Firm-Level Drivers of Stakeholder Compensation

Empirical Studies on the Impacts of Trade Unions, the COVID-19 Crisis, and Innovativeness

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Inaugural-Dissertation
zur Erlangung des akademischen Grades
Doctor rerum politicarum (Dr. rer. pol.)
der Technischen Universität Dortmund

March 2024

Acknowledgments

This thesis is part of my research at the Chair of Economic Policy and the Chair of Empirical Economic Research at the Technical University of Dortmund. At this point, I would like to thank everyone who has supported this project.

First and foremost, I would like to thank Prof. Dr. Kornelius Kraft, who supported me at all times as my supervisor and co-author with great commitment and constructive criticism. Similarly, I would like to thank Prof. Michael J. Böhm, Ph.D., who immediately agreed to be my second supervisor and supported the final phase of this dissertation with constructive feedback, and suggestions.

Special thanks also go to my colleague and co-author Tim Seidinger for the constructive collaboration, particularly on two chapters of this work. I also appreciate the excellent teamwork with my former and current colleagues at the professorship, Marek Giebel, Tim Grünebaum, Alexander Lammers, Fabian Möller, and Pia Rumi, as well as the student assistants, who gave me a great deal of valuable support, feedback and suggestions for my dissertation.

Furthermore, I gratefully acknowledge Katharina Wauters and the team of Kienbaum Consultants International GmbH as well as the teams of the German Business Panel and the Institute for Codetermination and Corporate Governance (I.M.U.) of the Hans-Böckler Foundation for their kind support by providing data and helpful discussions and advice.

Finally, special thanks go to my whole family for their unwavering support and encouragement at all stages of this project.

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Part I

Introduction

One of the most controversial topics of economic, social, and political discussion is that of wages and their fair distribution. This controversy arises from different objective functions of employees and employers and was already addressed by Adam Smith in his 1776 book *An Inquiry into the Nature and Causes of the Wealth of Nations*:

> *What are the common wages of labour depends every where upon the contract usually made between those two parties, whose interests are by no means the same. The workmen desire to get as much, the masters to give as little as possible. The former are disposed to combine in order to raise, the latter in order to lower the wages of labour.* (Smith, 1976, p. 83)

These thoughts show, on the one hand, that wages need to balance these objectives and, on the other, that employees and employers join forces among themselves, respectively, to assert their interests.

Various factors are involved in this process. According to economic theory, wages are determined by the equilibrium of labor supply and demand (e.g., Borjas, 2019) and can generally be influenced by human capital factors such as education and work experience (e.g., Becker, 1962, 1964; Mincer, 1974; Schultz, 1961). However, there are also various other factors that can generally influence compensation. For instance, legal regulations directly intervene in the structure or promote the transparency of compensation in Germany (e.g., minimum wages, prohibition on wage discrimination, laws on the appropriateness of executive pay, and obligations to disclose pay levels and composition). Moreover, firm-specific characteristics (e.g., firm size, location, sector, financial success, innovativeness), institutions (e.g., trade unions, works councils), or macroeconomic factors (e.g., economic crises) can also affect compensation. Such influencing factors must therefore be anticipated and taken into account at the firm level.

This thesis addresses this issue and examines three firm-level drivers of compensation setting in detail: (i) trade unions and parity codetermination as a driver of executive pay; (ii) the impact of the COVID-19 crisis as a driver of pay adjustments to different stakeholders; and (iii) the role of innovation as an additional driver of pay adjustments during the pandemic. However, this thesis does not aim to evaluate the fairness of compensation levels. Rather, it is intended to contribute to the understanding of how different drivers affect compensation in general. In the context of income distribution, it thus contributes to the literature by highlighting how the voice of the workforce, times of crisis, and firms' innovation investments affect pay structures.

(i) Trade Unions and Parity Codetermination

The **first chapter** of this thesis is entitled **"The Effects of Unions on Executive Compensation in Germany"** and investigates the role of trade unions as drivers of executive compensation in German firms. It examines the impact of trade unions on the level of total, fixed, and variable executive compensation and the share of variable remuneration. In this context, the special role of the framework of parity codetermination, which provides German trade unions with a unique say in the setting of executive pay, is taken into account.

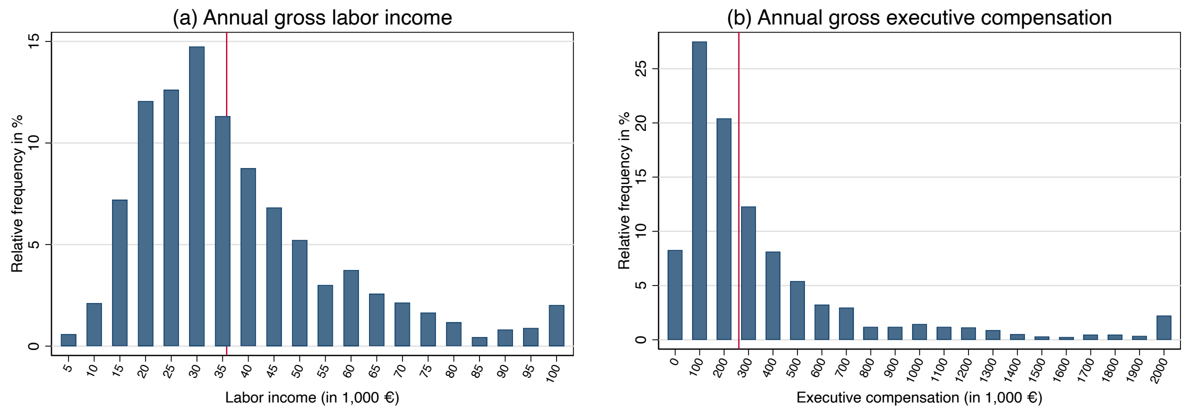
Executive compensation is a perennial subject of criticism. This was apparent, for example, during the 2008/2009 financial crisis, when some banks paid high bonuses to executives despite being rescued from insolvency by the government (see Fabbri and Marin, 2016 for an overview). More recently, high bonus payments to Deutsche Bahn executives for the year 2022 have also been criticized, as targets for punctuality and customer satisfaction were not achieved.[1] In contrast, it is argued that performance should be rewarded with additional bonuses on top of the base salary to incentivize good performance (e.g., Kramarsch, 2004; Murphy, 2013). However, the success of this incentive orientation is sometimes questionable. For instance, Fabbri and Marin (2016) find that the strong increase in executive pay in Germany between 1977 and 2007 is hardly attributable to executives' performance and that poor performance is scarcely penalized. With regard to high levels of executive pay (particularly when compared to the wages of regular employees), such findings might be a reason for trade unions to address the compensation of executives.

Figure 1 shows the 2018 income distribution of (a) full-time employees and self-employed workers, and (b) executives in Germany. Both groups show a right-skewed income distribution. Incomes are inherently skewed to the right, with the result that only a few employees earn the highest incomes (e.g., Neal and Rosen, 2000). While the annual income of employees ranges between 8.3 and 135 thousand euros, the average remuneration of executives is considerably higher and ranges between 31 thousand and 3.3 million euros. However, at 36 (40.4) thousand euros, the median (mean) income of employees is

[1] See, e.g., `https://www.tagesschau.de/investigativ/ndr-wdr/bahn-vorstand-bonus-100.html` (Last access: March 23, 2024).

at the lower end of the distribution. Similarly, the average compensation of executives is at the lower end of the executives' distribution with a median (mean) of 260 (421.6) thousand euros. Nevertheless, the median (mean) income of managers in 2018 was 7 (10) times that of regular employees.

Figure 1: Income distribution of (a) full-time employees, and (b) executives in 2018



Notes: Own calculations based on data of (a) the socio-economic Panel (SOEP, DOI: 10.5684/soep-core.v35) and (b) Kienbaum Consultants International GmbH; the red vertical lines indicate the median value.

Figure 1 implies both inequality among employees and managers, as well as a high inequality between managers and employees. According to the Fair Wage-Effort hypothesis (Akerlof and Yellen, 1990), employees could therefore intentionally reduce their performance in response to unfair wages. Performance reductions or even terminations thus represent an exit strategy according to the "Exit-Voice" theory of Freeman and Medoff (1984). The corresponding risk to the firm's productivity allows the workforce, and trade unions in particular, to use this as a threat potential (Freeman, 1976) to counteract unfair wages. In this way, the workforce, which is usually represented by trade unions, can raise its "voice" in order to achieve higher wages or lower executive pay.

While several studies describe the role of trade unions in setting the wages of employees (e.g., Bonaccolto-Töpfer and Schnabel, 2023; Card et al., 2020; Fitzenberger et al., 2013), the impact of trade unions on executive pay in Germany is hardly researched. In an international context, it is argued that unions are indeed able to affect the compensation of executives. For instance, trade unions, as the aggregated voice of the workforce, can express their concerns about high wage differentials, potentially supported by the threat of industrial action (see, e.g., DiNardo et al., 1997; Freeman and Medoff, 1984; Singh and Agarwal, 2002). Firms may therefore reduce the wage gap by lowering executive pay or raising workers' wages, making unions act like a tax on corporate profits (Banning and Chiles, 2007; Vedder and Gallaway, 2002) and leading to more inflexible decisions by managers (Boodoo, 2018; DiNardo et al., 1997; Gomez and Tzioumis, 2006). In this context, empirical studies find a negative impact of unions on CEO compensation in the United States and Korea (Banning and Chiles, 2007; DiNardo et al., 1997; Gomez and Tzioumis, 2006; Huang et al., 2017; Park, 2021), while in Canada no effects in metal-mining firms (Singh and Agarwal, 2002) or positive effects during the financial crisis (Boodoo, 2018) are observed.

Due to institutional settings in Germany, trade unions have a unique opportunity to influence executive compensation. In particular, large firms with more than 2,000 employees are generally subject to the regulation of parity codetermination. In this case, the supervisory board is made up of an equal number of shareholder and employee representatives, with the employees being represented by internal employees and trade union delegates. The responsibilities of the supervisory board include monitoring, appointing and dismissing members of the executive board and determining executive compensation. Consequently, trade unions already have a say in the planning of executive pay. Furthermore, trade unions in Germany differ from other countries, such as the United States, in that they do not act at the firm level, but at the industry level. This should strengthen the position of unions, as they are likely to be larger and have access to the accumulated knowledge of the industry. A stronger union is generally characterized by a higher union density, which reflects employees' expectations of traditional representation of their interests. Consequently, a higher union density implies that the union is legitimized by more employees and can therefore increase the pressure on firms.

The German framework of parity codetermination should therefore offer strong trade unions, in particular, a unique opportunity to influence executive remuneration. However, this specific field of research is still largely unexplored. Existing studies either focus solely on parity codetermination (Dyballa and Kraft, 2020; Gorton and Schmid, 2004; Lin et al., 2019) or use the mere presence of trade unions on the supervisory board of codetermined companies (Vitols, 2008) to examine the effects on executive compensation. The first chapter of this thesis relates to this research and to various studies from the United States, Korea, and Canada on the effect of unions on executive compensation. This chapter examines the impact of union density on executive pay in Germany and relates the effects to parity codetermination. For this purpose, a unique and large panel data set consisting of around 10,000 observations over the period from 1998 to 2017 is used. The utilization of panel data econometrics with a large number of observations is very rare in the German context. This provides unique insights that also take the long-term trends in executive remuneration and the power of trade unions into account.

The results of fixed-effects regressions show a negative effect of a marginal increase in union density on executives' total compensation and salaries. Moreover, the interaction with parity codetermination indicates that trade unions do indeed appear to use their position on the supervisory board to influence executive pay. Based on correlated random-effects estimations (Mundlak, 1978), a significantly higher level of executive pay and ratio of variable components can be found in codetermined firms. However, neither the effects of the union density on variable pay nor the redistribution effects of the compensation structure could be shown. Several robustness tests confirm the findings. Altogether, the results indicate a reducing effect of trade unions on total remuneration and fixed components, while the ratio of variable compensation is higher in codetermined firms. This suggests that unions use their position on the supervisory board to reduce the level of executive pay while maintaining incentives for good performance.

(ii) COVID-19

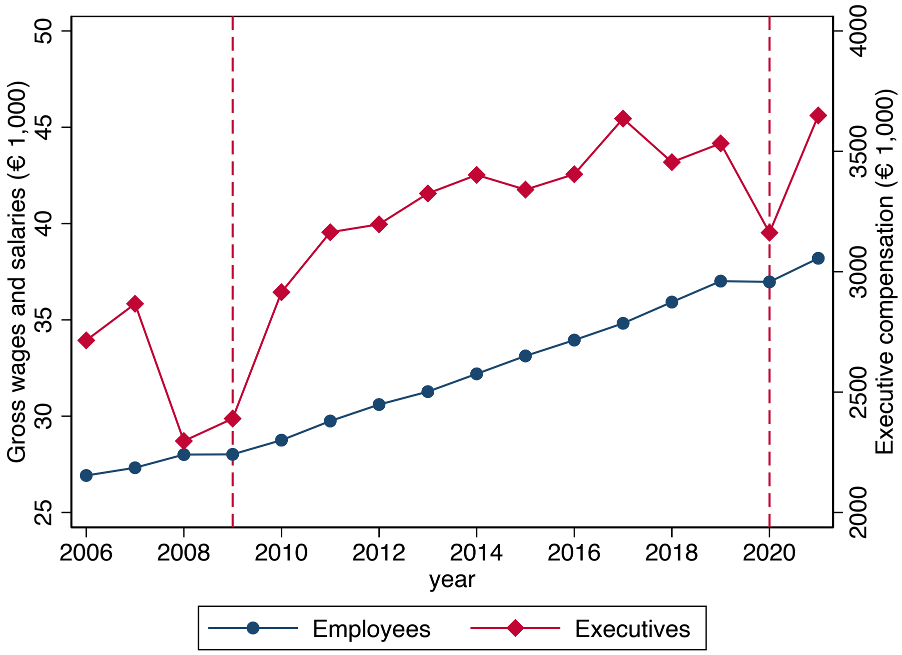
The **second chapter** of this thesis is entitled **"Who Pays for the COVID-19 Pandemic?: A Comparison of Stakeholders' Income Reductions in German Firms During the Crisis"**. It analyzes the probabilities of pay adjustments to internal stakeholders (i.e., shareholders, executives, middle managers, and other employees) for firms that are negatively affected by the COVID-19 pandemic.

The unexpected outbreak of the COVID-19 pandemic confronted the economy and society with major difficulties. Measures such as lockdowns and contact restrictions, as well as remote working and teaching, proved to be highly successful in containing the pandemic, especially at the beginning of the crisis in Germany. However, these measures had strong negative effects on the German economy, which is reflected in a GDP decline in 2020.[2] Moreover, a survey from 2020 shows that the majority of firms report severe negative economic consequences of the pandemic, which are particularly reflected in de-

[2]https://www.destatis.de/DE/Presse/Pressemitteilungen/2021/01/PD21_020_811.html (last access: March 23, 2024).

clining demand and financial constraints due to high wage payments (BMWi, 2020). In this context, Figure 2 compares the trend in executive compensation of German DAX firms with wages and salaries per regular employee during the period from 2006 to 2021.

Figure 2: Average gross wages vs. DAX executive compensation



Notes: The data on executive compensation is taken from the studies on management remuneration of the Deutsche Schutzvereinigung für Wertpapierbesitz e.V. (DSW) in cooperation with the Technical University of Munich (TUM); data on employees' wages are obtained from the Genesis data portal of the German Federal Statistical Office (Destatis; code 81000-0111); vertical dashed lines are official recession years.

Over these 16 years, executive compensation increased from 2.7 to 3.6 million euros while employees' wages and salaries grew from 26.9 to 38.2 thousand euros. During the financial crisis of 2008/2009 and the COVID-19 crisis, both executives and employees experienced a decline in pay growth. However, the impact on employees' wages was substantially lower than the effects on executive remuneration. In the context of the financial crisis, executive pay decreased by about 20% in 2008, while wage growth stagnated in 2009. This suggests that variable components, in particular, make executive pay more adjustable than the wages of regular employees. These observations are also apparent during the pandemic, as wages declined by only approximately 0.1%, while executive pay decreased by 10%.

Several studies already empirically investigated the impact of crises on dividends (e.g., Ali, 2022a; Hauser, 2013; Kilincarslan, 2021; Krieger et al., 2021), executive compensation (e.g., Batish et al., 2020; Gabaix et al., 2014; Sonenshine et al., 2016), middle managers (e.g., Kampkötter and Sliwka, 2011; Kampkötter, 2015; Grund and Walter, 2015), and regular employees (e.g., Adams-Prassl et al., 2020; Akerman et al., 2022; Grabka, 2021). These studies, however, do not compare pay adjustments to different groups of stakeholders. A combined analysis would provide insights into whether and to what extent companies are passing through the implicit costs of the crisis differently to the various groups. Each group is decisive for the firm's success, requiring a careful weighing up of the decision to reduce costs at the expense of stakeholders. However, based on the current state of knowledge, such a study has not yet been conducted.

The second chapter therefore addresses this research gap. For this purpose, cross-sectional survey data on 6,650 German companies during the pandemic year 2020 provided by the German Business Panel (GBP) is used. The affected firms are identified by pandemic-related revenue declines compared to the beginning of 2020. This refers to several studies that find a strong link between revenues and the affectedness (e.g., Bloom et al., 2021; Bruhn et al., 2023; Fairlie and Fossen, 2022; Makni, 2023; Shen et al., 2020). Various probit regressions are applied to determine the probability that negatively affected firms pass on the implicit costs of the crisis to the respective stakeholder groups.

The results show that affected firms are approximately 20.6 to 24.4 percentage points more likely to reduce pay to all groups of stakeholders. This might be attributable to the Fair Wage-Effort hypothesis (Akerlof and Yellen, 1990), as there are most likely interactions between these stakeholder groups causing them to respond to the pay (adjustments) of the other groups. As a result of unilateral adjustments, a reduction in the effort of the affected group would be possible. For this reason, an adjustment of all stakeholders seems appropriate to avoid dissatisfaction among the stakeholder groups. Moreover, the results show that executives differ significantly from the other stakeholders as they have the highest probability of pay cuts. Further regressions provide evidence of effect heterogeneity, as the probabilities become higher for firms that are more affected. Again, the likelihood is highest for executives. Further effect heterogeneity can be found in terms of firm size, as larger firms tend to have a higher probability of pay cuts, particularly for executives, middle managers, and other employees. Moreover, measuring the affectedness continuously to determine the impact of a marginal increase in revenue declines confirms the previous results. 2SLS regressions using revenue changes in Swedish industries as instrumental variables further support the findings. Finally, several further robustness tests, including inverse probability weighting, complement and validate the results.

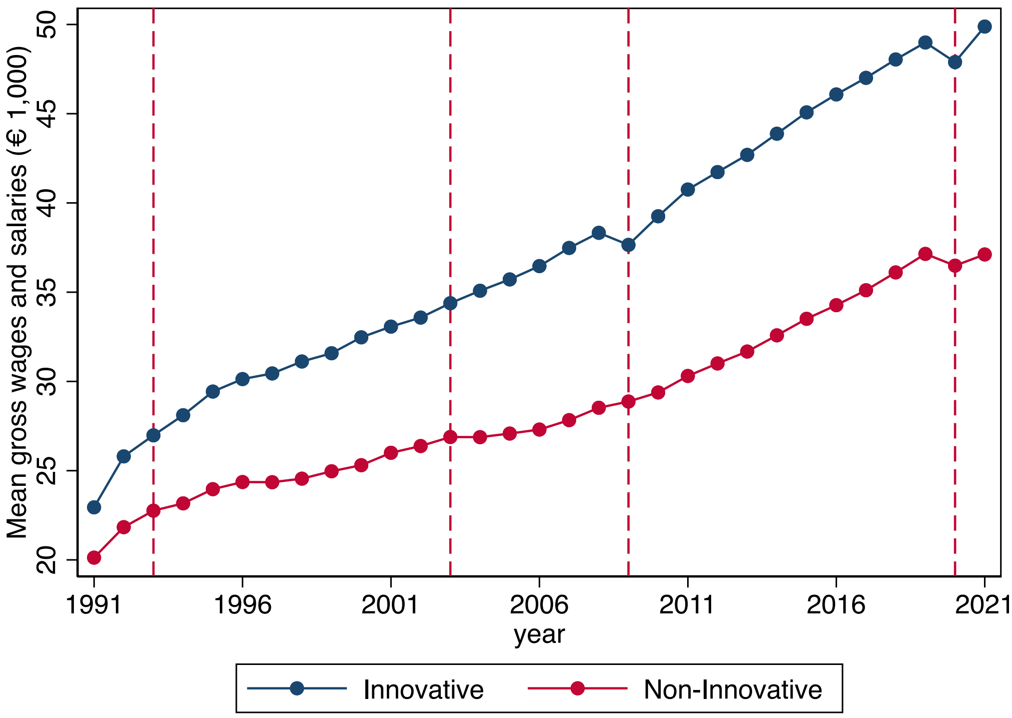
(iii) Innovation during COVID-19

The **third chapter** of this thesis is entitled **"A comparison of pay adjustments to stakeholders during COVID-19 between innovative and non-innovative firms"** and considers the important role of innovativeness in times of economic crisis. While several studies find that innovative firms are more resilient to crises (e.g., Cefis et al., 2020; Khan et al., 2022; Özşuca, 2023; Roper and Turner, 2020), this chapter aims to identify different cost adjustment strategies of innovative firms as a possible underlying reason for this observation. Specifically, the study examines the extent to which innovative and non-innovative companies and industries that are affected by the COVID-19 crisis differ in the adjustment of payments to various stakeholders (shareholders, executives, middle managers, and other employees). This chapter therefore extends the previous one by considering innovation as a decisive factor in dealing with the COVID-19 crisis.

The role of innovations during economic crises is of special interest. In particular, the advantages of innovative firms, such as greater competitiveness or better adaptability to new market situations, are well known (e.g., Aghion et al., 2005; Aw et al., 2007; Cefis and Marsili, 2006). Nevertheless, in innovative firms, the higher stock of specific human capital (Becker, 1962; D'Amore et al., 2017) and the importance of skilled employees in the innovation process (Lenihan et al., 2019; Subramaniam and Youndt, 2005; Sun et al., 2020) should be accompanied by high personnel costs and therefore increase the risk of liquidity constraints in times of crisis.

Figure 3 shows the trend in average gross wages and salaries according to the innovation status of the respective industry. Over the entire period, it can be seen that innovative industries pay higher wages than non-innovative ones, and the trend between innovative and non-innovative sectors is largely parallel. However, there are differences in times of crisis. During the recession periods of 1993 and 2003, no decline in wages can be observed. In contrast, during the financial crisis, wages in non-innovative industries increased by 1.2%, while they decreased by 1.8% in innovative sectors. However, during the COVID-19 crisis, wages declined in both types of industries. While wages in non-innovative industries fell by 1.8%, the decline in innovative ones was 0.4 percentage

Figure 3: Mean gross wages and salaries by innovation status



Notes: The data on employees' wages are obtained from the Genesis data portal of the German Federal Statistical Office (Destatis) (code 81000-0111); innovative industries are identified using the Stifterverband Wissenschaftsstatistik, whereby industries are innovative if their R&D intensity exceeds the median value of all industries; vertical dashed lines are official recession years.

points higher.

Although it might be surprising that innovative industries reduce wages more strongly than non-innovative ones during the financial and COVID-19 crises, from a theoretical point of view, there are several reasons why innovative firms and industries have to respond more strongly to economic crises. First, the higher specific human capital stocks mentioned above bind the workforce to the company, as specific knowledge can hardly be applied in other firms. This should simplify the reduction of payments to executives, middle managers, and regular employees in innovative firms. Secondly, particularly for other employees, the generally higher qualifications of the workforce are likely to result in wages above the collectively agreed rates (Aghion et al., 2017; Ammermueller et al., 2009). Third, high R&D investments lead to larger financial requirements and thus to a higher risk of financial constraints. To ensure the ability to innovate, a greater need to reduce costs via compensation cuts would therefore be likely.

The fourth chapter addresses these considerations and empirically investigates how innovative industries and firms differ from non-innovative ones in adjusting payments to stakeholders in response to the impacts they faced due to the COVID-19 crisis. This study is probably the first that focuses on the adjustment strategies of innovative firms/industries during the pandemic in relation to these stakeholder groups. The findings thereby contribute to the state of research by highlighting possible reasons why innovative firms are more resilient to crises.

The econometrical approach is divided into two parts. The first part distinguishes payment adjustments to the four stakeholder groups due to the crisis and examines differences between firms in innovative and non-innovative sectors. For this purpose, sectors are classified as innovative if their research and development (R&D) intensity is above the median of all industries. Data on R&D intensity is obtained from the Stifterverband Wissenschaftsstatistik. This data is added to the GBP survey and thus enables a direct cross-sectional comparison of innovative and non-innovative sectors in terms of the respective adaptation strategies. An interaction between a dummy variable indicating innovative sectors and an affectedness variable measured by the crisis-related decline in revenues enables a difference-in-differences interpretation.

In the second part, innovations are measured at the firm level. For this purpose, a panel data set for the period from 2012 to 2020 consisting of approximately 114,000 observations is generated on the basis of data from Bureau van Dijk (Orbis Intellectual Property and Dafne) and the Stifterverband. This data set enables a direct distinction between innovative and non-innovative firms, as well as the application of panel data econometrics regarding actually realized adjustments. However, this data set does not allow a distinction between different stakeholder groups. Instead, adjustments to average personnel expenses per employee are used as the dependent variable. Using linear probability and fixed-effects models, difference-in-differences regressions are performed based on the interaction of a dummy for innovative firms and a crisis dummy (year = 2020). In addition, triple differences estimations are carried out by adding the affectedness (measured as revenue declines between 2019 and 2020) as a third dimension.

The results indicate that firms in innovative industries that are affected by the COVID-19 crisis cut back on payments to shareholders and executives in particular. Supplementary estimates, including a 2SLS approach that instruments the affectedness with sectoral revenue declines in Austria, confirm these results and also provide evidence for adjustments for middle managers and other employees. This suggests that innovative firms are especially passing on the implicit costs of the crisis to the groups with the greatest financial leeway. In addition, there is evidence that innovative firms reduce personnel expenses per employee during the crisis. This can be demonstrated both when all firms are considered to be affected in general and when the affectedness of the firms is explicitly taken into account.

Further tests show that innovative industries tend to be more financially constrained, which suggests that they are more likely to be forced to cut pay. In particular, the variable remuneration structure of executives and the volatility of dividend payouts could possibly be a reason why innovative firms/industries are primarily compensating the costs of the crisis through the saving potential of shareholders and executives. Various robustness tests indicate, among others, that the reduction in average personnel expenses is neither due to a simple decline in employment nor to the German short-time work program.

Part II

Main Chapters

Chapter 1

The Effects of Unions on Executive Compensation in Germany

Co-authored with Kornelius Kraft

This study examines the relationship of trade union power and executive compensation in German companies. We primarily study the unique ability of unions, as representatives of the workforce, to influence the setting of executive compensation in parity-codetermined firms. For this purpose, we use a unique dataset that consists of about 10,000 firm-years for the period 1998–2017. We find that executive compensation in codetermined firms declines by 1.7% when union density increases by one percentage point. We also find that these effects are particularly due to a decline in salaries. However, an effect of unions on the composition of compensation could not be demonstrated. Several robustness tests confirm our results. We therefore conclude that unions use their say on executive compensation on the supervisory board of codetermined firms to reduce base compensation but maintain performance-oriented pay.

1.1 Introduction

The demand for equality and codetermination is more strongly embraced in society than ever before. For instance, demands for equality in speech, career choice, and pay, or codetermination in political processes, such as the issue of climate policy, are becoming increasingly louder. Against this background, the amount of executive compensation does not fit into the idea of an equal society. For instance, in 2021 the executives of the 40 DAX companies earned an average of 3.9 million euros, which is per capita 53 times more than the average wages of employees.[1] It is therefore hardly surprising that unions are also focusing on the high amounts of executive compensation. In the context of an increasing income gap between management and employees, the German Trade Union Confederation (DGB) criticizes a gradual redistribution of remuneration structures from the bottom to the top. This trend is particularly perceived as inappropriate by employees if the increase in management compensation is not directly linked to the executive's performance (DGB, 2017). In addition, the trend in management compensation is also perceived critically by society. For instance, a representative survey commissioned by the DGB in 2007 shows that 83% of the German voting population also consider the compensation of DAX CEOs to be inappropriate (DGB, 2007a). For this reason, the DGB advocates for a slowdown in the growth of executive compensation and a sustainable long-term incentive-based compensation (DGB, 2007b). Thus, unions seem to be external factors that firms have to take into account when setting compensation structures (Jensen and Murphy, 1990).

Our research question therefore asks whether unions have an impact on executive compensation in Germany. In this context, in an international comparison, German trade unions have unique options to influence executive compensation. For instance, the German Codetermination Act (MitbestG) of 1976 provides employee representatives in large companies with more than 2,000 employees a special say.[2] Here, 50% of the seats on supervisory boards are filled by employee representatives (by employees of the firm and external representatives of the unions).[3] One important function of the supervisory boards is to determine the compensation of the management boards. This provides labor representatives with a unique opportunity to participate directly in the concrete design and composition of executive compensation. Unions, as the aggregated voice of the workforce (Freeman and Medoff, 1984), are more effective in asserting the ideas and interests of employees in negotiations with capital representatives. We argue that stronger unions, measured by the union density, are legitimized by more employees and are therefore in a better position to assert their position more aggressively on the supervisory board. The union density thus reflects the workers' expectations of a traditional representation of their interests. Strong unions in particular are not conflict-averse, as they bring their

[1] https://www.dsw-info.de/presse/archiv-pressekonferenzen/pressekonferenzen-2022/dsw-vorstandsverguetungsstudie-2022/ (last access: March 23, 2024).

[2] For a general overview of the impact of parity codetermination, see e.g., Jirjahn (2011).

[3] This form of board-level representation in Europe is quite unique. Employees generally receive 20–40% of the seats on the board. The German Codetermination Act differs in a special way, as the employees are parity represented on the board (Jäger et al., 2022).

experience from collective bargaining in the industry to the supervisory board. Consequently, unions have the ability to use parity codetermination as a channel to influence the amount and structure of executive compensation. Since German unions operate at the industry level, union delegates act as the voice of employees across the industry (Eulerich et al., 2022), and contribute the aggregated knowledge and concerns of the workforce from many companies to the negotiations.

To the best of our knowledge, this specific field of research is still unexplored. We contribute to the state of the research by observing industry-level aggregate unions that have a direct impact on executive compensation due to parity codetermination. The role of employee representation is of particular interest in this context and may provide insights with regard to the increasing discussion on the introduction of codetermination regulations in the United States, the United Kingdom or Canada (see, e.g., Jäger et al., 2022).

