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CRM Adoption and Job Quality in Europe

Evidence on Work Fatigue and Worker Autonomy

Relatori:
Stefano Sacchi
Gregorio Buzzelli

Candidato:
Enrico Borra

Contents

1. Introduction 5
1.1 Background and Motivation 5
1.2 Research Question and Contribution 7
1.3 Empirical Approach 8
1.4 Main Findings 10
1.5 Structure of the Thesis 10
2. Literature Review 12
2.1 Digitalization and the Transformation of Job Quality 12
2.2 Customer Relationship Management Systems as Organizational Technologies 14
2.3 Digital Monitoring, Standardization and Managerial Control 17
2.3.1 The Datafication of Work 17
2.3.2 The Standardization of Work Processes 18
2.3.3 Monitoring and Managerial Control 21
2.4 Summary and Research Gap 23
3. Theoretical Mechanism and Research Hypotheses 26
3.1 CRM Systems and the Transformation of Work Organization 26
3.2 CRM Adoption, Work Intensification and Job Strain 28
3.3 CRM Adoption and Workers' Autonomy 30
3.4 Institutional Moderation 32
3.5 Heterogeneous Effects 34
3.5.1 Differences by education level 34
3.5.2 Gender differences 36
3.6 Summary of Research Hypotheses 37
4. Data, Variables and Descriptive Statistics 40
4.1 Data Sources 40
4.2 Construction of the Analytical Sample 41
4.3 Dependent Variables 42
4.4 Main Independent Variable: CRM Adoption 44
4.5 Institutional Variables 45
4.6 Control Variables 46
4.7 Descriptive Statistics 48
4.8 Descriptive Evidence on Job Quality Outcomes 49
4.9 Summary and Transition to the Empirical Strategy 52
5. Empirical Strategy 54

5.1 Empirical Specification 54
5.2 Institutional Moderation 56
5.3 Heterogeneity Analysis by Education and Gender 59
5.4 Robustness Analysis 61
5.5 Interpretation of the Estimates and Limitations of the Empirical Strategy 64
6. Results 68
6.1 Overview of the Empirical Results 68
6.2 CRM Adoption and *Work Fatigue* 69
6.3 CRM Adoption and Workers' Perceived Autonomy 74
6.3.1 Organizational Autonomy 75
6.3.2 Temporal Autonomy 78
6.3.3 Overall Assessment of H2 79
6.4 The Moderating Role of Labor Market Institutions 81
6.4.1 Collective Bargaining and Work Fatigue 82
6.4.2 Union Density and Work Fatigue 83
6.4.3 Autonomy 84
6.4.4 Individual Trade Union Membership 85
6.4.5 Overall Assessment of H3.1-H3.3 86
6.5 Heterogeneity by Educational Level 86
6.5.1 Educational Level and Work Fatigue 88
6.5.2 Educational Level and Organizational Autonomy 89
6.5.3 Educational Level and Temporal Autonomy 90
6.5.4 Alternative Specifications of the Education Measure 91
6.5.5 Overall Assessment of H4.1-H4.3 93
6.6 Gender Heterogeneity 94
6.6.1 Gender and Work Fatigue 95
6.6.2 Gender and Organizational Autonomy 96
6.6.3 Gender and Temporal Autonomy 97
6.6.4 Overall Assessment of H5.1-H5.3 98
6.7 Overall Assessment of the Empirical Results 99
7. Conclusions 105
7.1 Main Findings and Answer to the Research Question 105
7.2 Implications for the Digitalization of Work 109
7.3 Limitations 111
7.4 Directions for Future Research 112
7.5 Final Remarks 114

References 116
Appendix 119

1. Introduction

1.1 Background and Motivation

Digital technologies have become an increasingly important component of contemporary work organizations. Their diffusion has transformed not only production processes and the types of tasks performed by workers, but also the way information is collected, activities are coordinated and employee performance is monitored. While much of the debate on technological change has traditionally focused on automation, employment and skill demand (Autor, Levy and Murnane, 2003; Autor, 2015), digitalization also affects workers through less visible organizational mechanisms. Digital systems increasingly mediate everyday work activities, shaping how tasks are organized, recorded and evaluated (Leonardi and Treem, 2020).

Customer Relationship Management (CRM) systems provide a particularly relevant example of this transformation. Originally developed to support the management of customer relationships, CRM systems have progressively evolved into broader organizational platforms through which firms collect and centralize information, coordinate activities and structure interactions with customers (Payne and Frow, 2005; Buttle and Maklan, 2019). Their diffusion therefore has implications that extend beyond sales and marketing performance. By embedding information flows, operational procedures and performance-related data within a common digital infrastructure, CRM systems can influence the conditions under which employees perform their daily work.

From the perspective of job quality, these characteristics generate potentially contrasting consequences. On the one hand, the centralization of information and the availability of shared organizational tools may reduce information frictions, facilitate coordination and allow workers to organize some aspects of their activities more independently (Buttle and Maklan, 2019; Leonardi and Treem, 2020). On the other hand, the systematic recording of work activities makes employee behavior and performance increasingly visible and measurable. Combined with standardized workflows and performance indicators, this increased visibility may expand opportunities for managerial monitoring, strengthen performance pressure and contribute to work intensification (Ball, 2010; Wood, 2021; Baiocco et al., 2022).

Overall, these mechanisms show that CRM systems can affect job quality in different ways. Their implications cannot be understood only by looking at the technology itself or at its contribution to organizational efficiency. Instead, they depend on how information, coordination and monitoring interact within the workplace. Despite the widespread organizational relevance of CRM systems, their implications for workers have received comparatively limited attention. Existing research on CRM has predominantly examined customer management, organizational capabilities and firm performance (Payne and Frow, 2005; Buttle and Maklan, 2019), whereas research on the consequences of digitalization for workers has concentrated more extensively on automation, electronic monitoring, call centers, workplace surveillance and, more recently, algorithmic management (Autor, 2015; Taylor and Bain, 1999; Ball, 2010; Kellogg, Valentine and Christin, 2020; Wood, 2021). CRM systems occupy an important position between these strands of literature: they are widely used organizational technologies that are not primarily introduced as monitoring devices, yet their operation can make everyday work activities increasingly standardized, traceable and measurable.

Understanding these consequences is particularly relevant because job quality is multidimensional (Gallie, 2007). Digital technologies may affect workers differently depending on whether attention is directed towards work-related strain, control over the organization of daily activities or control over working time (Baiocco et al., 2022). Moreover, the relationship between digital technologies and working conditions may vary across institutional environments and groups of workers (Gallie, 2007; Baiocco et al., 2022). Labor-market institutions can shape how technologies are implemented and how managerial control is exercised, while differences in education, occupational position and gender may influence workers' exposure to the organizational processes associated with CRM systems (Borle et al., 2021; Sorgner, 2019; Kohlrausch and Weber, 2020).

In this context, this thesis examines how CRM diffusion relates to different dimensions of job quality across European countries. Rather than viewing CRM only as a customer-management technology, the analysis considers it as an organizational technology that can influence information flows, coordination and managerial visibility. It also examines whether these relationships differ across institutional contexts and groups of workers.

1.2 Research Question and Contribution

Building on these considerations, the main research question addressed by this thesis is:

How is the diffusion of Customer Relationship Management systems associated with different dimensions of job quality, and how does this relationship vary across institutional contexts and groups of workers?

Job quality is not a unidimensional measure, but is made up of various components (Gallie, 2007). The three main aspects that this thesis focuses on are work fatigue, organizational autonomy and temporal autonomy. CRM systems may influence these three elements in different directions, so it is important to keep them separate. For example, with the adoption of CRM systems, the visibility of work activities may increase, making workers feel greater pressure because they know that their activities can be monitored. This may contribute to work intensification and potentially increase work fatigue (Leonardi and Treem, 2020; Wood, 2021; Baiocco et al., 2022). At the same time, improved access to information and coordination tools may help employees organize their daily activities more independently (Payne and Frow, 2005; Buttle and Maklan, 2019). Therefore, it is important to analyze these dimensions separately to better understand how CRM diffusion may be associated with different aspects of job quality.

The thesis contributes to the existing literature in three main respects. First, it shifts attention from the conventional interpretation of CRM systems as tools for customer management and organizational performance (Payne and Frow, 2005; Buttle and Maklan, 2019) towards their implications for workers and working conditions. By conceptualizing CRM systems as organizational technologies, the thesis connects the CRM literature with the broader research on digitalization, managerial control and job quality.

Second, the analysis emphasizes the potentially ambivalent relationship between CRM diffusion and job quality. By examining work fatigue alongside organizational and temporal autonomy, the thesis considers whether CRM diffusion is associated differently with distinct aspects of workers' experiences rather than treating job quality as a single outcome. This multidimensional approach follows directly from the theoretical framework developed in the thesis.

Third, the thesis investigates whether the relationship between CRM diffusion and job quality is heterogeneous rather than uniform across workers and institutional environments. The

analysis considers the role of national labor-market institutions, particularly collective bargaining coverage and trade union density, and examines differences according to workers' education and gender. This extension is important because the consequences associated with digital technologies may depend not only on their technical characteristics but also on the institutional and organizational conditions in which they are embedded and on workers' position within the labor market (Gallie, 2007; Baiocco et al., 2022; Borle et al., 2021; Sorgner, 2019; Kohlrausch and Weber, 2020). The analysis therefore combines an examination of the average relationship between CRM diffusion and job quality with an assessment of how this relationship varies across institutional contexts and groups of workers.

Taken together, these contributions provide a worker-centered perspective on CRM diffusion. The objective is not to determine whether CRM systems are inherently beneficial or detrimental to job quality, but to examine how their diffusion is associated with workers' experiences across different dimensions and contexts. In doing so, the thesis treats CRM systems as part of the broader transformation of work associated with digitalization and focuses on organizational mechanisms that may remain less visible than automation or algorithmic management but are increasingly embedded in everyday working environments.

1.3 Empirical Approach

To investigate these relationships, the analysis draws on three main data sources. The first one is Eurostat, which is used to obtain data on CRM diffusion in Europe. This diffusion is measured as the percentage of enterprises that use CRM software at the country-year level. The second one is the European Social Survey (ESS), which, through individual-level surveys, provides information on working conditions and workers' characteristics. The survey rounds used in the analysis cover the period from 2014 to 2023, although the availability of specific variables varies depending on the outcome considered. The third and final source is ICTWSS, which is used to gather information on labor market institutions, in particular collective bargaining coverage and trade union density. These data are then combined to construct the analytical samples, with CRM and institutional data measured at the country-year level matched with individual observations from the ESS.

The analysis focuses on three dimensions of job quality. The first is work fatigue, which is measured by asking workers how often they are too tired after work to do the things they would like to do at home, and is used as an indicator of work-related strain. The second is

organizational autonomy, which measures workers' influence over how their daily work is organized. The third is temporal autonomy, which measures how much freedom workers have to decide when to start and finish working. These two forms of autonomy are considered separately because CRM systems may facilitate the organization and coordination of daily activities without necessarily increasing workers' control over working time (Morgeson and Humphrey, 2006; Payne and Frow, 2005; Buttle and Maklan, 2019).

The analysis relates these individual-level outcomes to differences in CRM diffusion across countries and years. The main independent variable is therefore CRM adoption, measured as the standardized share of firms adopting CRM systems at the country-year level. Other individual and job-related characteristics are also included in the models as controls. Depending on the specification and data availability, country and year fixed effects are included where appropriate. Standard errors are clustered at the country level. Finally, to assess the robustness of the relationships between job quality and CRM adoption, additional models are estimated by progressively introducing further controls.

In addition, the analysis examines whether the relationship between CRM diffusion and job quality differs depending on the institutional context or across groups of workers. For the institutional context, two measures are considered: collective bargaining coverage and trade union density. Through interactions between these variables and CRM adoption, the analysis examines whether the relationship between CRM diffusion and job quality changes across different institutional contexts. Heterogeneity analyses are then conducted considering educational level and gender. Finally, particular attention is paid to low-educated workers in routine customer-facing occupations since, following the theoretical framework and the literature, they are expected to be particularly exposed to standardization and monitoring at work.

Overall, the empirical design combines individual-level information on working conditions with country-year data on CRM diffusion and, for the institutional analysis, with national labor market characteristics. This approach makes it possible to examine whether workers observed in environments characterized by different levels of CRM diffusion report different levels of fatigue and autonomy. At the same time, the design does not identify individual CRM use. CRM adoption is measured at the country-year level and should therefore be interpreted as a characteristic of the broader technological and organizational environment in which workers

operate. Accordingly, the estimates are interpreted as conditional associations rather than causal effects of individual CRM use.

1.4 Main Findings

The empirical results show that the relationship between CRM diffusion and job quality is multidimensional rather than uniformly positive or negative. The clearest finding concerns workers' autonomy. Higher levels of CRM diffusion are associated with greater organizational and temporal autonomy. The positive association with organizational autonomy is consistent with the hypothesized direction and with the idea that the information and coordination capabilities associated with CRM systems may facilitate workers' ability to organize aspects of their daily activities, whereas the positive association with temporal autonomy is contrary to the hypothesized direction.

The evidence on work-related strain is more heterogeneous. The results do not indicate a robust generalized relationship between CRM diffusion and work fatigue across workers. However, the CRM–fatigue relationship is stronger among low-educated workers in routine customer-facing occupations than among other workers, although the strength of the statistical evidence varies across specifications. The findings also suggest that stronger labor-market institutions may attenuate the relationship between CRM diffusion and work fatigue, while some gender differences also emerge.

Overall, the findings do not support a simple interpretation of CRM systems as either beneficial or detrimental to job quality. Rather, they suggest that the relationship between CRM diffusion and job quality varies across different dimensions, groups of workers and institutional contexts. Taken together, the empirical evidence is consistent with the broader argument of the thesis that the consequences of digitalization for workers depend on both the specific dimension of job quality considered and the context in which digital technologies are embedded.

1.5 Structure of the Thesis

The remainder of the thesis is organized as follows. Chapter 2 reviews the literature on digitalization and job quality and introduces CRM systems as organizational technologies. It discusses how the growing datafication of work, the standardization of work processes and the expansion of digital monitoring may influence workers' experiences, while identifying the gap

between the extensive literature on the organizational benefits of CRM systems and the more limited evidence on their implications for workers and working conditions.

Chapter 3 develops the theoretical framework and derives the hypotheses tested in the empirical analysis. Building on the mechanisms identified in the literature review, it examines how CRM-related information centralization, coordination, standardization and monitoring may be associated with work fatigue and different dimensions of workers' autonomy. The chapter also considers potential heterogeneity across occupational groups, institutional contexts, educational levels and gender.

Chapter 4 presents the data, variables and descriptive statistics. It describes the combination of Eurostat data on CRM diffusion, individual-level information from the European Social Survey and institutional indicators from the ICTWSS database. It also explains the construction of the analytical samples and the operationalization of the dependent variables, CRM adoption, institutional moderators and individual-level characteristics used throughout the empirical analysis.

Chapter 5 explains how the hypotheses are empirically tested and which econometric specifications are used. It then presents the interaction models used to examine whether the relationships differ across groups of workers and institutional contexts. Finally, it describes the robustness checks used to assess whether the results remain stable across different specifications and with additional controls.

Chapter 6 presents and discusses the empirical results. It first analyzes the relationship between CRM diffusion and work fatigue and then considers the two forms of autonomy, organizational and temporal. The chapter subsequently examines the role of labor market institutions and the heterogeneity hypotheses, focusing on differences by educational level and gender. Finally, it provides an overall assessment of the empirical evidence.

Finally, Chapter 7 concludes the thesis by summarizing the main findings and discussing their implications for the study of digitalization and job quality. It also considers the limitations of the empirical analysis and identifies possible directions for future research.

2. Literature Review

Digital technologies have become increasingly incorporated into firms' activities and now influence many aspects of organizational processes. Their diffusion has transformed not only production processes and employment structures, but also the way work is organized and managed (Autor, Levy and Murnane, 2003; Autor, 2015; Baiocco et al., 2022). For this reason, growing attention has been devoted to understanding how digital technologies influence job quality, managerial control and the organization of work (Ball, 2010; Kellogg, Valentine and Christin, 2020; Wood, 2021).

CRM systems are a particularly relevant case for studying job quality. Initially, they were conceived mainly to manage relationships with clients. Today, however, they have taken on a much broader role and are directly used in many workers' daily activities. They can be used to coordinate tasks, record information and activities, and manage different work processes (Payne and Frow, 2005; Buttle and Maklan, 2019). Moreover, they centralize information, organize workflows, and make work activities more visible and easier to monitor (Buttle and Maklan, 2019; Leonardi and Treem, 2020). Because of these characteristics, they provide a useful context for understanding how digital technologies can affect different dimensions of job quality.

This chapter first discusses the general relationship between digitalization and job quality. It then introduces CRM systems as organizational technologies and examines three main mechanisms: the increased availability of information in the workplace, the standardization of work activities, and monitoring and managerial control. Finally, it addresses the research gap in the literature and introduces the theoretical framework developed in the following chapter.

2.1 Digitalization and the Transformation of Job Quality

In the last few decades, digital technologies have profoundly changed production processes, the way work is organized and coordinated, and how workers are supervised. Today, their role is not limited to the automation of tasks, as it has also expanded to organizational processes. In particular, digital technologies influence decision-making, information management, and the coordination and control of work activities.

A large part of the literature on technological change has focused on the consequences of digital technologies for productivity, skill demand and employment dynamics. Within labor

economics, the Routine-Biased Technological Change (RBTC) framework represents an important reference for understanding these transformations. In this perspective, technological change does not affect all types of work in the same way, but changes the relative demand for different tasks. More specifically, digital technologies tend to replace activities that are more routine and codified, while increasing the importance of tasks that require non-routine cognitive skills (Autor, Levy and Murnane, 2003; Autor, 2015). This framework has significantly improved our understanding of the relationship between technological change, employment structures and labor market opportunities. However, its main focus remains on employment and skill demand, while less attention is paid to the way digital technologies transform the organization of work and the quality of work itself.

The effects of digitalization, however, extend beyond employment. Digital technologies also enter more directly into the organization of work, influencing how activities are coordinated, how tasks are supervised and how workers carry out their daily work within organizations. In recent decades, several studies have examined the consequences of digital technologies for job quality, managerial control and workers' autonomy. In particular, studies on call centers, electronic monitoring systems and, more recently, algorithmic management have shown how the growing availability of data and the integration of work activities into digital platforms can transform employees' working experience.

Research on call centers has been particularly important in this respect. These studies show how digital technologies may reshape job quality through standardized procedures, performance targets and electronic monitoring. Call centers have often been interpreted as work environments in which digital systems make employees' activities highly visible and measurable, increasing managerial control over the pace and content of work (Fernie and Metcalf, 1998; Taylor and Bain, 1999; Bain and Taylor, 2000). At the same time, this literature also shows that the effects of monitoring are not always the same. The use of scripts, performance indicators and monitoring technologies can reduce workers' discretion and contribute to work intensification, but the consequences may vary depending on how monitoring is implemented and whether it is used mainly for control or also for feedback and support (Lankshear, Cook, Mason, Coates and Button, 2001; Holman, 2003).

Through the collection, processing and use of large amounts of information, digital technologies allow firms to coordinate production processes, monitor performance and

standardize procedures that in the past left workers with greater margins of discretion. These developments have led the literature to pay increasing attention to the effects of digital technologies on the organization of work and different dimensions of job quality.

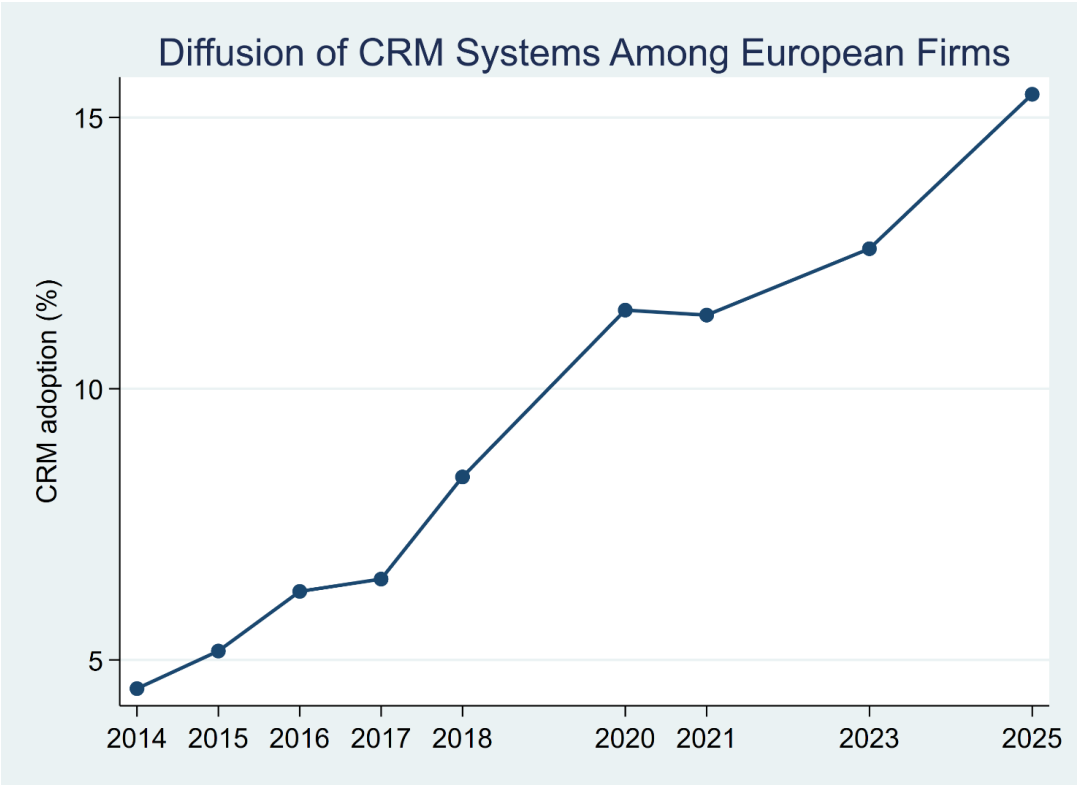
Therefore, job quality has become an increasingly important topic in the studies associated with digitalization. Following Gallie (2007), job quality can be understood as a broad set of characteristics of the work experience, including decision-making autonomy, control over one's work intensity, opportunities to use and develop skills, and exposure to managerial supervision. This perspective is particularly useful for the objectives of this thesis, as it conceives job quality as a multidimensional phenomenon that includes aspects such as autonomy, work intensity and managerial supervision. These are dimensions that can be directly influenced by the adoption of digital technologies and, more specifically, by the processes of information management, standardization and monitoring associated with CRM systems. Digital technologies can affect each of these dimensions, with both positive and negative consequences. On the one hand, immediate access to information, greater integration of information flows and improvements in coordination processes can make work activities easier to carry out and increase organizational efficiency (Leonardi and Treem, 2020; Baiocco et al., 2022). On the other hand, the growing ability to collect data, monitor performance and standardize work processes can reduce the possibility for workers to decide how to carry out their work and increase the pressure to meet measurable targets (Wood, 2021; Baiocco et al., 2022).

For this reason, the effects of digitalization on job quality should not be looked at only through the most visible forms of technological change, such as automation or artificial intelligence. Many digital technologies affect work in a more indirect way, through the management of information, communication systems and organizational processes. Looking at these tools is therefore essential since they help to understand how technological change affects not only employment, but also the way work is organized and experienced by workers.

2.2 Customer Relationship Management Systems as Organizational Technologies

Among the numerous digital technologies implemented by companies in recent decades, Customer Relationship Management systems (CRMs) have assumed an increasingly central role in the management of organizational activities.

Figure 2.1— Diffusion of CRM systems among European firms



Note: *Own elaboration based on Eurostat data, "Share of enterprises using any business software (ERP, CRM or BI)".*

CRM systems are now widely used by firms and have been extensively studied within the management and information systems literature. Most of this research has focused on the role of CRM systems in supporting customer relationship management and improving organizational performance. In particular, attention has been devoted to how these technologies help firms manage customer information, support customer-oriented strategies and improve business outcomes (Payne and Frow, 2005; Buttle and Maklan, 2019). By contrast, much less is known about their implications for workers and work activities, even though CRM systems have become an increasingly important part of many employees' daily work.

CRM systems were originally developed to support sales activities and customer relationship management. Over time, however, they evolved into broader organizational platforms used to collect, process and share information across different parts of the organization. Today, CRM is generally understood as more than a simple technological tool. As noted by Payne and Frow

(2005), CRM involves the integration of people, processes and technology within a broader organizational approach. Similarly, Buttle and Maklan (2019) describe CRM as a combination of technologies, processes and practices used to manage customer-related information in a strategic way.

The main objective of CRM systems is to enable companies to manage in an efficient way relationships with clients. These systems support interactions with customers from the initial contact through to after-sales services. Thanks to the continuous collection of data on customer contacts, preferences, purchases, communication and other relevant information, CRM systems enable firms to develop a deeper understanding of their customers and therefore improve decision-making processes related to marketing, sales and customer support (Payne and Frow, 2005; Buttle and Maklan, 2019).

With the development of digital technologies and the ability to process an increasingly large amount of data, the traditional use of CRM systems has expanded to include tasks well beyond simply managing relationships with customers. Today, they enable firms to coordinate work activities, share information between different working units, standardize operational procedures and monitor in real time numerous aspects of business processes. From this perspective, CRMs can be conceived as organizational infrastructures rather than mere support tools (Payne and Frow, 2005; Buttle and Maklan, 2019), able to influence the way work is organized and coordinated within firms, and not only how companies interact with their customers.

As highlighted by Buttle and Maklan (2019), a particularly relevant characteristic of CRM systems is their ability to transform knowledge and practices that in the past were informal into codified and easily accessible information. Through the systematic recording of customer interactions, work activities and results achieved, these systems enable firms to centralize information that would otherwise be distributed among different employees or relied on individual experience. This process can help firms maintain greater operational continuity and reduce the reliance on the tacit knowledge held by individual workers.

The diffusion of CRMs among firms shows how central the management of information has become for companies. Through detailed and continuously updated data, firms can coordinate activities more easily, reduce organizational inefficiencies and make decision-making

processes more informed. At the same time, when work processes are integrated into digital platforms, they tend to become more formalized and workers' activities more traceable.

CRM systems centralize information within a single platform. Thanks to this, access to the information and resources needed is much easier for workers. Without CRM systems, these data may be scattered across different sources, making the process of finding them much more time-consuming. Therefore, thanks to this centralized access, workers can carry out routine activities and coordinate their tasks with less reliance on supervisors or colleagues. An ambivalent effect therefore emerges: CRM systems can increase managerial control, but at the same time they can also increase workers' autonomy in carrying out their daily activities (Buttle and Maklan, 2019; Leonardi and Treem, 2020).

