %bias is an indicator to assess the distance in the marginal distribution of the control variables (see Caliendo & Kopeinig, 2008: 48).

Appendix 16: Comparison of treatment and control group (Epanechnikov kernel)

	Union present (Treated)	***Difference between untreated and treated (ATT)***	***|T-value|***	***Union not present (Not treated)***
Problem-solving	2.83	-0.05*	1.94	2.88
Direction	1.98	-0.03	1.13	2.02
Planning	2.92	-0.07***	2.44	2.99
Job variety	1.60	-0.06*	1.94	1.66
Autonomy	2.04	-0.08***	3.05	2.12
Skill use	2.13	-0.04*	1.85	2.17
Absence of control	1.67	-0.08***	3.12	1.74

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The matching algorithm is Epanechnikov kernel (bandwidth 0.1). Difference between treated (union present) and control group (no union present) represents the average treatment effect on the treated. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Appendix 17: Trade union density by sector

	Union density (in %)			
	1997	**2001**	**2006**	**2012**
All	**30.7**	**29.3**	**28.3**	**26.0**
Agriculture, forestry and fishing	9.4	11.3*	10.2	n/a
Mining and quarrying	32.0	27.6	23.4	18.6
Manufacturing	30.4	27.1	22.5	18.6
Electricity, gas, steam and air conditioning supply	66.5	53.8	50.8	43.6
Water supply, sewerage, waste management and remediation	58.5	46.3	44.6	34.8
Construction	24.1	21.0	17.6	15.8
Wholesale and retail trade, repair of motor vehicles and motorcycles	10.3	11.6	11.1	12.7
Transportation and storage	47.5	46.8	43.9	39.8
Accommodation and food service activities	6.9	5.7	5.6	3.5
Financial and insurance activities	33.1	25.7	24.0	15.9
Real estate activities	n/a	n/a	6.9	11.8
Professional, scientific and technical activities	8.9	10.0	8.2	8.8
Administrative and support service activities	10.5	9.8	10.5	11.1
Public administration and defense; compulsory social security	62.3	59.7	57.1	52.2
Education	55.6	53.2	55.0	52.0
Human health and social work activities	47.8	45.3	43.6	41.0
Arts, entertainment and recreation	27.0	27.8	21.5	14.8
Other service activities	11.6	13.0	13.2	10.1

Source: Department for Business Innovation and Skills (Version April 1st, 2014). * indicates trade union density in 2000.

Appendix 18: Fixed-effect panel estimation (clustered standard errors, w2012)

	Dependent variables						
	Job variety	Autonomy	Skill use	Absence of control	Problem-solving	Direction	Planning
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Employee involvement	-0.39	-0.22	0.25	-0.45	0.54	1.13***	0.41
	(0.434)	(0.310)	(0.561)	(0.178)	(0.129)	(0.003)	(0.188)
Task discretion	0.53***	0.84***	0.17	0.40**	0.43**	0.54***	0.64***
	(0.008)	(0.000)	(0.326)	(0.032)	(0.024)	(0.006)	(0.000)
ICT use	-0.01	0.08**	0.03	-0.02	0.17***	0.15*	0.26***
	(0.878)	(0.012)	(0.703)	(0.835)	(0.006)	(0.056)	(0.000)
Trade union density	-1.27**	-0.57	0.32	-0.13	-1.35***	-0.73	-0.32
	(0.031)	(0.120)	(0.534)	(0.734)	(0.009)	(0.145)	(0.488)
R^2	0.81	0.86	0.83	0.74	0.91	0.94	0.92
N	186	186	140	186	186	186	186

Note: Own calculations based on the SES, waves 1997, 2001, 2006, and 2012. The coefficients present the average effect of trade union density on the respective dependent variables (ceteris paribus) across industries. All industries with n < 5 are dropped. Estimates are weighted according to the cell size in 2012. Clustered standard errors are used in every specification. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Statutory declaration

I hereby affirm that I, Simon Eisele, have authored this thesis independently, that I have not used other than the declared sources, and that I have explicitly marked all material which has been quoted either literally or by content from the used sources.
This thesis has not been submitted or published either in whole or part, for a degree at this or any other university or institution.

Paderborn, 24.10.2018