Our study is structured as follows: Section 1.2 describes the institutional framework in Germany and discusses how unions can affect executive compensation. It also provides a literature review. In the Section 1.3, we describe our data set, the descriptive statistics, and the estimation methodology used. Section 1.4 presents the results of the empirical investigation and examines the factors driving the results. We also estimate the impact of codetermination separately by using correlated random-effects regressions in Section 1.5. Several robustness tests in Section 1.6 confirm these results, with Section 1.7 providing a summary of the relevant results and a conclusion to the study.

1.2 Institutional Framework of Trade Unions in Germany

1.2.1 The Trend in Executive Compensation in Germany

As in the United States, the compensation of German executives is characterized by a strong upward trend. For instance, Figure 1.1 (a) shows that, over a period of 20 years, real executive compensation in Germany has increased from around 500 thousand euros to over 750 thousand euros, characterized by greater reductions only during the financial crisis of 2008/2009.[4] By comparison, compensation in the United States follows a very similar

[4]Note that this data also includes information on small companies. Most studies only consider the largest companies, which thus have much higher executive compensation.

trend, but with considerably higher amounts of remuneration. For instance, American executives have experienced an increase in real compensation from around 2.4 million to over 4 million dollars over the same period. Even though executive compensation in Germany is in an entirely other dimension, it shows a strong pay gap compared to ordinary employees.

Figure 1.1: Comparisons of the trend in executive compensation

Notes: Data on executive compensation and annual wages are deflated by the consumer price index (2015 = 100), sources: Kienbaum compensation data, Bureau van Dijk, Compustat, and OECD.

Figure 1.1 (b) illustrates the trend in real executive compensation in Germany against the real annual wages of employees. Starting with wages of about 34.5 thousand euros in 1998, wages increase to about 39 thousand euros by 2017. This also points to a widening income gap between executives and ordinary workers, already at 14.5 in 1998 and rising to 19.8 by 2017.

Moreover, Figure 1.1 (c) illustrates a strong link between firm size and executive compensation, while Figure 1.1 (d) suggests that executives seem to be paid largely independent of their performance. Several empirical studies confirm these findings (see, e.g., Fabbri and Marin, 2016; Gabaix et al., 2014; Gabaix and Landier, 2008).

Particularly in light of the missing link to firm performance, the high pay gap between executives and employees is frequently criticized by society, politics, and trade unions. For instance, the DGB argues that the development of executive compensation is still perceived by many employees as being unfair and may lead to negative effects on firm performance in the long term. Therefore, the DGB demands a mandatory cap on executive compensation in relation to employee income as well as a cap on variable compensation components and a stronger focus on long-term incentives (DGB, 2017). Moreover, German legislation introduced binding rules to increase the transparency and appropriateness of management pay with the Management Board Compensation Disclosure Act (VorstOG), which was enacted in 2006, and the Act on the Appropriateness of Management Board Compensation (VorstAG), which came into force in 2009. However, the increasing trend in compensation and pay inequality remains, and can thus lead to pronounced frustration among workers (Edmans et al., 2017; Freeman, 1976). Trade unions have been concerned with the remuneration of managers for some time and have made a number of efforts to counteract inappropriate pay.

1.2.2 Discussion in Literature

Previous literature distinguishes various channels through which trade unions can have an impact on executive compensation. For instance, Freeman and Medoff (1984) describe unions as the aggregated voice of the workforce, which provides an institutional counterweight to the management. This allows unions to express their concerns about high wage differentials to management without causing individual employees to fear personal consequences. Expressing concerns about executive compensation builds pressure at the board level, especially during collective bargaining or labor disputes, and can be reinforced by further actions such as threats of strikes or raising public awareness (DiNardo et al., 1997; Singh and Agarwal, 2002). In addition, unions can interpret high compensation levels as a signal of a firm's good financial health and intensify wage demands. As a consequence, a more prudent determination of executive pay would be rational as an avoidance strategy (Jensen and Murphy, 1990). This could be a particularly rational response since unions act like a tax on corporate profits by increasing workers' wages without increasing productivity simultaneously (Banning and Chiles, 2007; Vedder and Gallaway, 2002). Moreover, it is argued that the presence of unions leads to more inflexible decisions by managers, increased resources devoted to bargaining, and a redistribution of returns to employees. For this reason, the profitability and share price of companies react negatively to the presence of unions, which in turn leads to a reduction in variable compensation components (Boodoo, 2018; DiNardo et al., 1997; Gomez and Tzioumis, 2006).

In an international context, there is also empirical support for these theories. Most studies refer to the United States. For instance, DiNardo et al. (1997) find a negative correlation between union density and CEO compensation, but no effect of a change in union density on CEO compensation growth over time. Instead, they find evidence of a redistribution of rents towards employees by reducing the number of board members and thus the total compensation. Moreover, Gomez and Tzioumis (2006) find that total CEO compensation is lower in unionized firms. In particular, the effects are due to a reduction in stock-based compensation and have a stronger effect for higher percentiles. Similarly, Banning and Chiles (2007) find that union presence as well as union density lead to a reduction in total compensation and, as an offset, lower compensation risk for CEOs. Huang et al. (2017) also find a negative effect of industry-specific union density on CEO compensation, particularly in the context of contract negotiations.

In contrast, Singh and Agarwal (2002) find no relationship between union density and CEO compensation in the Canadian metal mining industry, but a redistributive effect towards fixed salaries. Boodoo (2018) even finds for Canada that higher union density in recessions leads to higher CEO compensation, which is particularly due to fixed pay as well as restricted stock units. He concludes that unions cannot exert pressure on CEO compensation in times of financial crisis. Finally, for South Korea, Park (2021) finds a negative effect of union presence and union density on cash compensation and the probability of stock option compensation.

1.2.3 The German Framework of Parity Codetermination

So far, the literature has provided some evidence and explanation of the impact of unions on executive compensation. However, due to the special institutional settings, these approaches do not seem to fit as well for Germany. In particular, as opposed to most other countries, Germany is characterized by a two-tier system consisting of an executive board and a supervisory board. While the executive board of a company is responsible for the executive operating decisions, the supervisory board is accountable for monitoring the decisions of the managers, appointing its members, and determining executive remuneration. Therefore, it is the responsibility of the supervisory board to implement adequate compensation systems that take account of competition from the market for managers and simultaneously provide appropriate incentives for the executives to act in the interests of the shareholders.[5] Thus, in addition to salaries, variable compensation elements are also defined, whose amounts depend on various performance measures, for example, and thus provide incentives for good leadership.[6]

With respect to the impact of employee representation on executive compensation, in international comparison, German law provides a special feature with the framework of parity codetermination. The German Codetermination Act (MitbestG) of 1976 states that, particularly in public corporations with more than 2,000 employees, half of the supervisory board must generally be composed of employee representatives.[7] In this case, the representatives of the trade unions and the employees are directly involved in determining the remuneration of the management board.[8] Therefore, German trade unions have a unique opportunity to affect executive compensation through the direct channel. German trade unions do not operate directly in the company, but primarily conduct collective bargaining at the industry level. Thus, unions can initially be expected to exert an industry-related influence on executive compensation. However, the ability

[5] The standard approach to analyzing the problem of separating ownership and control is the principal-agent model (see among many contributions Jensen and Meckling, 1976 or Holmstrom and Milgrom, 1987).

[6] While in the international context variable compensation components have long been a decisive factor in total compensation, variable compensation components have only gained importance in Germany since around the turn of the millennium (Kramarsch, 2004). For example, Fernandes et al. (2013) find that, in 2006, CEO compensation consisted of 39% salaries, 10% other pay, to 41% bonuses, and only 10% stocks and options. At the same time, CEO compensation in the United States consisted of 28% salaries, 6% other pay, 27% bonuses, and 39% stocks and options.

[7] In Germany, there were already regulations on parity codetermination in companies before the Codetermination Act of 1976, such as the Montan Codetermination Act of 1951 for companies in the mining, and iron- and steel-producing industries. Moreover, according to the Act on One-Third Employee Participation on the Supervisory Board (DrittelbG), only one third of the supervisory board must consist of employee representatives if more than 500 but no more than 2,000 employees work in the company.

[8] In addition to parity codetermination, the Works Constitution Act also stipulates that companies with at least five employees are allowed to form a works council. Works councils are not mandatory, but they are found in a large number of companies and most of the members of the works councils are union members. They do not have the right to participate in setting executive compensation, but they do have a strong say on other matters and veto rights. They also communicate regularly with employees and management on many issues, and may also raise concerns about excessive manager salaries in this context. Unfortunately, we do not have precise data on the presence of works councils in the companies we studied, but since we tend to have larger firms in our sample, the majority are likely to have a works council.

of employee representatives from the company and the trade unions to exert influence is limited as, together, they have the same voting rights as the shareholders. Since the chairman of the supervisory board has dual voting rights and is always provided by the shareholders, they can outvote the employee representatives.

In the context of codetermination, Gorton and Schmid (2004) find that firm performance has a negative impact on executive compensation in parity codetermination firms, which is attributed to the consideration of different objective functions of employee representatives and shareholders on the supervisory board. In contrast, Dyballa and Kraft (2020) find a positive causal impact of parity codetermination on the share of variable compensation, and conclude that employee representatives and shareholders pursue a similar objective function to ensure the long-term survival of the firm. Similarly, Lin et al. (2019) also find a positive impact of parity codetermination on executive compensation. Since better employment protection was also observed, the authors conclude that greater cooperation between employees and managers in codetermined firms leads to an alliance between the two groups. These results are also in line with the findings of Bertrand and Mullainathan (2003), namely, that managers tend to care more about employees than shareholders in order to avoid conflicts with unions. Finally, Vitols (2008) finds that union presence on the supervisory board of codetermined firms reduces very high total compensation amounts as well as the share-based proportion of CEO compensation.

It is thus obvious that trade unions can indeed choose the direct way by applying their "voice" to the determination of executive compensation. This should also be the main difference compared to most other countries. However, even if trade unions operate as representatives of the employees, it can be expected that all three groups on the supervisory board pursue their own interests (see, e.g., Gorton and Schmid, 2004). The divergence among employee representatives and trade unions is attributable to differing perspectives. While the employee representatives advocate the interests of the company, the union delegates stand for the interests of all employees in the industry (Eulerich et al., 2022). Thus, unions act as the voice of the workforce of the entire industry. In this way, they can also contribute the knowledge and concerns of the workforce from other companies in the industry to the negotiations. We further argue that a stronger union has a better ability to assert its position on the supervisory board. Union power reflects workers' expectations of a traditional representation of their interests. A stronger union is legitimized by more employees and is thus able to enforce demands more aggressively. Additionally, as large unions have more sector-specific resources, they can exert greater pressure on the company (Chyz et al., 2023; Eulerich et al., 2022). We therefore expect that the union density, as an indicator of union power as well as of workforce expectations, will show how effectively union representatives use their voice on the supervisory board to limit executive compensation.

1.3 Data and Methodology

1.3.1 Data and Sample Selection

For our study, we combine different data sources. Since there is no suitable data set on German executive compensation, we received data from Kienbaum Consultants International GmbH. This data contains information on firms that are subject to the disclosure obligations for executive compensation. Therefore, compared to most other studies for Germany, we can use detailed information on small companies as well as on the largest ones. However, since accounting data are limited, we add financial and employment data of firms obtained from Bureau van Dijk's Dafne and Osiris database.[9] Due to the institutional framework in Germany described above, we also include a dummy variable for parity-codetermined firms obtained from the Hans-Böckler Foundation.[10] In addition, we use union density as a proxy for the power of unions to mobilize employees and exert public pressure (see, e.g., Park, 2021).

Data on unionization can be obtained as a time series from official statistics (e.g., OECD) at the country level. However, in order to include a cross-sectional dimension, we generate the union density for Germany at the industry level using data on union membership from the DGB[11] and the number of employees per industry available from EU Klems (Stehrer et al., 2019). Additionally, we assign the DGB unions to the different

[9] To link compensation and firm data, we identify the different firms by the so-called "Crefonummer". This is an individual number assigned by the leading credit agency in Germany, Creditreform, to firms, which are rated by them (almost every German firm is rated by Creditreform).

[10] Many studies on German codetermination calculate a dummy variable that takes the value 1 if the firm has more than 2,000 employees and 0 otherwise. This measure can indeed be used since German law directly links parity codetermination to the number of employees. However, there are possible deviations, where firms with more than 2,000 employees are not codetermined (e.g., in the case of the Societas Europaea), or where firms with less than 2,000 employees are voluntary codetermined. Hence, using the information of the Hans-Böckler Foundation is a more accurate way to measure parity codetermination.

[11] This data is available at https://www.dgb.de/uber-uns/dgb-heute/mitgliederzahlen (last access: March 23, 2024).

industrial sectors based on the individual union statutes. We therefore define the ratio of union members to employees in the respective union-represented industry as the gross union density. A union may operate in more than one industry. Therefore, we weight the number of union members by the ratio of employees in one industry to the sum of employees in all industries for which the union is responsible. This makes it possible to assign the number of union members to the respective industries. Since an industry may also be represented by more than one union, we sum the number of all union members within an industry. Thus, by dividing the number of union members in an industry by the number of employees in the sector, we obtain the industry-specific gross union density.

Since EU Klems provides only the relevant data for union density up to 2017, we restrict our observation period to 1998–2017. Moreover, we remove observations from NACE revision 2 sections A (agriculture, forestry and fishing), B (mining and quarrying), E (water supply; sewerage, waste management, and remediation activities), O (public administration and defence; compulsory social security), P (education) and Q (human health and social work activities) since their executives are remunerated according to other criteria. Some firms are also classified in NACE category 70 (activities of head offices; management consultancy activities) as they are managed through holding companies. We assume that the assignment does not reflect the correct industry relevant for the unions and therefore we remove observations from this sector as well. Furthermore, most variables are winsorized by the upper and lower 1% to account for outliers. Altogether, we thus obtain an unbalanced panel with 10,027 observations from 1,508 firms for the years 1998 to 2017.

Dependent variables. We examine different regression models with similar specifications of control variables. In particular, this study aims to examine the impact of unions on executive compensation. For this purpose, $Comp$ is defined as the total compensation per head in thousands of euros. Furthermore, the variable $Salary$ measures the fixed part and $VarComp$ the variable part of average executive compensation, also measured in thousands of euros. These variables are included logarithmized in the estimation models.[12] Moreover, the variable $VarCompRatio$ represents the ratio of variable compensation to total compensation and accounts for the compensation structure in the firms.

[12]Since variable compensation also includes zero values, the logarithm is defined using the inverse hyperbolic sine transformation (see, e.g., Bellemare and Wichman, 2020).

Independent variables. We estimate the impact of union power via parity codetermination on executive compensation using the interaction term $UnionDensity \times Codetermined$. It consists of the industry-level gross union density ($UnionDensity$) measured in percentages, which is defined as described above and is additionally included in the regression model. By including union density at the sectoral level while measuring compensation at the firm level, we can largely rule out endogeneity biases. The interaction term also consists of the dummy variable $Codetermined$, which takes the unit value if the corresponding firm is parity-codetermined in at least one year of observation and zero otherwise. Since this variable does not vary over time, we cannot estimate the effect of codetermination separately using fixed-effects regression.[13]

Control variables. We include a set of control variables in our model. Standard regressors in the literature on executive compensation are firm size and a measure of firm performance. Therefore, we control for firm size using the logarithm of number of employees. We also use return on equity (ROE) as an operating performance indicator.[14] Additionally, we include the dummy variable Profit, which takes the unit value in the case of positive annual net incomes and zero otherwise, and interact this variable with the current return on equity ($ROE \times Profit$). We thereby test whether and to what extent good performance is rewarded by compensation structures. Furthermore, we control for the number of executives in the board ($BoardSize$). To account for experience in business, we control for firm age by the variable $\ln(Age)$. Since German firms often have a very long history, we include the firm age logarithmized in the estimation. Finally, time and industry dummies control for a time trend and for industry-specific effects.

1.3.2 Estimation Methodology

Our panel data structure suggests the use of random-effects or fixed-effects regressions. A Hausman test indicates that the assumption of uncorrelated regressors with the unobservable heterogeneity does not hold, and that random-effects regressions therefore yield

[13]However, since the individual effects of codetermination are nevertheless of interest, we estimate them in Section 1.5 using correlated random-effects regressions.

[14]Since the return on equity reveals huge outliers, we only use observations in the range between -100% and +100%.

inconsistent results. We therefore estimate fixed-effects models of the form

$$Y_{it} = \alpha + \beta_1 UnionDensity_{jt} + \beta_2 UnionDensity_{jt} \times Codetermined_{it} + \gamma X_{it} + \lambda_t + \varepsilon_{it} \quad (1.1)$$

where Y_{it} represents our dependent variables (the logarithmized amount of total, fixed and variable compensation, and the ratio of variable to total compensation) for firm i and period t. Moreover, the variable $UnionDensity_{jt}$ stands for the gross union density of industry j in period t. We interact this variable with our codetermination dummy $Codetermined_{it}$ for firm i and period t. We do not include the codetermination dummy separately since it does not vary over time and thus cannot be estimated by fixed-effects regressions. Furthermore, the vector X_{it} represents the control variables for firm i and period t, and λ_t denotes time dummies. Finally, α is the Constant term and ε_{it} stands for the error term.

1.3.3 Descriptive Statistics

Table 1.1 shows the descriptive statistics of our sample. Since our data only includes information on variable and fixed compensation from 2003 onwards, we report our descriptive statistics separately for the entire period from 1998 to 2017 and for the period from 2003 to 2017. In total, our sample includes 10,027 observations for the entire 1998–2017 period, while our sample for salaries, and the amount and ratio of variable compensation includes only 4,837 observations for the 2003–2017 period.

In the full sample, an average manager on the board of executives receives a compensation of about 516 thousand euros. In contrast to other studies, which focus only on the largest listed firms, the variable share of total compensation is only 36% in the period from 2003 to 2017. This is due to the fact that we also observe smaller firms, which still tend to compensate their executives to a larger degree with fixed salaries. In absolute terms, however, variable compensation exceeds salaries on the mean. For instance, an average executive in our sample receives around 307 thousand euros in salaries and around 351 thousand euros in variable components. In both samples, about 22% of all employees in an average industry are unionized and 25% of the firms are subject to parity codetermination. The firm size suggests that an average firm is very large with about 7,500 employees for the total sample and even 9,900 employees in the sample from 2003 to 2017, indicating an increasing trend in firm size. Firm performance, measured by return

Table 1.1: Descriptive statistics

	1998–2017		2003–2017	
	mean	sd	mean	sd
Dependent variables				
Comp (€1,000)	516.11	588.60		
Salary (€1,000)			306.96	206.21
VarComp (€1,000)			351.40	588.11
VarCompRatio (ratio)			0.36	0.23
Explanatory variables				
UnionDensity (%)	22.45	16.08	21.58	15.84
Codetermined (dummy)	0.25	0.44	0.25	0.43
Control variables				
Employment (count)	7516.55	27389.36	9915.96	32503.50
ROE (%)	5.44	22.31	5.95	21.84
Profit (dummy)	0.75	0.43	0.77	0.42
BoardSize (count)	2.96	1.53	2.89	1.48
FirmAge (years)	48.74	47.35	48.27	47.84
Observations	10,027		4,837	

on equity, is on average around 5.4% (6%) for the entire (shorter) period. An average company is therefore profitable due to a positive return on equity. In our regressions, we use an interaction of the current return on equity with the dummy variable $Profit$, indicating positive net income. In this way, we can distinguish between the effects of profitable and non-profitable firms on executive compensation. The mean value of the dummy variable indicates that 75% (77% in the period of 2003–2017) of the companies are profitable and thus have a positive firm performance. Moreover, an average board consists of about three members and the average age of the company is about 49 years.

1.4 Empirical Results

Table 1.2 displays the results of the fixed-effects estimations of the union density on average total, fixed and variable executive compensation.[15] Columns (1), (3), and (5) show the effects of union density on the dependent variables and Columns (2), (4), and (6) additionally include the interaction of union density and codetermination. All models include the same control variables to adjust for firm- and time-specific effects.

Table 1.2: Estimation results on total, fixed, and variable compensation

	ln(Comp)		ln(Salary)		ln(VarComp)	
	(1)	(2)	(3)	(4)	(5)	(6)
UnionDensity	-0.0179*	-0.0062	-0.0222*	-0.0091	-0.0363	-0.0679
	(0.0094)	(0.0101)	(0.0114)	(0.0122)	(0.0529)	(0.0606)
UnionDensity×Codetermined		-0.0168**		-0.0175**		0.0425
		(0.0074)		(0.0081)		(0.0343)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No	No	No
Observations	10,027	10,027	4,837	4,837	4,837	4,837
R^2 (within)	0.289	0.291	0.295	0.297	0.148	0.148

Notes: Results of fixed-effects estimations, robust and firm-clustered standard errors in parentheses, $^{*}p < 0.1,^{**}p < 0.05,^{***}p < 0.01$.

First of all, we find significant coefficients for union density at the 10% level in Columns (1) and (3). It suggests that a one percentage point increase in the industry's union density reduces total executive compensation by about 1.8% and salaries by about 2.2%. However, we cannot find a significant union effect on variable compensation, even though the sign of the coefficient is in the same direction. We therefore conclude that unions do indeed have an impact on executive compensation, that is, particularly on the basis of executives' salaries.

We argue primarily about the unique situation of the German parity codetermination framework, which grants unions a direct say in determining executive compensation. Therefore, the common effect of union density in codetermined firms is of particular interest. In these specifications (Columns 2, 4, and 6), we find significant coefficients of the moderating effect on total executive compensation and on salaries at the 5% level, but no significant effect on variable pay. In codetermined firms, a one percentage point

[15]The results of the control variables are presented in Table 1.9 in the Appendix.

increase in union density reduces total executive compensation by about 1.7% and salaries by about 1.8%. Therefore, it becomes evident that unions do indeed use their position on the supervisory board to affect the amount of executive compensation directly, especially through salaries. Since some studies find that salaries are largely independent of performance (see, e.g., Bebchuk and Fried, 2006), we conclude that unions only affect base salaries to cut total executive compensation without reducing incentives for a good performance. In contrast, we do not find significant union effects in non-codetermined firms.

Table 1.3: Estimation results on the ratio of variable to total compensation

	VarCompRatio	
	(1)	(2)
UnionDensity	0.0046	0.0041
	(0.0064)	(0.0079)
UnionDensity×Codetermined		0.0006
		(0.0049)
Controls	Yes	Yes
Time dummies	Yes	Yes
Industry dummies	No	No
Observations	4,837	4,837
R^2 (within)	0.160	0.160

Notes: Results of fixed-effects estimations, robust and firm-clustered standard errors in parentheses, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Moreover, we test whether unions also affect the compensation structure of the firm, for instance, by linking compensation more closely to incentive-based pay. For this purpose, in Table 1.3, we estimate the effects of union density (Column 1) and the interaction with the codetermination dummy (Column 2) on the share of variable compensation in total compensation. We find no evidence of an effect of unions overall or of an effect of union density in codetermined or non-codetermined firms on the variable ratio of executive compensation. We therefore find no union effects on the remuneration structure. Since unions are quite interested in increasing sustainable incentive-based compensation components (see, e.g., DGB, 2017), we conclude that they are unable to enforce these changes on the supervisory board due to the double voting rights of the chairman, who is always provided by the capital side.

1.5 Estimating the Codetermination Effect

The fixed-effects estimates provide evidence of the effects of union density and the essential role of codetermination in asserting the unions' interests when determining executive compensation. We are also interested in observing the effects of codetermination on executive pay. However, a fixed-effects estimation of the time-fixed codetermination dummy does not provide this information, and the Hausman test indicates that random-effects estimations yield inconsistent results. Therefore, we use the correlated random-effects (CRE) approach of Mundlak (1978).[16] This approach represents a combination of fixed-effects and random-effects models by preserving the random-effects specification but solving the problem of the restrictive correlation assumption. In the CRE model, the unobservable heterogeneity is identified by calculating averages of the time-varying regressors over time. Thus, these time averages identify the fixed effects, as including time averages in a random-effects estimation yields the same results as demeaning variables and estimating by pooled OLS. CRE therefore leads to the same estimator as in the fixed-effects model, but allows for the estimation of time-fixed variables as in the case of our codetermination dummy.

Similar to our fixed-effects equation 1.2, we estimate CRE models of the form

$$Y_{it} = \alpha + X'_{it}\beta + \bar{X}'_i\pi + \lambda_t + z'_i\gamma + w_i + \varepsilon_{it} \tag{1.2}$$

where Y_{it} stands for the dependent variables, the vector X_{it} represents the explanatory and control variables for firm i and period t, and λ_t denotes time dummies.[17] Again, α is the Constant term. Moreover, the CRE approach includes time averages of the time-varying variables $\bar{X}_i$ for firm i. z_i is a vector that contains the time-fixed variables and therefore does not require time averages. Finally, the error term is now composed of a time-constant unobservable part w_i and the idiosyncratic shock ε_{it}. In addition to our previous specification, we also include time-fixed industry (NACE rev. 2, 2-digit) and legal form dummies to consider that some industries or companies with specific legal forms may be more frequently subject to codetermination (e.g., manufacturing industry, joint-stock corporations "Aktiengesellschaft").

Table 1.4 displays the results of the correlated random-effects estimations of the union

[16] For further information on the CRE approach, see e.g., Allison (2009), Greene (2020), Schunck (2013), and Wooldridge (2010, 2020).

[17] Note that union density is measured at the industry level.

density on average total, fixed, and variable executive compensation.[18] Columns (1), (3), and (5) show the effects of union density and codetermination on the dependent variables while Columns (2), (4), and (6) additionally include the interaction term of both variables. All models include the same control variables to adjust for firm-, time-, and sector-specific effects.

Table 1.4: Estimation results on total, fixed, and variable compensation

	ln(Comp)		ln(Salary)		ln(VarComp)	
	(1)	(2)	(3)	(4)	(5)	(6)
UnionDensity	-0.0179*	-0.0062	-0.0222*	-0.0091	-0.0363	-0.0679
	(0.0094)	(0.0101)	(0.0114)	(0.0121)	(0.0527)	(0.0604)
Codetermined	0.2769***	0.1537*	0.1921***	0.0760	0.5708***	0.0589
	(0.0456)	(0.0830)	(0.0443)	(0.0737)	(0.1618)	(0.2581)
UnionDensity×Codetermined		-0.0168**		-0.0175**		0.0425
		(0.0074)		(0.0081)		(0.0342)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,027	10,027	4,837	4,837	4,837	4,837

Notes: Results of correlated random-effects estimations, robust and firm-clustered standard errors in parentheses, CRE time means not displayed, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

According to the definition of correlated random-effects, the coefficients and significance levels of the time-varying regressors do not differ from the fixed-effects results in Table 1.2. Therefore, in this section, we only discuss the codetermination dummy. When estimating the effect of parity codetermination on executive pay, we find significant positive coefficients at the 1% level (Columns 1, 3, and 5). Accordingly, codetermined firms pay their executives around 27.7% higher total compensation, around 19.2% higher salaries, and around 57.1% higher variable compensation than non-codetermined firms. This seems surprising at first glance, as one might expect that the presence of labor representatives on the supervisory board would lead to a reduction in executive compensation. However, consistent with several previous studies, the effects might be explained by a higher performance and productivity in codetermined firms (see, e.g., Campagna et al., 2020; FitzRoy and Kraft, 2005; Kraft and Ugarković, 2006; Renaud, 2007).[19]

Since variable compensation components are closely linked to performance factors,

[18] The results of the control variables are presented in Table 1.10 in the Appendix.

[19] However, the survey study by Conchon (2011) suggests that there is no clear empirical evidence on the effect of codetermination on firm performance.

it is hardly surprising that codetermination has an impact on the amount of variable compensation in particular. We also find a positive coefficient for codetermination on total executive pay in Column (2), suggesting that codetermination has an impact even in the absence of union power. However, this coefficient is only significant at the 10% level and does not prove to be very robust when testing other specifications.

Table 1.5: Estimation results on the ratio of variable to total compensation

	VarCompRatio	
	(1)	(2)
UnionDensity	0.0046	0.0041
	(0.0064)	(0.0079)
Codetermined	0.0775***	0.0188
	(0.0181)	(0.0291)
UnionDensity×Codetermined		0.0006
		(0.0049)
Controls	Yes	Yes
Time dummies	Yes	Yes
Industry dummies	Yes	Yes
Observations	4,837	4,837

Notes: Results of correlated random-effects estimations, robust and firm-clustered standard errors in parentheses, CRE time means not displayed, $^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0.01$.

Column (1) in Table 1.5 also shows at the 1% level a significant effect of codetermination on the variable pay ratio. Compared to non-codetermined firms, the ratio of variable compensation is about 7.8 percentage points higher in a firm that is parity-codetermined. These findings are widely in line with the results of Dyballa and Kraft (2020), who argue that shareholders and labor representatives have a similar target function to ensure the survival of the company. For this purpose, a performance-based remuneration can be an appropriate way, as the managers receive stronger incentives to pursue a successful corporate strategy.

1.6 Robustness Check

1.6.1 Firm Size

Codetermination is an important factor in explaining the impact of unions on executive compensation. However, since German law links codetermination to the number of employees, the results may be driven by firm size. Hence, we control for robustness of the results by using alternative specifications for firm size.

First of all, in Panel A, we test for quadratic effects of firm size by additionally including the squared logarithm of the number of employees. Moreover, we do not specify a concrete pattern of the firm size effect but use five categories of the number of employees (1–250, 251–750, 751–1500, 1501–2500, and >2500 employees) in Panel B. The group of 1–250 employees builds the reference category. Furthermore, we substitute employment as a measure of firm size with firm sales. Again, we use the logarithm of sales (Panel C) and six sales dummies (Panel D) (0–10, 11–50, 51–100, 101–250, 251–500, and >500 million euros), with 0–10 million euros representing the reference category. Finally, in Panel E, we control for outliers by winsorizing the number of employees in the bottom and top 5%.

Table 1.6 illustrates that the robustness tests confirm our previous findings. For total and fixed compensation, all coefficients remain in the same direction, and have similar amounts and significance levels. Only when using the variable $\ln(Sales)$ to control for firm size do the significance levels become slightly lower, but remain significant at a p-value $<$ 0.06. Hence, we do not expect that firm size drives our results.