Because CRM systems are directly embedded in workers' daily activities, they provide a particularly relevant context for examining how digitalization may affect job quality. Although CRM systems are generally introduced to improve organizational efficiency and customer relationships, they also reshape the environment in which workers carry out their daily activities. These transformations may therefore have implications for work organization and different dimensions of job quality.

2.3 Digital Monitoring, Standardization and Managerial Control

2.3.1 The Datafication of Work

One of the most relevant consequences of digitalization is the growing observability of work activities within organizations. Through the diffusion of digital technologies, an increasing number of activities, interactions, and organizational processes leave digital traces that can be collected, processed, and utilized by organizations.

Recent literature has highlighted how digitalization should not be interpreted exclusively as a process of automating work activities, but also as a transformation in the way organizations produce and use information. Earlier contributions had already emphasized that digital technologies do not simply automate work processes but also generate information about those processes, making them more visible and analyzable (Zuboff, 1988). Building on this perspective, Leonardi and Treem (2020) argue that the growing diffusion of digital technologies is leading to an increase in so-called behavioral visibility, defined as the possibility of accessing and recording information about behaviors, interactions and activities that were previously

difficult to monitor and measure. Through the digitalization of work processes, an increasing share of workers' activities leaves digital traces, making organizational processes more transparent and easier to analyze.

The growing visibility of work activities represents a significant transformation in the informational environment of organizations. In the past, much of the information about how work was carried out remained dispersed, informal or accessible only to those directly involved in the activities. The diffusion of digital technologies has significantly changed this situation by making many aspects of work that were previously difficult to observe or verify more visible and accessible within organizations. As a result, information asymmetries across different organizational levels can be reduced.

Greater visibility may generate important benefits for organizations. Access to more complete and timely information can make it easier to coordinate activities, improve the circulation of knowledge and support decision-making processes. In addition, having a clearer view of how activities are performed may help organizations understand better how work is carried out and identify inefficiencies or problems within work processes. In this sense, digital systems increasingly allow organizations to collect and process large amounts of information generated through workers' activities, which becomes an important resource for coordination and management (Baiocco et al., 2022).

Although this increased visibility can provide important benefits for organizations, it does not only produce positive effects. As behaviors, interactions, and outcomes become increasingly visible, companies gain new opportunities to evaluate, compare, and supervise activities that were previously difficult to monitor and control. Consequently, consistent with previous research on workplace monitoring and digital control, the new forms of visibility generated by digital technologies create the conditions for the emergence of new forms of workplace monitoring and managerial control, which will be discussed in the following sections.

2.3.2 The Standardization of Work Processes

The growing visibility of work activities made possible by digital systems is not only a source of information for organizations but also represents the basis for a progressive standardization of work processes. Once activities, interactions and outcomes become observable, recordable and analyzable, firms gain the opportunity to identify recurring procedures, formalize

operational practices and promote more uniform ways of carrying out work across the organization.

Standardization represents one of the main organizational transformations associated with digitalization. Recent literature has highlighted how digital technologies do not simply automate certain activities but increasingly contribute to defining the way work is carried out. In particular, Fernández-Macías, Bisello, Peruffo and Rinaldi (2023) show how the growing diffusion of digital technologies is often accompanied by an increasing standardization of work processes. According to the authors, digitalization promotes the diffusion of activities characterized by more codified and repeatable procedures based on predefined rules, contributing to the routinization of processes that previously left greater room for individual initiative.

In this context, CRM systems play a particularly relevant role. As pointed out by Buttle and Maklan (2019), these tools do not simply collect and organize customer information, but also enable organizations to incorporate operational procedures and information flows into shared digital platforms. Through predefined workflows, mandatory fields, standardized procedures for recording information, and systems for coordinating activities, CRM systems contribute to making the way work is carried out more uniform across the organization.

Through these operational tools, activities that were previously based mainly on individual experience can be progressively incorporated into shared and formalized procedures. More generally, this process reflects a broader tendency towards the routinization of work associated with digitalization, as digital technologies contribute to the codification of work activities through standardized procedures and predefined operational rules (Fernández-Macías et al., 2023).

Codification of work practices has important effects on organizations. The knowledge required to perform specific activities does not remain exclusively in the hands of individual workers but is progressively incorporated into formalized procedures and digital systems. This makes it easier for firms to spread skills and information across different units and reduces the extent to which organizations depend on the tacit knowledge held by individual workers (Buttle and Maklan, 2019).

From an organizational point of view, standardization can generate several benefits. The presence of shared procedures makes it easier to coordinate different units, reduces information asymmetries and facilitates the diffusion of practices considered more efficient. Moreover, the availability of codified processes allows new workers to integrate more quickly and contributes to greater uniformity in the way activities are carried out across the organization (Buttle and Maklan, 2019; Fernández-Macías et al., 2023).

However, standardization may also have implications for job quality. As procedures, behaviors and work practices become progressively incorporated into digital systems, workers may experience a reduction in their level of discretion. This issue has been widely discussed in research on call centers, where standardized scripts, predefined interaction procedures and quantitative performance indicators have often been interpreted as mechanisms through which organizations seek to control not only the outcomes of work, but also the process through which work is carried out (Taylor and Bain, 1999; Callaghan and Thompson, 2001). Workers may therefore find themselves operating within more structured processes, where an increasing share of decisions regarding how activities should be carried out is defined by the organization through codified procedures. In this context, the integration of work activities into digital systems can strengthen organizations' ability to direct and coordinate workers' behavior, reducing the degree of autonomy associated with the exercise of individual judgment (Kellogg, Valentine and Christin, 2020).

The effects of standardization on workers' autonomy are not necessarily straightforward. While predefined procedures may reduce workers' discretion in carrying out their activities, digital systems may also make information easier to access, reduce uncertainty and facilitate the organization of work activities. In CRM systems, customer information, communication histories and other relevant data are stored within a shared platform and can be accessed more easily by workers. This may reduce workers' reliance on supervisors or colleagues when carrying out routine activities, responding to customers or organizing their daily tasks. As a result, standardization may reduce some forms of discretion while at the same time making it easier for workers to organize and coordinate their activities independently. However, the increased visibility of activities, deadlines and performance indicators may also create new constraints regarding the pace, timing and execution of work. For this reason, the effects of

CRM-enabled standardization on workers' autonomy may not always be the same and ultimately remain an empirical question (Wood, 2021; Fernández-Macías et al., 2023).

Therefore, the standardization of work processes represents one of the main mechanisms through which digital technologies may influence job quality. Understanding how this process relates to different dimensions of workers' autonomy helps to assess the broader implications of digitalization for working conditions.

2.3.3 Monitoring and Managerial Control

Another consequence of digitalization is the expansion of monitoring and managerial control. As work activities become more observable, measurable and comparable, companies gain access to new ways to supervise employees and evaluate their performance through information generated during the course of daily working activities.

In the past, managerial control relied mainly on direct supervision and hierarchy. Sewell and Wilkinson (1992) argued that information systems could increase firms' ability to monitor workers. This is because these systems enable the collection and processing of information generated during work processes. Traditionally, managers had much more limited information about employees' daily activities, making monitoring more expensive and difficult. With the diffusion of digital technologies, this situation has changed. Today, companies can gather, store and analyze continuous streams of information generated during work. As a consequence, monitoring can increasingly be carried out through digital systems, without relying only on direct supervision of workers.

CRM systems represent a particularly relevant example of this transformation. Through the systematic recording of customer interactions, sales activities, response times, completed tasks and various performance indicators, CRM platforms generate a continuous flow of information about workers' activities. Although these systems are primarily designed to support customer relationship management and organizational coordination, the information they produce can also be used to evaluate performance, monitor the achievement of organizational objectives and supervise work processes. As a result, activities that were previously difficult to observe become progressively more visible to managers.

Leonardi and Treem (2020) similarly argue that the growing availability of data generated during work activities expands organizations' ability to monitor and evaluate work. By making

performance and outcomes more visible and comparable, digital systems allow managerial control to rely increasingly on information generated during the work process rather than on direct supervision alone.

From an organizational point of view, the expansion of monitoring capabilities can generate several benefits. The availability of detailed and timely information can facilitate the coordination of activities, improve accountability mechanisms and allow managers to quickly identify operational inefficiencies. Moreover, monitoring systems are able to support performance evaluation processes and contribute to a more efficient allocation of resources through access to more accurate information about ongoing activities (Leonardi and Treem, 2020; Baiocco et al., 2022).

However, the expansion of monitoring capabilities also raises important questions regarding job quality. Research on workplace surveillance and electronic monitoring has shown that digital monitoring does not only increase the amount of information available to managers, but may also affect workers' experience of autonomy, privacy, stress and organizational trust (Ball, 2010). As highlighted by Baiocco et al. (2022), digital technologies increasingly enable organizations to collect, process and use information generated by workers' activities, creating unprecedented opportunities for supervision and performance evaluation. In many contexts, monitoring can operate continuously and with a level of detail that would be difficult to achieve through traditional forms of managerial supervision.

The growing availability of performance-related information can therefore strengthen managerial control over work activities. This dynamic has been clearly documented in research on call centers, where digital systems have been shown to make workers’ activities continuously visible, measurable and comparable through indicators such as call duration, response times, waiting times, number of calls handled and compliance with predefined procedures (Taylor and Bain, 1999; Bain and Taylor, 2000; Lankshear, Cook, Mason, Coates and Button, 2001). Wood (2021) argues that digital technologies can expand organizations' ability to coordinate, direct and evaluate workers' behavior by embedding monitoring mechanisms directly into the tools used during the work process. As workers become aware that their activities are visible and measurable, monitoring can influence their behavior even in the absence of direct supervision. This may lead workers to feel greater pressure to achieve performance targets, meet organizational expectations and maintain high levels of

productivity. Similar dynamics have been documented in studies on call centers, where performance monitoring has been associated with greater pressure and lower employee well-being when it is perceived as particularly intensive. At the same time, forms of monitoring based on feedback and employee development may produce more favorable outcomes (Holman, 2003). Moreover, information generated through monitoring systems may also provide workers with continuous feedback on their activities and objectives. Access to this information may reduce uncertainty and make it easier to organize daily tasks, allowing workers to coordinate their activities with less reliance on supervisors. As a result, monitoring systems may strengthen organizational control while simultaneously supporting certain forms of worker autonomy.

The implications of monitoring for workers are not necessarily straightforward. While greater accountability and the availability of performance feedback may contribute to improving organizational effectiveness, more pervasive forms of monitoring may also affect workers' perceived control over their work, increase performance-related pressure and contribute to greater work intensification. The ability of digital systems to continuously collect and analyze information about work activities therefore creates a tension between organizational control and workers' autonomy, making monitoring one of the most debated consequences of the digitalization of work.

These considerations are particularly relevant for CRM systems. Increased managerial visibility over workers' activities may strengthen organizational control and reduce workers' perceived autonomy (Sewell and Wilkinson, 1992), while access to performance-related information may also help workers organize their activities more independently. The overall relationship between CRM-enabled monitoring and job quality therefore cannot be assumed in advance and remains an empirical question.

2.4 Summary and Research Gap

The literature reviewed in this chapter highlights how digitalization is transforming not only production processes and employment structures, but also the organization and management of work within firms. In this context, CRM systems represent a particularly relevant organizational technology, as they combine information management, work coordination and performance measurement within a shared digital platform. Although originally developed to

support customer relationship management, CRM systems increasingly influence how work activities are organized, recorded and evaluated within firms.

Despite the widespread diffusion of CRM systems among firms, the implications of these technologies for workers and working conditions have received much less attention. Most studies have focused on customer-related and organizational outcomes, such as customer retention, sales performance, marketing effectiveness and firm productivity (Payne and Frow, 2005; Buttle and Maklan, 2019). As a result, CRM systems have usually been studied for their contribution to organizational performance, while their consequences for workers and daily work activities remain less explored.

This does not mean that the relationship between digital technologies and job quality has been ignored. On the contrary, research on call centers, electronic monitoring, workplace surveillance and algorithmic management has shown that digital systems can affect the way work is organized, controlled and evaluated. These studies show that digital technologies can influence work not only by automating tasks, but also by changing how activities are organized, monitored and measured. In particular, they have shown that digital systems may reduce autonomy, increase work intensity and strengthen managerial control, especially when workers' activities become more visible and measurable (Taylor and Bain, 1999; Bain and Taylor, 2000; Ball, 2010; Kellogg, Valentine and Christin, 2020; Wood, 2021). However, these contributions have often focused on forms of digital control that are particularly explicit and easily observable, such as call centers, workplace surveillance systems and algorithmically managed work. Less attention has been paid to CRM systems as ordinary organizational technologies that combine information management, workflow standardization and performance visibility within everyday work activities.

The literature reviewed in this chapter suggests three main mechanisms through which CRM systems may influence workers. By collecting and centralizing information generated during work activities, CRM platforms increase the availability of information within organizations and make work activities more visible. Furthermore, they contribute to the standardization of work through shared procedures, workflows and operational practices. By making activities increasingly observable and measurable, CRM systems also create new opportunities for monitoring and performance evaluation. While these mechanisms may improve coordination,

information sharing and organizational efficiency, they may also strengthen managerial control and influence workers' autonomy and discretion.

At the same time, the effects of CRM systems on job quality cannot be assumed in advance. Greater access to information may help workers organize and coordinate their activities more independently, while standardization and monitoring may reduce discretion and increase managerial control. For this reason, the overall impact of CRM systems on job quality remains an empirical question.

This thesis seeks to contribute to this area by examining CRM systems not only as customer management tools, but also as organizational technologies that may influence job quality. In doing so, it brings together insights from the literature on CRM adoption and organizational performance with research on digitalization, managerial control and working conditions.

Addressing this gap requires a framework capable of explaining how CRM adoption may affect different dimensions of job quality. The following chapter develops this theoretical framework and derives a set of hypotheses for empirical analysis.

3. Theoretical Mechanism and Research Hypotheses

The previous chapter showed that digital technologies can influence job quality not only through automation, but also by transforming the way work is organized, monitored and evaluated. It also highlighted that CRM systems remain relatively underexplored from this perspective, despite their wide diffusion and their growing integration into workers' daily activities. Building on this literature, this chapter develops the theoretical framework linking CRM adoption to different dimensions of job quality. The central argument is that CRM systems should not be interpreted only as tools for customer management, but also as organizational technologies that structure information flows, codify work processes and increase the visibility of work. Through these mechanisms, CRM systems may influence both the pressure experienced by workers and their ability to organize daily activities. The theoretical framework developed in this chapter is based on a central tension. On the one hand, CRM systems can strengthen managerial control by making work activities more visible, measurable and comparable. When information on customer interactions, completed tasks, response times, follow-up activities and performance outcomes becomes available through the CRM, work can be monitored in a more systematic way. This may increase work intensity and work-related strain. At the same time, however, CRM systems can also make information easier to access and support the coordination of activities. By centralizing customer data, communication histories and operational priorities, they may reduce workers' dependence on supervisors or colleagues and support some forms of operational autonomy. For this reason, the effects of CRM adoption on job quality cannot be assumed to be unidirectional. CRM systems may simultaneously support coordination and increase control. Their consequences depend on the way these mechanisms combine within specific organizational and institutional contexts. The following sections develop this argument and derive the hypotheses that will guide empirical analysis.

3.1 CRM Systems and the Transformation of Work Organization

The adoption of CRM systems can be interpreted as an organizational transformation that modifies the way work is coordinated, recorded, monitored and evaluated within firms. Although these systems are generally introduced with the objective of improving customer relationship management and increasing organizational efficiency, their implementation tends to produce effects that go beyond the simple management of commercial information.

By integrating activities, communication flows and operational procedures within a shared digital platform, CRM systems become part of the organizational infrastructure through which firms coordinate daily activities and manage employees' work. The theoretical mechanism developed in this thesis starts from the idea that CRM systems transform work by modifying the informational conditions within which activities are carried out. Through CRM platforms, information related to customer interactions, completed tasks, response times, follow-up activities, deadlines and achieved results is systematically recorded and stored. Information that in the past was dispersed across different documents, informal exchanges or workers' individual experience is progressively centralized within a common digital environment. In this way, CRM systems make information more accessible, but at the same time they make work more traceable. This transformation has important consequences for work organization. A first mechanism concerns the centralization of information. Customer data, communication histories, operational priorities and information related to the activities to be carried out become available through a shared platform. This can improve coordination between workers, teams and organizational units, since workers can access relevant information more directly and organize their activities with less dependence on supervisors or colleagues. From this perspective, CRM systems can support the operational management of work by reducing uncertainty and facilitating the circulation of information within the organization.

A second mechanism concerns the codification of work processes. CRM systems do not simply collect information on work activities, but also contribute to structuring the way these activities have to be carried out and recorded. Through predefined workflows, mandatory fields, standardized procedures, task management tools and reporting systems, CRM platforms incorporate organizational rules into the digital environment in which work is performed. Activities that previously relied more on individual experience or informal practices can therefore become more formalized, comparable and standardized across workers and organizational units. A third mechanism concerns the greater visibility of work. Since the activities carried out through CRM systems leave digital traces, organizations can observe and compare different aspects of work with greater precision. Information on customer contacts, completed activities, response times, follow-up actions and performance outcomes can be used to monitor work processes and evaluate results. As a consequence, managerial control becomes less dependent on direct supervision alone and relies

increasingly on the information generated during the performance of work activities. The central point is that these mechanisms operate simultaneously. CRM systems centralize information, but this same centralization also makes work more visible. They standardize procedures, but this same standardization may reduce some forms of discretion. They support coordination, but the same information used to coordinate work can also be used to monitor performance. For this reason, CRM systems should be interpreted as organizational technologies that combine coordination and control within the same digital infrastructure. This dual character is central to the theoretical framework of the thesis. On the one hand, CRM systems can make the organization of daily activities easier. Since information is more accessible and coordination is supported by the platform, workers can retrieve customer information, reconstruct previous interactions, identify priorities and manage routine activities with less dependence on supervisors or colleagues. In this sense, CRM systems can support some forms of operational autonomy. On the other hand, the same systems can also strengthen managerial control. As activities become more visible, measurable and comparable, organizations can monitor performance more systematically and evaluate workers through indicators related to time, task completion, customer interactions and achieved results. This can increase performance-related pressure and contribute to work intensification, especially when measurable indicators become central in the organization of activities.

The theoretical mechanism proposed in this chapter therefore does not assume that CRM adoption has a single and uniform relationship with job quality. On the contrary, it argues that CRM systems modify the conditions within which work is organized and experienced. These relationships depend on the interaction between informational support and managerial control, and between operational autonomy and performance pressure. This tension represents the basis for the hypotheses developed in the following sections.

3.2 CRM Adoption, Work Intensification and Job Strain

Starting from the theoretical mechanism discussed in the previous section, a first relevant consequence of CRM adoption concerns the possible increase in work intensity and work-related strain. The central point is that, by making work activities more visible, measurable and comparable, CRM systems may change the way workers experience organizational control and the pressure associated with the achievement of performance objectives.

Through the systematic recording of customer interactions, completed tasks, response times, deadlines and achieved results, CRM platforms make work more easily observable by the organization. Information that in the past could remain partly dispersed, informal or difficult to verify becomes progressively available within a shared digital system. This allows firms to monitor with greater continuity the way activities are carried out and to evaluate individual or group performance on the basis of more precise indicators.

This transformation does not necessarily mean that working conditions become worse. Greater availability of information may make objectives clearer, improve coordination and help organizations identify inefficiencies or delays in operational processes. At the same time, when work becomes more visible and is connected to quantitative targets, reporting systems, dashboards and performance indicators, this greater visibility may also create stronger pressure on workers. In these cases, work is not only coordinated more efficiently, but also becomes more closely oriented toward the achievement of measurable results.

In this sense, CRM systems may contribute to work intensification. Work intensification does not necessarily imply an increase in working hours, but rather a greater density of activities, a faster work pace and stronger pressure during working time (Green, 2001). Workers may perceive greater pressure to complete tasks within defined deadlines, respond quickly to customers, constantly update information in the system and maintain high levels of productivity. The possibility that delays, inactivity or results below expected standards become visible to the organization may push workers to increase the pace of work and reduce the margins of discretion in the management of daily activities.

This mechanism is particularly relevant in contexts where CRM systems are used to manage commercial activities, support services, customer service or standardized administrative processes. In these areas, a significant part of work can be translated into recordable and measurable activities, such as the number of contacts made, response times, case updates, follow-up activities and the achievement of operational targets. The continuous availability of this information may make performance more easily comparable across workers, teams and organizational units.

As a consequence, CRM adoption may be associated with higher levels of work-related strain. This strain does not necessarily derive from the technology itself, but from the way it

reorganizes the relationship between work activities, performance measurement and managerial control. When work becomes more observable and comparable, workers may experience greater pressure to meet deadlines, achieve targets and maintain an intense pace of work. From an empirical point of view, this mechanism is examined in the thesis through work fatigue, which represents one of the main ways in which work intensification may be experienced by workers.

On the basis of this reasoning, the first hypothesis of the thesis is divided into two related components. The first concerns the general relationship between CRM adoption and work fatigue:

H1a: CRM adoption is associated with higher levels of work fatigue.

The mechanisms described above may be particularly relevant for low-educated workers employed in routine customer-facing occupations, where work activities are more likely to be standardized, recorded and compared through CRM-related processes (Buttle and Maklan, 2019; Fernández-Macías et al., 2023). The second component therefore focuses on whether the association differs for this group:

H1b: The association between CRM adoption and work fatigue is stronger among lower-educated workers employed in routine customer-facing occupations.

3.3 CRM Adoption and Workers' Autonomy

A second dimension of job quality that may be influenced by CRM adoption concerns workers' autonomy. Compared to work-related strain, for which the theoretical mechanism suggests a more direct relationship with the increased visibility of work and performance pressure, the relationship between CRM systems and autonomy appears more ambiguous. CRM systems can strengthen managerial control, but at the same time they can provide workers with information and tools that are useful to organize some daily activities in a more autonomous way.

To understand this relationship, it is necessary to distinguish between different forms of autonomy. Work autonomy does not only concern the general possibility of freely deciding how to carry out one's work, but includes different dimensions (Morgeson and Humphrey, 2006). On the one hand, there is a form of organizational autonomy, understood here in

operational terms, related to the possibility of accessing the necessary information, coordinating activities, managing priorities and organizing daily work.

This distinction is particularly important in the case of CRM systems. The centralization of information within a shared digital platform may increase workers' organizational autonomy. Information related to customers, previous communications, the status of ongoing activities, deadlines and operational priorities becomes more easily accessible. Without these tools, a relevant part of this information could remain dispersed among colleagues, supervisors, separate documents or informal practices. CRM systems may therefore reduce some forms of informational dependence, allowing workers to directly retrieve the information needed to carry out their activities.

From this perspective, CRM adoption may facilitate the daily management of work. Workers can more easily organize communications with customers or colleagues, check the status of activities, identify operational priorities and coordinate different steps of the work process without constantly relying on the direct intervention of supervisors. The autonomy that derives from this process does not necessarily correspond to full professional discretion, but rather to a form of operational autonomy. It mainly concerns the possibility of managing and coordinating daily work with greater continuity thanks to the immediate availability of information and organizational tools.

However, this greater operational autonomy may coexist with a reduction in other forms of autonomy. The same systems that facilitate access to information also make response times, the progress of activities, compliance with deadlines and achieved results more visible. As a consequence, workers may have more information to organize their activities, but less freedom in deciding the pace at which to carry them out. The platform may therefore facilitate coordination and, at the same time, introduce stricter constraints on timing, priorities and performance.

The central point is therefore that the relationship between CRM systems and autonomy should not be interpreted in a one-dimensional way. The same technology may be associated differently with autonomy depending on the dimension considered. If the focus is on organizational autonomy, CRM systems may be positively associated with this dimension, because they make information more accessible, reduce uncertainty and allow a more

autonomous management of daily activities. If, instead, the focus is on temporal autonomy, the association may be weaker or even negative, because the greater traceability of work makes times, delays, deadlines and the pace of execution of activities more visible.

This possible difference is consistent with the theoretical mechanism developed in Section 3.1. CRM systems do not eliminate managerial control, but modify the conditions within which work is carried out. On the one hand, they strengthen the ability of the organization to monitor and evaluate work activities; on the other hand, they provide workers with informational tools that may facilitate coordination and the autonomous management of tasks. The autonomy supported by CRM systems is therefore mainly a situated and operational autonomy, exercised within a work environment that is more visible, formalized and monitorable.

On the basis of this reasoning, the second hypothesis of the thesis is the following:

H2: CRM adoption is associated with higher levels of perceived organizational autonomy and lower levels of temporal autonomy.

3.4 Institutional Moderation

The theoretical mechanism discussed in the previous sections suggests that CRM adoption may influence job quality through the increased visibility of work activities, the expansion of monitoring and the greater relevance of performance indicators. However, these effects should not be interpreted as automatic or uniform across all contexts. The way in which the information generated by CRM systems is used also depends on the institutional environment in which firms operate and on the degree of protection available to workers.

From this perspective, labor market institutions may play an important role in moderating the effects of digitalization on the working experience. In contexts characterized by stronger collective regulation of working conditions, stronger trade union representation and greater possibilities of collective representation and intervention, the managerial use of digital tools may be subject to stricter constraints. In these cases, the introduction of technologies capable of making work more visible and measurable may be accompanied by negotiated procedures, greater transparency in evaluation criteria or forms of collective control over the use of data produced during work (Gallie, 2007; Baiocco et al., 2022).

This aspect is particularly important in the case of CRM systems. As discussed in the previous sections, these systems allow firms to record information on completed activities, customer interactions, response times, deadlines and achieved results. This information can be used to improve the coordination and organization of work, but also to evaluate performance and strengthen managerial control. However, the passage from the availability of information to pressure on workers is not inevitable: it depends on the way this information is actually used within the organization.

In more protective institutional contexts, the data generated by CRM systems may be accompanied by greater constraints on their use for individual control. The presence of trade unions or forms of worker representation may help limit an excessively disciplinary use of digital monitoring, by intervening on the transparency of evaluation criteria, on the limits to the use of individual data and on the ways through which performance is measured. In this sense, institutions may weaken the link between greater visibility of work and the intensification of pressure on workers.

By contrast, in contexts characterized by weaker protections, the information produced by CRM systems may more easily become an instrument of individual control and performance pressure. When workers have fewer tools to negotiate or contest the use of data generated during work, the greater observability of activities may strengthen managerial power more directly. In these cases, dashboards, performance indicators and reporting systems may contribute more strongly to the increase in work pace and work fatigue.

The role of institutions should therefore be interpreted as a condition of moderation. CRM adoption may increase the visibility of work and the firm's ability to monitor performance, but the extent to which this translates into work-related strain may vary depending on the institutional context. Stronger labor market institutions may therefore weaken the relationship between CRM adoption and work fatigue. At the same time, by limiting the disciplinary use of digital monitoring and supporting negotiated forms of work organization, stronger institutions may allow the information and coordination functions associated with CRM systems to translate more easily into workers' autonomy. In this sense, stronger institutional protection may also be associated with a more favorable relationship between CRM adoption and both organizational and temporal autonomy.

On the basis of this reasoning, the third hypothesis of the thesis is divided into three sub-hypotheses:

H3.1: The positive relationship between CRM adoption and work fatigue is weaker in contexts characterized by stronger institutional protection and worker representation.

H3.2: The positive relationship between CRM adoption and organizational autonomy is stronger in contexts characterized by stronger institutional protection and worker representation.

H3.3: The negative relationship between CRM adoption and temporal autonomy is weaker in contexts characterized by stronger institutional protection and worker representation.

3.5 Heterogeneous Effects

The mechanisms discussed in the previous sections suggest that the effects of CRM adoption on job quality may not be uniform for all workers. CRM systems influence work through the centralization of information, the standardization of procedures and the increased visibility of activities. However, workers may differ both in their degree of exposure to these mechanisms and in their ability to use the information and tools made available by the platform.

For this reason, the impact of CRM systems on job quality may vary according to workers' individual characteristics and occupational position. In particular, this section considers two possible sources of heterogeneity: education level and gender. The objective is not to assume that technology produces different effects automatically, but to examine whether the relationship between CRM systems and job quality changes according to workers' resources, skills and occupational position. This approach is consistent with studies showing that the effects of digitalization may vary across different groups of workers, in relation to socio-economic position, available skills and the occupational distribution of men and women (Borle et al., 2021; Sorgner, 2019; Kohlrausch and Weber, 2020).

3.5.1 Differences by education level

A first dimension of heterogeneity concerns workers' level of education. As discussed in the previous sections, CRM systems increase both the availability of information and the

organization's ability to monitor and evaluate work activities. However, the information made available by these systems may not have the same meaning for all workers.

Workers with higher levels of education may be more able to use the information provided by CRM systems to organize their activities, coordinate different tasks and manage daily work with greater autonomy. In these cases, the CRM may be perceived not only as a monitoring tool, but also as an organizational resource that facilitates access to information, reduces uncertainty and supports the operational management of work.

By contrast, workers with lower levels of education may benefit less from the information and coordination functions offered by CRM systems. For these workers, the organizational implications of CRM systems may be more closely related to recording, standardization and performance control. As a consequence, the pressure linked to the continuous measurement of activities and results may be more intense.

This reasoning is related to the literature on digital work intensification, which distinguishes between the simple use of digital technologies and the forms of work intensification associated with their implementation. Borle et al. (2021), for example, show that digital work intensification may be associated with worse outcomes in terms of mental health and work ability, and emphasize the importance of considering socio-economic differences when examining these relationships.

Education level can therefore be interpreted as a relevant dimension for understanding whether workers are more exposed to the control aspects of digital systems or, by contrast, more able to benefit from their informational and organizational functions. From this perspective, the relationship between CRM adoption and job quality may vary according to education level. Lower levels of education may make workers more exposed to the pressure associated with digital monitoring and the standardization of activities, leading to a stronger relationship between CRM adoption and work fatigue. At the same time, workers with lower levels of education may have fewer opportunities to translate the information and coordination functions of CRM systems into greater control over the organization and timing of their work. The relationship between CRM adoption and the two dimensions of autonomy may therefore also be less favorable for these workers.

On the basis of this reasoning, the fourth hypothesis of the thesis is divided into three sub-hypotheses:

H4.1: Among workers with lower levels of education, the association between CRM adoption and work fatigue is stronger.

H4.2: Among workers with lower levels of education, the positive association between CRM adoption and organizational autonomy is weaker.

H4.3: Among workers with lower levels of education, the negative association between CRM adoption and temporal autonomy is stronger.

3.5.2 Gender differences

A second possible source of heterogeneity concerns gender. The effects of CRM systems may vary between men and women not because technology produces different consequences in itself, but because men and women tend to be distributed differently across sectors, occupations and organizational roles. This different distribution may influence the degree of exposure to the mechanisms of monitoring, standardization and coordination associated with CRM adoption.

This aspect is particularly relevant because CRM systems are often used in sales, customer service, administrative support and customer relationship management activities. In these areas, a significant share of work can be recorded, monitored and evaluated through digital platforms. If men and women are present to different degrees in these activities, they may also experience differently the consequences of CRM adoption on work fatigue.

The literature on digitalization and gender provides support for this hypothesis. Sorgner (2019) emphasizes that new digital technologies may produce differentiated effects for men and women also because of differences in sectoral distribution, skills and access to the opportunities of digital transformation. Similarly, Kohlrausch and Weber (2020) show that digitalization may reorganize gender relations at work, modifying the boundaries and conditions within which men and women participate in work processes.

Gender may therefore interact with the forms of autonomy and pressure generated by CRM systems. Women are more frequently employed in customer-facing, administrative and support activities, where work can be more directly exposed to recording, standardization and

performance monitoring through digital systems. In these contexts, the greater visibility associated with CRM systems may translate into stronger work pressure and a stronger relationship with work fatigue. At the same time, the organizational constraints associated with these activities may limit the extent to which the information and coordination functions of CRM systems translate into greater autonomy.

For this reason, gender is considered as a potential source of heterogeneity across all three dimensions of job quality. The argument does not assume that men and women respond intrinsically differently to technology. Rather, their different occupational and organizational positions may lead them to experience differently the monitoring and coordination mechanisms associated with CRM systems. The CRM-related associations with job quality are therefore expected to be comparatively less favorable among women.

On the basis of this reasoning, the fifth hypothesis of the thesis is divided into three sub-hypotheses:

H5.1: Among women, the association between CRM adoption and work fatigue is stronger.

H5.2: Among women, the positive association between CRM adoption and organizational autonomy is weaker.

H5.3: Among women, the negative association between CRM adoption and temporal autonomy is stronger.

3.6 Summary of Research Hypotheses

The theoretical framework developed in this chapter suggests that CRM systems may influence job quality through different organizational mechanisms. On the one hand, the centralization of information and coordination tools may facilitate the organization of daily activities and support some forms of operational autonomy. On the other hand, the greater visibility of work, the standardization of procedures and the expansion of monitoring possibilities may strengthen managerial control, increase performance pressure and contribute to work intensification.

The overall effect of CRM adoption on job quality cannot therefore be assumed to be unidirectional. CRM systems may simultaneously support coordination and increase control.

Their consequences depend on the way these mechanisms combine within organizations and on the institutional context in which firms operate. Moreover, the effects of CRM adoption may vary across different groups of workers, in relation to education level, available skills, occupational position and gender.

On the basis of the theoretical mechanism discussed in the chapter, the empirical analysis will test the following hypotheses:

H1a: CRM adoption is associated with higher levels of work fatigue.

H1b: The association between CRM adoption and work fatigue is stronger among lower-educated workers employed in routine customer-facing occupations.

H2: CRM adoption is associated with higher levels of perceived organizational autonomy and lower levels of temporal autonomy.

H3.1: The positive relationship between CRM adoption and work fatigue is weaker in contexts characterized by stronger institutional protection and worker representation.

H3.2: The positive relationship between CRM adoption and organizational autonomy is stronger in contexts characterized by stronger institutional protection and worker representation.

H3.3: The negative relationship between CRM adoption and temporal autonomy is weaker in contexts characterized by stronger institutional protection and worker representation.

H4.1: Among workers with lower levels of education, the association between CRM adoption and work fatigue is stronger.

H4.2: Among workers with lower levels of education, the positive association between CRM adoption and organizational autonomy is weaker.

H4.3: Among workers with lower levels of education, the negative association between CRM adoption and temporal autonomy is stronger.

H5.1: Among women, the association between CRM adoption and work fatigue is stronger.

H5.2: Among women, the positive association between CRM adoption and organizational autonomy is weaker.

H5.3: Among women, the negative association between CRM adoption and temporal autonomy is stronger.

The next chapter presents the data, variables and descriptive statistics used in the empirical analysis.

4. Data, Variables and Descriptive Statistics

The previous chapter developed the theoretical mechanism linking CRM adoption to different dimensions of job quality. In particular, it argued that CRM systems may influence workers' experience through two partially contrasting processes. On the one hand, the centralization of information and the availability of shared organizational tools may facilitate the coordination of daily activities and support some forms of operational autonomy. On the other hand, the greater visibility of work activities, the standardization of procedures, and the possibility of monitoring performance may increase work-related pressure and contribute to work intensification.

Building on this theoretical framework, the present chapter introduces the data and variables used to examine empirically the relationship between CRM adoption and job quality. The analysis combines information on the diffusion of CRM systems across European countries with individual-level data on working conditions. This strategy makes it possible to examine whether workers employed in contexts characterized by higher levels of CRM adoption report different levels of work fatigue and perceived autonomy.

The chapter is organized as follows. Section 4.1 presents the data sources used in the empirical analysis. Section 4.2 describes the construction of the analytical samples. Section 4.3 introduces the dependent variables, with particular attention to work fatigue and autonomy. Section 4.4 presents the main independent variable, namely CRM adoption. Section 4.5 describes the institutional variables used to examine moderation effects, while Section 4.6 presents the individual-level control variables. Finally, Sections 4.7 and 4.8 report the descriptive statistics and provide preliminary descriptive evidence on the main job-quality outcomes examined in this thesis.

4.1 Data Sources

The empirical analysis makes use of three data sources. The first is Eurostat, which is used to obtain information on CRM diffusion among firms. This variable indicates the percentage of enterprises that adopt CRM systems, measured at the country-year level. Before using it in the regressions, one additional step is required: the variable is standardized to make the coefficients easier to interpret and compare across specifications.

The second source is the European Social Survey (ESS). Five survey rounds are used, covering the period from 2014 to 2023. Only employed respondents are considered in the analysis. From the ESS, three main outcomes are constructed: work fatigue, temporal autonomy and organizational autonomy. The distinction between organizational and temporal autonomy follows the theoretical framework developed in the previous chapter. As discussed in Chapter 3, CRM systems may facilitate access to information and the coordination of daily activities, while greater traceability may reduce workers' control over working time.

The third data source is ICTWSS, from which information on the institutional context of European countries is obtained. The two main variables are collective bargaining coverage and trade union density. These variables are used to investigate whether the institutional context moderates the relationship between CRM adoption and the three dimensions of job quality considered in the analysis. Following H3.1–H3.3, stronger labor market institutions are expected to weaken the positive association between CRM adoption and work fatigue, strengthen the positive association with organizational autonomy, and weaken the negative association with temporal autonomy.

The three data sources are combined by matching country-year information from Eurostat and ICTWSS with individual-level observations from the ESS. Information on CRM adoption and labor market institutions is therefore measured at the country-year level, whereas information on job quality and workers' characteristics is observed at the individual level.

4.2 Construction of the Analytical Sample

The analytical samples are constructed by combining the three data sources described in the previous section. The analysis is based on ESS Rounds 7 to 11, covering the period from 2014 to 2023. These survey rounds are selected because they can be matched with Eurostat information on CRM adoption at the country-year level. To facilitate the matching procedure, the ESS data are harmonized by creating a common time variable and using country codes consistent with the other data sources.

The sample includes only individuals who are currently employed. This choice reflects the objective of the analysis, which is to examine the relationship between CRM adoption and current working conditions. Since the dependent variables refer to respondents' current jobs,

including individuals who are not employed would make the interpretation of the results less straightforward.

Observations with missing information on the variables required for each specification are then excluded. In particular, each outcome-specific analytical sample excludes observations with missing values for the relevant dependent variable, the main socio-demographic characteristics, or the variables required for merging the different data sources. As a result, the empirical analysis relies on outcome-specific analytical samples. The number of observations differs across models because the ESS variables used to measure work fatigue, organizational autonomy and temporal autonomy are not available for exactly the same respondents and survey rounds. The sample is further restricted in the models examining institutional moderation, since these specifications require the additional merge with ICTWSS variables. For this reason, differences in sample size should be interpreted as a consequence of variable availability and of the merging procedure across data sources.

The individual-level dataset is then matched with the Eurostat data on CRM adoption at the country-year level. In this way, each respondent is assigned the level of CRM adoption observed in the corresponding country and year. For the analysis of institutional moderation, the dataset is further integrated with information from the ICTWSS database on collective bargaining coverage and trade union density. These variables are also matched at the country-year level.

The resulting analytical samples therefore combine information measured at different levels. Individual-level information on job quality and workers' characteristics is combined with country-year information on CRM adoption and labor market institutions. This structure makes it possible to examine whether workers observed in contexts characterized by higher CRM diffusion report different levels of work fatigue and autonomy. At the same time, the estimates should be interpreted with caution, because CRM adoption is measured at the country-year level and does not capture individual CRM use.

4.3 Dependent Variables

The dependent variables used in the empirical analysis capture different dimensions of job quality. Consistent with the theoretical framework developed in the previous chapters, the analysis focuses on work fatigue and autonomy. Work fatigue captures a possible consequence of work intensification, while the two measures of autonomy make it possible to

examine whether CRM diffusion is associated with workers' control over different aspects of their work. This choice is consistent with the multidimensional view of job quality adopted in this thesis, according to which working conditions should not be evaluated only in terms of employment or earnings, but also by considering workers' control over their activities, the organization of work and their well-being (Gallie, 2007).

The first dependent variable is work fatigue. It is measured using the ESS variable trdawrk, which asks respondents how often they are too tired after work to enjoy or carry out the things they would like to do at home. Higher values indicate that work fatigue is experienced more frequently. In this thesis, work fatigue is used as an indicator of work-related strain. As discussed in the previous chapter, CRM systems may increase the visibility of work activities, expand the possibilities for performance monitoring and strengthen the pressure associated with achieving measurable targets (Leonardi and Treem, 2020; Wood, 2021; Baiocco et al., 2022). If these mechanisms contribute to work intensification, one possible consequence is a higher level of work fatigue.

The second dependent variable is organizational autonomy. This variable is based on the ESS question wkdcorga, which measures the extent to which workers can decide how to organize their daily work. Higher values indicate greater control over the organization of daily activities. This dimension is particularly relevant for the analysis of CRM systems, since these technologies may facilitate access to information, support coordination and make some work activities easier to manage (Payne and Frow, 2005; Buttle and Maklan, 2019). From this perspective, organizational autonomy can be interpreted in operational terms as workers' ability to organize and coordinate daily tasks within a more information-rich organizational environment.

The third dependent variable is temporal autonomy. It is measured using the ESS variable dcsfwrka, which asks respondents to what extent they can decide their starting and finishing times. This variable captures control over working time rather than control over the organization of daily tasks. The distinction between organizational and temporal autonomy is important for the theoretical argument of this thesis. CRM systems may support the coordination and organization of work activities without necessarily increasing workers' control over the timing and pace of work. For this reason, the association between CRM diffusion and temporal autonomy is expected to be negative.

Work fatigue, organizational autonomy and temporal autonomy are all considered in the institutional moderation and heterogeneity analyses. This makes it possible to examine whether the relationships predicted by H3.1–H3.3, H4.1–H4.3 and H5.1–H5.3 differ across the three dimensions of job quality considered in the thesis.

4.4 Main Independent Variable: CRM Adoption

The main independent variable is CRM adoption, measured as the share of firms adopting CRM software. The variable is constructed using Eurostat data, which are available at the country-year level, and is then linked to the individual observations from the European Social Survey. In this way, each respondent is assigned the level of CRM adoption observed in the corresponding country and year.

The use of this variable is consistent with the purpose of the analysis. The objective is not to determine whether individual workers use a CRM system in their daily work, but rather to assess whether differences in the diffusion of CRM systems across countries and years are associated with differences in job quality. As discussed in the previous chapters, CRM systems may influence the way work is organized by centralizing information, facilitating coordination and making work activities more visible (Payne and Frow, 2005; Buttle and Maklan, 2019; Leonardi and Treem, 2020). In this sense, CRM adoption is considered a characteristic of the organizational environment in which workers operate, rather than an individual characteristic of workers themselves.

Before estimating the models, the CRM variable is standardized. This makes the estimated coefficients easier to interpret and compare across the different specifications. Since CRM adoption is measured in standard-deviation units, coefficients involving this variable can be interpreted in relation to a one-standard-deviation difference in CRM diffusion. In models including interaction terms, the relevant coefficients indicate whether the association between CRM diffusion and job quality differs across institutional contexts or groups of workers.

In the merged ESS–CRM analytical sample, CRM adoption ranges from approximately 1.3 to 34.6 per cent of firms, with an average value of about 9.8 per cent. This indicates substantial cross-national and temporal variation in the diffusion of CRM technologies and provides the variation required for the empirical analysis.

One limitation of this measure should be noted. The CRM variable does not indicate whether respondents directly use a CRM system in their daily work. Instead, it captures the overall diffusion of CRM systems within each country and year. The estimated relationships should therefore be interpreted as associations between CRM diffusion and job quality rather than as causal effects of individual CRM use.

4.5 Institutional Variables

To test hypotheses H3.1–H3.3 on institutional moderation, the analysis includes information on labor market institutions from the ICTWSS database. These variables are used only in the specifications testing institutional moderation and are therefore not included in the main descriptive table. The objective is to examine whether the relationships between CRM adoption and the three dimensions of job quality change across countries characterized by different levels of institutional protection and worker representation. As discussed in the previous chapter, the greater visibility of work activities generated by CRM systems does not necessarily produce the same consequences in every country. The way firms use the information generated through these systems may also depend on labor market institutions, collective bargaining and the role of worker representation (Gallie, 2007; Baiocco et al., 2022).

The first institutional variable is collective bargaining coverage. This variable measures the share of workers covered by collective agreements and is used as an indicator of the degree of collective regulation of working conditions. In countries with higher collective bargaining coverage, the introduction of digital monitoring technologies may be subject to negotiated rules or collective forms of control. For this reason, stronger collective bargaining coverage is expected to weaken the positive association between CRM adoption and work fatigue, strengthen the positive association with organizational autonomy, and weaken the negative association with temporal autonomy.

The second institutional variable is trade union density, measured as the share of workers who are members of a trade union. This variable captures the strength of worker representation at the national level. A stronger union presence may give workers more opportunities to negotiate the introduction of digital technologies, question monitoring practices or demand greater transparency in the use of performance indicators. By contrast, where trade union representation is weaker, CRM systems may more easily contribute to greater managerial control and work pressure.

The analysis also includes individual trade union membership, available in the ESS data. This variable distinguishes between current trade union members, former members and non-members. It is included to account for individual differences in workers' relationship with collective representation. The main focus of hypotheses H3.1–H3.3, however, remains on the national institutional context and on its role in shaping the relationship between CRM adoption and job quality.

Taken together, these measures allow the analysis to distinguish between the role of national labor market institutions and individual workers' relationship with collective representation. Collective bargaining coverage and trade union density capture the institutional context in which firms operate, while individual union membership accounts for whether respondents are personally connected to trade union representation.

4.6 Control Variables

The empirical analysis includes a set of individual-level control variables.

The first group of controls refers to workers' socio-demographic characteristics. The analysis includes gender, age, age squared and years of education. Gender is included to account for differences in working conditions between men and women. It is also used in the analysis of heterogeneous associations by gender, through a dummy variable identifying female respondents. Age is entered both in linear and squared form, in order to allow for a non-linear relationship with the dependent variables. Years of education are included because education may be related both to workers' occupational position and to their exposure to digital technologies. For the H4.1–H4.3 heterogeneity analysis, however, educational attainment is measured using the harmonized ES-ISCED classification. Respondents in categories 1–5 are classified as having non-tertiary education, while those in categories 6–7 constitute the tertiary-education reference group. As an additional robustness check, years of education are also used as a continuous moderator.

The second group of controls refers to workers' socio-economic and organizational position. These variables include perceived household income, firm size and supervisory responsibilities. Perceived household income accounts for differences in workers' economic conditions, while firm size and supervisory responsibilities capture differences in the organizational context and in workers' position within the firm.

The analysis also includes a measure identifying lower-educated workers in routine customer-facing occupations. This variable is constructed using occupational classification and educational level. In particular, workers in ISCO major groups 4 and 5 with no more than 12 years of education are classified as lower-educated workers in routine customer-facing occupations. This operational definition is intended to identify workers employed in clerical, service and sales occupations with relatively lower educational resources, where CRM-related processes are more likely to be connected to routine customer-facing activities. This measure is relevant because CRM systems are more likely to be used in activities involving customer relations, sales, administrative work and support services. These are occupational contexts in which work activities may be more easily recorded, standardized and monitored through digital systems (Buttle and Maklan, 2019; Fernández-Macías et al., 2023). This control is important because workers employed in these occupational groups may experience different job-quality conditions regardless of CRM use, potentially confounding the relationship between CRM adoption and job quality.

Additional controls, included depending on the outcome and variable availability, include weekly working hours, type of contract, sector of employment and frequency of Internet use. Weekly working hours account for differences in exposure to work demands, while contract type captures differences between more and less stable employment relationships. Sector controls account for differences across economic activities, and Internet use captures a broader familiarity with digital technologies. In some autonomy specifications, additional work-organization variables are also included, such as managerial support, team integration and responsiveness outside working time.

The control variables are introduced progressively in the empirical models. Starting from a parsimonious specification, additional controls are added one at a time while keeping the rest of the model unchanged. This strategy makes it possible to assess whether the estimated association between CRM adoption and job quality is robust to the inclusion of each specific control.

Overall, the control variables are included to reduce the risk that the estimated association between CRM adoption and job quality reflects compositional differences across workers, occupations, sectors or firms. However, they do not eliminate all possible sources of

confounding. For this reason, the empirical results should be interpreted as conditional associations rather than causal estimates.

4.7 Descriptive Statistics

Table 4.1 reports the descriptive statistics for the main variables used in the analysis. The table provides an overview of the variables included in the empirical models before presenting the regression results.

Table 4.1 — Descriptive Statistics

	Count	Mean	SD	Min	Max
Work fatigue	14146	2,982	0,911	1,000	5,000
Organizational autonomy	92809	6,639	3,232	0,000	10,000
Temporal autonomy	14106	1,797	0,752	1,000	3,000
CRM adoption (%)	93178	9,679	7,495	1,290	34,550
CRM adoption, standardized	93178	0,055	0,971	-1,033	3,278
Age	95274	44.348	12.564	15,000	97,000
Female	93178	0,497	0,500	0,000	1,000
Years of education	94491	14.260	3.590	0,000	35,000
Weekly working hours	86235	37.335	11.935	0,000	168,000
Supervisor	93178	0,303	0,460	0,000	1,000
Routine customer-facing occupation	93178	0,116	0,320	0,000	1,000
Internet use	75148	4,573	0,986	1,000	5,000

Note: *Own elaboration based on Eurostat and ESS data. Descriptive statistics refer to the merged ESS–CRM analytical sample. The number of observations differs across variables because of outcome-specific availability and missing values. CRM adoption is measured as the percentage of firms adopting CRM systems.*

The dependent variables show substantial variation across workers. On average, work fatigue is close to 3 on a five-point scale, while organizational autonomy has a mean value of about 6.6 on a scale from 0 to 10. Temporal autonomy is measured on a three-point scale and has an average value of about 1.8.

The CRM variable also shows considerable variation across the country-year contexts represented in the analytical sample. The share of firms adopting CRM systems ranges from about 1.3 percent to 34.6 percent, with an average of about 9.8 percent. In the regression models, the standardized version of the variable is used in order to facilitate the interpretation of the estimated coefficients.

The descriptive statistics show that the analytical sample includes workers with different demographic and occupational characteristics. On average, respondents are around 44 years old and have approximately 14.3 years of education. Women account for about half of the

sample, while about 30 percent of respondents hold supervisory responsibilities. The table also shows variation in working hours, lower-educated routine customer-facing status and Internet use, which are included to account for differences in work exposure, occupational position and familiarity with digital technologies.

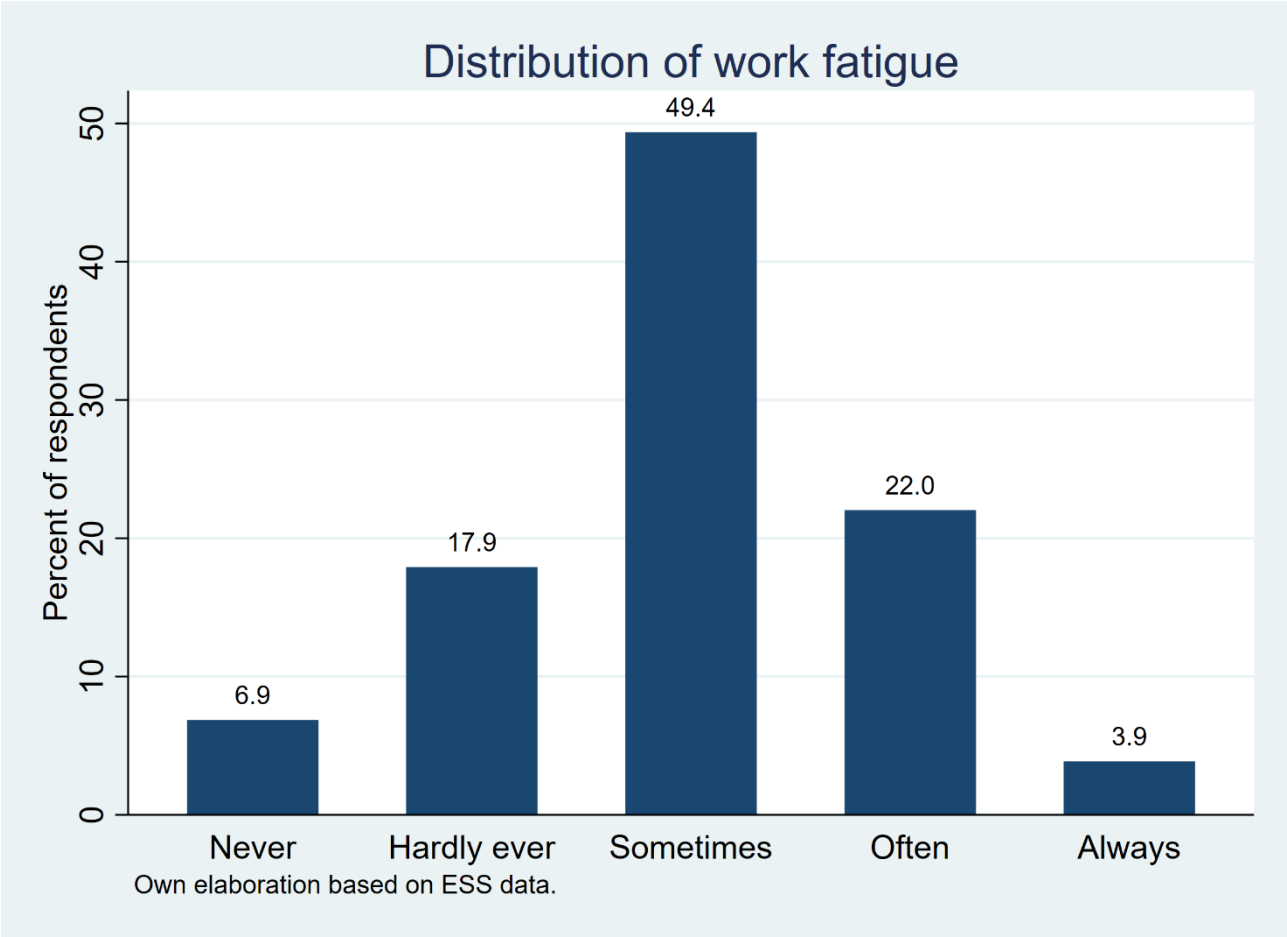
Overall, the descriptive statistics indicate that the dataset provides sufficient variation in both the individual-level and aggregate variables used in the empirical analysis. At the same time, these results should be interpreted only as a description of the analytical sample. The empirical analysis presented in the following chapter examines more systematically the relationship between CRM adoption and the main dimensions of job quality considered in this thesis.