Table 1.6: Robustness tests—firm size

	ln(Comp) (1)	ln(Salary) (2)	ln(VarComp) (3)	VarCompRatio (4)
Panel A				
UnionDensity	-0.0067	-0.0096	-0.0688	0.0040
	(0.0099)	(0.0121)	(0.0607)	(0.0079)
UnionDensity×Codetermined	-0.0158**	-0.0169**	0.0437	0.0008
	(0.0073)	(0.0083)	(0.0362)	(0.0050)
ln(Employment)	0.0720	0.0506	0.1504	0.0132
	(0.0801)	(0.0697)	(0.2604)	(0.0259)
$\ln(\text{Employment})^2$	0.0084	0.0021	0.0040	0.0005
	(0.0064)	(0.0049)	(0.0224)	(0.0023)
Panel B				
UnionDensity	-0.0039	-0.0091	-0.0669	0.0043
	(0.0104)	(0.0123)	(0.0614)	(0.0079)
UnionDensity×Codetermined	-0.0208***	-0.0184**	0.0365	-0.0002
	(0.0078)	(0.0083)	(0.0351)	(0.0050)
$\text{Employment}_{[251-750]}$	0.2027***	0.0463	0.3197**	0.0382**
	(0.0327)	(0.0294)	(0.1609)	(0.0182)
$\text{Employment}_{[751-1500]}$	0.3016***	0.0870**	0.5020**	0.0537**
	(0.0484)	(0.0355)	(0.2163)	(0.0245)
$\text{Employment}_{[1501-2500]}$	0.4234***	0.1513***	0.5626**	0.0648**
	(0.0585)	(0.0529)	(0.2682)	(0.0313)
$\text{Employment}_{[>2500]}$	0.5817***	0.1798***	0.8627***	0.0987***
	(0.0668)	(0.0554)	(0.2881)	(0.0334)
Panel C				
UnionDensity	-0.0033	-0.0111	-0.0709	0.0037
	(0.0100)	(0.0123)	(0.0605)	(0.0079)
UnionDensity×Codetermined	-0.0139*	-0.0159*	0.0407	0.0002
	(0.0074)	(0.0081)	(0.0350)	(0.0050)
ln(Sales)	0.1575***	0.0491***	0.2159**	0.0279***
	(0.0217)	(0.0115)	(0.0916)	(0.0105)

(continued on next page)

Table 1.6: Robustness tests—firm size (continued)

	ln(Comp) (1)	ln(Salary) (2)	ln(VarComp) (3)	VarCompRatio (4)
Panel D				
UnionDensity	-0.0014	-0.0121	-0.0717	0.0037
	(0.0104)	(0.0123)	(0.0610)	(0.0080)
UnionDensity×Codetermined	-0.0215***	-0.0178**	0.0271	-0.0014
	(0.0078)	(0.0083)	(0.0354)	(0.0051)
$Sales_{[11-50]}$	0.2089***	0.0724*	0.2741	0.0332*
	(0.0424)	(0.0403)	(0.1951)	(0.0182)
$Sales_{[51-100]}$	0.3684***	0.1129**	0.6646***	0.0698***
	(0.0530)	(0.0438)	(0.2483)	(0.0236)
$Sales_{[101-250]}$	0.4781***	0.1276***	0.9001***	0.1111***
	(0.0598)	(0.0486)	(0.2641)	(0.0265)
$Sales_{[251-500]}$	0.5758***	0.1821***	1.0438***	0.1246***
	(0.0723)	(0.0531)	(0.2983)	(0.0336)
$Sales_{[>500]}$	0.7278***	0.2680***	1.2280***	0.1414***
	(0.0824)	(0.0698)	(0.3667)	(0.0408)
Panel E				
UnionDensity	-0.0058	-0.0093	-0.0681	0.0041
	(0.0102)	(0.0122)	(0.0606)	(0.0079)
UnionDensity×Codetermined	-0.0189**	-0.0189**	0.0375	0.0002
	(0.0075)	(0.0082)	(0.0343)	(0.0049)
ln(Employment)	0.1860***	0.0855***	0.2540***	0.0241**
	(0.0186)	(0.0169)	(0.0931)	(0.0097)
Controls	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No
Observations				
Panels A, B, E	10,027	4,837	4,837	4,837
Panels C, D	9,916	4,809	4,809	4,809

Notes: Results of fixed-effects estimations, robust and firm-clustered standard errors in parentheses, $^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$.

1.6.2 Measuring Firm Performance

Since firm performance has an impact on the variable compensation in particular, we also test several variations in performance measures. To account for a delayed effect of firm performance on (variable) compensation, in Panel A, we also include return on equity lagged by one year ($LagROE$). Panel B includes the current and lagged return on equity as well as current profits but excludes the interaction term $ROE \times Profit$. Furthermore, we use only lagged ROE and lagged profits without an interaction term of both in Panel C. In addition, Panel D includes ROE as well as profits and their interaction in both the current and previous periods. We also use return on assets (ROA) as an alternative measure on firm performance. To do so, we use ROA, profit, and the interaction of both in Panel E, additionally including a lag of ROA in Panel F.

Table 1.7 presents the results of these specifications and confirms our estimation results. Moreover, in Panels A, D, and F, we find a weakly significant effect (10%) of union density in codetermined firms on the amount of variable compensation. These results, however, are not very robust but provide a tentative indication that employee representatives in codetermined firms may have an interest in setting incentive-based compensation.

Table 1.7: Robustness tests—firm performance

	ln(Comp) (1)	ln(Salary) (2)	ln(VarComp) (3)	VarCompRatio (4)
Panel A				
UnionDensity	-0.0078	-0.0136	-0.0707	0.0020
	(0.0115)	(0.0125)	(0.0658)	(0.0085)
UnionDensity×Codetermined	-0.0194**	-0.0150*	0.0595*	0.0020
	(0.0080)	(0.0084)	(0.0348)	(0.0052)
ROE	-0.0003	-0.0015***	0.0055**	0.0005*
	(0.0004)	(0.0005)	(0.0028)	(0.0003)
LagROE	0.0007***	-0.0002	0.0032*	0.0005***
	(0.0003)	(0.0002)	(0.0018)	(0.0002)
Profit	0.0774***	0.0016	0.9441***	0.0897***
	(0.0156)	(0.0143)	(0.1104)	(0.0100)
ROE×Profit	0.0045***	0.0014**	0.0112***	0.0023***
	(0.0007)	(0.0007)	(0.0041)	(0.0005)

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Table 1.7: Robustness tests—firm performance (continued)

	ln(Comp) (1)	ln(Salary) (2)	ln(VarComp) (3)	VarCompRatio (4)
Panel B				
UnionDensity	-0.0061	-0.0135	-0.0423	0.0062
	(0.0116)	(0.0125)	(0.0657)	(0.0087)
UnionDensity×Codetermined	-0.0183**	-0.0138*	0.0556	0.0016
	(0.0081)	(0.0083)	(0.0359)	(0.0054)
LagROE	0.0011***	-0.0002	0.0048***	0.0007***
	(0.0003)	(0.0002)	(0.0017)	(0.0002)
Profit	0.1206***	-0.0242**	1.2013***	0.1282***
	(0.0138)	(0.0123)	(0.0998)	(0.0087)
Panel C				
UnionDensity	-0.0066	-0.0139	-0.0162	0.0089
	(0.0116)	(0.0124)	(0.0699)	(0.0091)
UnionDensity×Codetermined	-0.0181**	-0.0137*	0.0434	0.0003
	(0.0081)	(0.0083)	(0.0383)	(0.0056)
LagROE	0.0011***	0.0001	0.0030	0.0005**
	(0.0003)	(0.0003)	(0.0019)	(0.0002)
LagProfit	0.0334**	-0.0318**	0.4547***	0.0495***
	(0.0152)	(0.0135)	(0.0912)	(0.0093)
Panel D				
UnionDensity	-0.0078	-0.0138	-0.0735	0.0016
	(0.0115)	(0.0124)	(0.0655)	(0.0084)
UnionDensity×Codetermined	-0.0195**	-0.0152*	0.0628*	0.0024
	(0.0080)	(0.0084)	(0.0347)	(0.0051)
ROE	-0.0002	-0.0015***	0.0059**	0.0005**
	(0.0004)	(0.0005)	(0.0026)	(0.0003)
LagROE	-0.0003	-0.0002	-0.0043	-0.0004
	(0.0004)	(0.0004)	(0.0031)	(0.0003)
Profit	0.0749***	0.0039	0.9170***	0.0866***
	(0.0153)	(0.0138)	(0.1085)	(0.0098)
LagProfit	0.0355**	-0.0263*	0.4208***	0.0489***
	(0.0141)	(0.0136)	(0.0896)	(0.0088)
ROE×Profit	0.0043***	0.0012*	0.0104***	0.0022***
	(0.0007)	(0.0007)	(0.0040)	(0.0005)
LagROE×LagProfit	0.0012*	0.0006	0.0063*	0.0008*
	(0.0006)	(0.0005)	(0.0038)	(0.0004)

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Table 1.7: Robustness tests—firm performance (continued)

	ln(Comp) (1)	ln(Salary) (2)	ln(VarComp) (3)	VarCompRatio (4)
Panel E				
UnionDensity	-0.0045	-0.0095	-0.0639	0.0052
	(0.0099)	(0.0120)	(0.0611)	(0.0077)
UnionDensity×Codetermined	-0.0160**	-0.0177**	0.0475	0.0016
	(0.0073)	(0.0080)	(0.0350)	(0.0049)
ROA	-0.0010*	-0.0017***	0.0101**	0.0008**
	(0.0006)	(0.0005)	(0.0046)	(0.0004)
Profit	0.0810***	-0.0139	0.9470***	0.0906***
	(0.0146)	(0.0135)	(0.1012)	(0.0090)
ROA×Profit	0.0102***	0.0015	0.0173**	0.0041***
	(0.0017)	(0.0011)	(0.0078)	(0.0010)
Panel F				
UnionDensity	-0.0059	-0.0139	-0.0618	0.0034
	(0.0112)	(0.0123)	(0.0643)	(0.0082)
UnionDensity×Codetermined	-0.0183**	-0.0142*	0.0629*	0.0026
	(0.0078)	(0.0082)	(0.0356)	(0.0051)
ROA	-0.0017***	-0.0017***	0.0079*	0.0006
	(0.0006)	(0.0006)	(0.0045)	(0.0004)
LagROA	0.0018***	-0.0002	0.0116***	0.0014***
	(0.0006)	(0.0004)	(0.0036)	(0.0003)
Profit	0.0818***	-0.0074	0.9415***	0.0908***
	(0.0156)	(0.0142)	(0.1065)	(0.0095)
ROA×Profit	0.0121***	0.0015	0.0223***	0.0049***
	(0.0020)	(0.0012)	(0.0084)	(0.0011)
Controls	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No
Observations				
Panels A, D	7,946	4,238	4,238	4,238
Panels B, C	8,143	4,334	4,334	4,334
Panel E	10,351	5,027	5,027	5,027
Panel F	8,326	4,462	4,462	4,462

Notes: Results of fixed-effects estimations, robust and firm-clustered standard errors in parentheses, $^{*}p < 0.1,^{**}p < 0.05,^{***}p < 0.01$.

1.6.3 Time Measure and Deflation

We also test for time-specific trends or effects to rule out that the results are only due to time events over the period observed. In Panel A, we do not control for time effects. Furthermore, we replace time dummies with a linear and quadratic time trend (Panel B). To ensure that the effects are not driven by the global financial crisis, in Panel C, we exclude the years 2007 to 2009. Finally, in Panel D, we also deflate our dependent variables by the consumer price index (2020 = 100) to account for inflation-related increases in executive pay.

The results of Panels B, C, and D in Table 1.8 confirm our findings. However, when not controlling for time trends, we do not obtain the previous results on the effect of union density in codetermined firms on total compensation. In contrast, we find negative and significant results for union density in non-codetermined firms. This suggests that we obtain biased results when we do not control for time trends and that, therefore, controlling for time-trends is crucial to our analysis.

Table 1.8: Robustness tests—time measure and deflation

	lnComp (1)	lnSalary (2)	lnVarComp (3)	VarCompRatio (4)
Panel A				
UnionDensity	-0.0488***	-0.0513***	-0.1380***	-0.0065
	(0.0054)	(0.0067)	(0.0340)	(0.0043)
UnionDensity×Codetermined	-0.0113	-0.0141*	0.0498	0.0022
	(0.0075)	(0.0083)	(0.0345)	(0.0048)
Panel B				
UnionDensity	-0.0095	-0.0050	-0.0821	-0.0022
	(0.0093)	(0.0103)	(0.0529)	(0.0066)
UnionDensity×Codetermined	-0.0155**	-0.0180**	0.0438	0.0015
	(0.0073)	(0.0081)	(0.0339)	(0.0048)
t	0.0335***	0.0276***	0.0551	0.0092**
	(0.0096)	(0.0081)	(0.0424)	(0.0045)
t^2	-0.0006**	-0.0004	-0.0021	-0.0006***
	(0.0003)	(0.0003)	(0.0019)	(0.0002)

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Table 1.8: Robustness tests—time measure and deflation (continued)

	lnComp (1)	lnSalary (2)	lnVarComp (3)	VarCompRatio (4)
Panel C				
UnionDensity	-0.0062	-0.0103	-0.1057*	0.0020
	(0.0104)	(0.0137)	(0.0631)	(0.0083)
UnionDensity×Codetermined	-0.0182**	-0.0168**	0.0571	0.0021
	(0.0075)	(0.0084)	(0.0350)	(0.0051)
Panel D				
UnionDensity	-0.0061	-0.0094	-0.0517	0.0056
	(0.0101)	(0.0123)	(0.0604)	(0.0081)
UnionDensity×Codetermined	-0.0171**	-0.0162**	0.0478	0.0005
	(0.0073)	(0.0080)	(0.0332)	(0.0050)
Controls	Yes	Yes	Yes	Yes
Time dummies				
PanelsA, B	No	No	No	No
Panels C, D	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No
Observations				
Panels A, B	10,027	4,837	4,837	4,837
Panel C	8,308	3,777	3,777	3,777
Panel D	9,914	4,724	4,724	4,724

Notes: Results of fixed-effects estimations, robust and firm-clustered standard errors in parentheses, $^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$.

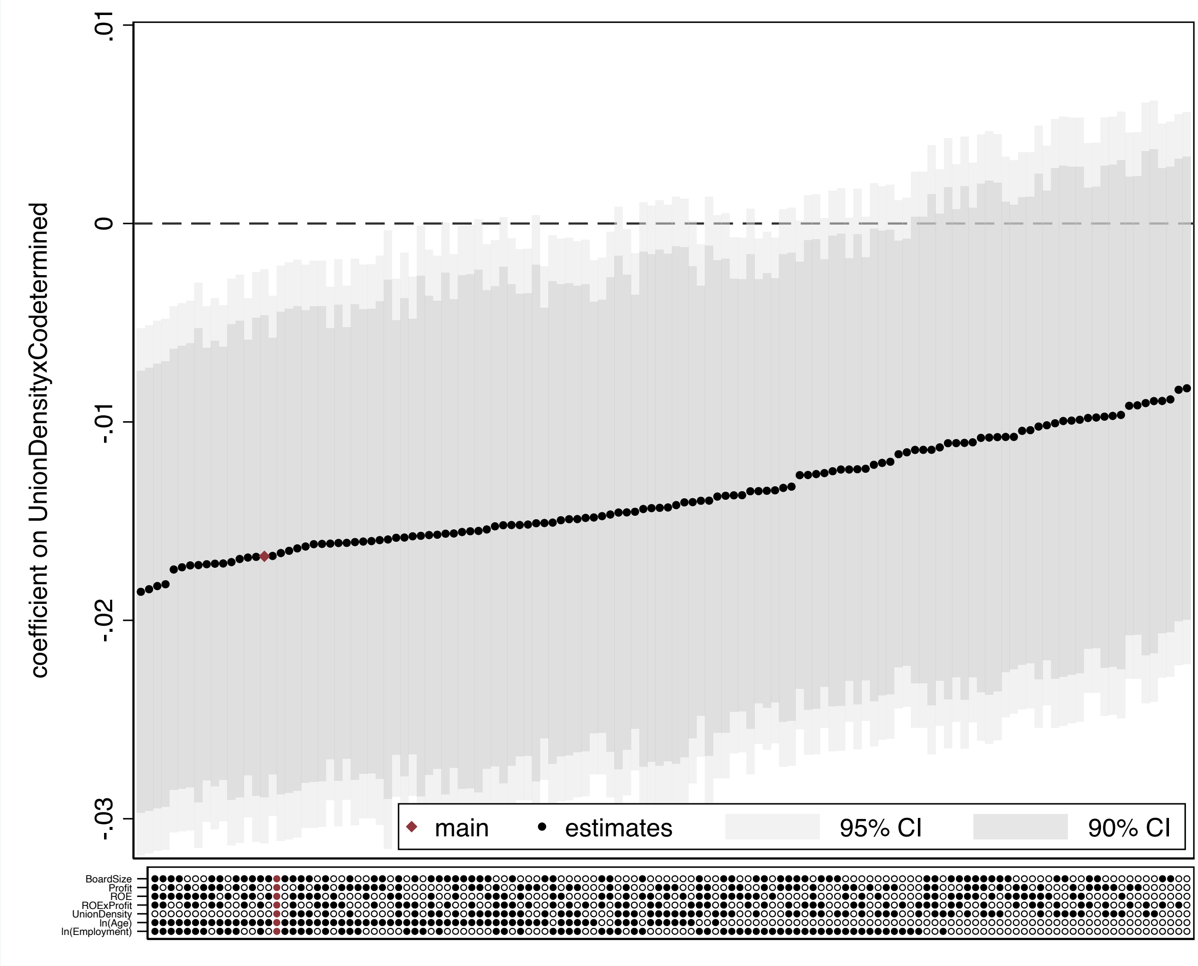
1.6.4 Specification Curve Analysis

Finally, we test whether the control variables in our specification are meaningful and necessary. For this purpose, we test each possible combination of our control variables. Since this yields 127 combinations, we do not provide tables of the results. Instead, we present the results using a specification curve analysis that presents the estimated coefficient sorted by size across all specifications. A "dashboard chart" shows the control variables used for each result. This allows a visual comparison of the variation and covariation between the specifications (Simonsohn et al., 2020).

Figure 1.2 and 1.3 contain the coefficients of the interaction term (UnionDensity× Codetermined) for the base specification in Section 1.4 (red rhombus) and for each variation in control variables (black dots).[20] Additionally, the 90% and the 95% confidence intervals are illustrated for each estimation. Since testing for a time trend is crucial for

[20]The specification curve analysis graphs of ln(VarComp) and VarCompRatio are presented in Figure 1.4 and 1.5 in the Appendix.

Figure 1.2: Specification curve analysis—dependent variable: ln(Comp)

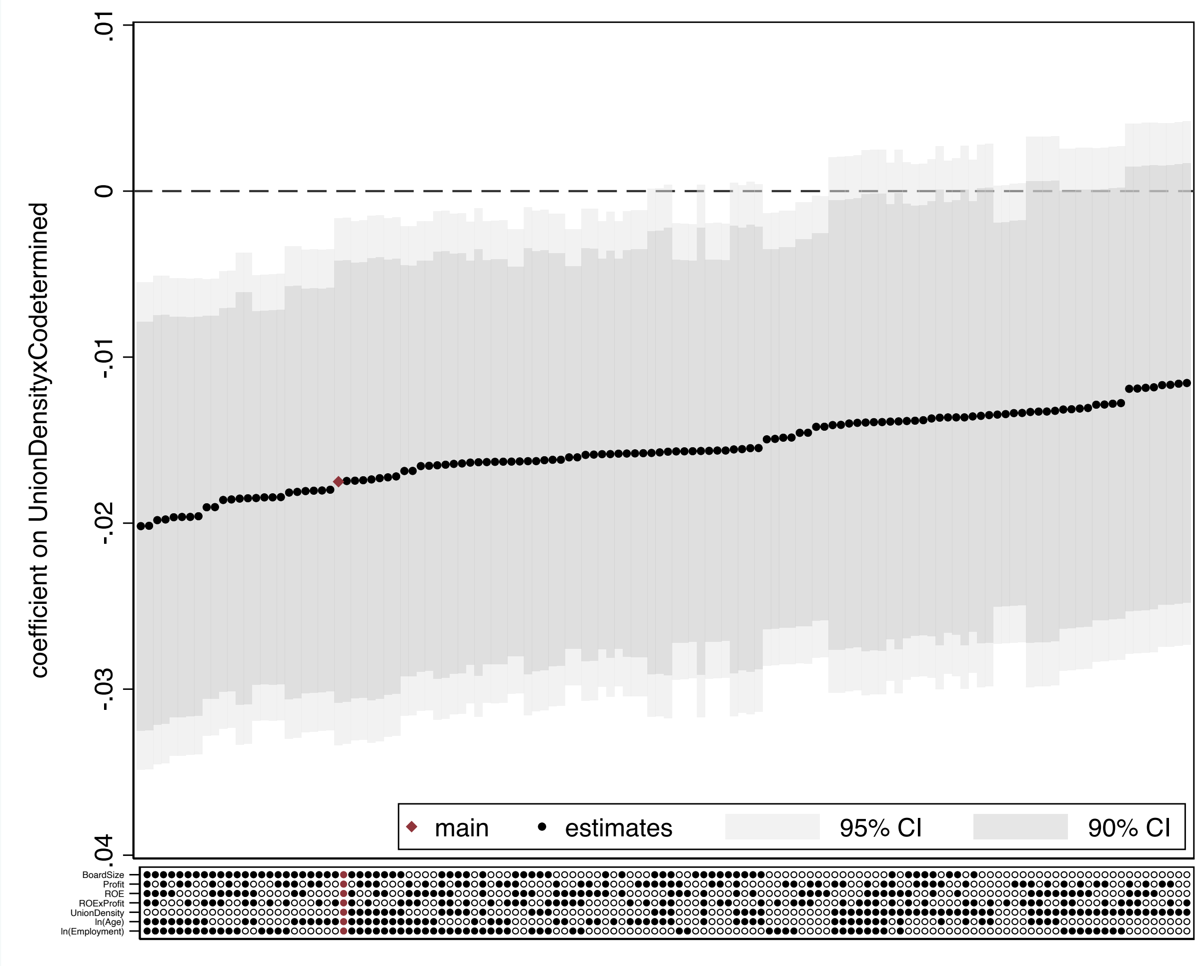


the results (see Section 1.6.3), all specifications include time fixed-effects.

Figure 1.2 shows the results of the robustness tests for total executive compensation as the dependent variable. For each specification, the coefficient of the interaction term is negative, and ranges between about -0.01 and -0.02. For most specifications, the 95% or at least the 90% confidence interval is also below 0, indicating significant coefficients. Essentially, only the specifications in which we do not control for firm size yield insignificant results for the interaction term. This is not very surprising, however, since codetermination is related to the number of employees and it is therefore crucial to include firm size in the regressions.

The results regarding the effect of the interaction term on fixed compensation also prove to be robust in Figure 1.3. All coefficients are negative and also exhibit only a small dispersion of the coefficients. Therefore, the selection of the control variables is not expected to drive our results.

Figure 1.3: Specification curve analysis—dependent variable: ln(Salary)



Overall, the robustness tests confirm our findings that unions do indeed use codetermination as a channel to influence both total and fixed executive compensation, but do not affect the amount or ratio of variable compensation.

1.7 Conclusion

This study examines the impact of union power on executive compensation in Germany. While this topic has already been addressed for other countries, we focus on the unique institutional framework of parity codetermination in Germany. Parity codetermination grants representatives of the firms' workforce and external union members a direct say in determining executive compensation through their participation on the supervisory board, which is responsible for setting executive pay. We argue that a powerful union has better opportunities to enforce its positions on the supervisory board. For this purpose, we measure the power of a trade union using the industry's gross union density, which expresses the attitude of the employees toward "traditional" and also conflict-open representation. This should also be reflected in the work of union representatives on the board, and so we reason that more powerful unions reduce executive compensation via their role on the board.

Using a unique unbalanced panel of about 1,500 German firms for the years 1998 to 2017, we estimate the effects of industry-specific union power in parity-codetermined firms on executive compensation. We find a significant reduction in executive compensation when union density increases. This is broadly consistent with the findings of studies in the United States, which conclude that both pure union presence in the firm and an increase in union density lead to lower CEO compensation (Banning and Chiles, 2007; DiNardo et al., 1997; Gomez and Tzioumis, 2006; Huang et al., 2017). In our findings, we attribute the effect of unions to parity codetermination, as we find a significant reducing effect in codetermined but not in non-codetermined firms. We find that a one percentage point increase in union density in codetermined firms leads to a 1.7% reduction in total executive compensation. Examining the composition of executive pay, we also find that the reduction is due to a decline in salaries of about 1.8% when union density in codetermined firms increases by one percentage point. In contrast, we find neither evidence of a union effect on the amount of variable compensation, nor on the ratio of variable to total compensation. Several robustness tests, including a specification curve analysis, confirm our results.

Furthermore, using correlated random-effects regression, we find a significant positive impact of parity codetermination on all types of compensation and on the ratio of variable in total compensation. Parity codetermination has a particularly strong effect on the level of variable compensation, which might be attributed to higher performance in codetermined firms. Since the ratio of variable compensation is also about 7.8 percentage points higher in codetermined firms than in non-codetermined ones, we suggest that employee representatives have an interest in setting appropriate incentives for managers to ensure the long-term success of the firm. However, we do not find a separate codetermination effect in the case where unions have no power.

In sum, we conclude that unions do indeed have the ability to limit executive compensation. Through its position on codetermined supervisory boards, a more powerful union can more effectively enforce its positions in setting executive pay. As we find a reducing effect of unions on salaries, but no evidence of an impact on the amount or ratio of variable compensation, we reason that unions are interested in setting incentive-based pay. We therefore suggest that unions are not interested in reducing executive pay per se, but rather in reducing pay that is not related to performance. Especially in the context of an increasing discussion about the introduction of codetermination regulations in other countries, our results may provide further insights. For instance, codetermination might also be a powerful tool for unions in the United States to reduce the enormously high amounts of executive pay without removing incentives for good performance.

There are limitations that also reveal further research demands. First, the results might be more precise with better data on union density. For instance, allocating the members of each union to the single industries and excluding inactive union members (e.g., pensioners and unemployed) would measure union power more accurately, but these data are not available for Germany. Second, a close examination of the supervisory board structure in the company could provide more insight into the role of union power on the board. And third, executive compensation could be set in relation to employee wages to investigate whether there is a redistribution within the company or the industries. This could be the subject of further research.

1.8 Appendix

Figure 1.4: Specification curve analysis—dependent variable: ln(VarComp)

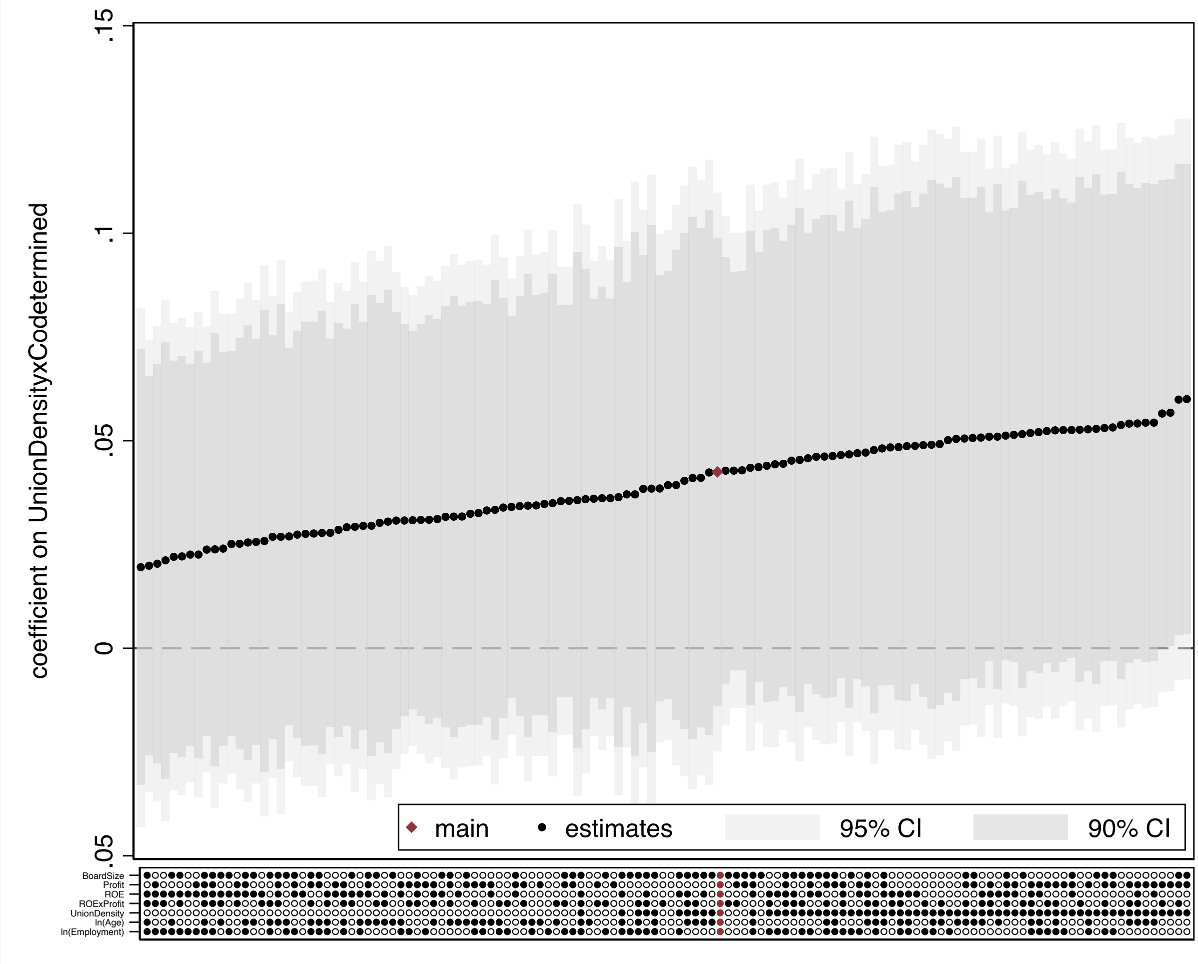


Figure 1.5: Specification curve analysis—dependent variable: VarCompRatio

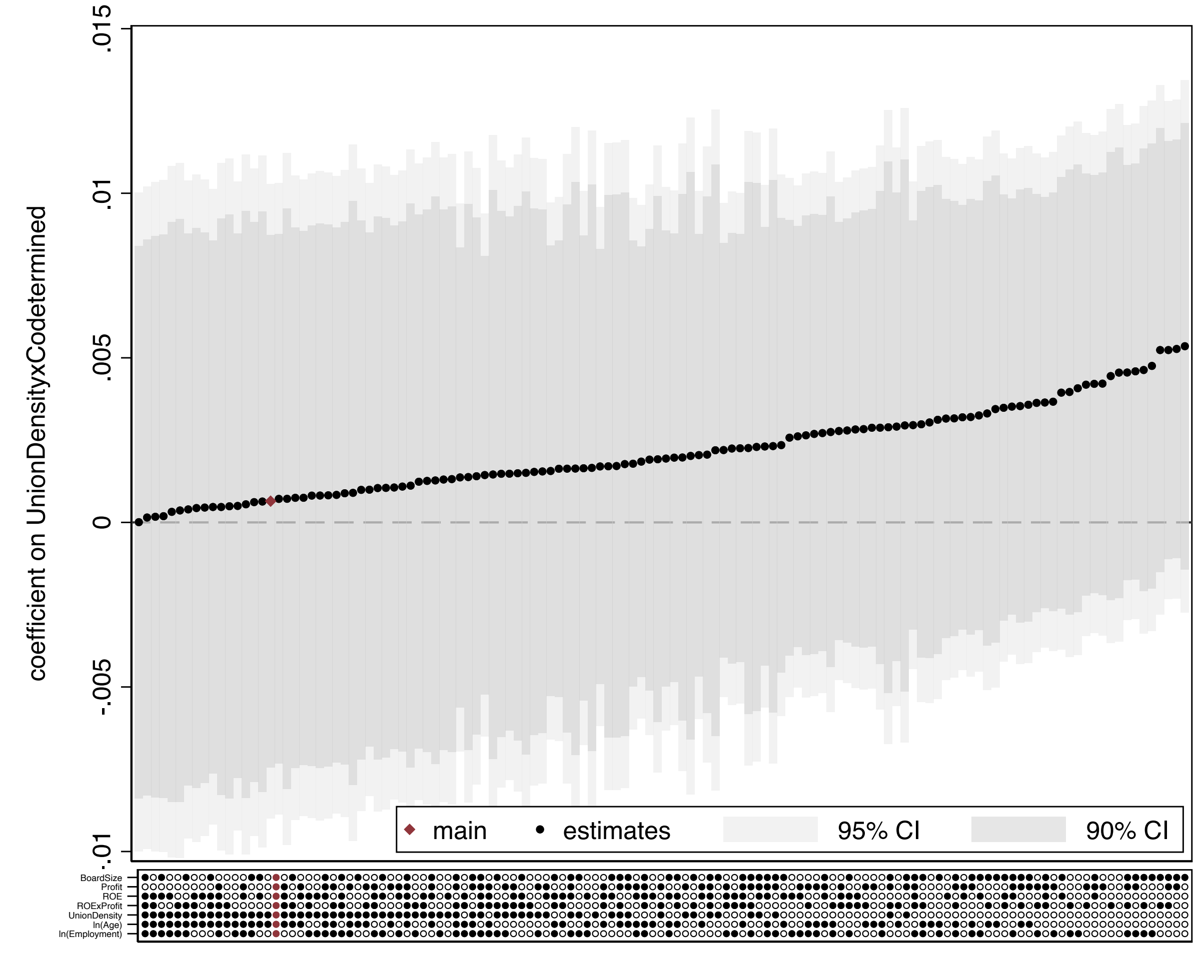


Table 1.9: Full estimation results of Tables 1.2 and 1.3 (fixed-effects)

	ln(Comp)		ln(Salary)		ln(VarComp)		VarCompRatio	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
UnionDensity	-0.0179*	-0.0062	-0.0222*	-0.0091	-0.0363	-0.0679	0.0046	0.0041
	(0.0094)	(0.0101)	(0.0114)	(0.0122)	(0.0529)	(0.0606)	(0.0064)	(0.0079)
UnionDensity×Codetermined		-0.0168**		-0.0175**		0.0425		0.0006
		(0.0074)		(0.0081)		(0.0343)		(0.0049)
ln(Employment)	0.1732***	0.1735***	0.0776***	0.0785***	0.2045**	0.2024**	0.0193**	0.0193**
	(0.0207)	(0.0206)	(0.0177)	(0.0176)	(0.0873)	(0.0878)	(0.0088)	(0.0089)
ROE	-0.0001	-0.0002	-0.0015***	-0.0015***	0.0012	0.0012	0.0003	0.0003
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0029)	(0.0029)	(0.0002)	(0.0002)
Profit	0.0796***	0.0800***	-0.0059	-0.0065	1.0439***	1.0454***	0.0978***	0.0979***
	(0.0142)	(0.0142)	(0.0136)	(0.0136)	(0.1036)	(0.1036)	(0.0089)	(0.0089)
ROE×Profit	0.0031***	0.0031***	0.0015***	0.0015***	0.0109***	0.0108***	0.0019***	0.0019***
	(0.0006)	(0.0006)	(0.0005)	(0.0005)	(0.0038)	(0.0038)	(0.0004)	(0.0004)
BoardSize	-0.0489***	-0.0487***	-0.0539***	-0.0546***	-0.0686*	-0.0669*	0.0019	0.0020
	(0.0090)	(0.0090)	(0.0080)	(0.0079)	(0.0385)	(0.0386)	(0.0043)	(0.0043)
ln(FirmAge)	0.0726**	0.0824***	0.0073	0.0203	0.0721	0.0404	0.0161	0.0156
	(0.0318)	(0.0319)	(0.0334)	(0.0342)	(0.2251)	(0.2321)	(0.0230)	(0.0236)
Constant	4.5859***	4.3945***	5.6855***	5.4949***	3.5564***	4.0192***	-0.0304	-0.0234
	(0.2997)	(0.2993)	(0.2462)	(0.2548)	(1.1667)	(1.2706)	(0.1445)	(0.1634)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No	No	No	No	No
Observations	10,027	10,027	4,837	4,837	4,837	4,837	4,837	4,837
R^2 (within)	0.289	0.291	0.295	0.297	0.148	0.148	0.160	0.160

Notes: Results of fixed-effects estimations, robust and firm-clustered standard errors in parentheses, $^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0.01$.

Table 1.10: Full estimation results of Tables 1.4 and 1.5 (correlated random-effects)

	ln(Comp)		ln(Salary)		ln(VarComp)		VarCompRatio	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
UnionDensity	-0.0179*	-0.0062	-0.0222*	-0.0091	-0.0363	-0.0679	0.0046	0.0041
	(0.0094)	(0.0101)	(0.0114)	(0.0121)	(0.0527)	(0.0604)	(0.0064)	(0.0079)
Codetermined	0.2769***	0.1537*	0.1921***	0.0760	0.5708***	0.0589	0.0775***	0.0188
	(0.0456)	(0.0830)	(0.0443)	(0.0737)	(0.1618)	(0.2581)	(0.0181)	(0.0291)
UnionDensity×Codetermined		-0.0168**		-0.0175**		0.0425		0.0006
		(0.0074)		(0.0081)		(0.0342)		(0.0049)
ln(Employment)	0.1732***	0.1735***	0.0776***	0.0785***	0.2045**	0.2024**	0.0193**	0.0193**
	(0.0207)	(0.0206)	(0.0177)	(0.0175)	(0.0872)	(0.0876)	(0.0088)	(0.0088)
ROE	-0.0001	-0.0002	-0.0015***	-0.0015***	0.0012	0.0012	0.0003	0.0003
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0029)	(0.0029)	(0.0002)	(0.0002)
Profit	0.0796***	0.0800***	-0.0059	-0.0065	1.0439***	1.0454***	0.0978***	0.0979***
	(0.0142)	(0.0142)	(0.0136)	(0.0136)	(0.1034)	(0.1034)	(0.0089)	(0.0089)
ROE×Profit	0.0031***	0.0031***	0.0015***	0.0015***	0.0109***	0.0108***	0.0019***	0.0019***
	(0.0006)	(0.0006)	(0.0005)	(0.0005)	(0.0038)	(0.0038)	(0.0004)	(0.0004)
BoardSize	-0.0489***	-0.0487***	-0.0539***	-0.0546***	-0.0686*	-0.0669*	0.0019	0.0020
	(0.0090)	(0.0090)	(0.0080)	(0.0079)	(0.0384)	(0.0385)	(0.0043)	(0.0043)
ln(FirmAge)	0.0726**	0.0824***	0.0073	0.0203	0.0721	0.0404	0.0161	0.0156
	(0.0317)	(0.0318)	(0.0334)	(0.0341)	(0.2246)	(0.2316)	(0.0229)	(0.0235)
Constant	4.3187***	4.3528***	4.4191***	4.4151***	-0.1948	-0.2020	-0.0914	-0.0920
	(0.7870)	(0.7883)	(0.4069)	(0.4062)	(1.9656)	(1.9842)	(0.1774)	(0.1785)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Legal form dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,027	10,027	4,837	4,837	4,837	4,837	4,837	4,837

Notes: Results of correlated random-effects estimations, robust and firm-clustered standard errors in parentheses, time means are not displayed, *LegalForm* represents four dummy variables indicating the limited partnership (KG), joint-stock company (AG), and Societas Europaea (SE), the limited liability company (GmbH) represents the reference category, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Hemker, T., Kraft, K. and Seidinger, T. (2024). Who Pays for the COVID-19 Pandemic? A Comparison of Stakeholders' Income Reductions in German Firms During the Crisis. *Unpublished*.

Chapter 2

Who Pays for the COVID-19 Pandemic?

A Comparison of Stakeholders' Income Reductions in German Firms During the Crisis

Co-authored with Kornelius Kraft and Tim Seidinger

This study examines the extent to which German firms that are affected by the COVID-19 pandemic pass on the costs of the crisis to stakeholders. In particular, we study survey responses on planned pay cuts to four different groups: shareholders, executives, middle management, and other employees. We use a unique firm-level dataset that provides in-depth information during the crisis in which companies are asked if and to what extent they are affected by the pandemic. We find that all these stakeholders of affected firms must pay with either lower dividends or lower future compensation increases. Affected firms are approximately 20.6 − 24.4 percentage points more likely to reduce stakeholders' payoffs. These effects become stronger for firms that are more affected. We also find evidence for effect heterogeneity in firm size as the probability for reductions is larger in firms with higher revenues. An IV approach addressing the potential endogeneity in managerial skills as well as several robustness checks confirm our results. Furthermore, in line with the Fair Wage-Effort hypothesis, correlations suggest that firms choose to pass through costs to groups with a related hierarchical standing.

2.1 Introduction

The COVID-19 pandemic caught the German society and economy completely unprepared. In less than a month after its first appearance in Wuhan, the Sars-Cov2 virus had already reached Germany. Barely two months later, a conference between German Chancellor Angela Merkel and the minister presidents of the 16 German states resulted in the first lockdown to limit the spread of the virus. This came into force on March 22, 2020, and ended on May 4, 2020. During this period, among other things, social contact had to be avoided. On the one hand, this affected the private environment as well as educational institutions, which were forced to switch to digital formats in a very short time. On the other hand, many companies had to shut down their production and/or activities. For instance, entire industries, such as tourism, gastronomy, and personal care services, were closed, and employees in many other industries had to work from home.[1]

The drastic interventions at the beginning of the pandemic had the effect that the spread of the coronavirus as well as the number of deaths in Germany remained at a comparatively low level. However, the German economy suffered from the policy measures enacted to address the emergency. In fact, for the first time in 10 years, the price-adjusted GDP did not increase but decreased by 5% in 2020 compared to the previous year.[2] Although government programs such as coronavirus aid, the deferral of insolvency proceedings, and short-time working allowances are intended to reduce the burden on companies, many firms have been seriously affected by the crisis.

For instance, a survey by KANTAR on behalf of the German Federal Ministry for Economic Affairs and Energy (BMWi, 2020) shows that three out of four companies are experiencing strong negative economic effects because of the pandemic. These are liquidity constraints that are primarily due to wage payments. Thus, a rational decision for firms might be to reduce payments to stakeholders to ensure the survival of the firm in the crisis. Therefore, we address the question of whether and to what extent the effects of the pandemic are indeed transferred to the firms' stakeholders. To this end, we examine whether firms that are negatively affected by COVID-19 reduce payments to four groups of stakeholders: shareholders, executives, middle managers, and other employees. This adds to the existing literature since our data enables us to compare these different stakeholder groups. Furthermore, to the best of our knowledge, we are the first to investigate this issue econometrically with respect to the COVID-19 crisis.

To do so, we use data on the onset of the pandemic in Germany, as provided by the German Business Panel (GBP). We use the decrease in monthly revenue compared to the

[1] https://www.bundesregierung.de/breg-de/themen/coronavirus/besprechung-der-bundeskanzlerin-mit-den-regierungschefinnen-und-regierungschefs-der-laender-vom-22-03-2020-1733248 (last access: March 23, 2024).

[2] https://www.destatis.de/DE/Presse/Pressemitteilungen/2021/01/PD21_020_811.html (last access: March 23, 2024).

beginning of 2020 to determine the affectedness of firms. We argue that affected firms reduce payments to stakeholders. Since each group represents another important function for the firms, there is a trade-off regarding which group should be penalized. We explore this trade-off and examine which group of stakeholders is particularly affected.

We place shareholders, executives, middle managers, and other employees at the center of our study as the key stakeholders of companies. The members of these groups are central to the long-term success of the companies. While on the one hand companies need to cut costs in the face of lower revenues, each firm must, on the other hand, weigh the negative effects of reduced payments to stakeholders. These include reduced effort and higher quit rates. Hence, compensating for the losses due to the crisis through pay cuts must be decided very carefully.

Our study is structured as follows. In the second section, we describe possible downsides of reducing stakeholders' payments as well as the state of empirical literature regarding each stakeholder group. The third section defines the database and methodology. Section 4 shows the findings of being affected by the crisis on payments to stakeholders. We perform regressions in Section 6 to account for firm heterogeneity and test for robustness in the seventh section. Finally, this study ends with a summary and a conclusion.

2.2 State of the Literature

Shareholder

The shareholders are the owners of the company. They contribute capital to the company and receive dividends depending on the company's performance. Even if shareholders expect dividends from their investments, it can be appropriate to reduce or cut dividends in times of crisis to ensure additional liquidity and flexibility for the companies (e.g., Hauser, 2013; Kouser et al., 2015; Krieger et al., 2021; Reddemann et al., 2010). However, there is a consensus in the literature that managers should avoid reducing dividends (Krieger et al., 2021). One possible reason is that a decline in dividends could be seen as a signal of poor financial health for the firm (e.g., Miller and Rock, 1985; Nguyen and Tran, 2016). A reduction in dividends in times of crisis can therefore be interpreted as a signal that the company is in a bad state. Hence, potential shareholders may be discouraged from investing in the company. Additionally, existing shareholders, who usually spread their holdings over several companies, may be given an incentive to sell their shares.

Hauser (2013) finds that the probability of dividend payments by U.S. industrial firms decreases during the financial crisis. He also finds changes in dividend policy that imply a greater importance of cash after the crisis and concludes that companies prioritize financial viability during the crisis. For Pakistan, Kouser et al. (2015) also find that the propensity to pay dividends has declined during the financial crisis and conclude that companies are pursuing a conservative strategy to retain cash. Similarly, Kilincarslan (2021) finds a negative impact of the global financial crisis of 2008 on dividend payments in firms traded on the London Stock Exchange. In contrast, Nguyen and Tran (2016) find that firms in the United States, Thailand and Singapore increased dividends in the post-crisis period from 2008-2012. Regarding the signaling theory, they conclude that firms avoid reducing dividends to send a signal of financial health to investors. However, Reddemann et al. (2010) find for European insurance companies that dividend cuts during the financial crisis are not seen as a signal for future problems.

More recently, for the United States, Krieger et al. (2021) examine the frequency of dividend cuts and cancellations associated with the COVID-19 pandemic and compare these results to quarterly dividend changes since 2015. They find that companies were three to five times more likely to cut dividends in the second quarter of 2020 than in any other quarter. In this context, industrial companies cut dividends more frequently than financial services or utilities. Moreover, they find similar results in relation to dividend omissions, although these are only present for industrial firms and only affect 7% of the firms. The authors conclude that companies cut or omit dividends in times of crisis to preserve more cash and flexibility to respond to uncertainty. For China, in contrast, Jebran and Chen (2022) find that managers with higher abilities tend to pay dividends during the COVID-19 crisis. They argue that the pandemic forces managers to use new strategies to ensure the survival of their operations. Ali (2022a) also finds that in the G-12 countries, most companies were able to maintain or even increase their dividends during the COVID-19 pandemic, consistent with the signaling theory. However, he finds that the share of dividend cuts and defaults was significantly higher in 2020 than in the pre-crisis period of 2015–2019.

Executives

German firms are characterized by a two-pillar system. This consists of the executive board, which makes the operational decisions, and a supervisory board, which controls the executive board and regulates its composition and compensation. The compensation is usually determined using a complex system based on fixed salaries and incentive-based variable components, which are intended to ensure the long-term success of the firm. Executives make strategic decisions that determine success or failure during the crisis period. Accordingly, lowering compensation could lead to disincentives or encourage talented managers to leave the firm, as tough competition for talented managers (Fabbri and Marin, 2016) may allow them to receive higher pay in other firms. In a different context, Beiner et al. (2011), Raith (2003), and Schmidt (1997) consider the incentive orientation of executive contracts in times of increased competition as a threat to the firm's survival. The results differ, but incentive orientation may well increase in times of a crisis. On the other hand, increasing bonus payments in firms that were rescued with taxpayers' money during the financial crisis led to a high level of public outrage (see again, e.g., Fabbri and Marin, 2016). Thus, increasing executive compensation in the COVID-19 crisis may also lead to public outrage, particularly if the wages of employees are reduced.

Vemala et al. (2014) find that the financial crisis has a positive impact on CEO total compensation in the United States, as cash compensation decreases while equity remuneration increases. Gabaix et al. (2014) find that CEO compensation in the United States declined by 28% during the 2007-2009 financial crisis but increased by 22% after the crisis. Sonenshine et al. (2016) test how determinants of CEO compensation in North America change due to the financial crisis and conclude that the composition of pay turns away from cash toward equity because of the crisis. Fabbri and Marin (2016) examine the trend in executive compensation in Germany and find that the financial crisis causes a stronger link between firm performance and compensation compared to previous recessions.

In a descriptive study, Batish et al. (2020) examine the impact of the COVID-19 crisis in the United States on pay for CEOs and other stakeholders. They find that 17% of the companies adjusted their CEO compensation. Moreover, they find that companies that change CEO compensation are much more likely to reduce personnel costs or cut or eliminate dividends. With respect to the COVID-19 crisis, Mahaboob (2022) uses secondary data reports (e.g. OECD publications and World Bank reports) dealing with Gulf Cooperation Council countries (Saudi Arabia, Kuwait, United Arab Emirates, Qatar, etc.) to investigate the effect of the crisis on workers compensation. Her data enables her to divide workers in five groups: CEO, senior management, middle management, professionals and support. For each country she reports the median of already implemented percentage reductions on base salaries. The CEO and senior management fit our definition of top management best. For these two groups, she reports a 20% decrease in the base salary in United Arab Emirates, Saudi Arabia, Oman, and Qatar. In Bahrain (Kuwait) CEOs salary decline is stronger with 15% (25%) in comparison to top management with a decline of 10% (24%). However, in all these countries salaries decrease by at least 10%.

Middle Managers

The term "middle manager" is not uniformly defined. Mintzberg (2010), for example, describes a person who simultaneously must report to superior managers and demands reports from subordinate managers. According to Bonsiep (2002), middle management has the responsibility, among other things, to ensure the implementation and achievement of goals and work processes and to contribute its own expertise and experience. Therefore, middle management usually has a high amount of specific human capital that is crucial for the proper running of the processes in the firm. However, the position between the top and bottom levels of the hierarchy can also imply problems for middle management. This position can lead to a high level of dissatisfaction, as middle managers are responsible for the proper functioning of the workforce and simultaneously can be made responsible or bypassed by the upper management (see, e.g., Dopson and Stewart, 1990). Therefore, a decrease in middle managers' income may lead to a reduction in effort or may even cause them to quit.

Kampkötter and Sliwka (2011) observe the relationship between firm performance and the bonus-to-base ratio (share of bonus payments to base salaries) of all hierarchical levels below top management in German banks and financial institutions. They find a positive relationship between 2003 and 2008, which is particularly strong in the higher hierarchy levels. Moreover, the financial crisis led to a considerable decline in bonus payments, which were again substantially stronger in higher hierarchy levels, and to an even stronger decline in firm performance. In a similar approach, Kampkötter (2015) analyzes how pay systems in the German and Swiss financial services industry changed in response to the financial crisis. He focuses on non-executive employees which excludes CEOs and top management positions and finds that the financial crisis had a large impact on the variable part of compensation. For the German chemical sector, Grund and Walter (2015) find a decline in bonus payments during the financial crisis while fixed salaries remain relatively stable. However, after the crisis, variable compensation and total compensation actually rise above the pre-crisis level. As mentioned above Mahaboob (2022) also reports salary decreases for middle management. Depending on the country she shows a percentage reduction in base salaries between 14% and 25%.

Other Employees

The employees form the basis of the company and carry out the work processes. Traditionally, the level of their wages is explained by human capital factors, implying that education, work experience, and on-the-job training yield higher wages (see, e.g., Becker, 1964; Mincer, 1974). However, in Germany, collective agreements have a major impact on wage levels. These result from collective bargaining between employers' associations and trade unions and are concluded largely independently of any intervention by the government. A negotiated collectively agreed wage is not to be regarded as a fixed amount, but rather as a wage minimum that may be exceeded. Such a collectively agreed wage cannot be simply undercut, as otherwise unions threaten to take labor actions such as strikes. Franz and Pfeiffer (2006) show that such labor union contracts are particularly important for the wage rigidity of less skilled workers. For the stickiness of high-skilled wages they emphasize that specific human capital and negative signals for new hires are the most important. Furthermore, Germany had a national wide minimum wage of 9.35 € per hour in 2020 that increased in the following years.[3] These institutional settings prevent or at least complicate short-term wage adjustments. Moreover, employees with accumulated experience are indispensable as the operational basis of the firm. Therefore, quits due to wage cuts would also cause lasting damage to the company.

Adams-Prassl et al. (2020) use survey data for the US, UK and Germany to study heterogeneity in the impact of the COVID-19 crisis. They find that workers in the US and UK face a higher risk of losing their jobs during the crisis and therewith realize wage losses.To a much smaller degree, this is the case for Germany, as many workers who are

[3]For details, see: https://www.destatis.de/EN/Themes/Labour/Earnings/Minimum-Wages/_node.html (last access: March 23, 2024).

no longer needed for production purposes receive public support through the short-time working program.[4] Grabka (2021) uses the German Socio-Economic Panel (SOEP) to investigate the changes in income inequality in Germany. He reports that income inequality decreased slightly since the beginning of the COVID-19 crisis pandemic.[5] However, he argues that this is might be mainly due to income reductions among the self-employed.

In addition to managers, Mahaboob (2022) also reports salary decreases for professionals and support workers who may be seen as the ordinary employees. For almost all countries both groups are treated equally with two exceptions. In the United Arab Emirates wages of support workers decrease 4 percentage points stronger than those for professionals. In Oman, it is the opposite. Professionals' wages decrease 8 percentage points more than the wages of support workers. In total, the descriptive study of Mahaboob (2022) finds a predominantly similar reduction of wages with a slight tendency to higher reduction at lower hierarchical stages. The paper by Akerman et al. (2022) is closest to ours. They study how the decline in output in Sweden during the pandemic affected workers' incomes. They distinguish workers by age, gender, education, and migration background, among other factors. Our study, in contrast, differentiates the workforce according to the hierarchical positions of the employees and we additionally include shareholders.

Fair Wage-Effort hypothesis

Until now, we considered the consequences of pay cuts for each single stakeholder group separately. However, we expect that there are interactions between workers and that fairness considerations affect the productivity effects of wage cuts. A stakeholder group might feel to be unfairly treated if only the members of their own group are affected by wage reductions, but not others. This fairness consideration is particularly relevant if a stakeholder group "close" in the hierarchy to one's own is differently treated (executives

[4]The German short-time work program allows companies to retain the employment contracts, while the Federal Employment Agency covers up to 66% of wage costs for a period of up to 12 months. In 2020, on average, almost 3 million workers were affected by short-time work (see, e.g., https://statistik.arbeitsagentur.de/Statistikdaten/Detail/Aktuell/iiia7/kurzarbeit-zr2/kurzarbeit-zr2-dwolkraa-0-xlsm.xlsm?__blob=publicationFile&v=1, last access: March 23, 2024). For further information, see, e.g., https://www.arbeitsagentur.de/en/press/en-2022-42-shorttime-working-benefit-for-temporary-work (last access: March 23, 2024).

[5]There exist other studies, which consider the effects of COVID-19 on wages and wage distribution, e.g. Adermon et al. (2022) and Braband et al. (2022). Braakmann et al. (2022) consider in addition to wages movements of workers leaving high-risk occupations in the UK.

versus middle managers, middle managers versus other employees). If members of a specific stakeholder group feel (subjectively) unfairly treated, they might react with effort reduction. This is essentially the content of the Akerlof and Yellen (1990) Fair Wage-Effort hypothesis and could be of relevance in our research context.

To avoid the potential problem of a reduction in effort due to pay decreases, it may be appropriate for firms to reduce payments to all stakeholders simultaneously. However, we assume that groups compare their wages, particularly with the neighboring group in the hierarchy. Accordingly, we expect high inequalities between non-managerial employees and middle managers to have a greater impact than between non-managerial employees and executives. In contrast, middle managers are in a position where they compare themselves more closely with both groups. Nonetheless, very large differences in terms of pay reductions are also likely to affect the satisfaction of the other groups. However, we expect that shareholders who are not directly integrated into the operational hierarchy of the company will be less involved in the comparison.

2.3 Data and Methodology

To address our research question, we use the German Business Panel (GBP, Bischof et al., 2021). The GBP is maintained as part of the Collaborative Research Centre TRR 266 Accounting for Transparency, which is funded by the German Research Foundation (DFG). It provides representative longitudinal data on companies in Germany, collected based on surveys of managers about the economic situation, entrepreneurial decisions, and subjective assessments. As the survey was conducted during the COVID-19 pandemic, and since the questions were targeted at the entrepreneurial and political measures taken to face the consequences of the pandemic, this database is particularly suitable for answering our research question. We restrict our sample to the first wave of the GBP surveys which was conducted between July 6 and October 3, 2020, for two reasons. First, with respect to our dependent variables, only dividends are surveyed more than once. Second, we observe the onset of the crisis where the firms faced the greatest uncertainty. Moreover, we exclude firms that report zero employees, as we expect that this category does not provide valid information about the four groups of stakeholders. In total, we obtain a data set consisting of 6,550 firms. In the following subsections, our main variables and the underlying questions are explained in more detail.

2.3.1 Variables: Definition and Questions

Dependent variables. Our dependent variables take into account the adjustments to the four groups of internal stakeholders. The variables are based on the question: "What measures are you taking in the short term (0-12 months) to cope with the burden of the corona crisis?" Multiple answers were possible, and the questions were closed. The important answers for us are affirmative answers regarding "decrease disbursement shareholders" and "decrease wage or bonus". For firms that answered the first question in the affirmative, we generate a dummy variable that takes the value one if dividends of the *shareholders* are decreased and zero otherwise. Firms that answered affirmatively regarding reduced wages/bonuses specify in a follow-up question which groups these decreases apply. The possible answers are (i) "salary/bonus reduction management board", (ii) "salary/bonus reduction middle management", and (iii) "salary/bonus reduction other employees". These again elicit yes or no answers. The questionnaire queries reductions in future increases within the next twelve months. This is reasonable, as it is often not possible to reduce current wages in the short term due to long-term contracts (e.g., Bauer et al., 2007). Therefore, we use this question to construct dummy variables taking unit value in the case of salary/bonus reductions for *executives*, *middle managers*, and *other employees*, and zero otherwise.

Independent variables. We use changes in revenues (revenue impact) to determine the extent to which firms are affected by the crisis (see Bloom et al., 2021 for a related measure), as the pandemic has severely impacted firms' revenues (e.g., Archanskaia et al., 2023; Bruhn et al., 2023; Makni, 2023; Shen et al., 2020). The corresponding question is: "To which extent have the following operating figures been impacted by the corona crisis? Please indicate, by how much percent the operating figures have changed with respect to 31.01.20." The answers are given as values (percentages) between -100 and +100. However, for better interpretation, we recode the variable to range from +100 to -100, indicating a more negative affectedness with higher values. Additionally, note that the question explicitly asked about changes due to the crisis. The first variable with respect to being affected is a dummy variable. It takes unit value if monthly revenues decrease compared to the beginning of 2020 and the value zero if revenues remain constant or increase. For the second group of variables, we subdivide the revenue impact into different categories. The first category ($Affected_{[-100,0]}$) contains all firms that report increasing or unchanged revenues. This serves as a reference category in our estimation. The remaining firms are distributed in categories of respectively 25 percentage point steps of the revenue impact. Therefore, the remaining categories are defined as follows: Category 2: 1–25% ($Affected_{[1,25]}$) decrease in revenues, Category 3: 26–50% ($Affected_{[26,50]}$) decrease in revenues, Category 4: 51–75% ($Affected_{[51,75]}$) decrease in revenues and Category 5: 76–100% ($Affected_{[76,100]}$) decrease in revenues. With these variables, we are able to analyze effect heterogeneity in dependence on the degree of affectedness. As a last measure of being affected, we use the continuous revenue impact.

Control variables. We control for firm size using six categories based on 2019 revenues measured in euros ($\leq$100k, 100k–350k, 350k–700k, 700k–2mil, 2mil–10mil, >10mil), where revenues of less than or equal to 100 thousand euros represent the reference category. Moreover, we include the dummy variable $Limited_i$, which takes the value one if the company has a legal form of limited liability (e.g., limited liability company GmbH or joint-stock company AG) and zero otherwise. Moreover, to reflect the perceived economic uncertainty, we consider four dummy variables indicating the expectation of the respondent regarding the end of the pandemic (2020, 2021, 2022, 2023 or later) with 2020 as reference category. Presumably, if the pandemic is expected to end later and the problems are predicted to last longer, there will be a greater tendency to adjust costs. Note that these restrictions are not specific legal restrictions like a curfew or mandatory nose and mouth coverage with a mask, but rather a more general question. We also control for the general risk aversion of decision-makers in the firm. In order to reduce the likelihood of encountering liquidity constraints, risk-averse decision-makers may be more inclined to reduce payments to stakeholders. However, in contrast to this hypothesis, risk-averse decision-makers may prefer to avoid conflicts with influential stakeholders and therefore may make fewer adjustments. Furthermore, payment reductions entail the risk of losing investors, top managers and other key employees. As it is uncertain whether these stakeholders can be recruited again after the end of the crisis, risk aversion could lead to lower cost of new hires. For this purpose, we use the queried Likert scale, which ranges from 0 (very risk-averse) to 11 (very risk-seeking). On this basis, we create the dummy variable *RiskAversion*, which takes unit value if the decision makers are very risk-averse (0–2), and zero otherwise (3–10). Finally, regional and sectoral effects are considered by state and industry dummies.

2.3.2 Descriptive Statistics

Table 2.1 reports the means and standard deviations of the variables defined above.[6] In the first section, the dependent variables are displayed. Since these are zero/one dummies, the means indicate the share of firms that are reporting to execute those activities. According to the descriptive statistics, firms intend to save first on executives followed by shareholders. Payments to middle managers and other employees are similarly likely to be cut. All things considered, those shares are quite similar with a difference of only 5 percentage points from the highest to the lowest value.