4.8 Descriptive Evidence on Job Quality Outcomes

The descriptive statistics presented in the previous section provide a first overview of the variables used in the analysis. In addition to Table 4.1, Figures 4.1 and 4.2 describe the distribution of the main job quality outcomes examined in this thesis. This descriptive evidence is useful because it shows how work fatigue, organizational autonomy and temporal autonomy are distributed across workers before moving to the regression analysis.

Figure 4.1 reports the distribution of work fatigue. The largest share of respondents reports being too tired after work “sometimes”, while smaller shares report never or always experiencing work fatigue. This suggests that work fatigue is not concentrated exclusively at the extremes of the scale, but varies meaningfully across respondents.

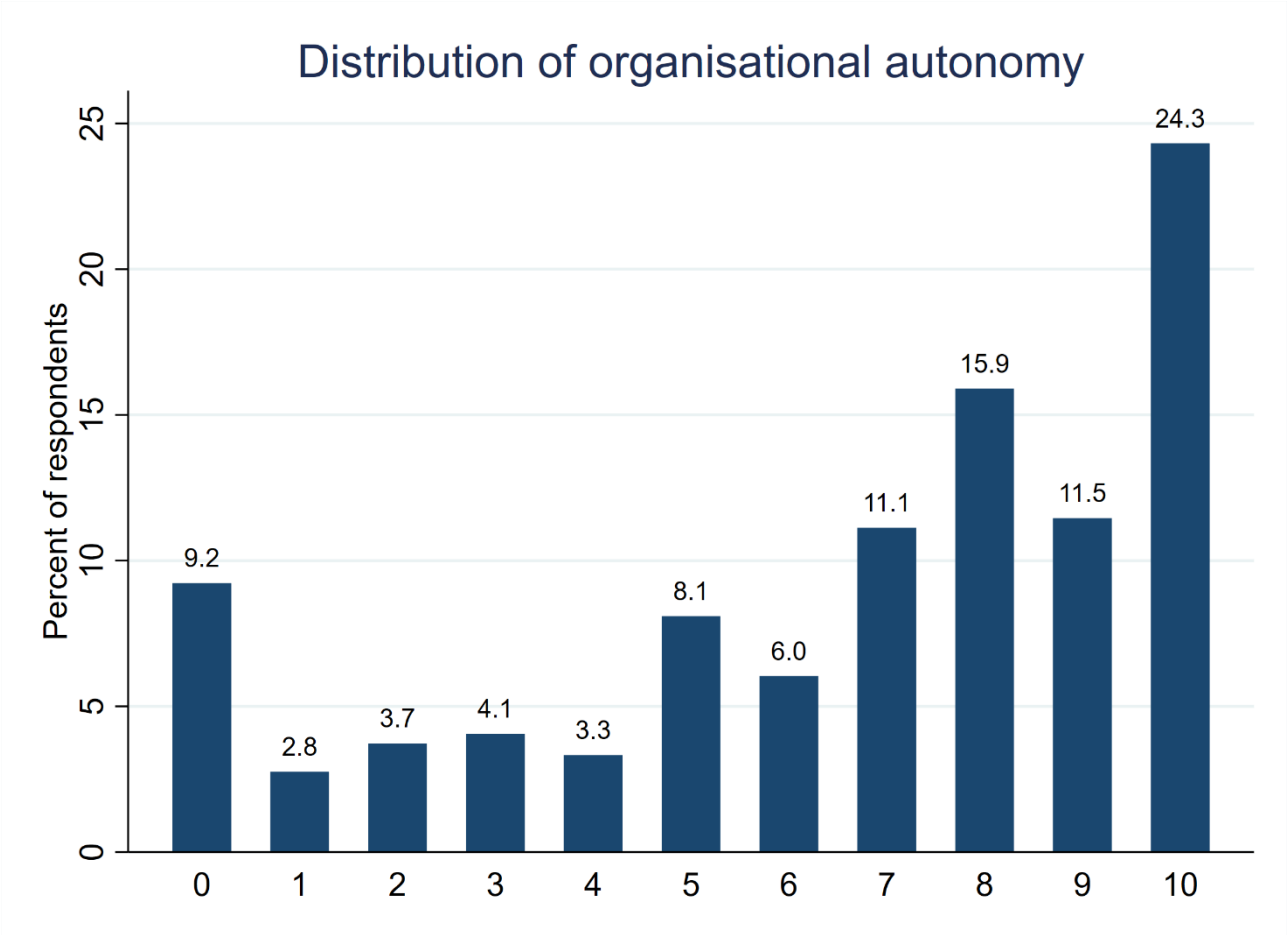
Figure 4.1 — Distribution of Work Fatigue



Note: *Own elaboration based on ESS data. Work fatigue ranges from 1 to 5, with higher values indicating that respondents more frequently feel too tired after work.*

Figures 4.2a and 4.2b report the distributions of the two autonomy measures used in the analysis. Figure 4.2a shows the distribution of organizational autonomy, which measures workers' perceived influence over how their daily work is organized. The distribution indicates that a substantial share of respondents reports relatively high levels of organizational autonomy, although responses are spread across the full scale.

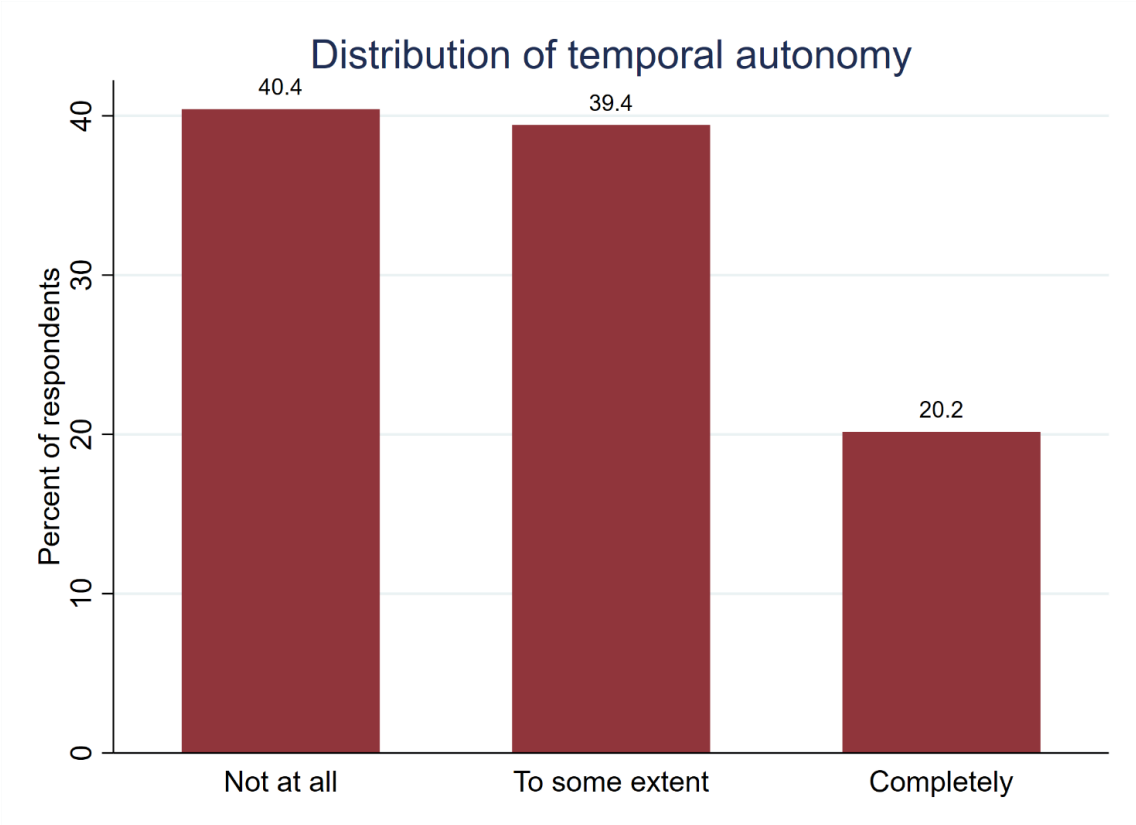
Figure 4.2a — Distribution of Organizational Autonomy



Note: *Own elaboration based on ESS data. Organizational autonomy ranges from 0 to 10, with higher values indicating greater influence over how daily work is organized*.

Figure 4.2b shows the distribution of temporal autonomy, which captures workers' control over their starting and finishing times. Compared with organizational autonomy, this variable is measured on a shorter three-point scale. The distribution shows that a large share of respondents reports having no or only partial control over working time, while a smaller share reports complete temporal autonomy.

Figure 4.2b — Distribution of Temporal Autonomy



Note: *Own elaboration based on ESS data. Temporal autonomy ranges from 1 to 3, with higher values indicating greater control over starting and finishing times.*

At the same time, this descriptive evidence should be interpreted with caution. The figures document the distribution of the main outcomes, but they do not assess the hypotheses of the thesis. Simple descriptive comparisons cannot account for differences in workers' characteristics, occupational composition, country-level institutions or year-specific factors. For this reason, the relationship between CRM adoption, work fatigue and autonomy is examined more systematically in the empirical analysis presented in the following chapter.

4.9 Summary and Transition to the Empirical Strategy

This chapter presented the data sources, variables and analytical samples used in the empirical analysis. The thesis combines Eurostat data on CRM adoption with individual-level information from the European Social Survey and institutional indicators from the ICTWSS database. This structure makes it possible to relate country-year variation in CRM diffusion to individual-level measures of job quality.

The chapter also clarified the main limitation of the empirical design. CRM adoption does not measure whether individual respondents directly use CRM systems, but captures the diffusion of these systems within each country and year. The empirical results should therefore be interpreted as associations between CRM diffusion and job quality, rather than as causal estimates of individual CRM use.

The following chapter presents the empirical strategy used to test the hypotheses developed in Chapter 3. It describes the models used to examine the association between CRM adoption, work fatigue and autonomy, as well as the interaction models used to assess institutional moderation and heterogeneity by education and gender.

5. Empirical Strategy

5.1 Empirical Specification

This section describes the empirical strategy adopted to examine the relationship between CRM adoption and the job-quality outcomes discussed in the previous chapters. Given the structure of the data, the analysis relies on a series of ordinary least squares (OLS) regression models combining individual-level information from the European Social Survey with country-year data on CRM adoption. This approach makes it possible to examine whether workers observed in country-year contexts characterized by higher CRM diffusion report different levels of work fatigue, organizational autonomy and temporal autonomy, while controlling for the main individual characteristics and, depending on the specification, country and year fixed effects.

The baseline empirical specification can be expressed as follows:

$$Y_{ict} = \alpha + \beta CRM_{ct} + \gamma X_{ict} + \delta_c + \lambda_t + \varepsilon_{ict}$$

where Y_{ict} denotes the job-quality outcome observed for individual i, in country c, and year t. Depending on the specification, the dependent variable corresponds to work fatigue, organizational autonomy or temporal autonomy. CRM_{ct} denotes the standardized level of CRM adoption in country c and year t, while X_{ict} is a vector of individual-level control variables. The terms δ_c and λ_t denote country and year fixed effects, respectively, when included in the specification, while ε_{ict} represents the idiosyncratic error term.

Although the dependent variables used in the analysis are measured on ordinal scales, OLS is retained as the main estimation method because it allows a more straightforward interpretation of the coefficients and facilitates comparisons across the different specifications. To verify that the results do not depend on treating these outcomes as cardinal variables, the main specifications are also re-estimated using *ordered logit* models, which explicitly account for the ordinal nature of the dependent variables. These estimates are used as a robustness check, and the comparison with the OLS models focuses mainly on the direction and statistical significance of the estimated relationships, since the magnitude of the coefficients cannot be directly compared across the two estimators. As described in the previous chapter, the CRM adoption variable is standardized before estimation. Consequently, the coefficient β can be interpreted as the change in the outcome associated with a one-

standard-deviation increase in CRM adoption. This transformation makes it easier to compare estimated CRM coefficients across specifications for the same outcome and to interpret the estimated coefficients, particularly in the models including interaction terms.

For H1a and H1b, the empirical analysis distinguishes between the two corresponding tests. H1a is tested using the baseline specification, which examines the overall association between CRM adoption and work fatigue. H1b is tested by extending this specification with an interaction between CRM adoption and the indicator identifying lower-educated workers employed in routine customer-facing occupations. The interaction coefficient therefore indicates whether the estimated relationship between CRM adoption and work fatigue is stronger for this group than for the rest of the sample.

For H2, the baseline specifications for organizational and temporal autonomy are also extended by interacting CRM adoption with the indicator for lower-educated routine customer-facing workers. This extension examines whether the relationship between CRM adoption and autonomy differs for the occupational group most directly exposed to routinized customer-facing processes. It is distinct from H4.1-H4.3, which compare workers according to educational attainment independently of their occupational group.

The vector X_{ict} includes the individual-level control variables introduced in Chapter 4. Specifically, the baseline specification controls for age, age squared, gender, years of education, perceived household income, establishment size and supervisory responsibilities. In the H4.1–H4.3 specifications, educational attainment replaces years of education as the education measure. The main interaction models therefore include the non-tertiary education indicator, while years of education are excluded from the control variables. Years of education are considered only in an additional robustness specification, where they are used as a continuous moderator. Additional controls are included only in robustness checks or when required by the specific hypothesis under examination. Including these variables helps account for observable differences in workers' characteristics that may be associated with both job quality and the likelihood of working in more digitally intensive environments.

The fixed-effects structure depends on the temporal variation available for each outcome and on the empirical specification considered. For organizational autonomy, which is observed across multiple ESS waves, the baseline and individual-level heterogeneity specifications

include country and year fixed effects. Work fatigue and temporal autonomy are observed only in the 2020 analytical sample, so their main specifications are cross-sectional and do not include country or year fixed effects. The institutional moderation models follow the separate fixed-effects structure described in Section 5.2. For selected interaction models based on the 2020 outcomes, country fixed effects are introduced separately as robustness checks when the interaction remains identifiable even though the country-level CRM main effect is absorbed.

Given the strong temporal component in the diffusion of CRM systems, specifications excluding year fixed effects are also estimated as a robustness check for organizational autonomy. This comparison makes it possible to assess whether the estimated relationships are sensitive to the absorption of common temporal variation. The same comparison is not informative for work fatigue and temporal autonomy, since these outcomes are observed only in the 2020 analytical samples.

Because the main explanatory variable is measured at the country-year level, observations within the same country may show correlated error terms. Standard errors are therefore clustered at the country level to account for within-country dependence and to obtain valid statistical inference.

The estimated effects must not be interpreted as causal effects, but as conditional associations after accounting for the controls included in the model. The use of individual controls and fixed effects helps reduce the role of some observable differences and unobserved factors that remain constant over time. However, an important limitation remains: CRM adoption is measured at the country-year level. Therefore, the analysis cannot determine whether individual workers actually use a CRM system in their daily activities. As a consequence, what can be verified is whether workers observed in countries and years characterized by different levels of CRM diffusion report different outcomes in terms of job quality. It cannot instead be concluded that CRM use directly caused those differences.

5.2 Institutional Moderation

Hypotheses H3.1–H3.3 examine whether the relationship between CRM adoption and job quality varies depending on the institutional context in which firms operate. As discussed in Chapter 3, the greater availability of information on workers' activities does not necessarily

translate into the same level of monitoring and work pressure across countries. In contexts characterized by stronger collective regulation of working conditions and stronger trade union representation, the use of information generated through digital systems may be subject to stricter rules, negotiated procedures and greater transparency. As a result, stronger labor market institutions are expected to weaken the positive association between CRM adoption and work fatigue, strengthen the positive association with organizational autonomy, and weaken the negative association with temporal autonomy.

To test this hypothesis, the baseline specification is extended by introducing an interaction term between CRM adoption and the institutional variable considered. The empirical specification can be expressed as follows:

$$Y_{ict} = \alpha + \beta_1 CRM_{ct} + \beta_2 INST_{ct} + \beta_3 (CRM_{ct} \times INST_{ct}) + \gamma X_{ict} + \lambda_t + \varepsilon_{ict}$$

where Y_{ict} denotes the job-quality outcome observed for individual i, in country c, and year t. Depending on the specification, the dependent variable corresponds to work fatigue, organizational autonomy or temporal autonomy. CRM_{ct} denotes the standardized level of CRM adoption, while $INST_{ct}$ represents the institutional variable, which is also standardized. The vector X_{ict} includes the individual-level control variables introduced in the baseline specification, λ_t denotes year fixed effects, and ε_{ict} is the error term.

The main institutional variable included in the analysis is collective bargaining coverage, measured as the share of workers covered by collective agreements. This variable reflects the extent to which working conditions are regulated through collective bargaining and makes it possible to examine whether the relationship between CRM adoption and job quality varies with the strength of collective regulation. As an alternative measure of labor market institutions' strength, the analysis also considers trade union density, measured as the share of workers who are members of a trade union. The two variables capture different aspects of the institutional environment: the first reflects the extent of collective regulation, while the second captures the strength of trade union representation among workers.

The institutional variables are standardized before estimation to facilitate the interpretation of the coefficients. In particular, β_1 represents the relationship between CRM adoption and the outcome when the institutional variable is at its average value. The coefficient β_2 indicates the relationship between the institutional variable and the outcome when CRM adoption is at its

average value. The coefficient of greatest interest is β_3, associated with the interaction term. It shows how the relationship between CRM adoption and job quality changes following a one-standard-deviation increase in the institutional variable.

H3.1 implies a negative interaction coefficient for work fatigue and positive interaction coefficients for organizational and temporal autonomy. For work fatigue, a negative interaction would indicate that the positive association between CRM adoption and work fatigue becomes weaker as collective bargaining coverage or trade union density increases. For organizational autonomy, a positive interaction would indicate that the positive association with CRM adoption becomes stronger as labor market institutions strengthen. For temporal autonomy, a positive interaction would indicate that the hypothesized negative association with CRM adoption becomes weaker as labor market institutions strengthen.

The analysis also considers individual trade union membership as an additional specification. Unlike collective bargaining coverage and trade union density, which describe the national institutional context, this variable captures the individual worker's relationship with trade union representation. The interaction between CRM adoption and individual union membership therefore makes it possible to examine whether the relationship between CRM adoption and job quality differs between current union members, former members and workers who have never been members of a trade union.

The baseline institutional moderation specifications do not include country fixed effects and therefore exploit cross-country variation and, where multiple waves are available, over-time variation in labor market institutions. As an additional robustness check, country fixed effects are introduced for organizational autonomy, which is observed across multiple ESS waves and provides within-country variation over time. For work fatigue and temporal autonomy, both observed only in the 2020 analytical sample, CRM adoption and the institutional indicators are constant within countries; their interaction terms are therefore absorbed by country fixed effects and cannot be separately identified. Year fixed effects and the full set of individual-level controls are retained where applicable, while standard errors are clustered at the country level. All institutional moderation specifications are estimated using the analytical weights provided by the European Social Survey.

5.3 Heterogeneity Analysis by Education and Gender

The last two sets of hypotheses examine whether the relationship between CRM adoption and job quality differs across different groups of workers. As discussed in Chapter 3, CRM systems may influence work through the centralization of information, the standardization of procedures and the greater visibility of work activities. However, workers may differ both in their exposure to these mechanisms and, particularly in relation to education, in their ability to use the information and tools made available by digital technologies. For this reason, the analysis considers education and gender as two possible sources of heterogeneity in the relationship between CRM adoption and job quality.

To examine these differences, the baseline empirical specification is extended by introducing an interaction term between CRM adoption and the individual characteristic considered. The general specification can be expressed as follows:

$$Y_{ict} = \alpha + \beta_1 CRM_{ct} + \beta_2 G_i + \beta_3 (CRM_{ct} \times G_i) + \gamma X_{ict} + \delta_c + \lambda_t + \varepsilon_{ict}$$

where Y_{ict} denotes the job-quality outcome observed for individual *i*, in country *c*, and year *t*. CRM_{ct} denotes the standardized measure of CRM adoption, while G_i represents the individual characteristic used as the moderator. Depending on the hypothesis being tested, this variable identifies workers with non-tertiary education or female workers. The vector X_{ict} includes the individual-level control variables, while δ_c and λ_t denote country and year fixed effects, respectively, when included in the corresponding specification.

The coefficient $\beta_1$measures the relationship between CRM adoption and the outcome for the reference group. In the education models, the reference group consists of workers with tertiary education, while in the gender models it consists of men. The coefficient $\beta_2$captures the average difference between the two groups when CRM adoption is at its average value. The main coefficient of interest is β_3, associated with the interaction term. This coefficient indicates whether the relationship between CRM adoption and job quality changes depending on the individual characteristic considered.

To test H4.1-H4.3, workers are divided according to their educational attainment. Based on the harmonized ES-ISCED classification, respondents in categories 1–5 are classified as having non-tertiary education, while those in categories 6–7, corresponding to tertiary education, constitute the reference group. This distinction makes it possible to examine whether the

relationship between CRM adoption and the three job-quality outcomes differs according to educational attainment, following the directional expectations specified in H4.1-H4.3. Although these systems may facilitate access to information and help workers organize their daily activities, workers with lower educational attainment may benefit less from these functions and experience more directly the pressure associated with digital monitoring.

H4.1 implies a positive interaction coefficient for work fatigue, while H4.2 and H4.3 imply negative interaction coefficients for organizational and temporal autonomy, respectively. For work fatigue, a positive interaction would indicate that the association between CRM adoption and fatigue is stronger among workers with non-tertiary education. For organizational autonomy, a negative interaction would indicate that the positive association with CRM adoption is weaker among workers with non-tertiary education. For temporal autonomy, a negative interaction would indicate that the hypothesized negative association with CRM adoption is stronger among workers with non-tertiary education. As a robustness check, education is also considered as a continuous measure using years of education, allowing the relationship between CRM adoption and job quality to vary across the education distribution without relying on the binary distinction between tertiary and non-tertiary education.

H5.1-H5.3 instead examine whether the relationships between CRM adoption and work fatigue, organizational autonomy and temporal autonomy differ by gender. In this case, the variable G_i takes the value of one for women and zero for men. The objective is not to assume that men and women respond differently to technology in itself, but to examine whether their different distribution across sectors, occupations and organizational roles translates into a different exposure to the mechanisms associated with CRM systems. Women may in fact be more represented in administrative, sales, customer service and customer-facing activities, where work is more easily recorded, standardized and evaluated through digital platforms. This overlap is also reflected in the descriptive statistics of the analytical sample. Women account for 69.1% of workers classified as low-educated routine customer-facing workers, compared with 47.1% among other workers. A similar pattern also emerges across sectors, with particularly high female shares in retail trade (65.2%), education (74.2%), human health activities (78.7%), social work activities (83.1%) and office administrative activities (64.1%).

H5.1 implies a positive interaction coefficient for work fatigue and negative interaction coefficients for organizational and temporal autonomy. A positive coefficient in the work fatigue

model would indicate that the relationship between CRM adoption and work fatigue is stronger among women, while a negative coefficient would indicate a weaker relationship compared with men. A statistically insignificant coefficient would instead provide no evidence that the relationship between CRM adoption and work fatigue differs systematically across the two groups. For organizational autonomy, a negative interaction coefficient would indicate that the positive association with CRM adoption is weaker among women. For temporal autonomy, a negative interaction coefficient would indicate that the hypothesized negative association with CRM adoption is stronger among women. The gender specifications also control for lower-educated routine customer-facing status in order to account for differences in the representation of men and women in this group.

H4.1–H4.3 and H5.1–H5.3 are tested using work fatigue, organizational autonomy and temporal autonomy. This makes it possible to examine whether differences associated with education and gender emerge across the three dimensions of job quality considered in the thesis. All models retain the individual-level controls, fixed-effects structure and country-clustered standard errors of the corresponding baseline specification. In the H4.1–H4.3 models, years of education are excluded from the control variables when educational attainment is used as the moderator, as discussed above.

5.4 Robustness Analysis

In addition to the main specifications, the analysis includes a series of robustness checks to examine whether the estimated relationships remain stable when additional controls or alternative definitions of the variables are introduced. These analyses are particularly important because the diffusion of CRM systems may be associated with other characteristics of work or of the organizational environment that may simultaneously influence work fatigue and autonomy. The stability of the estimated coefficients across the different specifications therefore provides additional evidence on whether the results depend on the particular structure of the baseline model.

As an additional robustness check, the main specifications are re-estimated using ordered logistic regression models. This alternative estimator explicitly accounts for the ordinal nature of work fatigue, organizational autonomy and temporal autonomy, while retaining the same controls, fixed effects and clustering structure used in the corresponding main specifications.

The ordered logit estimates are used to assess whether the direction and statistical significance of the main relationships are sensitive to the use of OLS.

Because the three dependent variables are measured on different scales, the corresponding baseline OLS specifications are also re-estimated using standardized outcomes. This robustness check facilitates the comparison of coefficient magnitudes across work fatigue, organizational autonomy and temporal autonomy (see Appendix Table A.11).

A further robustness check examines the sensitivity of the results to the inclusion of year fixed effects. Since organizational autonomy is observed across multiple ESS rounds, the relevant specifications for this outcome are re-estimated without year fixed effects, while retaining the remaining structure of the corresponding models. This makes it possible to assess whether the estimated relationships are driven by the absorption of common temporal variation in CRM diffusion. The same exercise is not informative for work fatigue and temporal autonomy, as these outcomes are available only in the 2020 analytical samples and year fixed effects therefore do not provide additional identifying variation.