Table 2.1: Descriptive statistics

	mean	sd
Shareholders (dummy)	0.34	0.47
Executives (dummy)	0.37	0.48
Middle Managers (dummy)	0.32	0.47
Other Employees (dummy)	0.32	0.47
Affected (continuous)	16.87	41.98
Affected (dummy)	0.60	0.49
Affected (categorical)	2.27	1.33
FirmSize (categorical)	3.58	1.45
Limited (dummy)	0.88	0.32
RiskAversion (dummy)	0.14	0.35
EndRestriction (categorical)	2021.17	0.61
Observations	6,550	

The second section contains the three affectedness measures. On average, revenues have decreased by about 17 percent due to the crisis. Considering our dummy variable, about 60% of firms are defined as being affected. The mean of all firms is Category 2 which represents a decrease in revenues between 1% and 25%. The shares of the revenue categories are as follows: Category 1 (-100% to 0%) 40%, Category 2 (1% to 25%) 22%,

[6] Due to data confidentiality issues, we are not permitted to report minimum and maximum values.

Category 3 (26% to 50%) 18%, Category 4 (51% to 75%) 10%, and Category 5 (76% to 100%) 10%.

In the last section, descriptive statistics on the control variables are displayed. According to German firm structures, most of the firms in the representative GBP sample are also quite small. Indeed, 82% of German companies are micro firms (so-called "Kleinstunternehmen") with up to 9 employees and up to 2 million euros in revenues.[7] Our data reflects this, since revenues in 2019 are on average between category 3 and 4, and therefore range between €350 thousand and €2 million. The shares of the categories are as follows: ≤€100k: 8%, €100k–350k: 20%, €350k–700k: 17%, €700k–2mil: 26%, €2mil–10mil: 20%, and >€10mil: 9%. About 88% of companies have a legal form that limits their owner's liability. Finally, 14% of the decision-makers are risk-averse and an average firm expects the restrictions to end in 2021.

For more information on the relatedness of firm decisions on payment reductions, Table 2.2 displays correlations between our four dependent variables. The table shows a decreasing correlation along the hierarchy level. While the correlation coefficient of reductions in dividends and executive compensation is around 0.4, the correlation coefficient of dividend reductions with middle management pay cuts is still around 0.32 and only around 0.23 for the workers. In contrast, higher correlation coefficients are shown within the top management, middle management, and other employees. For instance, the correlation coefficients of the decision to make payment cuts to executives are 0.75 to middle management and 0.55 to other employees. The intermediate hierarchical position of middle management is reflected in the correlations (Executives: 0.75 and Other Employees: 0.64). It appears that firms treat the groups that are "neighboring" similarly in terms of payment reductions. For example, firms that reduce dividends tend to reduce the payments to executives more often than the payments to other employees. It is thus clear that stakeholders compare themselves more closely with neighboring hierarchy groups. This confirms our expectations described by the Fair Wage-Effort hypothesis at a first glance.

[7] https://www.destatis.de/EN/Themes/Economic-Sectors-Enterprises/Enterprises/Small-Sized-Enterprises-Medium-Sized-Enterprises/Tables/total-cik.html (last access: March 23, 2024).

Table 2.2: Correlations of dependent variables

	Shareholders	Executives	Mid. Managers	Oth. Emp.
Shareholders	1			
Executives	0.40	1		
Middle Managers	0.32	0.75	1	
Other Employees	0.23	0.55	0.64	1

2.3.3 Econometric Approach

We examine the impact of being affected by the COVID-19 crisis on the pay of four groups of stakeholders in the company. Therefore, we estimate a probit model of the form

$$y_i = \alpha + \beta Affected_i + \gamma X_i + \varepsilon_i \tag{2.1}$$

where y_i stands for the four dependent variables: a decrease in the disbursement to shareholders, a reduction of future salary increases or bonus payments of the executives, middle managers, or the other employees. The variable $Affected_i$ is either a dummy, a categorical, or the continuous variable, which measures the effects of the crisis on firms' revenues. Furthermore, X_i is a vector including the control variables.

2.4 Empirical Results

Table 2.3 presents average marginal effects of probit estimates of equation 2.1 using the binary affectedness measure. The results for the different groups of stakeholders are presented in columns (1) to (4).

The marginal effects of the affectedness variable are positive in all cases and significant at the 1% level.

Our results show that the probability of dividend reductions is about 20.6 percentage points higher in affected firms than in non-affected ones. Regarding reductions of future increases in salaries or bonus payments, the coefficient of being affected is highest for executives at 0.24. This suggests a 24.4 percentage points higher probability of adjustments to executive compensation for affected firms. Analogously, the probability for pay adjustments to middle managers and other employees is about 21.8 and 22.2 percentage points higher if companies are affected by the crisis. Comparing the results of the four stakeholders, the effects are relatively close to each other. Further tests on the differences

Table 2.3: The impact of being affected (dummy) on stakeholder payments

	Dividends or salary/bonus reduction			
	Shareholders (1)	Executives (2)	Mid. Managers (3)	Oth. Emp. (4)
Affected (dummy)	0.2057***	0.2439***	0.2175***	0.2216***
	(0.0113)	(0.0110)	(0.0110)	(0.0111)
$\text{FirmSize}_{100k-350k}$	-0.0110	0.0013	-0.0195	0.0251
	(0.0232)	(0.0230)	(0.0215)	(0.0213)
$\text{FirmSize}_{350k-700k}$	0.0109	0.0437*	0.0402*	0.0775***
	(0.0240)	(0.0238)	(0.0225)	(0.0223)
$\text{FirmSize}_{700k-2mil}$	0.0139	0.0463**	0.0706***	0.1097***
	(0.0227)	(0.0223)	(0.0212)	(0.0209)
$\text{FirmSize}_{2mil-10mil}$	0.0410*	0.1002***	0.1492***	0.1664***
	(0.0238)	(0.0236)	(0.0227)	(0.0224)
$\text{FirmSize}_{>10mil}$	0.0037	0.1033***	0.2041***	0.1938***
	(0.0275)	(0.0277)	(0.0272)	(0.0269)
Limited	0.2180***	0.1225***	0.0940***	0.0240
	0.0203)	(0.0191)	(0.0187)	(0.0181)
RiskAversion	-0.0656***	-0.0665***	-0.0328**	0.0333**
	(0.0164)	(0.0163)	(0.0157)	(0.0155)
$\text{EndRestriction}_{2021}$	0.0052	0.0394*	0.0339	0.0080
	(0.0215)	(0.0217)	(0.0209)	(0.0212)
$\text{EndRestriction}_{2022}$	0.0150	0.0580**	0.0561**	0.0201
	(0.0247)	(0.0248)	(0.0240)	(0.0243)
$\text{EndRestriction}_{\geq 2023}$	0.0568	0.0784**	0.0293	0.0050
	(0.0353)	(0.0352)	(0.0340)	(0.0342)
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	6,550	6,550	6,550	6,550

Notes: Results of average marginal effects of the probit regression; dependent variables—reductions: shareholders' dividends, growth of salaries/bonus to executives, middle managers, and other employees; the variable $Affected$ is a dummy variable for being negatively affected by the pandemic; robust standard errors in parentheses; $^{*}p < 0.1$,$^{**}p < 0.05$,$^{***}p < 0.01$.

between the coefficients of the groups (see Table 2.11 in the Appendix) show that adjustments to executive compensation differ significantly from that to the other stakeholders. As a result, the probability of pay adjustments is highest for the executives. Nevertheless, the results imply that firms reduce payments to all stakeholders and these results are consistent with the descriptive findings of Batish et al. (2020).

In contrast, the control variables reveal greater heterogeneity across stakeholders. In terms of firm size, the effect on reducing dividends is only significantly different from the base category (<100k) in the category of firms with 2019 revenues between €2 million and €10 million. In contrast, pay cuts to executives, middle managers, and other employees become more probable with increasing firm size. The probability of pay reductions to all stakeholders except for other employees is significantly higher in firms with limited liability. For risk-aversion, we find different signs for the group of other employees and the remaining stakeholders. It seems that risk-averse decision-makers tend to avoid pay reductions to shareholders, executives, and middle managers. In contrast, decision-makers appear to be more willing to reduce payments to other employees. This could be due to a higher substitutability of non-managerial employees. Finally, we observe positive significant coefficients on the expected end of the restrictions for executives and middle managers, indicating that a longer expected duration of the crisis increases the propensity of pay cuts.

2.5 Identifying Heterogeneity

The results described above indicate that the payments (or their growth) to each of the four stakeholders are likely to decrease if the related firm is affected by the COVID-19 crisis. However, the results above do not differentiate by the extent of being affected. Therefore, we re-estimate the regression using five categorical variables that measure different levels of affectedness by the pandemic: (1) -100 to 0 (reference category), (2) 1 to 25, (3) 26 to 50, (4) 51 to 75, and (5) 76 to 100.

Table 2.4 provides the results of the categorical revenue impact, where all coefficients must be interpretated in comparison to the group of non-affected firms. In all categories of $Affected_i$, the effect is greatest for executives. Even in the lowest category, measuring a revenue decline of 1 to 25 percent, the probability of pay cuts increases for all stakeholders. In this category, the coefficients are relatively small, ranging between 0.15 and 0.16. From the first to the second category, the coefficients increase by a factor of more than 1.5 times. There is no longer any substantial change between the categories in the interval from 26% to 100%. While no significant differences between pay reductions to different stakeholder groups can be observed in the smallest category of affectedness, adjustments

Table 2.4: The impact of being affected (categorical) on stakeholder payments

	Dividends or salary/bonus reduction			
	Shareholders (1)	Executives (2)	Mid. Managers (3)	Oth. Emp. (4)
$\text{Affected}_{[1;\,25]}$	0.1495***	0.1636***	0.1590***	0.1631***
	(0.0149)	(0.0149)	(0.0143)	(0.0145)
$\text{Affected}_{[26;\,50]}$	0.2342***	0.3090***	0.2591***	0.2572***
	(0.0166)	(0.0168)	(0.0164)	(0.0165)
$\text{Affected}_{[51;\,75]}$	0.2460***	0.2998***	0.2652***	0.2767***
	(0.0210)	(0.0212)	(0.0209)	(0.0212)
$\text{Affected}_{[76;\,100]}$	0.2626***	0.3021***	0.2439***	0.2543***
	(0.0227)	(0.0226)	(0.0221)	(0.0225)
Controls	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	6,550	6,550	6,550	6,550

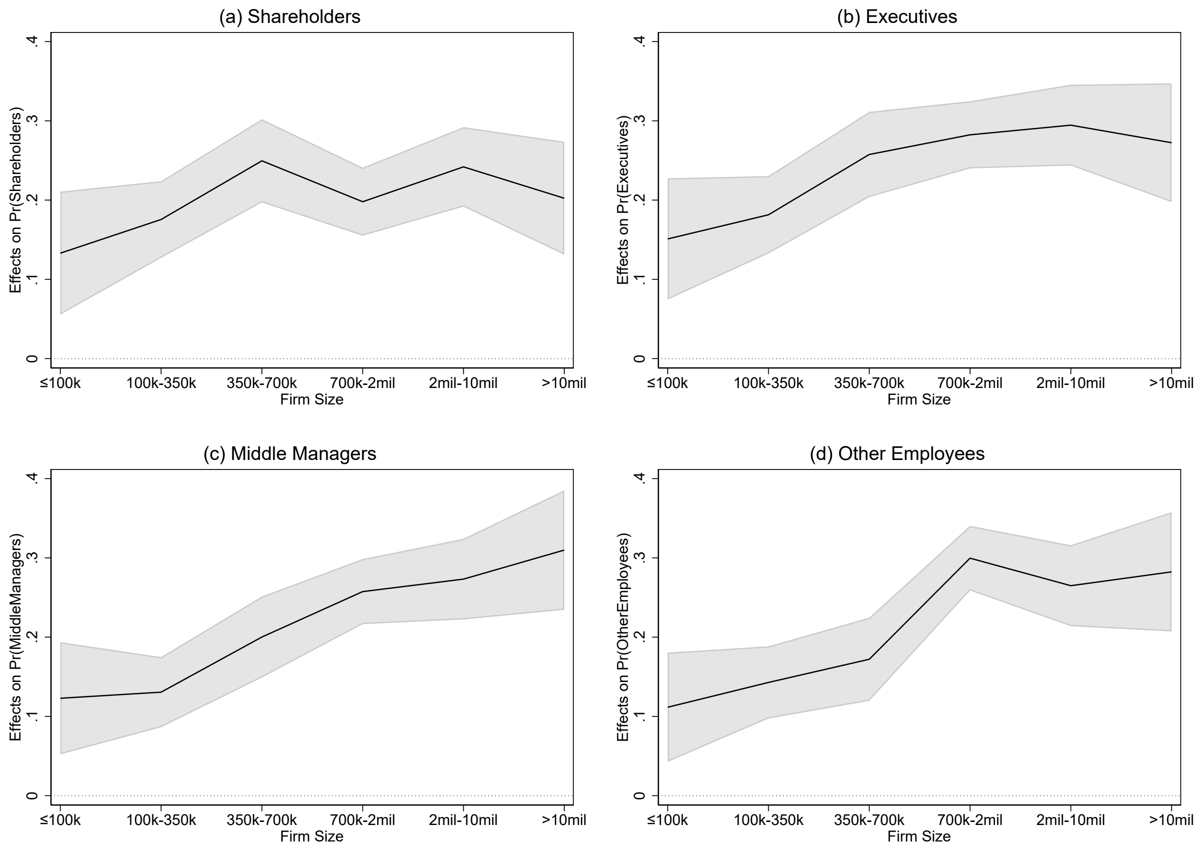
Notes: Results of average marginal effects of the probit regression; dependent variables—reductions: shareholders' dividends, growth of salaries/bonus to executives, middle managers, and other employees; $Affected_{[x,y]}$: revenue impact is between x and y; robust standard errors in parentheses; results of control variables are displayed in Table 2.12 in the Appendix; $^{*}p < 0.1,^{**}p < 0.05,^{***}p < 0.01$.

differ significantly between executives and the other groups in the three highest categories (see again, Table 2.11 in the Appendix). However, regarding adjustments, in the category of revenue declines between 51% and 75%, no significant difference to the other employees can be found, while in the category of 76%–100% no difference to the shareholders can be found. Nevertheless, the overall result shows that the probability of pay cuts appears to be highest for executives.

Our results as well as previous research indicate a significant impact of firm size on income. Indeed, there can be huge differences between small and large firms. Since the GBP sample is heterogeneous, we further investigate whether firm size has an impact on the probability of a decline in income in the affected firms. To do so, we include interactions between the affectedness variable and the six firm-size dummies and plot the margins and 95% confidence intervals in Figure 2.1.[8] For all stakeholders we find increasing marginal effects of the interaction between affectedness and firm size up to the third category (350k–750k). The effects of the remaining size categories differ with respect

[8] As an alternative, we re-estimate Table 2.3 but split the sample by firm size categories. The results are shown in Table 2.10 in the Appendix.

Figure 2.1: Margins of interaction between firm size and being affected (dummy) on stakeholder payments



Notes: Plot of average marginal effects and 95% confidence intervals of the interaction terms of being affected and firm size dummies (Probit model); dependent variables on the y-axis—reductions: shareholders' dividends, growth of salaries/bonus to executives, middle managers, and other employees; the variable $Affected$ is a dummy variable for being negatively affected by the pandemic.

to the stakeholder group. Starting with the third category, the impact on shareholders (a) fluctuates between 0.2 and 0.24, which indicates relatively low dispersion for larger companies. In the case of executives (b), the increase in the effect declines with higher firm size and finally drops. For middle managers (c), we observe a steady increase between each category. Finally, with regard to other employees (d), there is a strong increase in the marginal effect between the third and fourth category, which remains almost constant for larger firms.

2.6 Continuous Affectedness Variable and IV Estimation

In Table 2.5, we estimate the impact of being affected on the stakeholders' income using the continuous variable for the revenue impact instead of the dummy variable. This variable ranges from +100 to -100 and thus measures the extent of being affected by the crisis. In fact, the continuous variable provides more information, but it is also more vulnerable to outliers. As before, an increase in the revenue impact (firms that are more affected) is associated with a higher probability of decreasing payments. When the revenue impact increases by ten percentage point, the probability of pay cuts of the respective stakeholder group increases by about 2–2.5 percentage points. This confirms our previous results. Again, we find that pay adjustments to executives differ significantly from that to the other stakeholder groups (see Table 2.11 in the Appendix).

Table 2.5: The impact of being affected (continuous) on stakeholder payments

	Dividends or salary/bonus reduction			
	Shareholders (1)	Executives (2)	Mid. Managers (3)	Oth. Emp. (4)
Affected (continuous)	0.0020*** (0.0001)	0.0025*** (0.0002)	0.0021*** (0.0001)	0.0021*** (0.0001)
Controls	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	6,550	6,550	6,550	6,550

Notes: Results of average marginal effects of the probit regression; dependent variables—reductions: shareholders' dividends, growth of salaries/bonus to executives, middle managers, and other employees; the variable $Affected$ is the continuous revenue impact; robust standard errors in parentheses; results of control variables are displayed in Table 2.13 in the Appendix; $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

It cannot be excluded that our coefficients are biased and therefore an instrumental variable (IV) estimate might be appropriate. It is possible that in the case of high-quality management, the effect of the crisis is less pronounced and cost reductions are realized more frequently. The first part of the hypothesis that competent managers can handle such a crisis better than less skilled ones is probably obvious. Bloom et al. (2013) and Bloom and Van Reenen (2007) provide empirical evidence for a positive link between management quality and firm performance in general and Kumar and Zbib (2022) in context of the COVID-19 crisis. There is also empirical evidence for the second part of this hypothesis that good managers reduce wage costs. Bertrand and Schoar (2003) find that skilled CEOs (measured by MBA degrees) are more aggressive and pay lower dividends. Similarly, Bastos and Monteiro (2011) observe a tendency for more experienced managers to cut wages. While reducing wages is generally difficult, times of crisis offer opportunities to reduce wages due to higher uncertainty and lower demand for goods. This in turn leads to lower demand for labor which dampens the bargaining power of employees. Gunnigle et al. (2013) show that this is true for the Asian financial crisis of 1997. Since we cannot estimate managerial skills due to a lack of relevant data, we suspect that our results may be subject to omitted variable bias.[9] We expect a downward bias, indicating that the true coefficients are larger than the OLS coefficients.

However, when using industry-level data, the decisions of single managers have at most a minor impact on the whole industry. Therefore, to ensure that we are indeed measuring the impact of the pandemic and not just managerial decisions, we use a two-stage least squares (2SLS) estimation. For this purpose, we use the average revenue impact in the respective industry and construct an instrument analogous to our revenue impact variable. Higher values of the instruments are therefore associated with a higher level of affectedness measured by greater revenue declines. To preserve the exogeneity assumption between the compensation decisions and the instrument variable, we use industry averages at the 2-digit level of NACE Rev. 2 from Sweden provided by the Structural Business Statistics (SBS) of Eurostat.[10] We thereby follow Böhm and Qendrai (2023), who argue that Sweden is a suitable proxy for industry-level demand changes since Sweden has an economic structure and society relatively similar to those of Germany.

The results are displayed in Table 2.6. The coefficient of the instrument in the first stage is highly significant at the 1% level (column 5). Furthermore, the F-value, corresponding to the null hypothesis that the coefficient of the instrument in the first stage is zero, is about 240. Hence, the relevance assumption is likely to be fulfilled (Staiger and Stock, 1997). Since the industry-based revenue impacts in Sweden are expected to be independent of the management quality in German firms the exogeneity assumption should hold. Therefore, we assume that our instrument is valid.

[9] Feedback from the dependent variables to our main variables (endogeneity), the affectedness measures, is unlikely, as the dependent variables represent short-term adjustments that have not yet been necessarily implemented at the time of the survey.

[10] Further unpublished tests using data from Germany, France, the Netherlands, and Austria as instrumental variable confirm the results.

Table 2.6: The impact of being affected (continuous) on stakeholder payments—2SLS estimation

	2nd Stage				1st Stage
	Dividends or salary/bonus reduction				
	Shareholders	Executives	Mid. Managers	Oth. Emp.	Affected
	(1)	(2)	(3)	(4)	(5)
Affected (continuous)	0.0023***	0.0035***	0.0035***	0.0043***	
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	
$\text{FirmSize}_{100k-350k}$	0.0040	0.0229	0.0013	0.0534**	-5.4992**
	(0.0240)	(0.0242)	(0.0227)	(0.0233)	(2.4542)
$\text{FirmSize}_{350k-700k}$	0.0157	0.0630**	0.0632***	0.1130***	-8.0872***
	(0.0249)	(0.0252)	(0.0239)	(0.0245)	(2.4756)
$\text{FirmSize}_{700k-2mil}$	0.0200	0.0742***	0.1029***	0.1600***	-10.7365***
	(0.0239)	(0.0241)	(0.0230)	(0.0234)	(2.3361)
$\text{FirmSize}_{2mil-10mil}$	0.0523**	0.1392***	0.1940***	0.2236***	-10.3092***
	(0.0250)	(0.0251)	(0.0242)	(0.0246)	(2.3507)
$\text{FirmSize}_{>10mil}$	0.0268	0.1640***	0.2715***	0.2793***	-15.4304***
	(0.0295)	(0.0297)	(0.0291)	(0.0294)	(2.5237)
Limited	0.2125***	0.1394***	0.1062***	0.0305*	-1.7202
	(0.0150)	(0.0171)	(0.0164)	(0.0181)	(1.6604)
$\text{EndRestriction}_{2021}$	0.0125	0.0442**	0.0384*	0.0048	3.7046*
	(0.0214)	(0.0222)	(0.0212)	(0.0225)	(2.1438)
$\text{EndRestriction}_{2022}$	0.0188	0.0584**	0.0585**	0.0110	3.1967
	(0.0247)	(0.0253)	(0.0245)	(0.0255)	(2.4227)
$\text{EndRestriction}_{\geq 2023}$	0.0651*	0.0854**	0.0366	0.0041	3.9139
	(0.0357)	(0.0355)	(0.0340)	(0.0348)	(3.3739)
RiskAversion	-0.0734***	-0.0701***	-0.0347**	0.0314*	-2.2567
	(0.0154)	(0.0157)	(0.0154)	(0.0165)	(1.4419)
Instrument					0.7642***
					(0.0493)
Constant	0.0863*	0.0189	-0.0154	0.0456	19.3437***
	(0.0456)	(0.0464)	(0.0449)	(0.0467)	(4.2186)
State dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No	No
Observations	6,538	6,538	6,538	6,538	6,538
F-value					240.34

Notes: Results of 2SLS estimation; the F-value corresponds to the null hypothesis that the coefficient of the instrument (revenue impact at the industry level in Sweden) in the first stage is zero; dependent variables—reductions: shareholders' dividends, growth of salaries/bonus to executives, middle managers, and other employees; the variable $Affected$ is the continuous revenue impact and the dependent variable in the first stage; robust standard errors in parentheses; $^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0.01$.

The results of the second stage regressions are displayed in columns (1) to (4). Compared to Table 2.5, the magnitudes of the continuous variable $Affected_i$ increase by a factor in a range between 1.2 and 2 with the lowest value associated with shareholders and the highest value with other employees. These results confirm our theoretical considerations regarding the bias and its direction. This might indicate that skilled managers lowered the negative impact of the ongoing crisis. However, after eliminating possible biases, the coefficients do not change their signs. Overall, our main result that all stakeholders have to pay for the COVID-19 crisis is confirmed.

2.7 Robustness Tests

We perform several robustness checks to validate our results. To do so, we (i) change the affectedness measure, (ii) use linear probability model (LPM) and logit instead of probit regressions, and (iii) apply inverse probability weights.[11]

(i) Affectedness measures

So far, all measures were based on the revenue impact of the COVID-19 crisis. Now we consider three other variables to construct dummy variables: (a) impact on net income, (b) impact on liquidity, and (c) the claim of short-time work. For (a) and (b), we proceed similarly to the revenue dummy. Therefore, the new dummies take a unit value if the impact on net income/liquidity is negative, and zero otherwise. The third variable is already a dummy that indicates if firms have claimed short-time work (dummy equals 1) or not (dummy equals 0). The results are shown in Table 2.7. Overall, there are only minor changes in the coefficients, which are most notable for the short-time work dummy. However, this might be due to the compensatory effects of the wage cost savings from the use of short-time work; therefore, this dummy should only be used as an affectedness measure to a limited extent.

(ii) Estimation model

Since our dependent variables are dummies, we use a probit model. However, to ensure that our results are not driven by the model choice, we present results from linear probability model (LPM) estimates and logit regressions in Table 2.8. Again, the main results are confirmed.

[11] We also test the use of an alternative measure of firm size in an unpublished estimation. Instead of revenue categories, we use the current number of employees. Again, this change has no effect on our results.

Table 2.7: Robustness – Variation of the affectedness variables

	Dividends or salary/bonus reduction			
	Shareholders (1)	Executives (2)	Mid. Managers (3)	Oth. Emp. (4)
Profit (dummy)	0.2140***	0.2514***	0.2172***	0.2148***
	(0.0113)	(0.0109)	(0.0109)	(0.0111)
Liquidity (dummy)	0.1959***	0.2299***	0.2103***	0.2016***
	(0.0112)	(0.0109)	(0.0107)	(0.0108)
STW (dummy)	0.1466***	0.2172***	0.1968***	0.2188***
	(0.0127)	(0.0120)	(0.0116)	(0.0113)
Controls	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	6,084	6,084	6,084	6,084

Notes: Results of average marginal effects of the probit regression; dependent variables—reductions: shareholders' dividends, growth of salaries/bonus to executives, middle managers, and other employees; the dummy variables $Profit$ and $Liquidity$ take a unit value if firms' profits or liquidity decrease and are zero otherwise; STW takes unit value if the firm participates in the short-time working program and is zero otherwise; robust standard errors in parentheses; $^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0.01$.

Table 2.8: Robustness – LPM and Logit estimation

	Dividends or salary/bonus reduction			
	Shareholders (1)	Executives (2)	Mid. Managers (3)	Oth. Emp. (4)
LPM				
Affected (dummy)	0.2062***	0.2485***	0.2186***	0.2219***
	(0.0116)	(0.0117)	(0.0112)	(0.0113)
Logit				
Affected (dummy)	0.2067***	0.2451***	0.2201***	0.2244***
	(0.0114)	(0.0111)	(0.0112)	(0.0113)
Controls	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	6,550	6,550	6,550	6,550

Notes: Results of linear probability model and average marginal effects of logit regressions; dependent variables—reductions: shareholders' dividends, growth of salaries/bonus to executives, middle managers, and other employees; the variable $Affected$ is a dummy variable for being negatively affected by the pandemic; robust standard errors in parentheses; $^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0.01$.

(iii) Inverse probability weighting

The affectedness of firms might not be completely random since the firms that are affected might differ in important aspects from the firms that are not affected. This would bias our results. To tackle this issue, we apply re-weighting as a way to take selectivity on observables into account. In particular, we follow the approach proposed by Abadie and Cattaneo (2018) and Imbens and Wooldridge (2009). Hence, we calculate propensity scores for being affected and re-weight our sample by the inverse of these scores. The corresponding probit model contains the categorical variables firm size and end of restrictions and dummies for restricted legal forms, risk aversion, state, and industry (see Giebel and Kraft, 2023 and Liu, 2023 for a similar approach). For affected firms, the weight is one divided by the propensity score. For non-affected firms, the weight is one divided by one minus the propensity score. Table 2.9 shows that the signs, levels of significance, and magnitudes of the coefficients remain almost unchanged.

Table 2.9: Robustness – IPW estimation

	Dividends or salary/bonus reduction			
	Shareholders	Executives	Mid. Managers	Oth. Emp.
	(1)	(2)	(3)	(4)
Affected (dummy)	0.1990***	0.2362***	0.2094***	0.2128***
	(0.0108)	(0.0106)	(0.0104)	(0.0106)
Controls	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	6,650	6,650	6,650	6,650

Notes: Results of average marginal effects of the probit regression with inverse probability weights (IPW); dependent variables—reductions: shareholders' dividends, growth of salaries/bonus to executives, middle managers, and other employees; the variable $Affected$ is a dummy variable for being negatively affected by the pandemic; robust standard errors in parentheses; $^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0.01$.

2.8 Conclusion

The COVID-19 pandemic was arguably the worst economic crisis in Germany and probably the world since the financial crisis of 2008/2009. Firms had to deal with, e.g., supply chain problems due to restrictions in China, new work and health regulations as well as general higher uncertainty. These new circumstances probably raise costs but leave open the question of who will pay these costs. Data from the German Business Panel enables us to investigate the pass-through effects of costs on four internal stakeholders: shareholders, executives, middle management, and other employees. The possibility to separate these groups is quite rare.

There are drawbacks to cutting pay to either group, e.g., cutting dividends could be seen as a negative sign to investors while cutting wages or compensation could lower productivity or increase quits. Therefore, it is unclear on which group cuts should be made. The Fair Wage-Effort hypothesis suggests treating all groups equally in order to avoid dissatisfaction due to comparisons between groups. Our findings support this, as correlations suggest that firms choose to pass on costs to groups with a related hierarchical position. Furthermore, our probit results indicate that all stakeholders of affected firms must pay either with lower dividends or lower future pay increases, similarly. Overall, affected firms are about 20.6 – 24.4 percentage points more likely to reduce stakeholders' payoffs. These effects become stronger for firms that are more affected.

We also find evidence for effect heterogeneity regarding firm size. Even when controlling for the extent of affectedness larger firms tend to pass through costs to a higher extent. This is especially true for future pay cuts for executives, middle management, and other employees. Additionally, an IV approach as well as several robustness checks confirm our results.

The answer to the question of who pays for the COVID-19 crisis is particularly important for policymakers to be able to target particularly affected groups and understand what drives economic changes, e.g., lower wage growth, in the aftermath of the crisis. This might also be of particular interest to unions and the relevance of collective bargaining. In analyzing payment reductions for stakeholders, the distribution effects of the COVID-19 crisis can also be examined in dependence on hierarchical position.[12]

Our data is based on surveyed short-term (within the next 0-12 months) measures. Unfortunately, we are not able to investigate to which extent these measures were actually realized. Further research should take this into account. Moreover, additional research is needed regarding the size of the cutbacks since we only have information on the binary decision of whether firms plan to lower payments to stakeholders. To understand crisis-induced cost pass-throughs, the size of reductions is important.

[12] Bellani et al. (2021) examine preferences for redistribution during the crisis and Braband et al. (2022) consider redistribution effects.

2.9 Appendix

Table 2.10: The impact of being affected (differentiated by firm size) on stakeholder payments

	Dividends or salary/bonus reduction			
	Shareholders (1)	Executives (2)	Mid. Managers (3)	Oth. Emp. (4)
FirmSize ≤€100k				
Affected (dummy)	0.1277***	0.1184***	0.1067***	0.1373***
	(0.0428)	(0.0405)	(0.0368)	(0.0372)
Observations	490	497	503	496
FirmSize €100k–350k				
Affected (dummy)	0.1932***	0.2030***	0.1493***	0.1545***
	(0.0251)	(0.0255)	(0.0242)	(0.0249)
Observations	1,272	1,272	1,261	1,263
FirmSize €350k–700k				
Affected (dummy)	0.2328***	0.2505***	0.2045***	0.1855***
	(0.0277)	(0.0272)	(0.0275)	(0.0279)
Observations	1,049	1,066	1,044	1,072
FirmSize €700k–2mil				
Affected (dummy)	0.2035***	0.2748***	0.2513***	0.2938***
	(0.0221)	(0.0205)	(0.0209)	(0.0202)
Observations	1,723	1,719	1,717	1,720
FirmSize €2mil–10mil				
Affected (dummy)	0.2125***	0.2781***	0.2679***	0.2601***
	(0.0260)	(0.0241)	(0.0248)	(0.0247)
Observations	1,269	1,277	1,264	1,268
FirmSize >€10mil				
Affected (dummy)	0.2376***	0.2495***	0.2798***	0.2722***
	(0.0410)	(0.0372)	(0.0356)	(0.0376)
Observations	578	606	606	606

Notes: Results of average marginal effects of the probit regression; dependent variables—reductions: shareholders' dividends, growth of salaries/bonus to executives, middle managers, and other employees; the variable $Affected$ is a dummy variable for being negatively affected by the pandemic; all regressions include the control variables of Table 2.3 except for firm size dummies; robust standard errors in parentheses; $^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0.01$.

Table 2.11: Difference tests of Tables 2.3, 2.4, and 2.5

	Shareholders			Executives		Mid. Managers
	Executives	Mid. Managers	Oth. Emp.	Mid. Managers	Oth. Emp.	Oth. Emp.
Differences of Table 2.3						
Affected (dummy)	-0.0382***	-0.0118	-0.0159	0.0264***	0.0223**	-0.0041
	(0.0128)	(0.0135)	(0.0142)	(0.0079)	(0.0105)	(0.0095)
Differences of Table 2.4						
$\text{Affected}_{[1;\,25]}$	-0.0141	-0.0096	-0.0137	0.0045	0.0004	-0.0041
	(0.0170)	(0.0176)	(0.0189)	(0.0105)	(0.0140)	(0.0123)
$\text{Affected}_{[26;\,50]}$	-0.0748***	-0.025	-0.023	0.0498***	0.0518***	0.0019
	(0.0199)	(0.0207)	(0.0216)	(0.0130)	(0.0171)	(0.0152)
$\text{Affected}_{[51;\,75]}$	-0.0538**	-0.0193	-0.0307	0.0346***	0.0231	-0.0115
	(0.0253)	(0.0261)	(0.0278)	(0.0169)	(0.0226)	(0.0202)
$\text{Affected}_{[76;\,100]}$	-0.0395	0.0187	0.0083	0.0582***	0.0478**	-0.0104
	(0.0255)	(0.0271)	(0.0290)	(0.0179)	(0.0239)	(0.0210)
Differences of Table 2.5						
Affected (continuous)	-0.0005***	-0.0001	-0.0001	0.0004***	0.0003**	-0.0000
	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0001)

Notes: Results of differences and t-tests between stakeholder groups; dependent variables—reductions: shareholders' dividends, growth of salaries/bonus to executives, middle managers, and other employees; *Affected* is the binary, categorical or continuous affectedness variable as described in the respective tables; robust standard errors in parentheses; $^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$.

Table 2.12: Full estimation results of Table 2.4

	Dividends or salary/bonus reduction			
	Shareholders (1)	Executives (2)	Mid. Managers (3)	Oth. Emp. (4)
$\text{Affected}_{[1;\,25]}$	0.1495***	0.1636***	0.1590***	0.1631***
	(0.0149)	(0.0149)	(0.0143)	(0.0145)
$\text{Affected}_{[26;\,50]}$	0.2342***	0.3090***	0.2591***	0.2572***
	(0.0166)	(0.0168)	(0.0164)	(0.0165)
$\text{Affected}_{[51;\,75]}$	0.2460***	0.2998***	0.2652***	0.2767***
	(0.0210)	(0.0212)	(0.0209)	(0.0212)
$\text{Affected}_{[76;\,100]}$	0.2626***	0.3021***	0.2439***	0.2543***
	(0.0227)	(0.0226)	(0.0221)	(0.0225)
$\text{FirmSize}_{100k-350k}$	-0.0066	0.0050	-0.0180	0.0263
	(0.0231)	(0.0228)	(0.0213)	(0.0211)
$\text{FirmSize}_{350k-700k}$	0.0178	0.0507**	0.0436*	0.0808***
	(0.0239)	(0.0237)	(0.0225)	(0.0222)
$\text{FirmSize}_{700k-2mil}$	0.0233	0.0563**	0.0760***	0.1155***
	(0.0227)	(0.0223)	(0.0212)	(0.0209)
$\text{FirmSize}_{2mil-10mil}$	0.0531**	0.1127***	0.1566***	0.1745***
	(0.0239)	(0.0236)	(0.0227)	(0.0225)
$\text{FirmSize}_{>10mil}$	0.0249	0.1305***	0.2219***	0.2123***
	(0.0278)	(0.0279)	(0.0273)	(0.0271)
Limited	0.2187***	0.1227***	0.0944***	0.0247
	(0.0204)	(0.0191)	(0.0186)	(0.0181)
RiskAversion	0.0075	0.0415*	0.0354*	0.0097
	(0.0214)	(0.0215)	(0.0208)	(0.0211)
$\text{EndRestriction}_{2021}$	0.0151	0.0576**	0.0559**	0.0200
	(0.0246)	(0.0246)	(0.0239)	(0.0242)
$\text{EndRestriction}_{2022}$	0.0583*	0.0801**	0.0305	0.0059
	(0.0352)	(0.0350)	(0.0339)	(0.0341)
$\text{EndRestriction}_{\geq 2023}$	-0.0645***	-0.0646***	-0.0315**	0.0344**
	(0.0163)	(0.0162)	(0.0157)	(0.0155)
Controls	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	6,550	6,550	6,550	6,550

Notes: Results of average marginal effects of the probit regression; dependent variables—reductions: shareholders' dividends, growth of salaries/bonus to executives, middle managers, and other employees; $Affected_{[x,y]}$: revenue impact is between x and y; robust standard errors in parentheses; $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 2.13: Full estimation results of Table 2.5

	Dividends or salary/bonus reduction			
	Shareholders (1)	Executives (2)	Mid. Managers (3)	Oth. Emp. (4)
Affected (continuous)	0.0020***	0.0025***	0.0021***	0.0021***
	(0.0001)	(0.0002)	(0.0001)	(0.0001)
$\text{FirmSize}_{100k-350k}$	0.0012	0.0164	-0.0070	0.0361*
	(0.0233)	(0.0231)	(0.0213)	(0.0211)
$\text{FirmSize}_{350k-700k}$	0.0233	0.0596**	0.0532***	0.0883***
	(0.0241)	(0.0239)	(0.0224)	(0.0222)
$\text{FirmSize}_{700k-2mil}$	0.0280	0.0654***	0.0866***	0.1244***
	(0.0228)	(0.0225)	(0.0212)	(0.0209)
$\text{FirmSize}_{2mil-10mil}$	0.0580**	0.1213***	0.1670***	0.1828***
	(0.0239)	(0.0237)	(0.0227)	(0.0224)
$\text{FirmSize}_{>10mil}$	0.0317	0.1401***	0.2365***	0.2253***
	(0.0278)	(0.0279)	(0.0273)	(0.0271)
Limited	0.2189***	0.1220***	0.0937***	0.0234
	(0.0206)	(0.0195)	(0.0190)	(0.0184)
RiskAversion	0.0054	0.0397*	0.0350*	0.0082
	(0.0217)	(0.0220)	(0.0211)	(0.0215)
$\text{EndRestriction}_{2021}$	0.0101	0.0526**	0.0524**	0.0157
	(0.0249)	(0.0251)	(0.0243)	(0.0247)
$\text{EndRestriction}_{2022}$	0.0576	0.0788**	0.0294	0.0046
	(0.0359)	(0.0356)	(0.0340)	(0.0344)
$\text{EndRestriction}_{\geq 2023}$	-0.0655	-0.0663***	-0.0322**	0.0338**
	(0.0166)	(0.0165)	(0.0159)	(0.0157)
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	6,550	6,550	6,550	6,550

Notes: Results of average marginal effects of the probit regression; dependent variables—reductions: shareholders' dividends, growth of salaries/bonus to executives, middle managers, and other employees; the variable $Affected$ is a dummy variable for being negatively affected by the pandemic; robust standard errors in parentheses; $^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$.

Hemker, T., Kraft, K. and Seidinger, T. (2024). A Comparison of Pay Adjustments to Stakeholders During COVID-19 Between Innovative and Non-Innovaitve Firms. *Unpublished*.

Chapter 3

A Comparison of Pay Adjustments to Stakeholders During COVID-19 Between Innovative and Non-Innovative Firms

Co-authored with Kornelius Kraft and Tim Seidinger

This study investigates different pay adjustment strategies of innovative and non-innovative industries and firms during the COVID-19 pandemic. We use crisis-related revenue declines as a measure of affectedness and both industry- and firm-level data on innovation to identify differences in pay reductions towards (a) the workforce in general and (b) to four groups of stakeholders (shareholders, executives, middle managers, and ordinary workers). Our results show that the effect of the pandemic on the probability of pay cuts is significantly higher if firms or their industries are innovative. We argue that innovation-specific characteristics (e.g., pay structure, financial constraints) (i) enable firms to reduce compensation more easily, and (ii) require pay reductions.

3.1 Introduction

The COVID-19 pandemic severely affected both society and the economy. This impact has already been examined in general by many studies (see, e.g., Brodeur et al., 2021; Rathnayaka et al., 2023).[1] There are also multiple strains of literature regarding innovation in the crisis. Besides others, there are studies on the impact of the pandemic on research

[1]Studies on the impact of innovation on firms' survival probability in general can be found in, e.g., Audretsch (1995), Buddelmeyer et al. (2010), Cefis and Marsili (2005, 2006, 2012, 2019), and Fontana and Nesta (2009).

and development (R&D) (e.g., Belitz, 2022; Diekhof et al., 2021) and on how innovation affects firm survival during the crisis. Despite the high risks of innovation activities, innovative firms are more likely to survive the COVID-19 crisis and perform better in general (Ali, 2022b; de Uña-Álvarez et al., 2023; Khan et al., 2022; Kyrdoda et al., 2023; Özşuca, 2023). This is attributed to the adaptability and efficiency of innovative firms. However, adjustment strategies have not been investigated so far.

Our contribution is to examine the differences between innovative and non-innovative firms' adjustment strategies with regard to the consequences of the COVID-19 crisis. We concentrate on cost reduction strategies via cuts towards stakeholders of German firms, since personnel expenses are reported to be the major issue of liquidity constraints (BMWi, 2020). Adjustment strategies are of interest in themselves, but can also contribute to explaining the higher probability of survival of innovative companies.

The difference in adjustment strategies by innovation status can be attributed to firm-specific characteristics. It is well known that innovative and non-innovative firms differ in many respects such as human capital of employees, government subsidies, export intensity, productivity, survival probability, and growth rates of revenues and profits (Sam-Aggrey, 2009). We focus on two main arguments as to why innovative firms might behave differently. First, financial constraints have been shown to be particularly problematic for investments in innovation during crises (Amore, 2015; Archibugi et al., 2013a,b; Filippetti and Archibugi, 2011; Hottenrott and Peters, 2012; Paunov, 2012). This, in turn, could lead to a greater need for cost reductions when sales decrease and external funding is too expensive or not an option at all. Second, it might be easier for innovative firms to reduce wage costs. Employees of innovative firms have on average a higher amount of human capital, are also more productive and therefore earn salaries above collectively bargained wages, which can be adjusted more easily.

For our empirical analysis, we identify affected firms using revenue declines in response to the crisis in two different datasets.

The first data set combines a firm survey and industry-level R&D information. One cross-section of the survey offers the unique opportunity to distinguish between different stakeholder groups and not merely to consider stakeholders in general or a single group of stakeholders. In particular, we obtain information about cutbacks in shareholders' dividends and reductions of future pay increases to executives, middle managers, and other employees. We apply linear probability models and find that firms in innovative compared to non-innovative industries adjust differently in response to the crisis. The results indicate that the former have a significantly higher probability of reductions in future pay (increases), particularly for shareholders and executives. Furthermore, we deal with potential omitted variable bias by applying an instrumental variable (IV) approach. For this purpose, we instrument the affectedness of firms with revenue changes in corresponding foreign industries. This confirms our main findings and provides evidence that innovative industries also reduce future pay increases to middle managers and other employees.

The second dataset focuses on realized pay cuts in the form of reduced personnel expenses per employee. We combine published company financial data and add firm-level R&D and patent information to identify innovation at the firm level. This panel dataset allows us to carry out difference-in-differences as well as triple differences estimations at the firm-level. The results show that reported adjustments were indeed realized and that the probability of pay adjustments is higher in innovative firms.

Additionally, we can show that financial constraints are more binding and the variable compensation component is higher for firms in innovative industries. Overall, we show that innovation does matter for firms' adjustment strategies in response to the COVID-19 crisis.

Our study is structured as follows. Section 3.2 deals with theoretical considerations on how the crisis affects companies and which adjustment measures are possible. In this context, we consider potential differences between innovative and non-innovative industries. Section 3.3 describes the data, sample selection, methodology, descriptive statistics, and empirical results using industry-level innovation data. Section 3.4 has the same structure, with the difference here being the use of panel data and measuring innovation at the firm level. Subsequently, in Section 3.5, we discuss and provide evidence for possible underlying mechanisms. Finally, the study closes with a discussion of the results and an outlook.

3.2 Pay Adjustments in Innovative and Non-Innovative Firms

Today, it is widely known that innovations can lead to several advantages for firms, such as higher competitiveness, increasing productivity, higher profits, and a greater ability to quickly adapt to new market conditions (e.g., Aghion et al., 2005; Aw et al., 2007; Cefis and Marsili, 2006). The pandemic led to the introduction of regulations that posed significant challenges for most firms. Studies on previous crises find that innovative firms are more resilient (e.g., Cefis and Marsili, 2019; Cefis et al., 2020; Czarnitzki and Kraft, 2004, 2010; Gupta et al., 2018; Roper and Turner, 2020; Sidorkin and Srholec, 2014; see Ugur and Vivarelli (2021) for a survey). Consistent with those studies, Adam and Alarifi (2021), Khan et al. (2022), and Özşuca (2023) find that innovative firms also performed better during the COVID-19 pandemic than non-innovative firms. However, the role of firms' innovation orientation on their strategies to cope with the challenges of the crisis are ambiguous. In the following, we therefore discuss the most important arguments from a theoretical point of view.

A crucial factor of companies' success is human capital. The literature dealing with human capital has been established and known for a long time. For our research question, the most important part is the distinction between general and specific human capital (Becker, 1962). While general human capital is substitutable, specific human capital is only effective within the firm in which it is accumulated. For this reason, the costs and returns of specific human capital accumulation are assumed to be shared between firms and employees. As skilled workers are crucial for innovation success (Fonseca et al., 2019; Lenihan et al., 2019; Protogerou et al., 2017; Subramaniam and Youndt, 2005; Sun et al., 2020), innovative firms generally have a higher amount of (specific) human capital (D'Amore et al., 2017). Therefore, both sides face negative consequences in case of termination of employment. On the one hand, this would argue in favor of not adjusting payments in order to avoid such termination. On the other hand, the quasi-rent from specific qualifications is relatively high. This would make it possible to reduce payments relatively strongly without causing terminations. We therefore expect different decisions by innovative and non-innovative firms regarding pay cuts according to the extent of specific human capital. This argument is particularly reasonable for the stakeholder groups of executives, middle managers, and other employees.

Another argument, from an institutional point of view, is on the possibility of wage adjustments. In Germany, wages are determined by industry-wide negotiations between unions and employer associations. These so-called "Tariflöhne" represent lower limits for payment aside from the minimum wage (e.g., Bauer et al., 2007). However, companies are of course free to pay higher wages. Since employees in innovative firms are often better qualified than those in non-innovative companies, the wages in the former are highly likely to be above the collectively agreed wages (Aghion et al., 2017; Ammermueller et al., 2009; Pianta and Tancioni, 2008). This gives innovative firms greater scope to reduce wages than it is the case for their non-innovative counterparts, which are often unable to do so because of the collectively agreed wages. This argument mainly concerns the group of other employees, while middle managers and executives are less likely to be subject to collective agreements.

Finally, investments in innovation are particularly risky as they require high R&D expenditures and have highly uncertain ex ante prospects of success (Hottenrott and Peters, 2012). Moreover, innovation activities themselves can lead to financial constraints (Lahr and Mina, 2020; Lee et al., 2015). Therefore, it is frequently argued (e.g., Hall and Lerner, 2010; Kerr and Nanda, 2015) that R&D investments must be financed from the company's own resources.[2] For this purpose, it is necessary to acquire equity and not to induce shareholders to withdraw capital because of the low dividends. On the one hand, dividend cuts can be interpreted by shareholders as signaling of a poor financial situation of the firm, resulting in fewer investments (Miller and Rock, 1985; Nguyen and Tran, 2016). According to this argument, innovative companies would reduce dividends less than other companies because they are more dependent on capital investors. On the other hand, innovative firms would presumably have to save more in a crisis, if they were equally affected, because they would have more difficulties in accessing external financing. The literature often emphasizes that wages are rigid in the short run. If this is true, innovative firms would have to reduce costs where cuts are possible, and that is in dividends. The argument of flexibility also applies to another cost variable, namely executive compensation. A high proportion of this consists of flexible components. In crisis situations, these can be reduced more easily than fixed salaries.

It becomes apparent that the theoretical discussion leads to potentially opposing pre-

[2] Giebel and Kraft (2019) show that a credit supply shock during the financial crisis lowered current innovation activities as well as the initiation of future innovations.

dictions for innovative and non-innovative firms regarding all stakeholder groups. Empirical studies are therefore all the more important.

3.3 Different Stakeholders and Industry-Level Innovation

3.3.1 Data and Variables

We use different data sources to address our research question of whether firms in innovative industries pass on costs to stakeholders in a different way than firms in non-innovative industries. Our main source is the German Business Panel (GBP, see Bischof et al., 2021) that provides representative data on companies in Germany, based on surveys of managers. This data source provides a unique opportunity to observe the adjustments to payments to different stakeholders during the crisis. The GBP only queries pay cuts to the stakeholder groups in the first survey wave (July 6 to October 3, 2020). We therefore restrict the sample to this period. However, this comes with the advantage that we observe the greatest uncertainty among firms during the outbreak of the COVID-19 pandemic. Due to lack of data, we are not able to identify innovation in the GBP at the firm level. Instead, we use data on R&D intensity provided by the Stifterverband Wissenschaftsstatistik.[3] These contain industry-specific information on R&D expenditures and sales data. Smaller industries are aggregated and larger industries (especially the manufacturing sector) are presented in a more detailed manner on the basis of the WZ2008 classification. This allows us to identify the R&D intensity of 24 different industries. However, using innovation data at industry level has the advantage of capturing the total innovation effect, which is a combination of a direct and an indirect effect (Pianta and Tancioni, 2008). While the former represents the effect of innovation within innovative firms, the latter describes spillover effects across the entire industry. In total, we obtain a final dataset consisting of 7,967 observations. We use the following variables to perform our estimations:

Dependent variables. We refer to the question in the questionnaire "What measures are you taking in the short term (0–12 months) to cope with the burden of the corona

[3] Data is available at https://www.stifterverband.org/download/file/fid/10273, see Tables 3.2.1 and 3.2.3 (last access: March 23, 2024).

crisis?".[4] The relevant answers in our context are reduced disbursements to shareholders and decreases in wages or bonuses. Utilizing a follow-up question, we can distinguish pay cuts to executives, middle managers, and other employees. These dependent variables are dummy variables that take unit value if the respective firm reports such an adjustment, and zero otherwise. With regard to the compensation of executives, middle managers, and other employees, a reduction in growth is queried.

Independent variables. Previous literature finds a strong negative impact of the COVID-19 crisis on firms' revenues (e.g., Bruhn et al., 2023; Fairlie and Fossen, 2022; Makni, 2023; Shen et al., 2020). Therefore, we proxy affectedness by revenue changes due to the pandemic at the time of the survey compared to January 31, 2020 (see Bloom et al., 2021; Fackler et al., 2024 for a similar approach). We use both a dummy variable with unit value if revenues decrease and a continuous variable ranging from +100 (negatively affected) to -100 (positive affected).[5]

Innovation measure. In our baseline specification, we divide industries based on the R&D intensity. As a measure for R&D intensities, we take the share of R&D expenditures to total revenues within each industry. We define industries with an intensity above the median as innovative. Based on this assumption, we construct a dummy variable that takes unit value when the industry is innovative, and zero otherwise.

Control variables. We use several variables to control for firm or industry effects that may drive our results. First, we use six categories based on 2019 revenues measured in Euros (≤100k, 100k–350k, 350k–700k, 700k–2mil, 2mil–10mil, >10mil) to control for firm size. Revenues of less than or equal to 100 thousand Euros build the reference category. Second, we use a variable for the legal form with unit value for firms with legal forms of limited liability (e.g., limited liability company GmbH or joint-stock company AG), and zero otherwise. Third, four dummy variables indicating the time period when the respondents expected the pandemic to be over (2021, 2022, 2023 or later, with 2020

[4] The GBP questionnaire can be found at https://backend.gbpanel.org/app/uploads/2022/01/Codebook_Welle1.pdf (last access: March 23, 2024).

[5] The original variable in the GBP questionnaire ranges from -100 to +100. For reasons of comparability between the dummy and continuous variable, we recode this variable indicating a stronger level of affectedness when the variable increases.

as reference category) reflect the perceived economic uncertainty. Fourth, we take into account the general risk aversion of firms' decision-makers. Since the success prospects of innovation investments are subject to a high level of risk, decision-makers in innovative firms could, on the one hand, have a higher risk tolerance. On the other hand, these risks might cause them to be more risk-averse in other aspects. For this reason, they could seek to avoid reductions in payments to stakeholders. Therefore, we control for decision-makers' risk aversion by generating a dummy variable that takes unit value if the answer to the corresponding question in the 11-point Likert scale takes the three strongest values in the direction of risk aversion, and zero otherwise. Finally, regional and sectoral effects are considered using state and industry dummies.

3.3.2 Methodology

We aim to identify different adjustments for being affected by the COVID-19 pandemic between firms in innovative and non-innovative industries. To do so, we estimate a model of the form

$$y_i = \alpha + \beta_1 Innovative_i + \beta_2 Affected_i + \theta Innovative_i \times Affected_i + \gamma X_i + \varepsilon_i \quad (3.1)$$

where y_i measures short-term adjustments to stakeholders. The explanatory variable $Affected_i$ is used both as a dummy and as a continuous variable, and measures the effects of the pandemic on firms' revenues based on percentage changes from before, to during the crisis. $Innovative_i$ indicates whether a firm operates in an innovative industry or not. X_i contains the control variables that include dummies for industry, states, firm size, and the legal status.

To test for possible differences in the response of firms to the crisis, we interact the affectedness variable with the innovation dummy. Since the affectedness measure is already a difference (i.e., the change of revenues before and during the crisis) our specification corresponds to a difference-in-differences (DiD) approach, although we only have cross-sectional data available. We estimate equation (3.1) by using a linear probability model (LPM).

3.3.3 Descriptive Statistics

Table 3.1 shows the descriptive statistics for the total sample and separated by innovative and non-innovative industries. It also provides a t-test of group differences regarding means.

Table 3.1: Descriptive statistics

	Total		Innovative		Non-Innovative		Diff
	mean	sd	mean	sd	mean	sd	b
Shareholders (dummy)	0.33	0.47	0.36	0.48	0.30	0.46	0.06***
Executives (dummy)	0.36	0.48	0.39	0.49	0.33	0.47	0.06***
Middle Managers (dummy)	0.31	0.46	0.34	0.47	0.29	0.45	0.05***
Other Employees (dummy)	0.32	0.47	0.32	0.47	0.32	0.47	0.00
Affected (continuous)	17.79	43.01	14.18	38.72	20.80	46.07	-6.62***
Affected (dummy)	0.61	0.49	0.57	0.50	0.64	0.48	-0.07***
Innovative (dummy)	0.46	0.50					
FirmSize (categorical)	3.51	1.45	3.57	1.43	3.46	1.46	0.12***
Limited (dummy)	0.86	0.35	0.92	0.28	0.80	0.40	0.11***
EndRestriction (categorical)	2021.17	0.61	2021.17	0.60	2021.17	0.63	-0.00
RiskAversion (dummy)	0.15	0.36	0.15	0.35	0.15	0.36	-0.01
Observations	7,967		3,626		4,341		

Approximatively one third of all firms plan to adjust payments to stakeholders. Moreover, 61% of all companies report a decline in revenues, with an average decrease of almost 18%. 46% of the companies in our sample operate in innovative industries. When looking at these companies, it is noticeable that they are to a greater extent planning to cut pay to shareholders, executives, and middle managers than their non-innovative counterparts. However, there is no significant difference regarding other employees. In terms of being affected, the descriptive analysis indicates that firms in non-innovative industries are more frequently (measured by the dummy variable) and more strongly (measured by the continuous variable) affected by the pandemic than their counterparts. Furthermore, firms in innovative industries have on average more employees and more often a legal form of limited liability. Regarding the perceived economic uncertainty there is no difference since, on average, firms in innovative as well as non-innovative industries expect the crisis to end in 2021.

3.3.4 Empirical Results

Table 3.2 shows difference-in-differences estimators for each stakeholder group. This table is divided into two panels. Panel A (B) reports the LPM results of the interaction of innovative industries and the binary (continuous) affectedness measure. All specifications include the described control variables as well as state and industry dummies.

Table 3.2: Estimation results

	Shareholders (1)	Executives (2)	Mid. Managers (3)	Other Empl. (4)
Panel A: LPM—Affected (dummy)				
Innovative×Affected	0.0740***	0.0474**	0.0231	0.0165
	(0.0210)	(0.0212)	(0.0202)	(0.0206)
Panel B: LPM—Affected (continuous)				
Innovative×Affected	0.0011***	0.0007***	0.0002	0.0002
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Controls	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	7,967	7,967	7,967	7,967

Notes: Results of LPM difference-in-differences estimations, robust standard errors in parentheses, control variables include 2019 firm size, end of restrictions, risk aversion, and limited liability dummies, results of control variables are displayed in Table 3.6 in the Appendix, $^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0.01$.

We find significant coefficients of the interaction term Innovative×Affected for shareholders and executives. The probability of pay cuts for shareholders (executives) is about 7.4 (4.7) percentage points higher for affected firms in innovative industries. If we consider the extent of the affectedness through use of the continuous variable, the probability of observing a pay cut to shareholders (executives) in the case of firms operating in innovative industries (in comparison to the other industries) is about 1.1 (0.7) percentage points higher if the affectedness increases by ten percentage points. One reason why we only find significant differences for shareholders and executives might be that these groups generally (i.e., independent of innovation status) have the greatest financial scope for adjustments.

3.3.5 Robustness

So far, we have separated innovative and non-innovative industries using the median of R&D intensity. This is a rather broad definition of being innovative. To check whether our results are robust if we use a narrower classification, we now use the 4^{th} quartile of R&D intensity as a cutoff. The results, reported in Table 3.7 in the Appendix, confirm our previous findings. Further robustness tests (not presented, but available on request) regarding control variables and the estimation methodology confirm our results. Those include (i) replacing revenues as a firm size measure with employment categories; (ii) including a short-time work dummy; and (iii) removing all control variables except industry and state dummies.

In general, unobservable variables can be a problem in such econometric approaches. For example, firms with more highly qualified management might cope better with the crisis and be able to reduce costs to a greater degree, which could lead to a downward bias of the estimates (see, e.g., Bastos and Monteiro, 2011; Bertrand and Schoar, 2003; Gunnigle et al., 2013; Kumar and Zbib, 2022). Due to lack of management quality data, we apply a 2SLS estimation approach using industry-level revenue changes for Austria in the first stage to deal with this issue.

Regardless of the innovation measure used (based on the median or 4^{th} quartile), for shareholders and executives the results (Table 3.8 in the Appendix) go in the same direction. However, the magnitude of the coefficients increases. Additionally, using innovation based on the median of R&D intensity, we find significant coefficients for the groups of middle management and other employees. We also test the relevance assumption using the first stage F-values of our instrumental variables used (Table 3.9 in the Appendix). It takes the values of 17.3 (10.8) when innovative industries are specified by the median (4^{th} quartile) of R&D intensity. Therefore, the relevance assumption is likely to be fulfilled (Staiger and Stock, 1997).

All in all, our results prove to be robust. They could, however, be influenced by two possible inaccuracies: We measure innovation intensity only at the industry level and we use survey data for the main variable of interest. Therefore, we complement the previous analysis with an empirical study based on a panel of German companies, balance sheet data, and firm-level information on innovative activity.

3.4 Firm-Level Panel Data on Innovation

3.4.1 Data and Variables

In order to test for realized pay cuts at the firm level, we use balance sheet data provided by Bureau van Dijk's Dafne and add two sources of innovation information. First, we use firm-level information on R&D activities as an innovation input measure provided by Stifterverband. As a second source for innovation activities, we utilize patent data from the Orbis Intellectual Property (Orbis IP) database as an output measure. Information on financial figures and firm-level innovation activities come, however, at a cost. With this data we cannot distinguish between different groups of stakeholders. Nevertheless, we can generate an unbalanced panel that comprises a total of 113,781 observations over the years 2012 to 2020.

Dependent variables. Instead of considering different groups of stakeholders, we use employment adjusted personnel expenses (personnel expenses per employee), which are composed of compensation of executives, middle managers, and other employees. Thus, we interpret this variable as the average payments to these firm internal stakeholders. We generate the dummy $PayCut$ that takes unit value in case of decreasing average personnel expenses compared to the previous year, and zero otherwise. In contrast to the surveyed planned reductions of future salaries/bonuses of executives, middle managers, and other employees of Section 3.3, this dummy is based on realized pay reductions. Unfortunately, due to lack of data, we are not able to test for reductions in dividends.

Independent variables. We use revenue changes between 2019 and 2020 to identify affected firms. For this purpose, the variable $Affected$ measures both, the continuous range from +100 to -100, and the binary classification whether a firm is negatively affected by the crisis. We only look at the change from 2019 to 2020 to identify the effects of the COVID-19 pandemic. Changes between other years are discussed in more detail in Section 3.4.3.