For the 2020 interaction models, additional specifications including country fixed effects are estimated for H1b, H2, H4.1–H4.3, and H5.1–H5.3. Since CRM adoption is constant within countries in the 2020 analytical samples, its main coefficient is absorbed by the country fixed effects. The interaction terms remain identifiable because the corresponding moderators vary across individuals within countries. Specifically, these robustness checks concern lower-educated routine customer-facing status for H1b and H2, non-tertiary education for H4.1–H4.3, and gender for H5.1–H5.3. The organizational-autonomy specifications already include country fixed effects in the main analysis.

For the institutional moderation analysis, an additional robustness check examines the sensitivity of the estimates to the inclusion of country fixed effects. The main H3.1–H3.3 specifications exclude country fixed effects in order to preserve the cross-country institutional variation required to identify the moderating role of bargaining coverage and union density. Country fixed effects are nevertheless introduced for organizational autonomy, for which repeated observations across ESS rounds provide within-country variation over time. This specification cannot provide an equivalent test for work fatigue and temporal autonomy, since

these outcomes are observed only in the 2020 analytical sample and the institutional interaction terms cannot be separately identified once country fixed effects are included.

As a further robustness check for H3.1, the institutional moderation models for work fatigue are re-estimated allowing bargaining coverage and union density to use the maximum country sample available for each indicator within the H1 analytical countries, rather than restricting both measures to the common ICTWSS sample. This check assesses whether the estimated moderation is sensitive to differences in sample composition arising from the availability of institutional data (see Appendix Table A.12).

For the models on work fatigue, additional control variables are introduced progressively. The first extension includes the usual number of weekly working hours, since greater exposure to work may directly affect the probability of feeling too tired after work. The following specification controls for contract type, distinguishing workers with a permanent contract from those with a temporary contract or without a formal contract. These characteristics may be associated both with job security and with differences in work intensity and work organization.

Further specification introduces sector fixed effects. Including these effects makes it possible to compare workers employed in the same economic sector while accounting for structural differences across industries. Some sectors are characterized by a greater diffusion of digital technologies, different forms of work organization and different levels of work pressure, autonomy and customer interaction. Controlling for sector therefore reduces the possibility that the estimated relationship between CRM adoption and job quality mainly reflects differences in the sectoral composition of countries.

The last extension includes the frequency of Internet use as an individual indicator of exposure to and familiarity with digital technologies. This variable makes it possible, at least partially, to distinguish the specific diffusion of CRM systems from the more general level of digitalization experienced by workers. The specifications are estimated progressively, retaining the controls introduced in the previous models, so that it is possible to observe how the coefficient associated with CRM adoption changes as the model becomes more comprehensive. The same additional controls are also applied to the analyses of heterogeneous effects by education and gender and to all three job-quality outcomes considered in the analysis.

For the models on autonomy, the analysis also considers a number of organizational characteristics available in the European Social Survey. In particular, the supplementary specifications control for perceived management support, the sense of belonging to a work group and the expectation of responding to work-related issues outside normal working hours. These variables make it possible to examine whether the relationship between CRM adoption and autonomy depends on organizational characteristics that may either facilitate or limit workers' ability to organize their daily activities. Since these variables are available only for a smaller part of the sample, the results should be compared with the main specifications while also taking into account the differences in the number of observations.

For the analysis of heterogeneous effects by education, robustness is also assessed using an alternative specification in which years of education are treated as a continuous variable. While the main H4.1–H4.3 models distinguish between workers with non-tertiary and tertiary educational attainment based on the harmonized ES-ISCED classification, this alternative specification makes it possible to examine whether the same pattern of heterogeneity also emerges when education is measured continuously rather than through the binary distinction adopted in the main analysis.

Overall, the robustness analyses do not change the objective of the empirical strategy but provide additional evidence on the sensitivity of the results to alternative specifications and to the inclusion of further work-related, sectoral, digital and organizational characteristics. Their interpretation therefore focuses mainly on the stability of the sign and the statistical significance of the main coefficients and, where coefficients are directly comparable, on their magnitude. At the same time, even stable results across different specifications do not remove the limitations associated with the observational nature of the data and do not, by themselves, justify a causal interpretation of the estimated relationships.

5.5 Interpretation of the Estimates and Limitations of the Empirical Strategy

The interpretation of the estimated coefficients depends on the specification considered. In the models including interaction terms, the coefficient associated with CRM adoption represents the estimated relationship for the reference group, or when the standardized moderator is equal to its mean value, while the interaction coefficient indicates how this relationship changes across groups or institutional contexts. For this reason, the coefficients are interpreted jointly. In the specifications including multiple interaction terms, linear

combinations are used, when necessary, to recover the estimated relationship between CRM adoption and the outcome for the relevant groups.

A first limitation concerns the structure of the European Social Survey. The data used in the analysis do not constitute an individual panel following the same workers over time, but a series of repeated cross-sectional surveys conducted in different years. The analysis therefore examines changes in the average outcomes observed across different samples of workers belonging to the same country, without being able to reconstruct the evolution of working conditions for the same individuals over time. The individual-level controls account for part of the differences in the composition of the samples, but they cannot completely rule out the possibility that some of the observed variation reflects changes in the composition of the employed population.

The main limitation of the analysis, however, concerns the level at which the main explanatory variable is measured. CRM adoption is observed as the share of firms using CRM systems in each country and year, while the job-quality outcomes are measured at the individual level. It is therefore not possible to know whether individual workers actually use a CRM system, how frequently they use it or which specific functions are implemented within their organization. Two firms classified as CRM users may in fact use these systems in very different ways, either as coordination and support tools or as instruments for standardization and performance monitoring. The measure used in this analysis therefore captures the overall diffusion of CRM systems within the national economic context rather than the individual exposure of workers to the organizational mechanisms associated with these technologies.

The aggregated nature of the CRM variable also implies that it is not possible to fully distinguish its diffusion from other digitalization processes taking place during the same period. Countries experiencing a greater diffusion of CRM systems may simultaneously experience a greater adoption of other management software, changes in work organization or changes in the sectoral composition of employment. The use of individual-level controls, fixed effects where applicable, and additional robustness analyses helps reduce the influence of some of these differences, but it cannot completely rule out the presence of omitted variables.

The direction of the relationship cannot be established with certainty either. On the one hand, a greater diffusion of CRM systems may contribute to changes in working conditions. On the other hand, CRM systems may spread more rapidly in countries, sectors or organizations already characterized by particular forms of coordination, levels of autonomy or work pressure. In the absence of an exogenous source of variation in CRM adoption, such as a policy reform, a clearly identifiable technological shock or a valid instrumental variable, the estimated coefficients cannot be interpreted as causal effects.

Finally, statistical inference must also take into account the relatively limited number of countries included in the different specifications. Although standard errors are clustered at the country level to account for the dependence among observations belonging to the same country, the precision of the estimates may still be affected by the number of clusters and by the composition of the sample. This aspect is particularly relevant for the outcomes available only in some ESS waves and for the institutional models, where the merge with the ICTWSS data further reduces the number of country-year observations. Statistical significance is therefore interpreted together with the magnitude of the estimated coefficients, their stability across different specifications and their consistency with the theoretical mechanisms developed in Chapter 3, avoiding an interpretation based exclusively on conventional significance thresholds.

Overall, the empirical strategy makes it possible to identify systematic relationships between the diffusion of CRM systems and different dimensions of job quality while controlling for a wide range of individual and contextual characteristics. At the same time, the results should be interpreted as observational evidence on the relationship between CRM diffusion and job quality rather than as a causal estimate of the consequences of individual CRM use. The next chapter presents the empirical results, distinguishing between the baseline associations, the institutional moderation analysis and the heterogeneous effects by education and gender.

Table 5.1 — Summary of the Empirical Strategy

Hypothesis	Outcome(s)	Model	Moderator	Robustness
H1a	Work fatigue	Baseline model	—	Ordered logit; Additional controls
H1b	Work fatigue	Interaction model	Lower-educated routine customer-facing status	Ordered logit; marginal effects; country-FE robustness
H2	Organizational autonomy; Temporal autonomy	OLS; interaction model	Low-educated routine customer-facing status	Organizational controls; ordered logit; specifications without year fixed effects; country-FE interaction specification for temporal autonomy
H3.1	Work fatigue	Interaction model	Institutional indicators	Alternative institutional measures; ordered logit
H3.2	Organizational autonomy	Interaction model	Institutional indicators	Alternative institutional measures; ordered logit; specification without year fixed effects; country-FE robustness
H3.3	Temporal autonomy	Interaction model	Institutional indicators	Alternative institutional measures; ordered logit
H4.1	Work fatigue	Interaction model	Non-tertiary education	Alternative education specifications; ordered logit; country-FE interaction specification
H4.2	Organizational autonomy	Interaction model	Non-tertiary education	Alternative education specifications; ordered logit; specifications without year fixed effects
H4.3	Temporal autonomy	Interaction model	Non-tertiary education	Alternative education specifications; ordered logit; country-FE interaction specification
H5.1	Work fatigue	Interaction model	Gender	Ordered logit; country-FE interaction specification
H5.2	Organizational autonomy	Interaction model	Gender	Ordered logit; specifications without year fixed effects
H5.3	Temporal autonomy	Interaction model	Gender	Ordered logit; country-FE interaction specification

Note: *The table summarizes the empirical strategy adopted to test hypotheses H1a–H1b, H2, H3.1–H3.3, H4.1–H4.3 and H5.1–H5.3. Individual-level control variables are included in all specifications, while robustness analyses vary across hypotheses according to the corresponding empirical specification. Further details are provided in Sections 5.1–5.4.*

6. Results

6.1 Overview of the Empirical Results

This chapter presents the results of the empirical analysis on the relationship between the diffusion of CRM systems and the different dimensions of job quality. Consistent with the empirical strategy described in Chapter 5, the results are organized around the hypotheses developed in Chapter 3. The analysis first examines the relationship between CRM adoption and *work fatigue*, considering both the general association (H1a) and its heterogeneity among lower-educated workers employed in routine customer-facing occupations (H1b), and then considers its association with workers' organizational and temporal autonomy (H2). The following sections examine whether these relationships vary depending on the institutional context (H3.1-H3.3), workers' level of education (H4.1-H4.3) and gender (H5.1-H5.3).

For each hypothesis, the empirical evidence is presented progressively. The analysis starts from the main specification and then introduces the interaction terms needed to examine the presence of heterogeneous or moderating effects. The robustness checks are presented afterwards, making it possible to evaluate whether the estimated relationships remain stable after the inclusion of additional individual and work-related characteristics or, where appropriate, alternative measures of the moderating variables. This structure makes it possible to distinguish the main relationship from the additional evidence provided by the interaction terms and the robustness analyses.

The empirical specifications follow the approach described in Chapter 5. The main models are estimated using OLS regressions, with the inclusion of country and year fixed effects depending on the variation available for the outcome considered. In the baseline and individual-level heterogeneity specifications, country fixed effects are included for outcomes observed across multiple ESS waves, where repeated observations for the same countries make it possible to exploit within-country variation over time. For outcomes available only in the 2020 ESS wave, the specifications are cross-sectional and country fixed effects are not included, since the relevant variation is necessarily between countries. Standard errors are clustered at the country level to account for the possible correlation among observations belonging to the same national context. The main institutional moderation specifications for H3.1-H3.3 do not include country fixed effects, while additional country fixed-effects robustness checks are estimated

for organizational autonomy. For work fatigue and temporal autonomy, which are observed only in 2020, the country-level institutional interactions cannot be separately identified once country fixed effects are included.

Throughout the chapter, the diffusion of CRM systems is measured using the standardized country-year indicator introduced in Chapter 4. The corresponding coefficient therefore represents the change in the outcome associated with a one-standard-deviation increase in the diffusion of CRM systems. Particular attention is devoted to the interaction terms, which indicate whether the relationship between CRM adoption and the outcome differs across worker groups or institutional contexts. Whenever useful, the regression tables are accompanied by figures showing predicted values or conditional relationships, making the interpretation of the estimated effects more immediate.

Finally, the results should be interpreted as conditional associations rather than causal effects. As discussed in Chapter 5, the observational nature of the data and the measurement of CRM adoption at the country-year level do not make it possible to identify the causal effect of CRM adoption on individual workers. The objective of the analysis is therefore to examine whether the empirical regularities observed are consistent with the theoretical expectations developed in Chapter 3 and whether these relationships remain sufficiently stable across the different specifications considered.

6.2 CRM Adoption and *Work Fatigue*

The first part of the analysis examines the relationship between the diffusion of CRM systems and work fatigue, used as an indicator of the strain associated with work intensification. As discussed in Chapter 3, the greater availability of information on work activities, the systematic recording of customer interactions and the possibility of translating this information into comparable indicators may increase the visibility of workers' behavior and facilitate more systematic forms of monitoring and performance evaluation. From this perspective, H1a predicts a positive relationship between the diffusion of CRM systems and work fatigue. H1b predicts that this relationship is stronger among lower-educated workers employed in routine customer-facing occupations.

The analysis of *work fatigue* has a specific feature compared with the other outcomes considered in this chapter. In the sample used for the analysis, this variable is available only for

the year 2020. As a result, the analysis has a cross-sectional structure. Since CRM adoption is measured at the country-year level, each country has a single CRM-adoption value in the 2020 analytical sample. Country fixed effects are therefore not included in the main H1a and H1b specifications, because the main CRM coefficient would be perfectly collinear with the country indicators and could not be separately identified. Year fixed effects are not included because all observations belong to the same year. Standard errors are instead clustered at the country level to account for the possible correlation among observations belonging to the same national context. The baseline specification is estimated on a sample of 14,146 workers distributed across 17 countries.

Table 6.1 — CRM Adoption and Work Fatigue

	(1) Baseline	(2) Interaction	(3) Model 3	(4) Model 4	(5) Model 5	(6) Model 6
CRM adoption, standardized z-score	-0.034	-0.039*	-0.025	-0.028	-0.032	-0.032
	(0.022)	(0.021)	(0.018)	(0.019)	(0.018)	(0.018)
Lower-educated routine customer-facing status		-0.071*	-0.077**	-0.072**	-0.104***	-0.103***
		(0.034)	(0.032)	(0.033)	(0.033)	(0.032)
CRM × Routine customer		0.053*	0.050*	0.064**	0.066**	0.067**
		(0.028)	(0.028)	(0.027)	(0.027)	(0.027)
Individual/job controls	Yes	Yes	Yes	Yes	Yes	Yes
Weekly hours	No	No	Yes	Yes	Yes	Yes
Temporary contract	No	No	No	Yes	Yes	Yes
Sector FE	No	No	No	No	Yes	Yes
Internet use	No	No	No	No	No	Yes
Observations	14146	14146	12648	11582	11300	11287
R-squared	0.044	0.045	0.048	0.047	0.065	0.065

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Notes: *OLS estimates. Cluster-robust standard errors at the country level are reported in parentheses. Individual and job controls include age, age squared, gender, years of education, income feeling, establishment size and supervisory status. Country fixed effects are not included in the specifications reported in this table; an additional interaction specification including country fixed effects is reported in Appendix Table A.1. In that specification, the main CRM-adoption coefficient is not separately identified because CRM adoption is constant within countries in the 2020 analytical sample. Year fixed effects are not applicable because all observations belong to the same year. Columns (3)–(6) progressively add weekly working hours, temporary-contract status, sector fixed effects and internet use, respectively.*

The baseline specification, reported in the first column of Table 6.1, does not provide evidence in support of the positive relationship predicted by H1a. The coefficient associated with the standardized diffusion of CRM systems is equal to −0.034 and is not statistically significant at conventional levels ($p = 0.135$). Considering the full sample and holding constant the individual and work-related characteristics included in the model, there is therefore no evidence of a

general positive relationship between a greater diffusion of CRM systems and higher levels of *work fatigue*.

This first result does not support H1a. However, H1b focuses specifically on heterogeneity among lower-educated workers employed in routine customer-facing occupations. As discussed in Chapter 3, the theoretical mechanism suggests that the consequences associated with the greater visibility and standardization made possible by CRM systems may be particularly relevant in occupations characterized by routine tasks and direct customer interaction. To examine this possibility, the following specification introduces an interaction between CRM adoption and the indicator identifying lower-educated workers employed in routine customer-facing occupations.

As shown in the second column of Table 6.1, the interaction coefficient between CRM adoption and belonging to this occupational group is positive and equal to 0.053, with a p-value of 0.071. Although the point estimate is in the direction predicted by H1b, the difference between the two groups does not reach the conventional 5% significance threshold and its 95% confidence interval includes zero. The marginal effects also show no statistically significant association between CRM adoption and work fatigue within either occupational group (see Appendix Table A.2). Overall, the results do not provide convincing evidence that the CRM–fatigue relationship is stronger among lower-educated workers in routine customer-facing occupations.

Figure 6.1 — Marginal Effects of CRM Adoption on Work Fatigue by Occupational Group



Notes: *Points report the marginal effect of standardized CRM adoption on work fatigue for each occupational group, estimated from the H1b OLS interaction model. Vertical bars represent 95% confidence intervals. The horizontal line indicates a marginal effect of zero. The model includes individual and job controls and country-clustered standard errors.*

The following specifications examine whether this result remains stable after progressively introducing additional controls. After controlling for weekly working hours, the interaction coefficient remains positive and is equal to 0.050, reaching statistical significance at the 10% level (p = 0.089). In the specification that additionally controls for contract type, the coefficient is equal to 0.064 and is statistically significant at the 5% level (p = 0.031). Once sector fixed effects are also included, the interaction remains positive and is equal to 0.066 (p = 0.024). The result remains essentially unchanged in the final specification, which additionally controls for the frequency of Internet use: the interaction coefficient is equal to 0.067 and remains statistically significant at the 5% level (p = 0.024).

The robustness checks therefore provide a more nuanced picture than the one emerging from the baseline specification alone. The interaction term remains positive and statistically significant at least at the 10% level across all specifications. In particular, in the specification that additionally controls for contract type, the difference between the two groups is statistically significant at the 5% level and remains significant after the inclusion of sector fixed

effects and the control for Internet use. By contrast, the main coefficient associated with CRM adoption remains negative across all specifications and never reaches statistical significance at the 5% level. Together with the baseline result, this provides no evidence in support of the generalized positive relationship predicted by H1a.

As an additional check, the models were also estimated using an *ordered logit* specification, taking into account the ordinal nature of the *work fatigue* scale, which ranges from 1 to 5. This specification also produces a pattern consistent with the one observed using OLS. In the model including the interaction term, the interaction between CRM adoption and belonging to the lower-educated routine customer-facing group is positive and statistically significant at the 5% level ($\beta = 0.114$; $p = 0.043$). The positive and statistically significant interaction in the ordered logit specification therefore provides additional evidence on the direction of the estimated relationship, although it does not alter the lack of convincing evidence of a difference between the two groups in the main specification. Full estimates are reported in Appendix Table A.1.

As an additional robustness check, the interaction model is also estimated including country fixed effects. Since CRM adoption is constant within countries in the 2020 sample, its main coefficient is perfectly collinear with the country fixed effects and cannot be estimated separately. The interaction between CRM adoption and lower-educated routine customer-facing status, however, remains identifiable and is positive and statistically significant at the 10% level ($\beta = 0.029$; $p = 0.071$). This result provides additional evidence in the predicted direction, although it does not alter the lack of convincing evidence of a difference between the two groups in the main specification. Full estimates are reported in Appendix Table A.1.

Overall, the results for H1a and H1b should therefore be interpreted separately. The analysis does not provide support for the expectation of a generalized positive relationship between the diffusion of CRM systems and work fatigue, as predicted by H1a. For H1b, although the estimated difference between the two groups is in the predicted direction and reaches statistical significance in some robustness specifications, the main specification and the marginal effects do not provide convincing evidence of a difference in the CRM–fatigue relationship between lower-educated routine customer-facing workers and the rest of the sample. H1b is therefore not supported. Given the cross-sectional nature of the analysis and the relatively limited number of country clusters, these findings should nevertheless be interpreted as associational evidence rather than estimates of a causal effect.

6.3 CRM Adoption and Workers' Perceived Autonomy

The second hypothesis examines the relationship between the diffusion of CRM systems and workers' perceived autonomy. As discussed in Chapter 3, the use of digital systems for customer relationship management does not necessarily imply a uniform reduction in workers' discretion. The greater availability of information and the centralization of data may facilitate the coordination of activities and access to the information needed to carry out daily work, increasing, in some cases, workers' ability to organize their tasks more independently. At the same time, the greater traceability of work activities and the standardization of processes may limit other forms of discretion, particularly those related to the management of working time. For this reason, the analysis distinguishes between *organizational autonomy* and *temporal autonomy*, considering them as two different dimensions of workers' autonomy. H2 predicts a positive association between CRM adoption and organizational autonomy and a negative association with temporal autonomy.

Unlike *work fatigue*, the measure of *organizational autonomy* is available for several ESS rounds. The analysis therefore uses a pooled repeated cross-sectional structure, with different individuals surveyed in each ESS round. The baseline specification can therefore exploit the time dimension of the data and includes country and year fixed effects, together with the individual and work-related controls described in Chapter 5. Standard errors are clustered at the country level. For *temporal autonomy*, instead, the outcome is available only for the 2020 ESS wave. The analysis therefore has a cross-sectional structure, with CRM adoption varying across countries but not within countries over time. Country fixed effects are not included in the baseline temporal-autonomy specifications because CRM adoption is constant within countries in the 2020 sample and its main coefficient would therefore not be separately identified. However, they are introduced as a robustness check in the interaction specification, where the interaction between CRM adoption and lower-educated routine customer-facing status remains identifiable. Year fixed effects are not applicable because all observations refer to the same year. Standard errors remain clustered at the country level.

Table 6.2 — CRM Adoption and Workers' Autonomy: Baseline, Interaction and Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)
	Organizational autonomy			Temporal autonomy		
	Baseline	Interaction	Robustness	Baseline	Interaction	Robustness
CRM adoption, standardized z-score	0.182*	0.179*	0.324***	0.071***	0.070***	0.069***
	(0.090)	(0.089)	(0.095)	(0.021)	(0.022)	(0.019)
Low-educated routine customer-facing workers		-0.235***	-0.227**		-0.131***	-0.101***
		(0.073)	(0.082)		(0.024)	(0.023)
Low-educated routine customer-facing workers x CRM adoption, standardized z-score		0.102	0.118		0.000	0.003
		(0.064)	(0.071)		(0.021)	(0.021)
Individual/job controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	No	No	No
Year FE	Yes	Yes	Yes	No	No	No
Weekly hours	No	No	Yes	No	No	No
Sector FE	No	No	Yes	No	No	Yes
Internet use	No	No	Yes	No	No	Yes
Observations	92809	92809	66241	14106	14106	13755
R-squared	0.249	0.249	0.269	0.187	0.189	0.235

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

Notes: *OLS estimates. Cluster-robust standard errors at the country level are reported in parentheses. Individual and job controls include age, age squared, gender, years of education, income feeling, establishment size and supervisory status. Country and year fixed effects are included in the organizational-autonomy specifications. Country fixed effects are not included in the temporal-autonomy specifications because CRM adoption is constant within countries in the 2020 sample and its main coefficient would therefore not be separately identified. Year fixed effects are not applicable because all observations refer to the same year. The robustness specifications additionally include sector fixed effects and internet use. The organizational-autonomy robustness specification also includes weekly working hours.*

6.3.1 Organizational Autonomy

The results for organizational autonomy are consistent with the direction predicted by H2. In the specification including the interaction term, the coefficient associated with the standardized diffusion of CRM systems is positive and statistically significant at the 10% level, although it does not reach the conventional 5% threshold (β = 0.179; p = 0.054). For the reference group, a one-standard-deviation increase in the diffusion of CRM systems is therefore associated with an increase of approximately 0.18 points in the perceived organizational autonomy scale, holding constant the other characteristics included in the model.

This result suggests that a greater diffusion of CRM systems is not associated with lower levels of workers' discretion in the organization of their daily activities. On the contrary, for this dimension of autonomy a positive relationship emerges. This evidence is consistent with the

mechanism discussed in Chapter 3, according to which the greater availability of information and the coordination made possible by digital systems may increase workers' ability to organize their activities, even when work becomes more visible.

Given that CRM-related processes are expected to be particularly relevant to the daily activities of lower-educated workers in routine customer-facing occupations, the analysis also examines, as an extension of H2, whether the CRM–organizational autonomy relationship differs for this specific group. This differs from the educational heterogeneity examined in H4.2, which compares workers by educational attainment independently of their occupational group. The interaction between CRM adoption and lower-educated routine customer-facing status, however, does not show a statistically significant difference between the two groups. The interaction coefficient is positive, equal to 0.102, but has a *p*-value of 0.124. The baseline specification therefore does not provide evidence that the positive relationship between CRM adoption and organizational autonomy is significantly different for lower-educated workers employed in routine customer-facing occupations. A separate additive specification, including CRM adoption and lower-educated routine customer-facing status without their interaction, indicates that workers in this group report lower levels of perceived organizational autonomy. Holding CRM adoption and the remaining individual and work-related characteristics constant, lower-educated routine customer-facing status is associated with approximately 0.253 points lower organizational autonomy ($p = 0.002$).

The robustness check confirms the positive relationship between CRM adoption and organizational autonomy. In the specification additionally including weekly working hours, sector fixed effects and Internet use, the CRM coefficient remains positive and statistically significant at the 1% level ($\beta = 0.324$).

The specifications that additionally include variables such as perceived management support, team integration and availability outside normal working hours are restricted to the 2020 sample because of the availability of these variables and should therefore be interpreted with greater caution, given the substantial reduction in sample size. These variables are introduced as additional robustness controls to assess whether the estimated relationship between CRM adoption and organizational autonomy is sensitive to the inclusion of further work-organization characteristics. In the corresponding additive specifications without the interaction term, the CRM coefficient remains positive and statistically significant after adding managerial support

(β = 0.499; p < 0.001), team integration (β = 0.478; p < 0.001), and outside-work responsiveness (β = 0.456; p < 0.001) (see Appendix Table A.3). In the corresponding interaction specifications, a positive and statistically significant interaction between CRM adoption and low-educated routine customer-facing status also emerges. For example, after including *team integration*, the interaction coefficient reaches 0.419 (p = 0.009), while in the most complete specification it is equal to 0.372 (p = 0.005). However, the number of observations falls to 10,459 and 9,745 respectively, compared with more than 92,000 observations in the baseline specification. These results therefore provide additional evidence, but they are not sufficient to conclude that the heterogeneous relationship across occupational groups represents a general and robust finding.

The positive relationship is also confirmed using an *ordered logit* model, estimated as a robustness check to account for the ordinal nature of the outcome. In this specification, the coefficient associated with the diffusion of CRM systems is positive and statistically significant (β = 0.105; p = 0.037). Although the coefficient cannot be directly compared in magnitude with the OLS estimate, the result confirms the positive sign of the relationship and indicates that the evidence does not depend exclusively on the use of a linear specification.