Innovation measure. We use two different measures to identify innovative firms. For both, we observe the period from 2015 to 2019 and generate the dummy variable Innovative. It takes unit value if the respective firm (a) reports that it carries out R&D

activities internally or commission them externally (innovation input) or (b) has at least one granted patent (innovation output). In the case of non-innovative firms, the dummy is zero.

Control variables. We run several different specifications that include the following control variables. Again, we control for firm size using five employment categories (1–9, 10–49, 50–249, ≥250 employees), with 1–9 employees as a reference category. Moreover, dependent on the estimation model, we include dummy variables controlling for legal forms, industry, time, and states.

3.4.2 Methodology

Using balance sheet panel data enables us to estimate a "classical" difference-in-differences approach. This allows us to rule out the possibility that the measured effects are merely spurious influences between the two years 2019 and 2020. To do so, we use a panel for the period 2012 to 2020 and estimate a difference-in-differences model of the form:

$$PayCut_{it} = \alpha + \beta_1 Innovative_i + \beta_2 Crisis_t + \theta Innovative_i \times Crisis_t + \gamma X_{it} + \varepsilon_{it}. \tag{3.2}$$

Since the COVID-19 affectedness is not taken into account in this specification, an implicit assumption is that this burden would be the same for innovative and non-innovative companies. The dependent variable $PayCut_{it}$ is a dummy variable that takes unit value if the respective firm cuts pay between period t and $t-1$, and zero otherwise. Moreover, the binary variable $Innovative_i$ indicates whether a firm is innovative ($Innovative_i = 1$) or not ($Innovative_i = 0$). The dummy variable $Crisis_t$ takes unit value if the year is 2020, and zero otherwise. The interaction term between the crisis- and innovative-dummy is the difference-in-differences coefficient of interest and indicates the causal effect of innovative firms during the pandemic. Again, X_{it} is a vector of control variables and ε_{it} stands for the error term.

This approach identifies the crisis effect on pay cuts by differences within time and within firms' innovation status. One crucial assumption of unbiased DiD results is that the treatment and control group have similar pre-treatment trends (common trend assumption). However, within the innovative and non-innovative firms there might be differences regarding the affectedness by the pandemic. We assume that affected and non-affected firms differ in characteristics that we cannot observe (e.g., the degree of digitalization and automation). When the distribution of affected and non-affected firms varies within the innovative and non-innovative groups our common trend assumption might not hold. We test this empirically following Mora and Reggio (2015).

We use two approaches to address this issue. First, we add affectedness as a third dimension to estimate a more general model and to increase the probability that the common trend assumption is valid (e.g., Frölich and Sperlich, 2019; Wing et al., 2018; Wooldridge, 2020; Yu et al., 2023; see also Olden and Møen, 2022 for an overview of applications). It is reasonable to assume that innovative firms that are more severely affected by the COVID-19 crisis are more likely to cut pay than non-affected innovative firms. Taking this into account by using all possible interactions of (1) being innovative, (2) being in the crisis period, and (3) being affected by the crisis, we obtain a triple difference (difference-in-difference-in-differences; DDD) approach

$$\begin{aligned} PayCut_{it} =& \alpha + \beta_1 Innovative_i + \beta_2 Crisis_t + \beta_3 Affected_i + \beta_4 Innovative_i \times Crisis_t \\ & + \beta_5 Innovative_i \times Affected_i + \beta_6 Crisis_t \times Affected_i \\ & + \theta Innovative_i \times Crisis_t \times Affected_i + \gamma X_{it} + \varepsilon_{it}. \end{aligned} \tag{3.3}$$

θ is the coefficient of interest and shows the effect of an innovative firm that is affected during the COVID-19 pandemic. This approach mitigates potential problems of a violated common trends assumption in the difference-in-differences approach.

Secondly, we use inverse probability weighting and reweight the DiD regression to compare innovative and non-innovative firms that have a similar propensity score and are thus close to each other as regards their observable characteristics (e.g., Abadie and Cattaneo, 2018; Imbens and Wooldridge, 2009; Stuart et al., 2014).[6] We estimate the DDD and reweighted DiD models with LPM and a firm fixed-effects approach.

3.4.3 Descriptive Statistics

Table 3.3 shows the summary statistics for our firm-level data. It displays the mean and standard deviation for the total sample and separated into innovative and non-innovative firms (measured by R&D activities), and also provides a t-test of group differences regard-

[6] Our probit model is based on pre-crisis years and includes the employment categories, legal form dummies and the industry, state, and time fixed-effects. For similar applications of this method, see, e.g., Giebel and Kraft (2023) and Liu (2023).

ing the means. In total, we observe 20,162 firms in 2020, resulting in 113,781 observations for the full unbalanced panel of the period 2012–2020. Since our main variables ($PayCut$, $Innovative$ and $Affected$) are time-invariant, we only report cross-sectional descriptive statistics of 2020. However, the time-varying variables do not change considerably when using panel data or measuring innovation using patent data.

Table 3.3: Descriptive statistics for R&D intensity in 2020

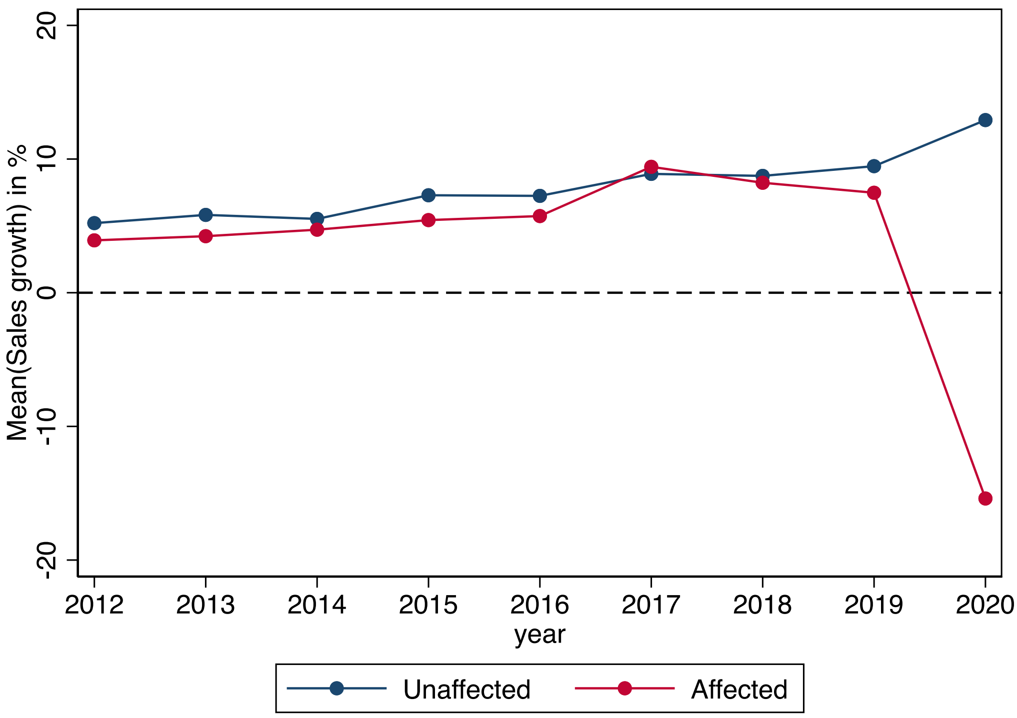
	Total		Innovative		Non-Innovative		Diff
	mean	sd	mean	sd	mean	sd	b
PayCut (dummy)	0.42	0.49	0.51	0.50	0.41	0.49	0.11***
Affected (continuous)	1.53	20.90	4.12	19.90	1.15	21.01	2.97***
Affected (dummy)	0.51	0.50	0.63	0.48	0.49	0.50	0.14***
Innovative (dummy)	0.13	0.33					
Employment (categorical)	3.13	0.89	3.53	0.60	3.07	0.91	0.46***
LegalForm (categorical)	2.27	0.89	2.11	0.69	2.29	0.92	-0.18***
Observations	20,162		2,540		17,622		

Using firm-level data, about 13% of companies are innovative. Moreover, approximately 42% of the firms actually cut payments to the workforce in 2020. We find a positive difference of 11 percentage points between the two types of firms, suggesting that innovative firms reduce pay more frequently than non-innovative firms.

In our sample, 51% of all firms are affected by the crisis and experience on average a decrease of revenues by about 1.5%. Furthermore, innovative firms are affected more often and to a higher degree. We observe considerable differences regarding innovation and affectedness compared to the GBP results. In terms of the innovation dummy, this is not surprising as our definition of innovative industries in Section 3.3 is based on the median R&D intensity. However, we expect the use of firm-level information to provide a more precise measure of firms' innovativeness. Regarding the affectedness, we attribute these differences to different reporting periods. In the balance sheet data, affectedness is based on the annual change of revenues between 2019 and 2020. In contrast, the revenue impact of the GBP sample only covers the difference between January 2020 and the questionnaire period, which mainly relates to the third quarter of 2020. Thus, adjustment effects of the progressed crisis (such as gradual openings after the lockdowns) are likely to explain lower levels of affectedness. These differences might also be the result of the larger companies observed in Dafne.

It might be the case that being affected by the COVID-19 crisis is not completely random, but that, for example, firms that generally perform worse are more likely to be affected. To investigate this, we illustrate the sales growth of both affected and unaffected firms in Figure 3.1. In the pre-crisis period, firms report on average positive sales growth of between 3.9% and 9.4%, regardless of whether they were affected by the pandemic or not. During this time period, the levels of sales growth are relatively similar among both groups with a maximum difference of 2 percentage points. In contrast, in 2020, affected firms experience a revenue decrease of about 15.4% while revenues of unaffected firms increase by approximately 12.9%. We therefore argue that the crisis impacts firms randomly, largely independent of their pre-crisis sales growth.

Figure 3.1: Sales growth by affectedness status



Regarding firm size, in the GBP firms have an average of 6–9 employees, while Dafne's average is 50–249 employees. Since the disclosure requirement for annual reports generally applies above a certain firm size, Dafne particularly provides valid information from larger firms. For this reason, differences in descriptive statistics are hardly surprising. However, when controlling for firm size, we expect similar results to the GBP.

3.4.4 Empirical Results

Table 3.4 contains the estimation results using firm-level panel data between 2012 and 2020. This table is divided into four panels. Panel A (B) shows the results of the (re-weighted) difference-in-differences approach model of innovative firms during the crisis. Additionally, the binary (Panel C) and continuous (Panel D) affectedness of the company is included as a further dimension, resulting in a triple differences approach. The causal effects are estimated using both linear probability models (Columns 1 and 3) and firm fixed-effects regressions (Columns 2 and 4). Furthermore, the innovation status of the firm

Table 3.4: Estimation results

	PayCut			
	LPM	FE	LPM	FE
	(1)	(2)	(3)	(4)
Panel A: Difference-in-Differences				
Innovative×Crisis	0.1106***	0.1157***	0.1357***	0.1413***
	(0.0115)	(0.0121)	(0.0089)	(0.0095)
Panel B: Re-weighted Difference-in-Differences				
Innovative×Crisis	0.0409***	0.0486***	0.0310**	0.0345***
	(0.0139)	(0.0148)	(0.0122)	(0.0132)
Panel C: Triple Differences—Affected (dummy)				
Innovative×Crisis×Affected	0.0846***	0.0854***	0.0756***	0.0785***
	(0.0224)	(0.0236)	(0.0175)	(0.0187)
Panel D: Triple Differences—Affected (continuous)				
Innovative×Crisis×Affected	0.0018***	0.0012**	0.0016***	0.0013***
	(0.0006)	(0.0006)	(0.0004)	(0.0005)
Innovation measure	R&D	R&D	Patents	Patents
Controls	Yes	Yes	Yes	Yes
State dummies	Yes	No	Yes	No
Industry dummies	Yes	No	Yes	No
Time dummies	Yes	Yes	Yes	Yes
Common trend test (p-values)				
Panel A	0.032	0.006	0.000	0.000
Panel B	0.647	0.608	0.000	0.002
Panel C	0.508	0.413	0.155	0.184
Panel D	0.830	0.850	0.164	0.324
Observations	113,781	113,781	113,781	113,781

Notes: Results of DiD (Panel A), re-weighted DiD (Panel B), and DDD (Panels C and D) estimations, robust and firm-clustered standard errors in parentheses, control variables include employment and legal form dummies, results of control variables are displayed in Table 3.10 in the Appendix, $^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$.

is defined by R&D activities (Columns 1 and 2) and additionally by patents (Columns 3 and 4). We report the results of the common trend test of Mora and Reggio (2015) below the other test results.[7]

The results of the four columns are similar regarding the size of the coefficients and their significance. We therefore find that measuring innovation via R&D activities or patents yield similar results. This is not surprising since R&D activities are a crucial input factor for firms' innovation output such as patents. Moreover, using fixed-effects regressions instead of a linear probability model confirms the results. Therefore, as we find robust specifications, we only interpret the coefficients of the fixed-effects model using innovation measured by R&D activities (Column 2).

Starting with the difference-in-differences approach in Panel A, we find that during the COVID-19 pandemic, innovative firms have an approximately 11.6 percentage points higher probability of pay cuts than their non-innovative counterparts. Thus, during the pandemic, innovative firms reduce personnel expenses per employee to a greater extent than non-innovative companies. However, the hypothesis of common trends has to be rejected. In contrast, in the case of the re-weighted regressions (Panel B) based on the R&D innovation measure, the common trend hypothesis is not rejected. The estimated coefficients are somewhat smaller than those reported in Panel A, but still highly significant.

The results of the DDD in Panels C and D again confirm our findings. By including affectedness as a third dimension, we adjust the formal common trend test of Mora and Reggio (2015). For this purpose, we estimate the triple differences models, but substitute the crisis dummy with annual time dummies. In the DDD setting, the null hypothesis requires that all the triple interactions before 2020 are jointly insignificant.[8] The null hypothesis cannot be rejected as indicated by the p-values in Table 3.4.[9] Therefore, the common trend assumption is likely to be met.[10]

[7]DiD approaches also require that the conditioning covariates are not affected by the treatment. To test this exogeneity assumption, we also estimate our regressions without controls and obtain similar results.

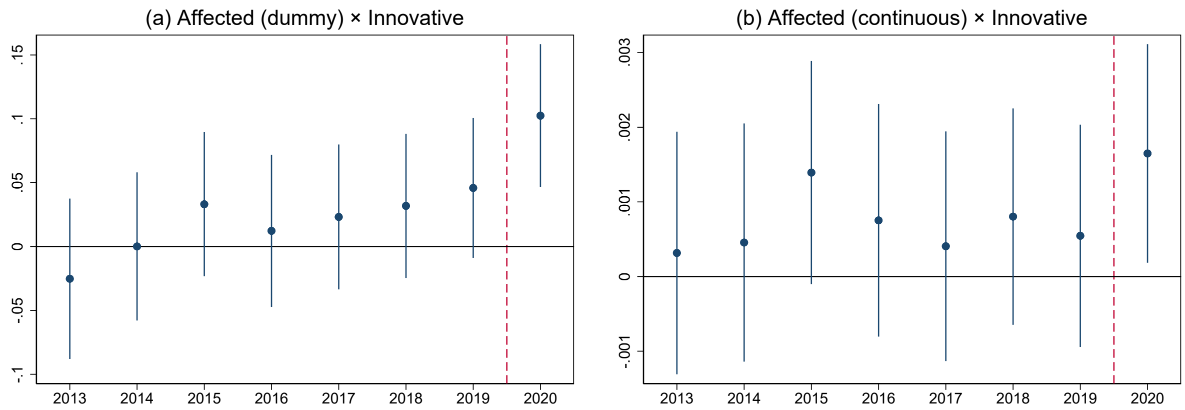
[8]For similar applications of a common trend test, see, e.g., Akosa Antwi et al. (2023), Wilson et al. (2023), and Yu et al. (2023).

[9]Using inverse probability weighting based on affectedness yields similar results of coefficients, their significance, and the F-value of the common trend test. This is unsurprising since both methods aim to reduce problems with a violation of common trends.

[10]As mentioned above, in the industry-level cross-section setting of Section 3.3, we are unable to test for common trends. However, our panel data approach shows that the affectedness is a decisive factor for the common trend assumption to hold. Since we include the affectedness in Section 3.3, we assume the common trend to apply.

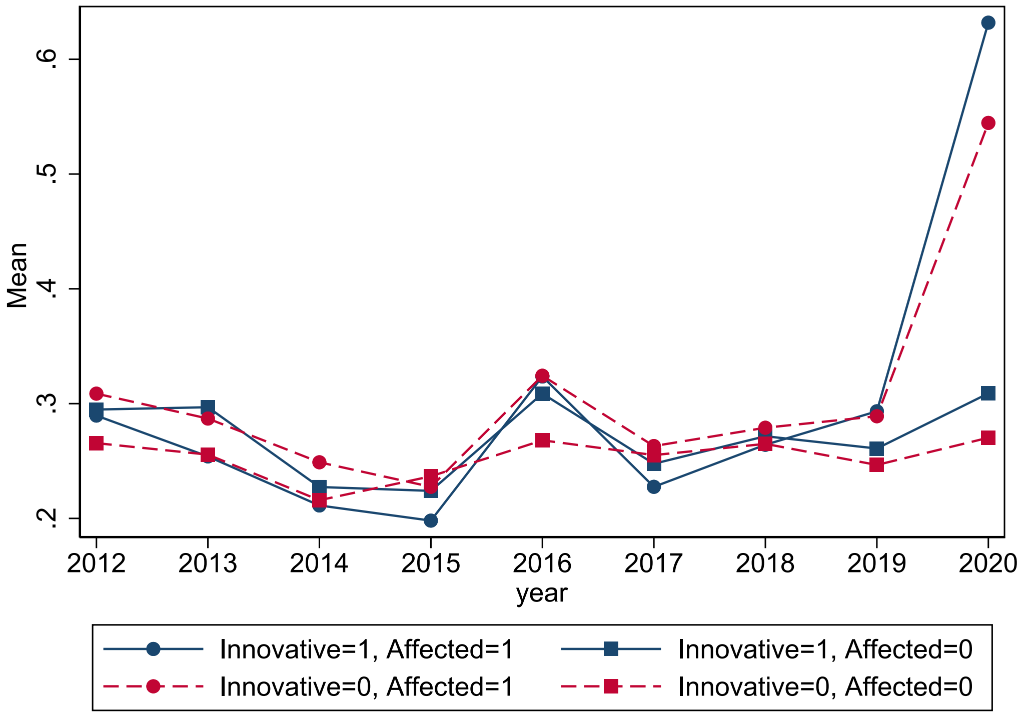
The test can also be displayed graphically. For this purpose, Figure 3.2 shows the point estimates and the 90% confidence intervals of the triple interaction of the (a) binary and (b) continuous affectedness measure with the innovation and time dummies. We find that the coefficients are insignificant for each year before 2020 for both the binary and continuous measurements of affectedness. These coefficients capture group differences within the years. In contrast to the pre-crisis interaction terms, the interaction in 2020 is significantly positive.

Figure 3.2: Common trend—dependent variable: *PayCut*



In the DDD case, we observe four relevant groups: innovative and affected, innovative and non-affected, non-innovative and affected, and non-innovative and non-affected firms. Figure 3.3 illustrates the share of firms within these groups that cut payments. (Non-)innovative firms are presented in (dashed red) solid blue lines while being (un)affected is indicated by (circles) squares. The pre-crisis trends seem to be fairly similar, with relatively little variation over time. The levels from 2012 and 2019 are almost unchanged. However, there are prominent changes in 2020. First, we observe an increase for all groups. Secondly, we see that the shares of affected firms that cut payments (circles) increase substantially in comparison to the non-affected (squares) for both innovative and non-innovative firms.

Figure 3.3: Impact of Innovation (R&D) and Affectedness on *PayCut*



The "simple" two period DDD estimator without covariates can be calculated with mean differences as shown in equation 3.4.

$$\hat{\delta} = \left[(\bar{Y}_{a=1,i=1,t=20} - \bar{Y}_{a=1,i=1,t=19}) - (\bar{Y}_{a=0,i=1,t=20} - \bar{Y}_{a=0,i=1,t=19})\right] - \left[(\bar{Y}_{a=1,i=0,t=20} - \bar{Y}_{a=1,i=0,t=19}) - (\bar{Y}_{a=0,i=0,t=20} - \bar{Y}_{a=0,i=0,t=19})\right] \quad (3.4)$$

In this setting, the average pay cuts $\bar{Y}$ depend on affectedness ($a = 1$: affected, $a = 0$: unaffected), innovativeness ($i = 1$: innovative, $i = 0$: non-innovative), and the period ($t = 19, 20$). All these averages are observable in Figure 3.3. The term in the first (second) round bracket of the first row of equation (3.4) equals the distance between the blue circles (squares) from 2019 to 2020. Thereby, the first row captures the effect of being affected by the crisis within innovative firms ($\hat{\delta}_{DiD|i=1}$). Furthermore, the term in the first (second) round bracket of the second row equals the distance between the red circles (squares) from 2019 to 2020. Analogously, the second row captures the effect of being affected by the crisis within non-innovative firms ($\hat{\delta}_{DiD|i=0}$). Consequently, the difference of those DiD models equals the DDD estimator $\hat{\delta}_{DDD} = \hat{\delta}_{DiD|i=1} - \hat{\delta}_{DiD|i=0}$.

3.4.5 Robustness

Table 3.4 shows robust coefficients when using different innovation measures. To validate our results, we additionally perform several robustness tests (not presented) regarding the dependent variable and control variables. Moreover, we re-estimate equation (1) of the GBP sample in Section 3.3 with balance-sheet data and innovation at the firm-level.

The use of fixed-effects regressions offers the advantage that we are able to control for time-constant unobservable heterogeneity. Factors such as management ability should therefore be taken into account. However, regarding the dependent variables, there are differences between the survey data (GBP) and the published company financial data used in this section. While the GBP explicitly queries pay reductions, in the financial data set, we only have information on annual changes in personnel expenses per employee. Adjustments to this variable are either due to changes in (i) personnel expenses or (ii) the number of employees. We expect that we are measuring pay adjustments. However, we cannot exclude the possibility that a change in the employment structure influences our dependent variable. For example, the dismissal of employees with above-average compensation can lead to a reduction in personnel expenses per employee, with the result that the dummy variable would take unit value. Therefore, in robustness tests we restrict the sample to firms whose employment remained constant from 2019 to 2020. This strict assumption is accompanied by a sample reduction to 8% of the original data (9,238 observations). Nevertheless, the results of the DiD regressions are confirmed, and the common trend test can no longer be rejected. With regard to the DDD estimations, the coefficients have identical signs and similar levels, but lose significance due to the substantially smaller sample. Furthermore, we restrict the sample to firms which change employment only up to 5%. This yields a sample size of more than 50% of the original data (61,497 observations). The results also confirm our previous findings with respect to the coefficients and their significance. Alternatively, we include the employment growth rate, which again leads to similar results. These robustness tests largely rule out the possibility that the change in personnel expenses is driven by employment adjustments.

Moreover, our dependent variable may also be influenced by the German short-time work program. In this case, the state covers up to two thirds of wage costs for a limited period in order to avoid dismissals. As long as there are no systematic differences in the usage of short-time work between innovative and non-innovative firms, our methodology captures this effect. For Germany, Diekhof et al. (2021) report the share of short-time workers by R&D intensity of sectors. Based on this, there is little evidence of systematic differences. If at all, innovative sectors (with the exception of the automotive sector) appear to use short-time working less frequently. However, we include the ratio of employees subject to short-time work to the total number of employees within industries (NACE Rev. 2, level 2 codes) to control for potential short-time work effects. The data on employees on short-time work are taken from the statistics of the Federal Employment Agency, the data on the number of employees per sector from EU Klems. Considering short-time work does not change the results, even if the automotive sector is excluded.

As argued above, the crisis potentially affects employment. Therefore, using firm size categories based on employment of the corresponding year might yield a bad control problem. However, when excluding control variables or using lagged employment to generate firm size categories, we obtain similar results.

Based on Figure 3.2, we have already shown that the impact of the COVID-19 pandemic does not depend on the trend in pre-crisis revenue growth. Nevertheless, we include the annual growth in revenues in a further robustness test, which confirms our results.

Finally, the GBP surveys pay cuts at an early stage of the pandemic, meaning that reported adjustments may not actually be realized. To take this into account, we replicate the cross-sectional GBP approach by restricting the panel data to the year 2020. Subsequently, we re-estimate equation (1) using firm-level innovation and realized cuts to personnel expenses per employee instead of surveyed pay cuts to different stakeholders. The results confirm our findings of Section 3.3.

Overall, we find evidence that innovative firms are more likely to reduce payments due to the crisis. Several robustness tests validate this result. The findings on the impact of affected firms on payment adjustments depending on industry-level innovations can thus be confirmed using firm-level data on innovativeness and realized pay cuts.

3.5 Mechanisms

To strengthen our theoretical argument of financial constraints as a mechanism, we use a Tax Incidence Survey Experiment from the GBP. Firms are assigned randomly to six distinct treatment groups. Each group experiences either a permanent decrease in profit tax burden of 1%, 10%, or 25%, or a permanent increase of 1%, 10%, or 25%. We are interested in what firms would do with the additional funds. Therefore, we focus on the treatment groups to which a reduction in the profit tax burden is allocated. The experiment offers different options for how firms can distribute the additional funds. In our context, an increase in investments is the relevant response, which leads to a follow-up question regarding the reason for this increase. The reasons are (i) "After the tax cut, more funds are available" and (ii) "After the tax cut, the investment is more worthwhile". Firms report a value between 0 (reason (i) is decisive) and 100 (reason (ii) is decisive) while a value of 50 would indicate that both reasons are equally important. We suppose that firms reporting a value closer to 0 are more financially constrained. Table 3.5 shows mean values and differences of the reported answers of innovative and non-innovative firms.

Table 3.5: Testing financial constraints

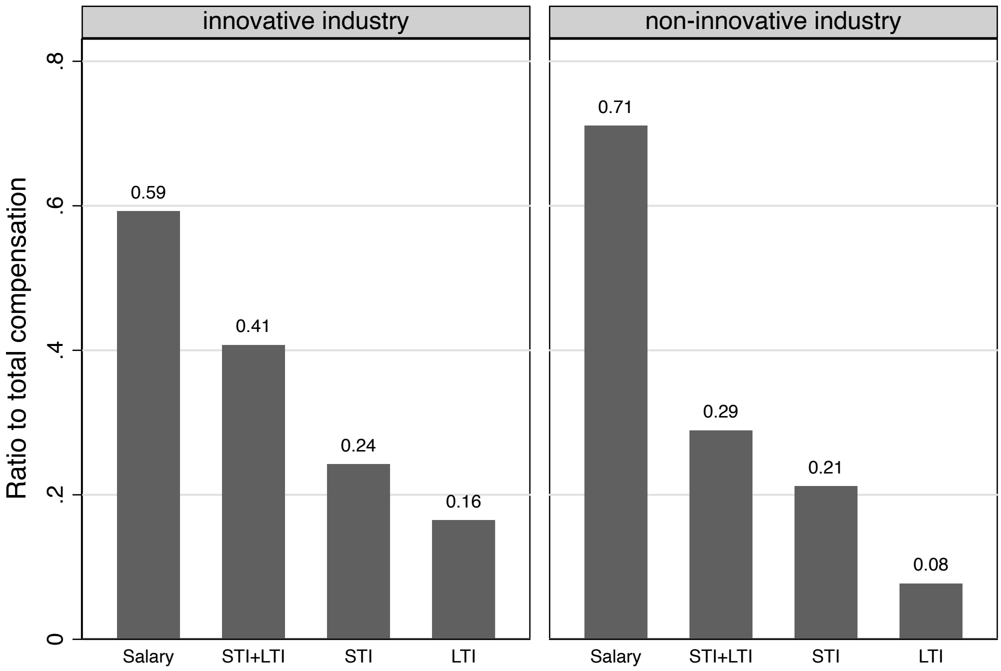
	Innovative		Non-Innovative		Diff
	mean	sd	mean	sd	b
1%	35.46	28.94	34.79	29.63	0.67
Observations	336		319		655
10%	35.29	27.06	38.99	29.13	-3.69*
Observations	372		396		768
25%	29.94	27.27	36.88	28.80	-6.95***
Observations	306		256		562

We find that innovative firms tend to report a significantly lower value and are therefore more likely to be financially constrained. The results remain robust when assigning innovative industries by the 4^{th} quartile. Therefore, we conclude that innovative firms are forced, both to a greater degree and more frequently, to defer financial resources during the pandemic to maintain innovativeness and thus ensure the survival of the firm.

Additionally, we argue that innovative firms are also more capable of cutting payments, since they generally pay wages above the collectively agreed rate, especially as the workforce tends to have a higher level of (specific) human capital. Furthermore, in this context, pay cuts to shareholders and executives in particular appear to be easily realized. Dividends to shareholders are determined on an annual basis by the Annual General Meeting and can therefore easily be adjusted downwards in times of financial difficulty, as in the COVID-19 crisis. Generally, firms avoid reducing dividends, as this can be perceived by shareholders as a signal of a poor economic situation (e.g., Miller and Rock, 1985; Nguyen and Tran, 2016). In the case of the pandemic, however, shareholders are likely to anticipate the existing risk and accept interim reductions.

In the same way, parts of executive compensation can be reduced relatively easily. Figure 3.4 shows the composition of executive remuneration between 2012 and 2019, divided into firms in innovative and non-innovative industries (compare Section 3.3). The data is provided by Kienbaum Consultants International GmbH, which specializes in executive compensation. This data has the advantage of including small companies, which is rare for Germany.

Figure 3.4: Composition of executive compensation



Source: Kienbaum executive compensation data
Own calculations based on Kienbaum executive compensation data

Figure 3.4 shows that German executives continue to be primarily compensated using fixed salaries. 59% of executive compensation in innovative industries consists of fixed salaries and 41% of variable components (STI+LTI). In contrast, firms in non-innovative industries compensate their executives to 71% with fixed and to 29% with variable remuneration. Compared with executives from non-innovative industries, top managers from innovative industries are paid on the basis of a more incentive-orientated compensation structure. Moreover, for both types of industries we find that the ratio of annual short-term incentives (STI) is larger than the ratio of long-term incentives (LTI). In innovative industries the STI ratio is 3% higher than is the case for their non-innovative counterparts, and for the LTI ratio the difference is about 8%. All differences are significant at the 1%-level. As firms in innovative industries remunerate executives to a greater extent with variable components, we consequently suggest that they can adjust compensation more easily and quickly during the pandemic than their non-innovative counterparts.

3.6 Conclusion

This study investigates the impact of innovation during the COVID-19 pandemic on adjustments to stakeholders. Previous research finds evidence that innovative firms have a higher adaptability and are thus more likely to survive in times of crisis. We contribute to the literature by showing how innovative and non-innovative firms adapt payments during the COVID-19 pandemic. Possible differences in turn might help explain the survival advantages of innovative firms. We argue that several firm-specific aspects, such as specific human capital, financial constraints, and collective bargaining agreements, lead to different cost adjustment strategies between both types of firms.