Finally, the conclusions remain unchanged when the organizational-autonomy specifications are re-estimated without year fixed effects, while retaining country fixed effects and the remaining controls. The CRM coefficient remains positive and statistically significant at the 10% level in both the baseline specification (β = 0.071; p = 0.067) and the interaction specification (β = 0.064; p = 0.097). The interaction with lower-educated routine customer-facing status also remains positive but statistically non-significant (β = 0.094; p = 0.154) (see Appendix Table A.8).

Overall, the results for organizational autonomy provide relatively consistent evidence of a positive relationship with the diffusion of CRM systems. This relationship emerges in the baseline specification, remains positive throughout the main robustness checks and is confirmed by the *ordered logit* model. By contrast, the main sample does not provide evidence of a systematic difference in this relationship for lower-educated routine customer-facing workers.

6.3.2 Temporal Autonomy

Contrary to the direction predicted by H2, the results for temporal autonomy reveal a positive relationship between CRM adoption and workers' control over their working time. In the baseline specification, the coefficient associated with CRM adoption is positive and statistically significant ($\beta = 0.071$; $p = 0.004$). Since CRM adoption is standardized, a one-standard-deviation increase in CRM adoption is associated with a 0.071-point increase in temporal autonomy, holding constant the individual and job-related characteristics included in the model. Unlike the organizational-autonomy models, this specification exploits cross-country variation within the 2020 ESS wave and therefore does not include country or year fixed effects.

The interaction model provides a very similar result to the baseline specification with respect to the CRM coefficient. The coefficient associated with CRM adoption remains positive and statistically significant ($\beta = 0.070$; $p = 0.006$). A separate additive specification, including CRM adoption and lower-educated routine customer-facing status without their interaction, indicates that low-educated routine customer-facing workers report lower levels of perceived temporal autonomy ($\beta = -0.131$; $p < 0.001$). However, the interaction between CRM adoption and lower-educated routine customer-facing status is very small and statistically non-significant ($\beta = 0.000$; $p = 0.995$). The results therefore do not indicate that the relationship between CRM diffusion and temporal autonomy differs systematically between low-educated routine customer-facing workers and the rest of the sample.

The positive relationship between CRM adoption and temporal autonomy is also robust to the inclusion of additional controls. In the specification including sector fixed effects and Internet use, the CRM coefficient remains positive and statistically significant ($\beta = 0.069$; $p = 0.002$), while the interaction remains small and statistically non-significant ($\beta = 0.003$; $p = 0.899$). The robustness specification therefore reinforces the main result: greater CRM diffusion is positively associated with temporal autonomy, but there is no evidence that this relationship is significantly stronger or weaker among low-educated routine customer-facing workers.

The ordered logit specification provides an additional robustness check by explicitly accounting for the ordinal nature of the temporal-autonomy measure. The coefficient associated with CRM adoption remains positive and statistically significant ($\beta = 0.197$; $p = 0.001$), leading to the same substantive conclusion as the baseline OLS model. The

consistency across the linear and ordinal specifications therefore strengthens the evidence that the positive association between CRM adoption and temporal autonomy is not driven solely by the use of OLS for a three-category outcome.

As an additional robustness check, the interaction specification is re-estimated including country fixed effects. Since CRM adoption is constant within countries in the 2020 sample, its main coefficient is absorbed by the country fixed effects, while the interaction with lower-educated routine customer-facing status remains identifiable. The interaction is negative but statistically non-significant ($\beta = -0.021$; $p = 0.262$). This result provides no evidence that the relationship between CRM adoption and temporal autonomy differs systematically for lower-educated routine customer-facing workers after accounting for time-invariant differences across countries (see Appendix Table A.8).

Overall, the temporal-autonomy results complement the evidence obtained for organizational autonomy. CRM diffusion is positively associated with both dimensions of autonomy, although the two results should be interpreted in light of their different empirical designs. For organizational autonomy, the association is estimated using observations across multiple ESS waves and remains positive after accounting for country and year fixed effects. For temporal autonomy, by contrast, the analysis is restricted to the 2020 cross-section and the positive association therefore reflects differences across countries rather than within-country changes over time. In neither case does the interaction with low-educated routine customer-facing status provide evidence that the association between CRM adoption and autonomy differs significantly for this group.

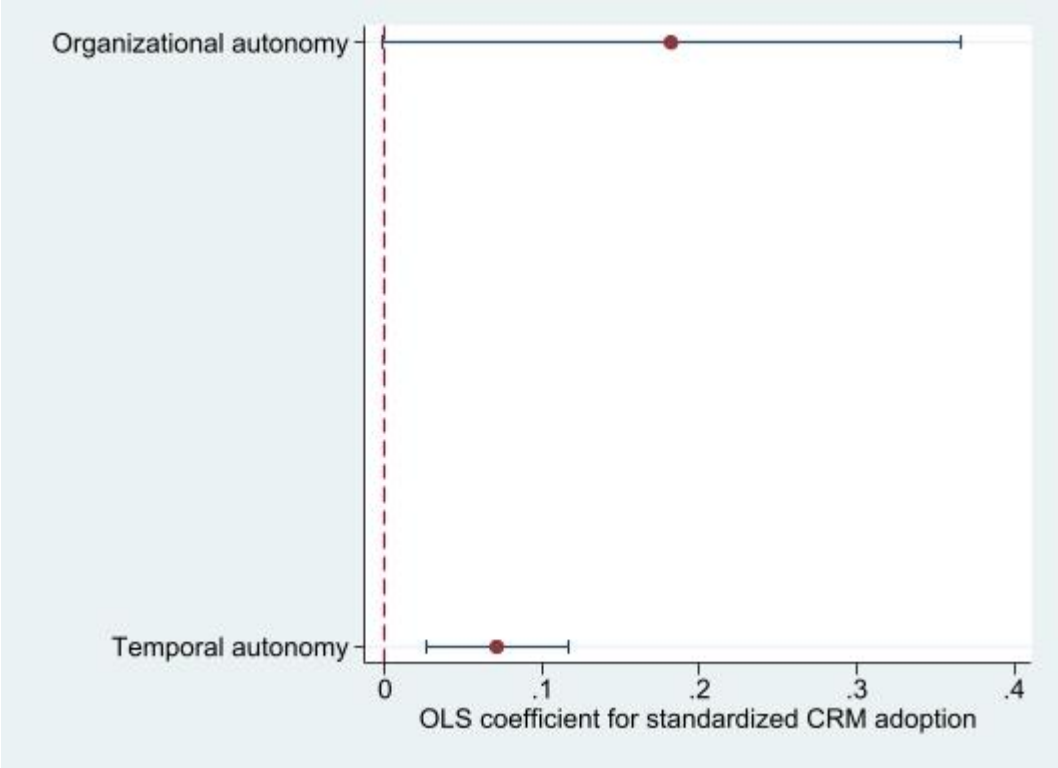
6.3.3 Overall Assessment of H2

Taken together, the results indicate a positive association between CRM diffusion and both dimensions of perceived autonomy considered in the analysis. Figure 6.2 summarizes this pattern by comparing the estimated CRM coefficients for organizational and temporal autonomy in the baseline specifications. In practical terms, greater CRM diffusion may facilitate workers' access to customer information, reduce the need to repeatedly request information from supervisors or colleagues, and make the coordination of everyday activities more immediate. For example, a worker using a shared customer-management system may be able to retrieve previous interactions, update information or organize follow-up activities without waiting for direct instructions. This interpretation is consistent with the coordination

mechanism discussed in Chapter 3, according to which digital information systems may increase workers' discretion over how daily tasks are organized.

The positive association found for temporal autonomy is contrary to the direction predicted by H2, although it should be interpreted more cautiously. One possible interpretation of this unexpected result is that greater access to shared and standardized information may, in some work settings, also make it easier to organize when certain activities are performed, for instance by reducing dependence on immediate coordination with other organizational actors. At the same time, the two results are based on different empirical settings: organizational autonomy is observed across multiple ESS waves and is estimated with country and year fixed effects, whereas temporal autonomy is available only for 2020. Figure 6.2 should therefore be read as showing a common positive pattern across the two dimensions rather than as evidence that CRM diffusion affects them in exactly the same way. Overall, H2 is therefore partially supported: the positive association with organizational autonomy is consistent with the hypothesized direction, while the positive association with temporal autonomy is contrary to the negative relationship predicted by H2.

Figure 6.2 — Estimated Association between CRM Adoption and Organizational and Temporal Autonomy



Note: *Points report OLS coefficients for standardized CRM adoption from the H2 baseline specifications. Horizontal lines represent 95% confidence intervals. The vertical dashed line indicates a coefficient of zero. Both models include individual and job controls and use country-clustered standard errors. Country and year fixed effects are included in the organizational-autonomy specification. Temporal autonomy is observed only in the 2020 ESS wave; year fixed effects are therefore not applicable, while country fixed effects are omitted from the baseline specification because they would absorb the country-level CRM main effect.*

6.4 The Moderating Role of Labor Market Institutions

Hypotheses H3.1–H3.3 examine whether the relationship between the diffusion of CRM systems and job quality varies depending on the institutional context in which firms operate. As discussed in Chapter 3, the greater availability of information on workers' activities does not necessarily translate into the same level of monitoring and work pressure in every country. In countries characterized by higher collective bargaining coverage and stronger trade union representation, the information generated by digital systems may be subject to stronger constraints, negotiated procedures and greater transparency requirements. As a result, stronger labor market institutions are expected to weaken the positive association between CRM adoption and work fatigue, strengthen the positive association with organizational autonomy, and weaken the negative association with temporal autonomy.

The analysis considers two country-year indicators of labor market institutions: bargaining coverage, measuring the share of workers covered by collective agreements, and union density, measuring the share of workers who are trade union members. Both variables are standardized and are interacted separately with the standardized CRM adoption indicator. Bargaining coverage is the main institutional variable used to test H3.1–H3.3, while union density is used as an alternative measure of the strength of labor market institutions. The main H3.1–H3.3 specifications do not include country fixed effects, since the purpose of the analysis is to exploit the variation in labor market institutions across countries. As an additional robustness check, country fixed effects are included for organizational autonomy, for which the interaction terms remain identifiable across multiple ESS waves. The same specification cannot identify the institutional interactions for work fatigue and temporal autonomy, which are observed only in 2020. Year fixed effects are retained where applicable, together with the individual-level controls, while standard errors continue to be clustered at the country level.

Table 6.3 — Institutional Moderation of the Association between CRM Adoption and Work Fatigue

	(1) OLS: Bargaining	(2) OLS: Union density	(3) OLogit: Bargaining	(4) OLogit: Union density
CRM adoption	0.114**	0.134***	0.248***	0.293***
	(0.029)	(0.006)	(0.051)	(0.004)
Bargaining coverage	-0.022		-0.048	
	(0.018)		(0.034)	
Union density		0.014		0.011
		(0.085)		(0.169)
CRM × Bargaining coverage	-0.060**		-0.113***	
	(0.016)		(0.032)	
CRM × Union density		-0.145*		-0.272**
		(0.065)		(0.125)
Individual/job controls	Yes	Yes	Yes	Yes
Analytical weights	Yes	Yes	Yes	Yes
Observations	5,248	5,248	5,248	5,248

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: *OLS and ordered logit estimates. Cluster-robust standard errors at the country level are reported in parentheses. All specifications use ESS analytical weights. Individual and job controls include age, age squared, gender, years of education, income feeling, establishment size and supervisory status. Bargaining coverage and union density are standardized country-level measures. The sample is restricted to 2020 because work fatigue is available only in that ESS wave. Year fixed effects are therefore not applicable. Country fixed effects are not included because CRM adoption, the institutional indicators and their interaction terms are constant within countries in the 2020 sample and cannot be separately identified once country fixed effects are introduced.*

6.4.1 Collective Bargaining and Work Fatigue

The results for bargaining coverage are consistent with H3.1. In the baseline specification, the interaction between CRM adoption and collective bargaining coverage is negative and statistically significant (β = −0.060; p = 0.014). Since both variables are standardized, a one-standard-deviation increase in bargaining coverage, corresponding to approximately 30 percentage points in the original measure, is associated with a 0.060-point reduction in the estimated change in work fatigue associated with a one-standard-deviation increase in CRM adoption, corresponding to approximately 7.8 percentage points in the original measure.

The marginal effects further clarify this pattern. The estimated association between CRM adoption and work fatigue decreases from 0.175 at one standard deviation below the mean of bargaining coverage to 0.114 at the mean and 0.054 at one standard deviation above the mean. The association is statistically significant at low and average levels of bargaining coverage (p = 0.005 and p = 0.010, respectively), but not at high levels (p = 0.111) (see Appendix Table A.5).

The negative interaction is consistent with the mechanism discussed in Chapter 3. In countries with higher collective bargaining coverage, the positive relationship between CRM adoption and work fatigue is less pronounced. This result suggests that stronger labor market institutions may reduce some of the pressure associated with the greater monitoring and visibility made possible by CRM systems. At the same time, it does not imply that collective bargaining removes this relationship completely. Rather, it suggests that its intensity changes depending on the institutional context.

The ordered logit specification confirms this result. The interaction between CRM adoption and bargaining coverage remains negative and statistically significant ($\beta = -0.113$; $p < 0.001$). Although the coefficients cannot be directly compared with those estimated using OLS, the result confirms both the direction and the statistical significance of the interaction. It therefore suggests that the moderating role of collective bargaining does not depend on the estimation method.

6.4.2 Union Density and Work Fatigue

Using union density as an alternative measure of labor market institutions leads to a similar result, although the evidence is weaker than for bargaining coverage. The interaction between CRM adoption and union density is negative ($\beta = -0.145$), consistent with the hypothesis that stronger labor market institutions weaken the relationship between CRM adoption and work fatigue. However, the corresponding p-value is 0.076. The interaction is therefore statistically significant at the 10% level, but it does not reach the conventional 5% significance threshold. The coefficient associated with CRM adoption remains positive and statistically significant ($\beta = 0.134$; $p < 0.001$).

The ordered logit specification confirms the same pattern. The interaction between CRM adoption and union density remains negative and becomes statistically significant at the 5% level ($\beta = -0.272$; $p = 0.030$), while the coefficient associated with CRM adoption remains positive and statistically significant ($\beta = 0.293$; $p < 0.001$). Although the coefficients cannot be directly compared with those estimated using OLS, the result confirms both the direction and the statistical significance of the interaction.

Overall, the results obtained using union density are consistent with those based on bargaining coverage. The evidence is weaker in the OLS specification, but the interaction remains in the

expected direction and becomes statistically significant in the ordered logit model. Taken together, the two institutional indicators therefore suggest that the relationship between CRM adoption and work fatigue becomes weaker as labor market institutions become stronger.

The sample-composition robustness check provides a more qualified picture. When bargaining coverage is estimated using its larger available sample of 8 countries (N = 7,238), the interaction remains negative but is no longer statistically significant (β = −0.082; p = 0.446). By contrast, using the larger available sample for union density, covering 11 countries (N = 9,717), the interaction is negative and statistically significant (β = −0.217; p = 0.001). The direction of the estimated moderation therefore remains consistent with H3.1 across both indicators, but its statistical strength is sensitive to the institutional measure and the composition of the available country sample (see Appendix Table A.12).

6.4.3 Autonomy

To examine the moderating role of labor market institutions for the dimensions of autonomy considered in H2, the same interaction terms are estimated using o*rganizational autonomy* and *temporal autonomy* as outcomes. These analyses constitute the tests of H3.2 and H3.3, respectively.

For organizational autonomy, the results do not provide evidence of a systematic moderating role of bargaining coverage. The interaction between CRM adoption and bargaining coverage is close to zero and not statistically significant in the OLS specification (β = 0.002; p = 0.991). The same result emerges from the ordered logit model (β = 0.012; p = 0.911). Similar evidence is found when union density is considered. The interaction is positive, but it does not reach conventional levels of statistical significance (β = 0.428; p = 0.113 in the OLS model and β = 0.284; p = 0.078 in the ordered logit model). Overall, the results do not provide evidence that labor market institutions systematically modify the relationship between CRM adoption and organizational autonomy. The same conclusion emerges when year fixed effects are excluded: the interaction remains statistically non-significant both for bargaining coverage (β = 0.050; p = 0.766) and for union density (β = 0.407; p = 0.203). This conclusion is also confirmed by the country fixed-effects robustness specifications. The interaction term remains statistically non-significant both for bargaining coverage (β = −0.104; p = 0.250) and for union density (β = −0.048; p = 0.576), indicating that the absence of systematic institutional moderation persists after accounting for time-invariant differences across countries (see Appendix Table A.4).

The results are different for temporal autonomy. The interaction between CRM adoption and bargaining coverage is positive and statistically significant in the OLS specification (β = 0.041; p = 0.045), and it remains positive and statistically significant in the ordered logit model (β = 0.124; p = 0.014). By contrast, the interaction with union density is not statistically significant either in the OLS specification (β = 0.045; p = 0.313) or in the ordered logit model (β = 0.126; p = 0.338).

These results suggest that *bargaining coverage* does not only weaken the relationship between CRM adoption and *work fatigue*, but it is also associated with a stronger positive relationship between CRM adoption and temporal autonomy. One possible interpretation is that, in contexts with broader collective bargaining coverage, working-time arrangements are more likely to be subject to collective regulation and negotiation, so that the coordination possibilities associated with CRM systems may translate more easily into greater flexibility over starting and finishing times rather than into tighter managerial control over working schedules. At the same time, this result should be interpreted with caution. The same pattern is not observed when union density is used as the institutional indicator.

6.4.4 Individual Trade Union Membership

As an additional analysis, the models are also estimated using individual trade union membership. Unlike *bargaining coverage* and *union density*, this variable does not describe the institutional context at the country level, but identifies the relationship between individual workers and trade union representation. This makes it possible to examine whether the relationship between CRM adoption and job quality differs across workers with different trade union membership status.

The results do not show a statistically significant moderating effect for *work fatigue*. Compared with the reference category, neither the interaction for workers who were previously trade union members (β = −0.028; p = 0.790) nor the interaction for workers who have never been trade union members (β = 0.065; p = 0.330) is statistically significant.

The same applies to temporal autonomy, where no statistically significant interaction emerges. For organizational autonomy, a positive interaction is observed for workers who were previously trade union members (β = 0.230; p = 0.064), which is statistically significant at the 10% level but not at the conventional 5% level. Overall, the results do not provide evidence that individual

trade union membership systematically modifies the relationship between CRM adoption and job quality.

6.4.5 Overall Assessment of H3.1-H3.3

Overall, the results provide partial support for H3.1, no support for H3.2, and partial support for H3.3. The clearest evidence concerns *bargaining coverage*. Higher collective bargaining coverage weakens the positive relationship between CRM adoption and *work fatigue*, and this result is confirmed both in the OLS and in the *ordered logit* specifications. *Union density* shows the same pattern, although the evidence is weaker in the OLS model and stronger in the *ordered logit* specification. The sample-composition robustness checks, however, show that the statistical strength of this moderation is sensitive to the institutional indicator and the available country sample. H3.1 should therefore be interpreted as partially supported rather than fully supported.

The results for autonomy provide a less clear picture. No systematic moderating effect emerges for organizational autonomy, and this conclusion remains unchanged in the specifications including country fixed effects. For temporal autonomy, the interaction with *bargaining coverage* is positive and statistically significant, but this result is not confirmed when *union density* is considered. Similarly, the analysis based on individual trade union membership does not show a clear and systematic pattern.

Overall, the results suggest that the moderating role of labor market institutions mainly concerns the strain dimension associated with the diffusion of CRM systems. In countries characterized by stronger labor market institutions, the positive relationship between CRM adoption and *work fatigue* is weaker. These results are consistent with the theoretical mechanism discussed in Chapter 3, but support differs across the three sub-hypotheses: H3.1 is partially supported for work fatigue, H3.2 is not supported for organizational autonomy, and H3.3 is only partially supported, since the predicted moderation for temporal autonomy emerges only when bargaining coverage is used as the institutional indicator.

6.5 Heterogeneity by Educational Level

Hypotheses H4.1–H4.3 examine whether the relationship between the diffusion of CRM systems and job quality differs depending on workers' level of education. As discussed in Chapter 3, these hypotheses are based on the idea that workers with lower levels of education

may be more exposed to the standardization and monitoring associated with the digitalization of organizational processes. H4.1 therefore predicts that the relationship between CRM adoption and work fatigue is stronger for workers with a lower level of education, H4.2 predicts that the positive association with organizational autonomy is weaker, and H4.3 predicts that the negative association with temporal autonomy is stronger for these workers. Accordingly, H4.1–H4.3 are tested separately for work fatigue, organizational autonomy and temporal autonomy.

To test these hypotheses, educational attainment is measured using the harmonized ES-ISCED classification. Respondents in categories 1–5 are classified as having non-tertiary education, while those in categories 6–7 constitute the tertiary-education reference group. In the analytical sample used for H4.1–H4.3, around 66% of workers belong to the non-tertiary education group. The main specification interacts this indicator with the standardized CRM adoption measure. Years of education are excluded from the main interaction models because they represent an alternative measure of the same educational dimension, and are instead used as a continuous moderator in a robustness specification. Country and year fixed effects are included in the models for organizational autonomy, whereas work fatigue and temporal autonomy are estimated using the 2020 cross-sectional sample. Standard errors are clustered at the country level.

Table 6.4 — Educational Heterogeneity in the Association between CRM Adoption and Job Quality

	(1) Fatigue: OLS	(2) Fatigue: Ordered logit	(3) Org. autonomy: OLS	(4) Org. autonomy: Ordered logit	(5) Temp. autonomy: OLS	(6) Temp. autonomy: Ordered logit
CRM adoption, standardized z-score	-0.0206	-0.0520	0.0905	0.0535	0.0813***	0.2076***
	(0.0192)	(0.0412)	(0.0827)	(0.0459)	(0.0252)	(0.0644)
Non-tertiary education	0.0531**	0.1111**	-0.9847***	-0.5563***	-0.2293***	-0.6730***
	(0.0250)	(0.0552)	(0.0728)	(0.0463)	(0.0280)	(0.0794)
Non-tertiary education x CRM adoption, standardized z-score	-0.0212	-0.0435	0.2065***	0.1197***	-0.0034	0.0234
	(0.0184)	(0.0398)	(0.0484)	(0.0330)	(0.0230)	(0.0607)
Individual/job controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	No	No
Year FE	No	No	Yes	Yes	No	No

Observations	14808	14808	94880	94880	14760	14760

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: *OLS and ordered logit estimates. Cluster-robust standard errors at the country level are reported in parentheses. Individual and job controls include age, age squared, gender, income feeling, establishment size and supervisory status. Non-tertiary education identifies respondents in ES-ISCED categories 1–5, while respondents in categories 6–7 constitute the tertiary-education reference group. Years of education are excluded from the main H4.1–H4.3 interaction specifications and are used instead as a continuous moderator in a separate robustness analysis. Country and year fixed effects are included in the organizational-autonomy specifications. Neither country nor year fixed effects are included in the work-fatigue and temporal-autonomy specifications, as these outcomes are available only in the 2020 ESS wave.*

6.5.1 Educational Level and Work Fatigue

The analysis of work fatigue does not provide evidence supporting H4.1, which predicts that the association between CRM diffusion and fatigue is stronger among workers with non-tertiary education. In the interaction specification reported in Table 6.4, the coefficient associated with CRM adoption is negative and statistically non-significant (β = −0.021; p = 0.298), while the interaction between CRM adoption and non-tertiary education is very close to zero and statistically non-significant (β = −0.021; p = 0.265). The estimated relationship between CRM diffusion and work fatigue therefore does not differ systematically between workers with tertiary and non-tertiary education.

The ordered logit specification leads to the same substantive conclusion. The coefficient associated with CRM adoption is negative and non-significant (β = −0.052; p = 0.207), while the interaction between CRM adoption and non-tertiary education is also negative and statistically non-significant (β = −0.044; p = 0.274). The absence of a significant interaction across both estimators indicates that educational level does not systematically moderate the relationship between CRM diffusion and work fatigue in the main specification. As an additional robustness check, the interaction model is re-estimated including country fixed effects. In this specification, the interaction between CRM adoption and non-tertiary education is negative and statistically significant (β = −0.031; p = 0.049), indicating heterogeneity in the opposite direction to that predicted by H4.1 (see Appendix Table A.10).

Overall, the results for work fatigue provide no support for the educational heterogeneity predicted by H4.1. The main and ordered logit specifications show no significant heterogeneity, while the country fixed-effects robustness check identifies a significant interaction in the opposite direction to the hypothesis. There is therefore no evidence that workers with non-tertiary education experience a stronger positive association between CRM diffusion and fatigue.

6.5.2 Educational Level and Organizational Autonomy

The analysis next examines educational heterogeneity in the relationship between CRM adoption and organizational autonomy. A markedly different pattern emerges for this outcome. Once educational heterogeneity is explicitly introduced, however, the results reveal a systematic difference between educational groups.

In the interaction model, the coefficient of the interaction term is positive and statistically significant (β = 0.206; $p < 0.001$). This indicates that the relationship between CRM adoption and organizational autonomy is stronger among workers with non-tertiary education than among workers with tertiary education. The result is also remarkably stable across the progressive robustness checks. After controlling for weekly working hours, the interaction coefficient is equal to 0.239 ($p < 0.001$). It remains positive and highly statistically significant after the inclusion of contract type (β = 0.259; p < 0.001) and, after sector fixed effects are introduced, the coefficient is equal to 0.238 ($p < 0.001$).

The robustness of this result is further supported by the *ordered logit* specification. After explicitly accounting for the ordinal nature of the organizational autonomy scale, the interaction between CRM adoption and non-tertiary education remains positive and statistically significant (β = 0.120; p < 0.001). Although the magnitude of this coefficient cannot be directly compared with the OLS estimates, the consistency of its sign and statistical significance provides additional evidence that the observed educational heterogeneity is not driven by the use of a linear estimator.

An additional sensitivity check excludes year fixed effects while retaining country fixed effects and the remaining baseline controls. The interaction remains positive and statistically significant in this alternative specification (β = 0.198; p < 0.001), further indicating that the result is not dependent on the inclusion of year fixed effects. At the same time, this specification is treated as a sensitivity analysis rather than as the main model, since organizational autonomy is observed across multiple years and the baseline specification therefore retains the available time fixed effects.

Importantly, this finding should not be interpreted as evidence that workers with non-tertiary education have higher levels of autonomy overall. The coefficient associated with low education itself is negative in the interaction models, indicating that these workers tend to

report lower organizational autonomy at the reference level of CRM adoption. The interaction instead shows that the positive relationship between CRM diffusion and organizational autonomy is stronger for workers with non-tertiary education.

One possible interpretation is that workers with non-tertiary education, who report lower levels of organizational autonomy at the reference level of CRM adoption, may have greater scope to benefit from the information centralization and coordination possibilities associated with CRM systems. In this case, easier access to shared information and more structured coordination may support the organization of daily tasks, particularly for workers who otherwise have less influence over how their work is organized.

To assess whether this pattern is related to occupational composition, an additional robustness check separates the ISCO 4–5 occupational component of the routine customer-facing measure from education. Non-tertiary workers are substantially more concentrated in these occupational groups (32.6% compared with 12.4% among tertiary-educated workers). However, the interaction between CRM adoption and non-tertiary education remains positive and statistically significant after accounting for occupational status ($\beta = 0.228$; $p < 0.001$). Moreover, the three-way interaction between CRM adoption, non-tertiary education and ISCO 4–5 occupational status is not statistically significant ($\beta = -0.097$; $p = 0.203$). This suggests that the stronger CRM–autonomy association among non-tertiary workers is not primarily driven by their greater concentration in these occupational groups (see Appendix Table A.6).

At this stage, the relevant empirical conclusion is that the organizational autonomy results provide clear evidence of educational heterogeneity, but in the opposite direction to that predicted by H4.2.

6.5.3 Educational Level and Temporal Autonomy

The analysis next examines educational heterogeneity in the relationship between CRM adoption and temporal autonomy. The results do not indicate that the relationship between CRM adoption and temporal autonomy differs systematically between workers with tertiary and non-tertiary education. In the interaction specification reported in Table 6.4, CRM adoption is positively and statistically significantly associated with temporal autonomy for the reference educational group ($\beta = 0.081$; $p = 0.005$). Non-tertiary education is negatively associated with

temporal autonomy (β = −0.229; p < 0.001), indicating that workers with non-tertiary education report lower levels of temporal autonomy at the reference level of CRM adoption.

The interaction between CRM adoption and non-tertiary education is close to zero and statistically non-significant in the OLS specification (β = −0.003; p = 0.884). This indicates that the positive association between CRM diffusion and temporal autonomy does not differ systematically between workers with tertiary and non-tertiary education. The results therefore provide no evidence of educational heterogeneity in the relationship between CRM adoption and temporal autonomy.

The ordered logit specification leads to the same substantive conclusion. The interaction between CRM adoption and non-tertiary education is positive but statistically non-significant (β = 0.023; p = 0.700). Although the magnitude of the ordered logit coefficient cannot be directly compared with the OLS estimate, the absence of a statistically significant interaction across both estimators provides no evidence that the relationship between CRM diffusion and temporal autonomy differs systematically between workers with tertiary and non-tertiary education.

As an additional robustness check, the interaction model is re-estimated including country fixed effects. Since CRM adoption is constant within countries in the 2020 sample, its main coefficient is absorbed by the country fixed effects, while the interaction with non-tertiary education remains identifiable. The interaction remains negative and statistically non-significant (β = −0.008; p = 0.713), providing no evidence of systematic educational heterogeneity in the CRM–temporal autonomy relationship (see Appendix Table A.10).

Overall, the evidence does not support the conclusion that educational attainment systematically moderates the relationship between CRM adoption and temporal autonomy. Both the OLS and the *ordered logit* specifications produce small and statistically non-significant interaction coefficients. There is therefore no evidence that the relationship between CRM adoption and temporal autonomy differs systematically between workers with tertiary and non-tertiary education.

6.5.4 Alternative Specifications of the Education Measure

The robustness of the results is further assessed using years of education as a continuous moderator. This alternative specification complements the main distinction between non-

tertiary and tertiary education by allowing the relationship between CRM adoption and job quality to vary continuously according to years of education. The specification is estimated separately for *work fatigue*, organizational autonomy and temporal autonomy.

For *work fatigue*, the continuous education specification does not provide evidence of educational heterogeneity. The interaction between CRM adoption and years of education is very small and statistically non-significant ($\beta = -0.00014$; $p = 0.961$). This result is consistent with the main specification based on educational attainment and indicates that the relationship between CRM adoption and *work fatigue* does not vary systematically with educational attainment.

For organizational autonomy, the continuous education specification confirms the pattern already identified in the main model. The interaction between CRM adoption and years of education is negative and statistically significant ($\beta = -0.0369$; $p < 0.001$). This indicates that the relationship between CRM adoption and organizational autonomy becomes less positive as years of education increase, consistently with the main result showing a stronger positive relationship among workers with non-tertiary education. For temporal autonomy, the continuous education specification does not provide evidence of educational heterogeneity. The interaction between CRM adoption and years of education is negative but statistically non-significant ($\beta = -0.0037$; $p = 0.109$). This result is consistent with the main attainment-based specification, indicating that the association between CRM diffusion and temporal autonomy does not vary systematically with educational attainment.

Overall, the continuous education specifications confirm the conclusions of the main analysis. For *work fatigue*, the interaction with years of education is not statistically significant, consistently with the main specification based on educational attainment. For organizational autonomy, the negative and statistically significant interaction confirms that the relationship between CRM adoption and organizational autonomy becomes less positive as years of education increase, consistently with the stronger association observed among workers with non-tertiary education in the main specification. For temporal autonomy, the interaction with years of education is again statistically non-significant, providing no evidence of systematic educational heterogeneity. Overall, there is no evidence that lower educational attainment systematically amplifies the adverse job-quality associations associated with the diffusion of CRM systems (see Appendix Table A.9).

6.5.5 Overall Assessment of H4.1-H4.3

Taken together, the results do not provide support for H4.1-H4.3. H4.1 predicted that the association between CRM adoption and work fatigue would be stronger among workers with lower levels of education, H4.2 predicted that the positive association with organizational autonomy would be weaker, and H4.3 predicted that the negative association with temporal autonomy would be stronger for these workers. These directional predictions do not receive empirical support.

For work fatigue, the main specification provides no evidence of educational heterogeneity. The interaction between CRM adoption and non-tertiary education is negative and statistically non-significant (β = −0.021; p = 0.265), and the ordered logit specification leads to the same conclusion (β = −0.044; p = 0.274). The continuous specification using years of education as the moderator likewise produces an interaction that is effectively zero and statistically non-significant (β = −0.00014; p = 0.961). However, the country fixed-effects robustness check produces a negative and statistically significant interaction (β = −0.031; p = 0.049), indicating educational heterogeneity in the opposite direction to that predicted by H4.1. Overall, the evidence does not indicate that workers with non-tertiary education experience a stronger increase in fatigue as CRM diffusion rises.

The clearest evidence of educational heterogeneity concerns organizational autonomy. The interaction between CRM adoption and low education is positive and statistically significant in the main OLS specification (β = 0.206; p < 0.001) and remains positive and significant in the ordered logit model (β = 0.120; p < 0.001). The result is also robust to the exclusion of year fixed effects, while the continuous specification produces a negative and statistically significant interaction between CRM adoption and years of education (β = −0.0369; p < 0.001), confirming that the association becomes less positive as education increases. The positive association between CRM diffusion and organizational autonomy is therefore stronger among workers with non-tertiary education.

For temporal autonomy, the main specification does not provide evidence of educational heterogeneity. The interaction between CRM adoption and non-tertiary education is very close to zero and statistically non-significant in the OLS model (β = −0.003; *p* = 0.884), and it remains statistically non-significant in the *ordered logit* specification (β = 0.023; *p* = 0.700). The alternative specification using years of education as the moderator leads to the same

conclusion (β = −0.0037; p = 0.109). Overall, the evidence does not indicate that the relationship between CRM adoption and temporal autonomy differs systematically according to educational attainment. Overall, the empirical evidence does not support the directional predictions underlying H4.1–H4.3. Lower educational attainment does not systematically strengthen the association between CRM diffusion and work fatigue. The main and ordered logit specifications show no significant educational heterogeneity for work fatigue, while the country fixed-effects robustness check identifies a significant interaction in the opposite direction to H4.1. For the autonomy outcomes, no significant educational heterogeneity emerges for temporal autonomy, while the clearest difference concerns organizational autonomy, for which the positive association with CRM adoption is stronger among workers with non-tertiary education. These findings do not imply that workers with non-tertiary education enjoy better working conditions overall. Indeed, the negative coefficient associated with non-tertiary education in the autonomy models indicates lower levels of autonomy for this group at the reference level of CRM adoption. Rather, the interaction results indicate that the association between CRM diffusion and the examined job-quality outcomes is not comparatively more adverse for lower-educated workers. This distinction is important because the interaction terms capture differences in the relationship with CRM adoption rather than differences in absolute levels of fatigue or autonomy between educational groups.

6.6 Gender Heterogeneity

Hypotheses H5.1–H5.3 examine whether the relationship between CRM adoption and job quality differs between men and women. As discussed in Chapter 3, gender differences in occupational positioning, task allocation and exposure to monitoring may cause the organizational consequences associated with CRM systems to be distributed unevenly across workers. H5.1–H5.3 therefore test whether the association between CRM adoption and job quality varies according to workers' gender. The hypotheses are tested across work fatigue, organizational autonomy and temporal autonomy, allowing gender heterogeneity to be assessed across all three dimensions of job quality considered in the thesis.

To test these hypotheses, the standardized measure of CRM adoption is interacted with a binary indicator identifying female respondents. The models retain the individual and job-related controls used in the previous analyses and additionally control for lower-educated routine customer-facing status. The available analytical samples contain 14,146 observations

for *work fatigue*, 92,809 for o*rganizational autonomy* and 14,106 for *temporal autonomy*. Because the availability of the three outcomes differs substantially across ESS waves, the results are interpreted separately for each dimension of job quality.

6.6.1 Gender and Work Fatigue

The baseline specification without the interaction term, reported in Panel A of Table 6.5, does not provide evidence of a positive overall relationship between CRM adoption and work fatigue (β = −0.035; p = 0.121). Women nevertheless report higher levels of fatigue than men, keeping constant all other covariates included in the model.

Once the interaction between CRM adoption and gender is introduced, the interaction term is positive and weakly statistically significant (β = 0.043; $p < 0.10$). This indicates that the estimated CRM–fatigue slope is higher among women than among men. The interaction therefore provides evidence consistent with the heterogeneity proposed by H5.1, although the statistical evidence is relatively weak.

The additional *ordered logit* specification produces a similar pattern. The interaction between CRM adoption and gender remains positive and weakly statistically significant (β = 0.082; p < 0.10). The consistency of its sign and significance across the two estimators provides additional evidence that the gender difference is not driven exclusively by the linear treatment of the fatigue scale.

As an additional robustness check, the interaction specification is re-estimated including country fixed effects. Since CRM adoption is constant within countries in the 2020 analytical sample, its main coefficient is absorbed by the country fixed effects, while the interaction between CRM adoption and gender remains identifiable. The interaction remains positive and similar in magnitude (β = 0.037), but is no longer statistically significant at the 10% level (p = 0.101). This indicates that the direction of the gender difference is preserved, although the statistical evidence becomes weaker once country fixed effects are included (see Appendix Table A.7).

Overall, the *work fatigue* results provide limited evidence of gender heterogeneity. The estimated CRM–fatigue slope is higher among women, and the interaction reaches the 10% significance level in both the OLS and ordered logit specifications, although it falls just outside this threshold when country fixed effects are included (β = 0.037; p = 0.101). The

evidence should therefore be interpreted cautiously, as the result is not fully robust to the inclusion of country fixed effects.

6.6.2 Gender and Organizational Autonomy

The results for organizational autonomy provide no evidence that the relationship between CRM adoption and this dimension of job quality differs systematically between men and women. In the baseline specification without the interaction term, CRM adoption is positively associated with organizational autonomy, although the coefficient lies just above the conventional 5% significance threshold (β = 0.182; p = 0.052).

Once the interaction between CRM adoption and gender is introduced, the estimated difference between men and women is extremely small. The interaction term is negative but close to zero (β = −0.006) and statistically non-significant (p = 0.782). There is therefore no evidence that the relationship between CRM diffusion and organizational autonomy differs between women and men. The *ordered logit* robustness specification leads to the same substantive conclusion. Accounting explicitly for the ordinal nature of the organizational autonomy measure does not reveal a systematic gender difference in the association with CRM adoption. The evidence is therefore consistent across the linear and ordinal specifications and provides no indication that the positive relationship between CRM diffusion and organizational autonomy identified in the preceding analyses is concentrated disproportionately among either men or women.

Finally, excluding year fixed effects while retaining country fixed effects and the remaining controls does not alter the substantive conclusion. The CRM coefficient remains positive and statistically significant at the 10% level (β = 0.073; p = 0.058), while the interaction with gender remains extremely small and statistically non-significant (β = −0.006; p = 0.782). The absence of gender heterogeneity in organizational autonomy therefore does not depend on the inclusion of year fixed effects.

Overall, the results for organizational autonomy provide no support for the gender heterogeneity predicted by H5.2. While CRM diffusion is positively associated with organizational autonomy in the broader analysis, there is no evidence that this relationship differs systematically between male and female workers. Gender therefore appears to play a limited moderating role for this particular dimension of autonomy.

6.6.3 Gender and Temporal Autonomy

A different pattern emerges for temporal autonomy. In the baseline specification without the interaction term, CRM adoption is positively and statistically significantly associated with workers' ability to determine their starting and finishing times. Higher CRM diffusion is therefore associated with greater temporal autonomy in the overall sample.

The interaction between CRM adoption and the female indicator is negative and statistically significant ($\beta = -0.026$; $p < 0.05$). The negative interaction indicates that the positive relationship between CRM diffusion and temporal autonomy is weaker for women than for men. The estimated association for women therefore becomes comparatively less favorable as CRM adoption increases, which is consistent with the direction predicted by H5.3.

The *ordered logit* specification provides additional, although weaker, evidence of the same pattern. The interaction between CRM adoption and the female indicator remains negative and is weakly statistically significant ($\beta = -0.052$; $p < 0.10$). Although coefficient magnitudes cannot be directly compared across OLS and ordered logit models, the persistence of the negative sign and statistical significance provides evidence that the direction of the gender heterogeneity is not driven exclusively by the linear treatment of the temporal-autonomy scale.

As an additional robustness check, the interaction specification is re-estimated including country fixed effects. Since CRM adoption is constant within countries in the 2020 analytical sample, its main coefficient is absorbed by the country fixed effects, while the interaction between CRM adoption and gender remains identifiable. The interaction remains negative and statistically significant ($\beta = -0.025$; $p = 0.013$), indicating that the lower estimated CRM–temporal autonomy slope for women relative to men persists after accounting for time-invariant differences across countries (see Appendix Table A.7).

Overall, temporal autonomy provides evidence consistent with the direction predicted by H5.3. CRM diffusion is positively associated with temporal autonomy, but the estimated CRM–temporal autonomy slope is significantly lower among women than among men. The result is statistically significant at the 5% level in the OLS specification, remains weakly significant in the ordered logit model and remains statistically significant in the country fixed-effects robustness check. The evidence therefore indicates gender heterogeneity in the CRM–temporal

autonomy relationship, although the strength of the statistical evidence varies across estimators.

6.6.4 Overall Assessment of H5.1-H5.3

Taken together, the results provide partial support for H5.1, no support for H5.2, and support for H5.3. H5.1 predicted that, among women, the association between CRM adoption and work fatigue would be stronger, H5.2 predicted that the positive association with organizational autonomy would be weaker, and H5.3 predicted that the negative association with temporal autonomy would be stronger. The estimated interaction provides limited evidence consistent with H5.1 for work fatigue, while the results support H5.3 for temporal autonomy, but provide no support for H5.2 for organizational autonomy.

For *work fatigue*, the interaction between CRM adoption and gender is positive and weakly statistically significant in the OLS specification ($\beta = 0.043$; $p < 0.10$), indicating that the estimated CRM–fatigue slope is higher among women than among men. The ordered logit specification produces a similar result, with a positive interaction that remains significant at the 10% level ($\beta = 0.082$; $p < 0.10$). When country fixed effects are included, the interaction remains positive and similar in magnitude ($\beta = 0.037$), but is no longer statistically significant at the 10% level ($p = 0.101$). The evidence is therefore consistent with the gender heterogeneity specified in H5.1, although the relatively weak statistical significance and the country fixed-effects result warrant caution.

For organizational autonomy, the results provide no evidence of gender heterogeneity. The interaction between CRM adoption and the female indicator is extremely small and statistically non-significant in both the OLS and *ordered logit* specifications. The relationship between CRM diffusion and organizational autonomy therefore appears to be substantially similar for men and women.

Temporal autonomy provides evidence consistent with H5.3. In the OLS specification, the interaction term is negative and statistically significant ($\beta = -0.026$; $p < 0.05$), indicating that the estimated CRM–temporal autonomy slope is lower among women than among men. The *ordered logit* specification preserves this negative interaction, although its statistical significance is weaker ($\beta = -0.052$; $p < 0.10$). The country fixed-effects robustness check also produces a negative and statistically significant interaction ($\beta = -0.025$; $p = 0.013$). The

direction of the finding is therefore consistent across specifications, while the strength of the statistical evidence varies.

Overall, gender moderates some, but not all, of the relationships between CRM diffusion and job quality examined in this study. Evidence consistent with H5.1 emerges for work fatigue in the main specifications, although this evidence becomes weaker when country fixed effects are included. Evidence of gender heterogeneity also emerges for temporal autonomy and remains robust to country fixed effects, whereas no corresponding gender heterogeneity is observed for organizational autonomy. The three sub-hypotheses therefore receive different levels of support: H5.1 is partially supported, H5.2 is not supported, and H5.3 is supported. The results do not indicate a generalized female disadvantage associated with CRM diffusion across all dimensions of job quality, but they provide limited evidence that the association with fatigue differs by gender and stronger evidence that the association with temporal autonomy is comparatively less favorable for women. This outcome-specific pattern further reinforces the importance of treating job quality as a multidimensional concept rather than assuming that the organizational consequences of CRM systems operate uniformly across different aspects of workers' experiences.

6.7 Overall Assessment of the Empirical Results

Taken together, the empirical analyses reveal a differentiated relationship between CRM diffusion and job quality. The results do not support a simple interpretation in which greater CRM adoption is associated with uniformly better or worse working conditions. Instead, the observed relationships vary across dimensions of job quality and, in several cases, across groups of workers and institutional contexts. This multidimensional pattern is consistent with the analytical framework developed in the previous chapters, in which CRM systems were conceptualized not simply as monitoring technologies, but as organizational infrastructures that can simultaneously facilitate coordination and increase the visibility and standardization of work.

The standardized-outcome robustness checks confirm this overall pattern. CRM adoption is not significantly associated with work fatigue ($\beta = -0.038$; $p = 0.135$), while the associations with organizational autonomy ($\beta = 0.056$; $p = 0.052$) and temporal autonomy ($\beta = 0.095$; $p = 0.004$) remain positive. These estimates facilitate comparison across outcomes measured on different scales and do not alter the main conclusions (see Appendix Table A.11).

The evidence concerning work fatigue is particularly dependent on the characteristics of workers and their institutional environment. H1a is not supported, as there is no robust evidence of a generalized positive relationship between CRM diffusion and fatigue in the baseline specification. H1b is also not supported. Although the estimated CRM–fatigue slope is higher among lower-educated routine customer-facing workers and the interaction becomes statistically significant in several robustness specifications, the main specification and the marginal effects do not provide convincing evidence of a difference between the two occupational groups. The results for autonomy further demonstrate the importance of distinguishing between different dimensions of job quality. H2 is partially supported. CRM diffusion is positively associated with both organizational and temporal autonomy. The positive association with organizational autonomy is consistent with H2, whereas the positive association with temporal autonomy is contrary to the hypothesized negative relationship. For organizational autonomy, the association is statistically significant at the 10% level in the main specifications and remains positive, with stronger statistical evidence in the robustness specifications. The association with temporal autonomy remains positive and statistically significant. These findings indicate that greater CRM diffusion can coexist with greater perceived discretion, although the magnitude and robustness of this relationship differ across dimensions of autonomy.

The institutional analyses provide partial support for H3.1, no support for H3.2, and partial support for H3.3. In the main common-sample specifications, greater bargaining coverage significantly attenuates the positive relationship between CRM diffusion and work fatigue, and this result is confirmed by the ordered logit robustness specification. However, the sample-composition robustness checks show that the statistical strength of this moderation is sensitive to the institutional indicator and the available country sample: the interaction with bargaining coverage remains negative but is no longer statistically significant in its larger available sample, whereas the interaction with union density is negative and statistically significant in its larger available sample. For organizational autonomy, no systematic institutional moderation emerges, while for temporal autonomy the predicted moderation is supported only when bargaining coverage is used as the institutional indicator. These findings suggest that the relationship between CRM diffusion and worker strain may depend partly on

the institutional context, although the evidence is sensitive to the institutional measure and sample composition.

The analyses of educational heterogeneity provide a different pattern from the one anticipated by H4.1-H4.3. H4.1-H4.3 are not supported. For work fatigue, the main, ordered logit and continuous-education specifications provide no evidence of significant educational heterogeneity, while the country fixed-effects robustness check identifies a negative and statistically significant interaction, in the opposite direction to H4.1. The clearest educational heterogeneity concerns organizational autonomy, for which the interaction between CRM adoption and non-tertiary education is positive and robust across alternative specifications, again opposite to the direction predicted by H4.2. For temporal autonomy, no significant educational heterogeneity emerges. Overall, lower educational attainment does not systematically amplify adverse associations between CRM diffusion and job quality.

H5.1 receives partial support, H5.2 is not supported, and H5.3 is supported. For *work fatigue*, the interaction between CRM adoption and gender is positive and weakly statistically significant in both the OLS and *ordered logit* specifications, but falls just outside the 10% significance level when country fixed effects are included, providing limited evidence of a stronger CRM–fatigue relationship among women. No meaningful gender heterogeneity emerges for organizational autonomy. For temporal autonomy, the interaction between CRM adoption and gender is negative and statistically significant in the OLS specification, remains weakly significant in the *ordered logit* model, and remains negative and statistically significant when country fixed effects are included. CRM diffusion is therefore positively associated with temporal autonomy, but this positive relationship is comparatively weaker among women. Gender heterogeneity consequently appears to be outcome-specific rather than indicative of a generalized female disadvantage across all dimensions of job quality.

Table 6.6 — Summary of Hypothesis Testing

Hypothesis	Expected relationship	Main empirical finding	Assessment
H1a	CRM adoption is associated with higher work fatigue.	No general positive association emerges in the baseline model or across the robustness specifications.	Not supported
H1b	The association between CRM adoption and work fatigue is stronger among lower-educated workers employed in routine customer-facing occupations.	The estimated interaction is positive and reaches statistical significance in some specifications, but the main specification and marginal effects do not provide convincing evidence of a difference between the two occupational groups.	Not supported
H2	CRM adoption is associated with higher perceived organizational autonomy and lower temporal autonomy.	CRM adoption is positively associated with both organizational and temporal autonomy. For organizational autonomy, the association is statistically significant at the 10% level in the main specifications and becomes stronger in the robustness specification. The association with temporal autonomy is positive and statistically significant. The positive association with temporal autonomy is contrary to the hypothesized direction.	**Organizational autonomy:** Supported **Temporal autonomy:** Not supported
H3.1	Stronger labor-market institutions weaken the positive association between CRM adoption and work fatigue.	The interaction is negative for both institutional indicators, but the statistical significance is sensitive to the institutional measure and the available country sample.	Partially supported
H3.2	Stronger labor-market institutions strengthen the positive association between CRM adoption and organizational autonomy.	No significant institutional moderation emerges for organizational autonomy.	Not supported
H3.3	Stronger labor-market institutions weaken the negative association	Bargaining coverage produces a positive and	Partially supported

	between CRM adoption and temporal autonomy.	statistically significant interaction, while union density does not.	
H4.1	Among workers with lower levels of education, the association between CRM adoption and work fatigue is stronger.	No significant educational heterogeneity emerges in the main and ordered logit specifications. The country fixed-effects robustness check identifies a significant interaction in the opposite direction to that predicted by H4.1.	Not supported
H4.2	Among workers with lower levels of education, the positive association between CRM adoption and organizational autonomy is weaker.	The interaction between CRM adoption and non-tertiary education is positive and statistically significant, opposite to the direction predicted by H4.2, and robust across alternative specifications.	Not supported
H4.3	Among workers with lower levels of education, the negative association between CRM adoption and temporal autonomy is stronger.	No significant educational heterogeneity emerges for temporal autonomy.	Not supported
H5.1	Among women, the association between CRM adoption and work fatigue is stronger.	The interaction between CRM adoption and female gender is positive and statistically significant at the 10% level in the main specifications, but becomes non-significant when country fixed effects are included.	Partially supported
H5.2	Among women, the positive association between CRM adoption and organizational autonomy is weaker.	No meaningful gender heterogeneity emerges for organizational autonomy.	Not supported
H5.3	Among women, the negative association between CRM adoption and temporal autonomy is stronger.	The positive average association between CRM adoption and temporal autonomy is significantly weaker among women, with the direction preserved across robustness specifications.	Supported

Notes: *The assessment summarizes the results from the main specifications and the robustness checks reported in Sections 6.2–6.6.*

Taken together, the results suggest that CRM diffusion is more consistently related to how work is organized than to a generalized increase in worker strain. The clearest pattern concerns autonomy, since higher CRM diffusion is associated with greater organizational and temporal autonomy, while the expected average increase in work fatigue does not emerge. For work fatigue, the institutional context appears to be more relevant: higher collective bargaining coverage, and less consistently union density, weakens the relationship between CRM diffusion and fatigue. The analyses by education and gender instead show that heterogeneity is outcome-specific and do not identify a single group of workers that systematically experiences less favorable associations with CRM diffusion. At the same time, the results should be interpreted as associational rather than causal evidence. The empirical strategy identifies systematic relationships between country-level CRM diffusion and individual job-quality outcomes, but the available observational data do not allow the analysis to isolate an exogenous change in CRM adoption.

The extent to which these empirical patterns are consistent with the mechanisms proposed in the theoretical framework, as well as the implications of the heterogeneous and partly unexpected findings, are discussed in the following chapter.

7. Conclusions

This thesis investigated how the diffusion of Customer Relationship Management systems is associated with different dimensions of job quality and whether these relationships vary across institutional contexts and groups of workers. The analysis started from the observation that CRM systems should not be considered exclusively as tools for managing customers. By centralizing information, structuring workflows and recording work activities, these systems increasingly form part of the organizational infrastructure through which work is coordinated and evaluated. Their diffusion may therefore affect workers even when monitoring is not their primary purpose.

The central question of the thesis was whether these organizational characteristics translate into systematically different working conditions. The empirical evidence suggests that the answer cannot be expressed in terms of an overall positive or negative relationship between CRM diffusion and job quality. Instead, the results point to a more specific transformation: CRM diffusion appears to change the way discretion, information and control are distributed within the organization. Greater access to information and more structured coordination can coexist with greater managerial visibility over workers' activities. Which of these mechanisms becomes more relevant depends on the dimension of job quality considered and, in some cases, on workers' occupational position and the institutional environment in which the technology is embedded.

7.1 Main Findings and Answer to the Research Question

The results for worker autonomy provide the clearest evidence of a favorable association with CRM diffusion. Higher CRM adoption is positively associated with both organizational and temporal autonomy, providing partial support for H2: the organizational-autonomy result is consistent with the hypothesized direction, whereas the temporal-autonomy result is not. The relationship with organizational autonomy is particularly stable across the alternative specifications considered in the analysis. Workers in environments characterized by greater CRM diffusion therefore tend to report greater influence over the organization of their daily activities. A positive association also emerges for temporal autonomy, although this relationship is less uniform across groups of workers.

These findings are important because they qualify the expectation that the standardization associated with digital technologies necessarily reduces worker discretion. CRM systems formalize procedures and make activities more traceable, but they also centralize information that would otherwise remain dispersed among workers, supervisors and organizational units. One interpretation consistent with the theoretical framework developed in this thesis is that this increased availability of information can reduce workers' dependence on direct supervision when performing and coordinating everyday tasks. A more standardized organizational environment may therefore constrain some aspects of how work is recorded while simultaneously giving workers more resources with which to organize their activities independently.

The evidence on work fatigue is different. H1a is not supported, as no robust generalized positive relationship between CRM diffusion and fatigue emerges across the entire sample. H1b is also not supported. Although the estimated CRM–fatigue relationship is stronger among lower-educated workers employed in routine customer-facing occupations and the interaction becomes statistically significant in several robustness specifications, the main specification and the marginal effects do not provide convincing evidence of a difference between this group and the rest of the sample.

The work-fatigue measure also has implications for work-life balance, since the ESS item explicitly refers to whether workers are too tired after work to engage in the activities they would like to do at home. The results on fatigue can therefore also be interpreted as providing evidence on one specific dimension of work-to-life spillover, although the measure does not capture work-life balance as a whole.

The distinction between the autonomy and fatigue results provides an important insight into the organizational role of CRM systems. Greater worker discretion and greater managerial visibility are not necessarily opposites. A CRM system can give workers easier access to information and allow them to manage their tasks with less direct intervention from supervisors while at the same time making the execution and outcomes of those tasks more visible to management. Within the theoretical framework developed in this thesis, this greater visibility may also increase performance pressure and work intensity, providing a direct link to the fatigue outcome. In this sense, digitalization may decentralize the execution of work without eliminating organizational control. The empirical findings are consistent with this possibility:

the average relationship with autonomy is positive, while the less favorable association with fatigue emerges more selectively where the potential for standardization and performance monitoring is greater. The institutional results reinforce this interpretation. H3.1 is partially supported, H3.2 is not supported, and H3.3 is partially supported. For work fatigue, both bargaining coverage and union density produce interactions in the predicted negative direction, but their statistical significance is sensitive to the institutional indicator and the available country sample. No systematic moderating effect emerges for organizational autonomy, while for temporal autonomy the predicted moderation is supported when bargaining coverage is used, but not when union density is considered. These results suggest that the information generated by digital technologies does not automatically translate into the same working conditions in every institutional environment. The relevant issue may therefore be not only how much technology is adopted, but also under which rules and employment relations it is introduced and used.

Collective bargaining may influence the extent to which greater technological visibility can be converted into work pressure. Where working conditions are more extensively subject to collective regulation, firms may face stronger constraints regarding performance evaluation, workload and the use of monitoring practices. The empirical analysis cannot observe these implementation processes directly, and the institutional results should therefore not be interpreted as evidence of a specific causal mechanism. Nevertheless, they are consistent with the broader argument that institutions can moderate the relationship between the technical capabilities of digital systems and workers' actual experience of work.

Some of the most interesting results are indeed those that go against the initial hypotheses. H4.1–H4.3 predicted less favorable associations between CRM adoption and job quality among lower-educated workers. However, none of the three sub-hypotheses is supported. For work fatigue, educational level does not significantly strengthen the relationship with CRM adoption. For organizational autonomy, instead, the association is relatively more favorable for lower-educated workers, while no significant educational heterogeneity emerges for temporal autonomy. The most robust result is the one for organizational autonomy, since it remains stable even when using different estimators and alternative specifications.

This unexpected result helps distinguish between standardization and loss of autonomy. In general, lower-educated workers have lower levels of organizational autonomy. However, as

CRM diffusion increases, the positive relationship with organizational autonomy becomes stronger, particularly for this group. A possible explanation is that more codified information, alongside more structured procedures, can be particularly useful for workers who would otherwise have less access to information or decision-making resources. Therefore, if information becomes easier to access, uncertainty may decrease and workers may need to rely less on supervisors or more experienced colleagues. It is important to understand that the results do not show that this is the actual causal mechanism, but it represents a possible interpretation based on the theoretical framework. Still, the results suggest that standardization should not automatically be associated with a loss of autonomy. Its effect may depend on the initial position of workers within the organization and on the type of autonomy considered.

A different pattern emerges when considering gender. H5.1 is partially supported, H5.2 is not supported, and H5.3 is supported. There are no substantial differences between men and women for organizational autonomy, while work fatigue and temporal autonomy show less favorable associations for women. For work fatigue, the interaction between CRM adoption and female is positive, but only weakly statistically significant. For temporal autonomy, the positive average relationship with CRM diffusion is significantly weaker among women, and the direction of this difference is preserved in the ordered logit robustness specification.

These findings do not support the idea of a generalized female disadvantage associated with CRM diffusion. Instead, they suggest that gender differences are concentrated in specific dimensions of job quality. One possible explanation, consistent with the framework developed in the thesis, concerns the different occupational and organizational positions of men and women. If women are more frequently employed in customer-facing, administrative or service activities in which digital systems structure interactions and make performance more visible, the coordination benefits associated with CRM systems may coexist with greater constraints on working time or greater work pressure. However, the available data do not make it possible to distinguish this mechanism from other differences between male and female workers. The gender results should therefore be interpreted as evidence of heterogeneous associations that require further investigation rather than as a direct estimate of the effect of CRM use on women.

Taken together, these findings provide an answer to the research question of the thesis. The diffusion of CRM systems is associated with a reorganization of job quality rather than with a

uniform improvement or deterioration in working conditions. Greater CRM diffusion is associated on average with higher perceived autonomy, particularly regarding the organization of daily work. At the same time, the potential relationship with work-related strain becomes more visible for workers whose activities are more easily standardized and monitored and is weaker in institutional environments characterized by broader collective bargaining coverage. The benefits and costs associated with CRM diffusion are therefore not necessarily mutually exclusive: they may concern different dimensions of work and may be distributed differently across workers.

7.2 Implications for the Digitalization of Work

The results of this thesis have broader implications for the study of digitalization and job quality. Much of the discussion surrounding technological change focuses on whether technologies substitute for workers, change skill requirements or automate particular tasks. The analysis developed here points to an additional mechanism. Digital technologies can transform work even when they do not replace any worker or automate an entire task. By changing the production and circulation of information within organizations, they can modify the relationship between workers, managers and work processes.

CRM systems are particularly useful for illustrating this mechanism because the same digital infrastructure performs several organizational functions simultaneously. The information contained in a CRM can help a worker understand previous customer interactions, coordinate with colleagues and independently determine what should be done next. The same information can also allow management to observe response times, completed activities and outcomes. Consequently, the organizational consequences of digitalization cannot be inferred from the technological tool alone. They depend on how the information generated by the system is used.

This helps explain why the empirical results do not follow a simple trade-off between autonomy and control. Greater organizational visibility does not necessarily require constant direct supervision. Indeed, the opposite may occur: once information and procedures are embedded in a digital system, workers may require less direct managerial intervention in order to perform daily activities, while management acquires greater capacity to observe those activities at a distance. CRM systems can therefore simultaneously increase operational independence and organizational traceability.

The results on collective bargaining provide a further implication. If the association between CRM diffusion and fatigue varies according to institutional context, technological adoption alone is an incomplete explanation of changes in working conditions. Institutions may influence how the capabilities created by technology are translated into management practices. The same increase in the availability of performance information may have different consequences depending on whether workload, monitoring and working conditions are subject to collective regulation. From this perspective, the effects of digitalization should be understood as the outcome of an interaction between technological capabilities and the institutional arrangements governing their use.

The findings on education point in a similar direction at the individual level. The workers initially expected to be most vulnerable to standardization are not systematically those who experience the least favorable associations. In particular, the stronger positive relationship between CRM diffusion and organizational autonomy among lower-educated workers suggests that digital codification can also redistribute organizational resources. Technologies that reduce the importance of tacit or individually held information may allow workers with fewer initial organizational resources to operate with greater independence. This interpretation does not imply that standardization is inherently beneficial, but it shows why its effects cannot be inferred solely from the reduction of informal discretion.

These results therefore support a worker-centered approach to digital transformation in which attention is directed not only to whether a technology is present, but to what it makes possible within an organization: who gains access to information, whose activities become visible, which decisions become standardized and under which institutional rules the resulting information can be used.

From a managerial perspective, these findings suggest that the implications of CRM diffusion for workers depend not only on the technology itself, but also on how its organizational capabilities are used. The same system can reduce informational dependence and support the coordination of daily activities while also increasing the visibility of workers' performance. This suggests that the design of workflows, performance indicators and monitoring practices may be important in shaping whether CRM-related organizational changes are associated mainly with greater worker autonomy or with stronger work pressure. The institutional results further indicate that these organizational choices do not take place in isolation, since collective

regulation may influence how the information generated by digital systems is used. These implications should nevertheless be interpreted cautiously, as the empirical analysis identifies associations rather than causal effects.

7.3 Limitations

The conclusions of the thesis must be considered in light of several limitations of the empirical design.

The most important limitation concerns the measurement of CRM adoption. The Eurostat indicator measures the share of firms using CRM systems at the country-year level, whereas job-quality outcomes are observed for individual workers. It is therefore not possible to establish whether a specific respondent actually uses CRM software, how intensively it is used or which functions are adopted by the respondent's organization. This distinction is particularly important for the theoretical mechanisms considered in the thesis, since CRM systems may be implemented primarily as information and coordination tools in some firms and used more extensively for standardization and performance monitoring in others.

For the same reason, CRM diffusion may partly capture broader processes of digital transformation. Countries in which CRM adoption increases may simultaneously experience greater diffusion of other business technologies or changes in organizational practices and employment composition. The inclusion of individual controls, sector controls where available, country and year fixed effects and additional robustness specifications reduces some of these concerns but cannot eliminate unobserved confounding factors.

A second limitation concerns the structure of the ESS data. The survey consists of repeated cross-sections rather than a panel following the same individuals over time. Changes observed within countries therefore compare different samples of workers rather than changes in the working conditions of the same workers. Moreover, work fatigue and temporal autonomy are available only for the 2020 analytical samples used in this thesis. These outcomes consequently provide cross-sectional evidence based primarily on differences between countries and cannot exploit within-country changes in CRM diffusion in the same way as organizational autonomy.

These characteristics also limit causal interpretation. The empirical models identify conditional associations between CRM diffusion and job-quality outcomes, but they do not

isolate an exogenous change in CRM adoption. Reverse causality and selection cannot be excluded: CRM systems may diffuse more rapidly in organizations and economies already characterized by particular forms of work organization, autonomy or performance management.

Finally, the number of countries providing the macro-level variation required by the analysis is relatively limited and becomes smaller in some specifications, particularly when institutional information from ICTWSS is required. The sample-composition robustness checks also show that the statistical significance of the institutional moderation results can be sensitive to the specific set of countries for which each ICTWSS indicator is available. Country-clustered standard errors account for within-country dependence, but statistical precision remains constrained by the number of independent national contexts. This consideration is especially important for the interaction models and for coefficients that are significant only at the 10 percent level. A multilevel modelling framework could provide a more explicit treatment of the hierarchical structure of workers nested within countries, although the relatively limited number of national contexts available in the present data constrains the feasibility and precision of such an approach.

A further limitation concerns the measurement of labor-market institutions. Bargaining coverage and union density summarize important aspects of worker representation, but they do not capture differences in how collective bargaining systems operate across countries. Similar levels of coverage may reflect different institutional arrangements, for example more centralized or sectoral forms of bargaining, which may influence how technological change is regulated in practice.

These limitations do not invalidate the empirical relationships documented in the thesis, but they define their interpretation. The results provide evidence of systematic patterns consistent with the organizational mechanisms proposed in the theoretical framework; they should not be read as estimates of the causal effect of an individual worker beginning to use a CRM system.

7.4 Directions for Future Research

The limitations of the present analysis also indicate several directions for future research. A first priority would be to obtain information on CRM use at the worker or firm level. Matched employer–employee data could distinguish workers directly exposed to CRM systems from

workers operating in firms that do not use them and could provide information on the intensity and specific characteristics of adoption. Distinguishing between functions related to information sharing and coordination and functions related to mandatory recording, performance dashboards or monitoring would make it possible to test more directly the mechanisms examined in this thesis.

Longitudinal data would provide a second important extension. Following workers or firms before and after CRM adoption would allow researchers to observe whether changes in working conditions occur when the technology is introduced. Where suitable institutional or technological shocks can be identified, quasi-experimental designs could also provide stronger evidence about the causal effects of CRM adoption.

A more detailed measurement of occupations and tasks would help clarify the heterogeneous results. The findings for routine customer-facing workers suggest that occupational exposure to the monitoring and standardization capabilities of CRM systems is relevant, while the results for education show that educational disadvantage alone does not identify the workers experiencing the least favorable associations. Future research could therefore examine workers' actual tasks, frequency of customer interaction and exposure to performance measurement rather than relying exclusively on broad occupational and educational categories.

Future research could also examine whether Generative AI changes the role of tacit knowledge by making previously dispersed or experience-based information more easily accessible to workers, and whether this produces similar differences in autonomy across skill groups.

Further research could also investigate more directly the role of labor-market institutions. The results for collective bargaining coverage suggest that institutions may shape the relationship between digitalization and strain, but national indicators cannot show how this occurs inside firms. Information on workplace representation, collective agreements, consultation procedures and negotiated rules governing monitoring could clarify which institutional mechanisms are responsible for the moderating relationships observed in this thesis.

Finally, the analysis could be extended to additional dimensions of job quality. Work fatigue and the two measures of autonomy capture important aspects of workers' experiences, but CRM systems may also influence work intensity, perceived monitoring, privacy, job satisfaction, skill

use and relationships with supervisors and colleagues. Examining these outcomes jointly would provide a more complete picture of how digital organizational technologies transform the experience of work.

7.5 Final Remarks

The growing diffusion of CRM systems illustrates a form of digital transformation that is less visible than automation but increasingly important for the organization of everyday work. These technologies do not simply process customer information. They alter who can access information, how activities are coordinated, which actions become traceable and how performance can be evaluated.

The evidence presented in this thesis suggests that these changes should not be understood through a simple opposition between technological empowerment and technological control. CRM diffusion is associated with greater autonomy on average, while less favorable relationships with worker strain emerge more selectively and depend on occupational and institutional conditions. Lower-educated workers do not appear systematically disadvantaged and may experience comparatively larger gains in organizational autonomy, whereas some less favorable associations emerge for women. Stronger collective bargaining coverage, meanwhile, is associated with a weaker relationship between CRM diffusion and fatigue.

The broader implication is that technology creates organizational possibilities rather than predetermined outcomes. The capacity of CRM systems to centralize information can support workers in organizing their activities, while their capacity to make work visible can also facilitate monitoring and performance pressure. Which of these possibilities becomes more relevant depends on how the technology is implemented, on workers' position within the organization and on the institutions governing the employment relationship.

For this reason, understanding the consequences of digitalization for job quality requires moving beyond the question of whether firms adopt digital technologies. It also requires examining how those technologies reorganize information and control inside the workplace and under which conditions their organizational capabilities are translated into workers' everyday experience. The analysis of CRM systems developed in this thesis provides one contribution in this direction, showing that the transformation of work associated with

digitalization is shaped not by technology alone, but by the organizational and institutional environment in which technology is embedded.

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Appendix

Table A.1 — Additional Robustness Checks for H1a and H1b

	(1) Ordered logit: Baseline	(2) Ordered logit: Interaction	(3) OLS: Country FE
main			
CRM adoption, standardized z-score	-0.0796*	-0.0895**	
	(0.0454)	(0.0427)	
Low-educated routine customer-facing workers		-0.1479*	-0.0489**
		(0.0788)	(0.0216)
CRM adoption # Low-educated routine customer-facing workers		0.1137**	0.0292*
		(0.0562)	(0.0151)
Individual/job controls	Yes	Yes	Yes
Country FE	No	No	Yes
Year FE	No	No	No
Observations	14146	14146	14146

Notes: Columns (1) and (2) report ordered logit estimates, while column (3) reports OLS estimates. Cluster-robust standard errors at the country level are reported in parentheses. The main CRM-adoption coefficient is not separately identified in column (3) because CRM adoption is constant within countries in the 2020 analytical sample and is perfectly collinear with the country fixed effects. * p < 0.10, ** p < 0.05, *** p < 0.01.

Table A.2 — Marginal Effects of CRM Adoption on Work Fatigue by Occupational Group

	Marginal effect	Std Error	p_value	CI lower	CI upper
Other workers	-0.0390	0.0205	0.076	-0.0825	0.0046
Routine customer facing	0.0145	0.0420	0.735	-0.0745	0.1034
Difference Routine minus Other	0.0534	0.0276	0.071	-0.0050	0.1119

Notes: Marginal effects are calculated from the baseline OLS interaction model using margins routine_customer, dydx(crm_adoption_z). They report the estimated change in work fatigue associated with a one-unit increase in standardized CRM adoption for each occupational group. The third row reports the difference between the two group-specific CRM–fatigue slopes, corresponding to the interaction coefficient. Standard errors are clustered at the country level. 95% confidence intervals are reported. N = 14,146.

Appendix Table A.3. Organizational Autonomy: Additional Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)
	Managerial		Team		Responsiveness	
	Additive	Interaction	Additive	Interaction	Additive	Interaction
CRM adoption	0.499***	0.468***	0.478***	0.449***	0.456***	0.430***
	(0.083)	(0.078)	(0.083)	(0.079)	(0.081)	(0.079)
Low-educated routine customer-facing	-0.486**	-0.532**	-0.465**	-0.516**	-0.395**	-0.456**
	(0.196)	(0.198)	(0.207)	(0.210)	(0.177)	(0.183)
CRM x Low-educated routine customer-facing		0.419**		0.419***		0.372***
		(0.144)		(0.141)		(0.114)
Observations	11450	11450	10459	10459	9745	9745
R-squared	0.266	0.267	0.275	0.276	0.271	0.272

* p<0.10, ** p<0.05, *** p<0.01

Notes: Standard errors in parentheses. All specifications use the 2020 analytical sample. All models include the baseline individual controls, sector fixed effects and Internet use. Standard errors are clustered at the country level.

Appendix Table A.4. H3.2 Organizational Autonomy: Country Fixed-Effects Robustness

	(1)	(2)
	Bargaining coverage	Union density
CRM adoption	0.125	0.146
	(0.195)	(0.215)
Bargaining coverage	-1.141	
	(1.048)	
CRM x bargaining coverage	-0.104	
	(0.087)	
Union density		1.599
		(1.962)
CRM x union density		-0.048
		(0.084)
Observations	45088	45088
R-squared	0.200	0.200

* p<0.10, ** p<0.05, *** p<0.01

Notes: *Standard errors in parentheses. All models include country and year fixed effects and the baseline individual controls. Standard errors are clustered at the country level.*

Appendix Table A.5. Marginal Effect of CRM Adoption on Work Fatigue by Bargaining Coverage

	M Effect	SE	pvalue	CI_low	CI_high
−1 SD	0.175	0.037	0.005	0.079	0.271
Mean	0.114	0.029	0.010	0.041	0.188
+1 SD	0.054	0.028	0.111	-0.018	0.126

Notes: *Marginal effects are calculated from the OLS interaction model between CRM adoption and bargaining coverage. Bargaining coverage is standardized, with −1 SD, the mean, and +1 SD representing low, average, and high levels of collective bargaining coverage. Standard errors are clustered at the country level.*

Appendix Table A.6. Educational Heterogeneity and Occupational Composition

	(1) Education interaction (same sample)	(2) Education and occupation interactions	(3) Education x occupation x CRM
CRM adoption	0.089	0.094	0.081
	(0.081)	(0.082)	(0.082)
Non-tertiary education	-0.978***	-0.928***	-1.011***
	(0.074)	(0.075)	(0.083)
CRM x non-tertiary education	0.206***	0.228***	0.248***
	(0.049)	(0.051)	(0.054)
ISCO 4-5 occupational group		-0.251***	-0.620***
		(0.050)	(0.072)
CRM x ISCO 4-5 occupational group		-0.085**	-0.000
		(0.034)	(0.062)
Non-tertiary education x ISCO 4-5 occupational group			0.462***
			(0.076)
CRM x non-tertiary education x ISCO 4-5 occupational group			-0.097
			(0.074)
Observations	93181	93181	93181
R-squared	0.250	0.251	0.252

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: *The dependent variable is organizational autonomy. All models are estimated on the common sample of respondents with non-missing occupational information. Column (1) re-estimates the education interaction on this restricted sample; Column (2) additionally includes ISCO 4–5 occupational status and its interaction with CRM adoption; Column (3) includes the three-way interaction between CRM adoption, non-tertiary education and ISCO 4–5 occupational status. The ISCO 4–5 indicator captures only the occupational component of the routine customer-facing measure and does not include any education criterion. All specifications include age, age squared, gender, income feeling, establishment size, supervisory status, country fixed effects and year fixed effects. Standard errors are clustered at the country level and reported in parentheses.*

Appendix Table A.7. H5.1 and H5.3 Country Fixed-Effects Robustness Checks

	(1) Work fatigue	(2) Temporal autonomy
Female	0.129***	-0.103***
	(0.023)	(0.014)
CRM x female	0.037	-0.025**
	(0.021)	(0.009)
Observations	14146	14106
R-squared	0.067	0.209

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: *OLS estimates with country fixed effects. All specifications include age, age squared, years of education, income feeling, establishment size, supervisory status and lower-educated routine customer-facing status. The main coefficient of CRM adoption is absorbed by country fixed effects because CRM adoption is constant within countries in the 2020 analytical sample, while the interaction between CRM adoption and gender remains identifiable. Cluster-robust standard errors at the country level are reported in parentheses*

Appendix Table A.8. H2 Additional Fixed-Effects Robustness Checks

	(1) Organizational autonomy - Baseline b/se	(2) Organizational autonomy - Interaction b/se	(3) Temporal autonomy - Country FE b/se
CRM adoption	0.071*	0.064*	—
	(0.037)	(0.037)	
Low-educated routine customer-facing workers		-0.236***	-0.113***
		(0.074)	(0.018)
CRM x lower-educated routine customer-facing workers		0.094	-0.021
		(0.064)	(0.018)
Individual/job controls	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	No	No	No
Observations	92809	92809	14106
R-squared	0.249	0.249	0.208

Note: *OLS estimates with country-clustered standard errors in parentheses. Columns (1) and (2) re-estimate the organizational-autonomy specifications without year fixed effects. Column (3) includes country fixed effects for temporal autonomy; the CRM main effect is absorbed because CRM adoption varies only at the country level in the 2020 sample. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Appendix Table A.9. H4.1–H4.3 Continuous-Education Robustness Checks

	(1) Work fatigue	(2) Organizational autonomy	(3) Temporal autonomy
	b/se	b/se	b/se
CRM adoption	-0.032	0.777***	0.125***
	(0.053)	(0.178)	(0.033)
Years of education	-0.000	0.136***	0.035***
	(0.004)	(0.014)	(0.004)
CRM x years of education	0.000	-0.037***	-0.004
	(0.003)	(0.008)	(0.002)
Individual/job controls	Yes	Yes	Yes
Country FE	No	Yes	No
Year FE	No	Yes	No
Observations	14642	94113	14598
R-squared	0.043	0.251	0.188

Note: *OLS estimates with country-clustered standard errors in parentheses. Education is measured continuously as years of education. All specifications include the individual- and job-level controls reported in the main analysis. The organizational-autonomy specification includes country and year fixed effects, while the work-fatigue and temporal-autonomy specifications use the 2020 cross-sectional samples and do not include country or year fixed effects. * p < 0.10, ** p < 0.05, *** p < 0.01.*

Appendix Table A.10. H4.1 and H4.3 Country Fixed-Effects Robustness Checks

	(1) Work fatigue	(2) Temporal autonomy
	b/se	b/se
Non-tertiary education	0.068***	-0.230***
	(0.022)	(0.019)
CRM x non-tertiary education	-0.031**	-0.008
	(0.015)	(0.022)
Individual/job controls	Yes	Yes
Country FE	Yes	Yes
Year FE	No	No
Observations	14808	14760
R-squared	0.064	0.206

Note: *OLS estimates with country fixed effects and country-clustered standard errors in parentheses. All specifications include the individual- and job-level controls reported in the main analysis. The main effect of CRM adoption is absorbed by the country fixed effects because both outcomes are observed only in the 2020 sample. * p < 0.10, ** p < 0.05, *** p < 0.01.*

Appendix Table A.11. Standardized-Outcome Robustness Checks

	(1) Work fatigue	(2) Organizational autonomy	(3) Temporal autonomy
CRM adoption	-0.0377	0.0563*	0.0948***
	(0.0240)	(0.0277)	(0.0281)
Individual/job controls	Yes	Yes	Yes
Country FE	No	Yes	No
Year FE	No	Yes	No
Observations	14146	92809	14106
R-squared	0.044	0.249	0.187

Notes: OLS estimates using standardized dependent variables. Work fatigue, organizational autonomy and temporal autonomy are standardized to mean zero and standard deviation one within their respective estimation samples. Each column reproduces the corresponding baseline specification, with the same individual/job controls and fixed-effects structure. CRM adoption is also standardized. Cluster-robust standard errors at the country level are reported in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01

Appendix Table A.12. H3.1 Sample-Composition Robustness Checks

	(1) Bargaining coverage	(2) Union density
CRM adoption	-0.0600	0.1447***
	(0.0785)	(0.0300)
Bargaining coverage	-0.0394	
	(0.0398)	
CRM adoption x Bargaining coverage	-0.0822	
	(0.1018)	
Union density		0.1024
		(0.0622)
CRM adoption x Union density		-0.2166***
		(0.0493)
Individual/job controls	Yes	Yes
ESS analytical weights	Yes	Yes
Countries	8	11
Observations	7238	9717

Notes: Each model uses the maximum country sample available for the corresponding institutional indicator within the H1 analytical countries. All models include the baseline individual/job controls and ESS analytical weights. Standard errors are clustered at the country level. The bargaining-coverage specification includes 8 countries, while the union-density specification includes 11 countries. * p < 0.10, ** p < 0.05, *** p < 0.01