First, we provide insights on the decisions regarding compensation of four different stakeholder groups: shareholders, executives, middle management, and employees. The possibility that these groups can be separated in this way is quite rare. We combine firm-level survey data with information on innovative industries on the basis of R&D intensities and apply a difference-in-differences approach. Our results indicate that innovative firms are more likely to reduce costs via pay adjustments particularly to shareholders and executives. We validate these findings with an instrumental variable approach to deal with, for example, omitted variable bias from management quality. This set-up confirms the findings for shareholders and executives, and additionally suggests higher pay adjustments to middle managers and workers in innovative industries.

Next, we show that surveyed pay cuts can be confirmed using panel data assigning the innovation status at the firm-level. We use both R&D activities and patent information to identify innovative firms. Besides innovation information at the firm-level, this data set offers the advantage of multiple time periods enabling panel data econometrics. In this part of the study, we cannot distinguish between stakeholder groups, but instead use personnel expenses per employee as measure of pay cuts. Difference-in-differences as well as triple differences estimations show that innovative firms adjust payments to a higher extent during the pandemic, especially when they are negatively affected by it.

We conclude that both the affectedness of a firm and the extent of being affected have an impact on how innovative and non-innovative firms adjust payments during the pandemic. Several robustness tests confirm our results.

To give further insight into the underlying mechanisms, we discuss the role of financial constraints and present some descriptive evidence on compensation compositions in the different kinds of firms. The data emphasizes that innovative firms are (i) more financially constrained, forcing them to reduce costs to a greater degree, and (ii) pay executives a higher share of variable compensation, which enables them to reduce their compensation more easily. This is in line with our results at the firm- and industry-level. Additionally, we argue that collectively bargained wages and higher amounts of specific human capital explain how innovative firms can reduce compensation to an extent greater than their non-innovative counterparts.

All in all, we conclude that innovative firms are indeed able to adapt more flexibly in times of crisis by making adjustments to stakeholder compensation. We interpret these results as possible explanations for the findings of the higher survival probability of innovative firms during crises. These insights into different adjustment strategies of innovative and non-innovative firms to reduce costs in times of crisis provide valuable information for companies and trade unions in particular. We argue that short-term compensation adjustments can be a legitimate strategy to increase firms' survival prospects. Moreover, innovative companies in particular should accumulate reserves to avoid the risk of excessive financial constraints in times of crisis. In this respect, an additional subsidy for innovative companies during crises would also be conceivable from a policy perspective (Giebel and Kraft, 2023; Hud and Hussinger, 2015).

This study has certain limitations that could be subject for further research. First, due to lack of data, we cannot distinguish between different stakeholders when using panel data. Second, more information on the extent of the pay adjustments could provide better insight into whether the compensation of stakeholder groups is adjusted equally. Third, a more detailed examination of the specific reasons for greater wage adjustments in innovative firms would be of interest. To this end, the additional inclusion of information on the (specific) human capital stock and financial restrictions as well as other firm-specific determinants would be useful. Finally, a direct causal attribution of the results to the actual survival probability of innovative firms remains open to be examined more closely.

3.7 Appendix

Table 3.6: Full estimation results of Table 3.2

	Shareholders (1)	Executives (2)	Mid. Managers (3)	Other Emp. (4)
Panel A: LPM—Affected (dummy)				
Innovative	-0.1603	0.0586	0.0267	0.0914
	(0.1658)	(0.1381)	(0.1419)	(0.1515)
Affected	0.1591***	0.2141***	0.1979***	0.2045***
	(0.0138)	(0.0140)	(0.0133)	(0.0139)
Innovative×Affected	0.0740***	0.0474**	0.0231	0.0165
	(0.0210)	(0.0212)	(0.0202)	(0.0206)
$\text{FirmSize}_{100k-350k}$	-0.0001	0.0128	-0.0020	0.0365*
	(0.0199)	(0.0200)	(0.0184)	(0.0189)
$\text{FirmSize}_{350k-700k}$	0.0271	0.0608***	0.0643***	0.1049***
	(0.0206)	(0.0207)	(0.0194)	(0.0199)
$\text{FirmSize}_{700k-2mil}$	0.0267	0.0653***	0.0896***	0.1298***
	(0.0195)	(0.0194)	(0.0184)	(0.0186)
$\text{FirmSize}_{2mil-10mil}$	0.0517**	0.1151***	0.1687***	0.1817***
	(0.0207)	(0.0208)	(0.0200)	(0.0201)
$\text{FirmSize}_{>10mil}$	0.0088	0.1143***	0.2152***	0.1988***
	(0.0249)	(0.0249)	(0.0243)	(0.0244)
Limited	0.2000***	0.1224***	0.0989***	0.0336**
	(0.0127)	(0.0141)	(0.0134)	(0.0149)
RiskAversion	-0.0508***	-0.0435***	-0.0161	0.0376***
	(0.0135)	(0.0140)	(0.0136)	(0.0145)
$\text{EndRestriction}_{2021}$	0.0022	0.0210	0.0177	-0.0020
	(0.0188)	(0.0192)	(0.0184)	(0.0190)
$\text{EndRestriction}_{2022}$	0.0095	0.0475**	0.0483**	0.0195
	(0.0216)	(0.0221)	(0.0213)	(0.0219)
$\text{EndRestriction}_{\geq 2023}$	0.0456	0.0614**	0.0205	0.0070
	(0.0311)	(0.0312)	(0.0298)	(0.0308)
Constant	0.0654	-0.1976	-0.1787	-0.1554
	(0.1637)	(0.1343)	(0.1380)	(0.1470)

(continued on next page)

Table 3.6: Full estimation results of Table 3.2 (continued)

	Shareholders (1)	Executives (2)	Mid. Managers (3)	Other Emp. (4)
Panel B: LPM—Affected (continuous)				
Innovative	-0.1439	0.0612	0.0244	0.0853
	(0.1621)	(0.1385)	(0.1430)	(0.1511)
Affected	0.0015***	0.0020***	0.0019***	0.0019***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Innovative×Affected	0.0011***	0.0007***	0.0002	0.0002
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
$\text{FirmSize}_{100k-350k}$	0.0122	0.0275	0.0104	0.0493***
	(0.0199)	(0.0201)	(0.0185)	(0.0189)
$\text{FirmSize}_{350k-700k}$	0.0372*	0.0724***	0.0740***	0.1148***
	(0.0207)	(0.0208)	(0.0196)	(0.0201)
$\text{FirmSize}_{700k-2mil}$	0.0401**	0.0808***	0.1024***	0.1429***
	(0.0196)	(0.0196)	(0.0186)	(0.0188)
$\text{FirmSize}_{2mil-10mil}$	0.0668***	0.1327***	0.1833***	0.1966***
	(0.0209)	(0.0210)	(0.0202)	(0.0204)
$\text{FirmSize}_{>10mil}$	0.0328	0.1424***	0.2389***	0.2230***
	(0.0250)	(0.0252)	(0.0247)	(0.0248)
Limited	0.1962***	0.1178***	0.0947***	0.0293**
	(0.0127)	(0.0143)	(0.0134)	(0.0149)
RiskAversion	-0.0506***	-0.0436***	-0.0165	0.0371**
	(0.0136)	(0.0141)	(0.0137)	(0.0146)
$\text{EndRestriction}_{2021}$	0.0009	0.0205	0.0181	-0.0015
	(0.0189)	(0.0194)	(0.0185)	(0.0191)
$\text{EndRestriction}_{2022}$	0.0048	0.0432*	0.0456**	0.0168
	(0.0217)	(0.0223)	(0.0214)	(0.0220)
$\text{EndRestriction}_{\geq 2023}$	0.0456	0.0631**	0.0233	0.0100
	(0.0314)	(0.0314)	(0.0296)	(0.0307)
Constant	0.1377	-0.0994	-0.0883	-0.0617
	(0.1602)	(0.1348)	(0.1391)	(0.1470)
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	7,967	7,967	7,967	7,967

Notes: Results of LPM difference-in-differences estimations, robust standard errors in parentheses, $^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$.

Table 3.7: Estimation results (innovation attributed at 4^{th} quartile)

	Shareholders (1)	Executives (2)	Mid. Managers (3)	Other Emp. (4)
Panel A: LPM—Affected (dummy)				
Innovative	-0.1532***	-0.1074**	-0.0451	-0.0646
	(0.0501)	(0.0536)	(0.0622)	(0.0635)
Affected	0.1733***	0.2173***	0.1987***	0.2069***
	(0.0122)	(0.0125)	(0.0119)	(0.0124)
Innovative×Affected	0.0656***	0.0612***	0.0324	0.0170
	(0.0234)	(0.0232)	(0.0222)	(0.0222)
$\text{FirmSize}_{100k-350k}$	-0.0009	0.0125	-0.0022	0.0364*
	(0.0199)	(0.0200)	(0.0184)	(0.0189)
$\text{FirmSize}_{350k-700k}$	0.0265	0.0602***	0.0640***	0.1048***
	(0.0206)	(0.0207)	(0.0194)	(0.0199)
$\text{FirmSize}_{700k-2mil}$	0.0264	0.0651***	0.0895***	0.1297***
	(0.0195)	(0.0195)	(0.0184)	(0.0186)
$\text{FirmSize}_{2mil-10mil}$	0.0515**	0.1149***	0.1686***	0.1816***
	(0.0208)	(0.0208)	(0.0200)	(0.0201)
$\text{FirmSize}_{>10mil}$	0.0081	0.1137***	0.2148***	0.1986***
	(0.0249)	(0.0249)	(0.0243)	(0.0244)
Limited	0.1999***	0.1223***	0.0988***	0.0335**
	(0.0127)	(0.0141)	(0.0134)	(0.0149)
RiskAversion	-0.0506***	-0.0432***	-0.0160	0.0376***
	(0.0135)	(0.0140)	(0.0136)	(0.0145)
$\text{EndRestriction}_{2021}$	0.0026	0.0215	0.0179	-0.0019
	(0.0188)	(0.0192)	(0.0184)	(0.0190)
$\text{EndRestriction}_{2022}$	0.0100	0.0481**	0.0486**	0.0196
	(0.0216)	(0.0221)	(0.0213)	(0.0219)
$\text{EndRestriction}_{\geq 2023}$	0.0456	0.0617**	0.0207	0.0070
	(0.0311)	(0.0312)	(0.0297)	(0.0308)
Constant	-0.0598	-0.1131*	-0.1388**	-0.0557
	(0.0613)	(0.0628)	(0.0614)	(0.0651)

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Table 3.7: Estimation results (innovation attributed at 4th quartile) (continued)

	Shareholders (1)	Executives (2)	Mid. Managers (3)	Other Emp. (4)
Panel B: LPM—Affected (continuous)				
Innovative	-0.2102***	-0.1817***	-0.1163**	-0.1399**
	(0.0496)	(0.0526)	(0.0575)	(0.0585)
Affected	0.0017***	0.0021***	0.0019***	0.0020***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Innovative×Affected	0.0008**	0.0006**	0.0002	0.0001
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
$\text{FirmSize}_{100k-350k}$	0.0115	0.0272	0.0103	0.0491***
	(0.0199)	(0.0201)	(0.0185)	(0.0189)
$\text{FirmSize}_{350k-700k}$	0.0368*	0.0722***	0.0739***	0.1147***
	(0.0207)	(0.0209)	(0.0196)	(0.0201)
$\text{FirmSize}_{700k-2mil}$	0.0395**	0.0805***	0.1023***	0.1428***
	(0.0196)	(0.0196)	(0.0186)	(0.0188)
$\text{FirmSize}_{2mil-10mil}$	0.0664***	0.1326***	0.1833***	0.1965***
	(0.0209)	(0.0210)	(0.0202)	(0.0204)
$\text{FirmSize}_{>10mil}$	0.0314	0.1415***	0.2386***	0.2227***
	(0.0250)	(0.0252)	(0.0247)	(0.0248)
Limited	0.1963***	0.1179***	0.0948***	0.0294**
	(0.0127)	(0.0143)	(0.0134)	(0.0149)
RiskAversion	-0.0508***	-0.0436***	-0.0166	0.0371**
	(0.0137)	(0.0141)	(0.0137)	(0.0146)
$\text{EndRestriction}_{2021}$	0.0017	0.0210	0.0183	-0.0013
	(0.0189)	(0.0194)	(0.0185)	(0.0191)
$\text{EndRestriction}_{2022}$	0.0059	0.0438**	0.0458**	0.0170
	(0.0217)	(0.0222)	(0.0214)	(0.0220)
$\text{EndRestriction}_{\geq 2023}$	0.0465	0.0636**	0.0235	0.0101
	(0.0314)	(0.0314)	(0.0296)	(0.0307)
Constant	0.0059	-0.0296	-0.0614	0.0257
	(0.0613)	(0.0634)	(0.0616)	(0.0645)
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	7,967	7,967	7,967	7,967

Notes: Results of LPM difference-in-differences estimations, robust standard errors in parentheses, $^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$.

Table 3.8: Results of 2SLS regressions (2^{nd} stage)

	Shareholders (1)	Executives (2)	Mid. Managers (3)	Other Emp. (4)
Panel A: LPM—Innovative (median)				
Affected	0.0035***	0.0040***	0.0039***	0.0041***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Innovative×Affected	0.0094***	0.0097***	0.0066***	0.0073***
	(0.0026)	(0.0027)	(0.0024)	(0.0025)
Innovative	-0.0854**	-0.0744*	-0.0393	-0.0796**
	(0.0396)	(0.0406)	(0.0363)	(0.0381)
$\text{FirmSize}_{100k-350k}$	0.0570*	0.0706**	0.0349	0.0917***
	(0.0331)	(0.0341)	(0.0296)	(0.0307)
$\text{FirmSize}_{350k-700k}$	0.0823**	0.1251***	0.1067***	0.1602***
	(0.0340)	(0.0350)	(0.0309)	(0.0322)
$\text{FirmSize}_{700k-2mil}$	0.1031***	0.1496***	0.1565***	0.2167***
	(0.0351)	(0.0358)	(0.0313)	(0.0324)
$\text{FirmSize}_{2mil-10mil}$	0.1286***	0.2065***	0.2417***	0.2738***
	(0.0346)	(0.0355)	(0.0313)	(0.0324)
$\text{FirmSize}_{>10mil}$	0.1216***	0.2509***	0.3334***	0.3394***
	(0.0396)	(0.0405)	(0.0365)	(0.0379)
Limited	0.2095***	0.1304***	0.0976***	0.0255
	(0.0192)	(0.0214)	(0.0193)	(0.0211)
RiskAversion	-0.0506***	-0.0485**	-0.0197	0.0475**
	(0.0193)	(0.0197)	(0.0180)	(0.0194)
$\text{EndRestriction}_{2021}$	-0.0347	-0.0032	0.0040	-0.0267
	(0.0285)	(0.0304)	(0.0264)	(0.0281)
$\text{EndRestriction}_{2022}$	-0.0325	0.0071	0.0216	-0.0255
	(0.0324)	(0.0342)	(0.0300)	(0.0317)
$\text{EndRestriction}_{\geq 2023}$	0.0057	0.0259	-0.0056	-0.0365
	(0.0447)	(0.0450)	(0.0406)	(0.0423)
Constant	0.0395	-0.0138	-0.0416	0.0352
	(0.0546)	(0.0558)	(0.0516)	(0.0534)

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Table 3.8: Results of 2SLS regressions (2nd stage) (continued)

	Shareholders (1)	Executives (2)	Mid. Managers (3)	Other Emp. (4)
Panel B: LPM—Innovative (4th quartile)				
Affected	0.0041***	0.0046***	0.0044***	0.0051***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Innovative×Affected	0.0088**	0.0066**	0.0011	0.0009
	(0.0035)	(0.0032)	(0.0027)	(0.0026)
Innovative	-0.0562	-0.0381	0.0338	0.0082
	(0.0539)	(0.0495)	(0.0415)	(0.0414)
$\text{FirmSize}_{100k-350k}$	0.0493	0.0539*	0.0129	0.0676***
	(0.0327)	(0.0305)	(0.0252)	(0.0254)
$\text{FirmSize}_{350k-700k}$	0.0751**	0.1057***	0.0818***	0.1319***
	(0.0333)	(0.0315)	(0.0266)	(0.0270)
$\text{FirmSize}_{700k-2mil}$	0.0960***	0.1269***	0.1263***	0.1815***
	(0.0345)	(0.0319)	(0.0268)	(0.0269)
$\text{FirmSize}_{2mil-10mil}$	0.1325***	0.1942***	0.2190***	0.2461***
	(0.0350)	(0.0326)	(0.0277)	(0.0279)
$\text{FirmSize}_{>10mil}$	0.1223***	0.2324***	0.3072***	0.3067***
	(0.0381)	(0.0363)	(0.0321)	(0.0323)
Limited	0.2075***	0.1326***	0.0988***	0.0263
	(0.0183)	(0.0195)	(0.0173)	(0.0189)
RiskAversion	-0.0484**	-0.0519***	-0.0278*	0.0366**
	(0.0190)	(0.0183)	(0.0165)	(0.0176)
$\text{EndRestriction}_{2021}$	-0.0246	0.0160	0.0256	-0.0035
	(0.0271)	(0.0265)	(0.0227)	(0.0238)
$\text{EndRestriction}_{2022}$	-0.0182	0.0305	0.0460*	0.0013
	(0.0305)	(0.0295)	(0.0258)	(0.0269)
$\text{EndRestriction}_{\geq 2023}$	0.0231	0.0541	0.0259	-0.0033
	(0.0429)	(0.0401)	(0.0358)	(0.0365)
Constant	0.0039	-0.0341	-0.0483	0.0191
	(0.0525)	(0.0512)	(0.0467)	(0.0484)
State dummies	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No
Observations	6,508	6,508	6,508	6,508

Notes: Results of 2SLS difference-in-differences estimations, robust standard errors in parentheses, the instrumental variable of 2SLS estimation is industry-level revenue impact in Austria provided by Eurostat, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 3.9: Results of 2SLS regressions (1st stage)

	Panel A (median)		Panel B (4th quartile)	
	Affected (1)	Innovative×Affected (2)	Affected (3)	Innovative×Affected (4)
Innovative	0.1928	11.5260***	-0.4521	11.5128***
	(1.2569)	(0.7763)	(1.3426)	(1.0896)
IV	0.9073***	-0.0064	0.8524***	-0.0063*
	(0.0650)	(0.0055)	(0.0577)	(0.0036)
Innovative×IV	-0.3658***	0.5559***	-0.2476	0.6217***
	(0.1148)	(0.0954)	(0.1528)	(0.1424)
$\text{FirmSize}_{100k-350k}$	-5.3273**	-4.5107**	-5.3571**	-3.4752**
	(2.4611)	(1.7726)	(2.4608)	(1.5908)
$\text{FirmSize}_{350k-700k}$	-7.7090***	-5.2248***	-7.7244***	-3.7322**
	(2.4829)	(1.7959)	(2.4836)	(1.5731)
$\text{FirmSize}_{700k-2mil}$	-10.1446***	-6.8529***	-10.2771***	-4.9235***
	(2.3350)	(1.6998)	(2.3354)	(1.4876)
$\text{FirmSize}_{2mil-10mil}$	-9.0806***	-5.9194***	-9.3461***	-4.8561***
	(2.3517)	(1.6970)	(2.3583)	(1.4910)
$\text{FirmSize}_{>10mil}$	-13.6849***	-7.7042***	-14.1832***	-5.2406***
	(2.5226)	(1.8049)	(2.5346)	(1.4697)
Limited	-2.5678	-0.5002	-2.5770	-0.5396
	(1.6978)	(1.0623)	(1.6961)	(0.8461)
RiskAversion	-1.9760	-1.9018*	-1.9695	-1.7934**
	(1.4537)	(1.0071)	(1.4544)	(0.7988)
$\text{EndRestriction}_{2021}$	3.2917	3.8838**	3.3013	2.5664**
	(2.1408)	(1.5308)	(2.1429)	(1.2363)
$\text{EndRestriction}_{2022}$	3.1414	4.3524**	3.1106	2.6884*
	(2.4231)	(1.7119)	(2.4261)	(1.3743)
$\text{EndRestriction}_{\geq 2023}$	3.6629	5.3129**	3.6008	3.5806*
	(3.3466)	(2.4290)	(3.3530)	(1.9549)
Constant	15.4100***	0.5120	15.7466***	2.6927
	(4.2330)	(2.7995)	(4.2275)	(2.2642)
State dummies	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No
F-values	113.5	17.3	118.1	10.8
Observations	6,508	6,508	6,508	6,508

Notes: First stage results of 2SLS difference-in-differences estimations, robust standard errors in parentheses, the instrumental variable (IV) of 2SLS estimation is industry-level revenue impact in Austria provided by Eurostat, $^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$.

Table 3.10: Full estimation results of Table 3.4

	PayCut			
	LPM	FE	LPM	FE
	(1)	(2)	(3)	(4)
Panel A: Difference-in-Differences				
Innovative	-0.0070		-0.0141***	
	(0.0044)		(0.0037)	
Crisis	0.1117***	0.0985***	0.0924***	0.0773***
	(0.0060)	(0.0063)	(0.0061)	(0.0066)
Innovative×Crisis	0.1106***	0.1157***	0.1357***	0.1413***
	(0.0115)	(0.0121)	(0.0089)	(0.0095)
$FirmSize_{10–49}$	0.0222***	0.1681***	0.0205**	0.1710***
	(0.0082)	(0.0269)	(0.0082)	(0.0269)
$FirmSize_{50–249}$	-0.0329***	0.2416***	-0.0356***	0.2453***
	(0.0079)	(0.0298)	(0.0078)	(0.0298)
$FirmSize_{\geq 250}$	-0.0754***	0.3233***	-0.0788***	0.3278***
	(0.0080)	(0.0313)	(0.0080)	(0.0313)
Constant	0.3039***	0.0357	0.3113***	0.0322
	(0.0140)	(0.0288)	(0.0140)	(0.0288)
Panel B: Re-weighted Difference-in-Differences				
Innovative	0.0069		0.0012	
	(0.0047)		(0.0044)	
Crisis	0.1834***	0.1690***	0.2070***	0.1955***
	(0.0115)	(0.0122)	(0.0114)	(0.0123)
Innovative×Crisis	0.0409***	0.0486***	0.0310**	0.0345***
	(0.0139)	(0.0148)	(0.0122)	(0.0132)
$FirmSize_{10–49}$	0.0053	0.1684*	0.0262	0.1691***
	(0.0387)	(0.0940)	(0.0264)	(0.0653)
$FirmSize_{50–249}$	-0.0306	0.2364**	-0.0174	0.2490***
	(0.0366)	(0.0950)	(0.0250)	(0.0679)
$FirmSize_{\geq 250}$	-0.0619*	0.3077***	-0.0489*	0.3229***
	(0.0366)	(0.0961)	(0.0249)	(0.0692)
Constant	0.2775***	0.0122	0.2698***	-0.0157
	(0.0399)	(0.0954)	(0.0299)	(0.0684)

(continued on next page)

Table 3.10: Full estimation results of Table 3.4 (continued)

	PayCut			
	LPM	FE	LPM	FE
	(1)	(2)	(3)	(4)
Panel C: Triple Differences—Affected (dummy)				
Innovative	0.0127*		-0.0060	
	(0.0068)		(0.0054)	
Crisis	-0.0098	-0.0329***	-0.0169**	-0.0398***
	(0.0068)	(0.0073)	(0.0070)	(0.0075)
Affected	0.0129***		0.0120***	
	(0.0032)		(0.0035)	
Innovative×Crisis	0.0240	0.0279	0.0490***	0.0500***
	(0.0171)	(0.0182)	(0.0131)	(0.0141)
Innovative×Affected	-0.0251***		-0.0061	
	(0.0082)		(0.0066)	
Crisis×Affected	0.2459***	0.2569***	0.2321***	0.2410***
	(0.0078)	(0.0086)	(0.0084)	(0.0093)
Innovative×Crisis×Affected	0.0846***	0.0854***	0.0756***	0.0785***
	(0.0224)	(0.0236)	(0.0175)	(0.0187)
$\text{FirmSize}_{10\text{–}49}$	0.0220***	0.1741***	0.0207**	0.1751***
	(0.0082)	(0.0272)	(0.0081)	(0.0273)
$\text{FirmSize}_{50\text{–}249}$	-0.0345***	0.2588***	-0.0363***	0.2597***
	(0.0078)	(0.0301)	(0.0078)	(0.0301)
$\text{FirmSize}_{\geq 250}$	-0.0758***	0.3535***	-0.0781***	0.3547***
	(0.0079)	(0.0316)	(0.0079)	(0.0316)
Constant	0.3008***	0.0156	0.3072***	0.0148
	(0.0140)	(0.0291)	(0.0140)	(0.0291)

(continued on next page)

Table 3.10: Full estimation results of Table 3.4 (continued)

	PayCut			
	LPM	FE	LPM	FE
	(1)	(2)	(3)	(4)
Panel D: Triple Differences—Affected (continuous)				
Innovative	-0.0023		-0.0112***	
	(0.0044)		(0.0037)	
Crisis	0.1053***	0.0830***	0.0891***	0.0660***
	(0.0059)	(0.0063)	(0.0061)	(0.0065)
Affected	0.0001		0.0001	
	(0.0001)		(0.0001)	
Innovative×Crisis	0.0869***	0.0948***	0.1091***	0.1135***
	(0.0112)	(0.0119)	(0.0088)	(0.0094)
Innovative×Affected	-0.0005**		-0.0000	
	(0.0002)		(0.0002)	
Crisis×Affected	0.0055***	0.0065***	0.0052***	0.0062***
	(0.0002)	(0.0002)	(0.0002)	(0.0003)
Innovative×Crisis×Affected	0.0018***	0.0012**	0.0016***	0.0013***
	(0.0006)	(0.0006)	(0.0004)	(0.0005)
FirmSize_{10-49}	0.0263***	0.1873***	0.0244***	0.1886***
	(0.0082)	(0.0278)	(0.0082)	(0.0278)
FirmSize_{50-249}	-0.0297***	0.2789***	-0.0321***	0.2803***
	(0.0078)	(0.0307)	(0.0078)	(0.0306)
$\text{FirmSize}_{\geq 250}$	-0.0713***	0.3785***	-0.0745***	0.3801***
	(0.0080)	(0.0321)	(0.0080)	(0.0321)
Constant	0.3024***	-0.0043	0.3096***	-0.0055
	(0.0140)	(0.0296)	(0.0140)	(0.0296)
Innovation measure	R&D	R&D	Patents	Patents
Controls	Yes	Yes	Yes	Yes
State dummies	Yes	No	Yes	No
Industry dummies	Yes	No	Yes	No
Time dummies	Yes	Yes	Yes	Yes
Common trend test (p-values)				
Panel A	0.032	0.006	0.000	0.000
Panel B	0.647	0.608	0.000	0.002
Panel C	0.508	0.413	0.155	0.184
Panel D	0.830	0.850	0.164	0.324
Observations	113,781	113,781	113,781	113,781

Notes: Results of DiD (Panel A), re-weighted DiD (Panel B), and DDD (Panels C and D) estimations, robust and firm-clustered standard errors in parentheses, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Part III

Summary and Conclusion

Summary

This dissertation investigates three specific factors influencing compensation. Chapter 1 examines the role of trade unions in combination with parity codetermination as an institutional driver of executive pay. Chapter 2 identifies the COVID-19 pandemic as an exogenous driving factor of payments to shareholders, executives, middle managers, and other employees in their role as internal stakeholders of companies. In this context, the special role of innovativeness is also examined in Chapter 3.

It is well known that trade unions positively influence the wages of regular employees and thus reduce wage inequality (e.g., Bonaccolto-Töpfer and Schnabel, 2023; Card et al., 2020; Fitzenberger et al., 2013). Moreover, especially in the context of the United States, previous studies suggest that trade unions have an impact in decreasing executive pay (e.g., Banning and Chiles, 2007; DiNardo et al., 1997; Gomez and Tzioumis, 2006; Huang et al., 2017). While employees in the United States are largely excluded from the decision-making processes of firms, the system of parity codetermination offers German employees extensive participation rights (Jäger et al., 2021). However, despite the unique German system in which representatives of the workforce and trade unions on the supervisory board have a say in the composition and level of executive compensation, there is hardly any research in this field. The first chapter therefore addresses this issue and examines the impact of union power (measured by union density) on executive pay in Germany, taking the special role of parity codetermination into account. Using a unique and large panel data set, this study provides new insights into the functionality of this specific institutional framework that strengthens the position of trade unions.

The main findings show a reducing impact of union density on executives' total pay and salaries. These findings are indeed attributable to parity codetermination, suggesting that trade unions use the direct way to influence executive compensation. In contrast, there is no evidence of a negative effect on incentive-based remuneration. Moreover, the ratio of variable to total compensation is even higher in codetermined firms. Trade unions thus appear to assert their positions through the German regulatory framework by reducing executive pay without taking away incentives for good performance.

The COVID-19 pandemic, particularly during the outbreak stage in 2020, had serious negative economic consequences. The associated decline in demand or regulations such as the closure of companies (e.g., BMWi, 2020) required the implementation of adaptation strategies to ensure the survival of the firm. The second chapter thus focuses on the impact of the COVID-19 pandemic on firms' pay adjustment strategies to different stakeholders (shareholders, executives, middle managers, and other employees). While there are already studies that examine pay adjustments for these groups separately (e.g., Adams-Prassl et al., 2020; Grund and Walter, 2015; Krieger et al., 2021; Mahaboob, 2022), this chapter offers unique insights into firms' strategic decisions during times of crisis by simultaneously examining pay cuts to the four groups of stakeholders.

The main results of this chapter show that affected firms are more likely to cut payments for all stakeholder groups, with greater affectedness resulting in a higher probability of pay cuts. Furthermore, the likelihood of reductions in executive compensation is significantly higher than for other groups. These results may be explained by the Fair Wage-Effort hypothesis (Akerlof and Yellen, 1990) according to which stakeholders compare payment within and between groups, and an "unfair" pay can encourage, for example, the disposal of company shares or a reduction in performance. The simultaneous reduction of payments to all stakeholders could therefore contribute to the acceptance of these adjustments. Altogether, compensation appears to be more aligned in times of crisis, as affected firms tend to reduce pay for all stakeholders during the COVID-19 pandemic. This suggests that cost savings are not only made at the expense of the lowest hierarchical levels but rather tend to occur more frequently at higher hierarchical levels.

Several studies show that innovative firms have advantages in times of crisis (e.g., Aghion et al., 2005; Cefis et al., 2020; Gupta et al., 2018; Khan et al., 2022; Roper and Turner, 2020). The third chapter links to these studies and examines how innovative firms/industries differ from non-innovative ones during the pandemic in terms of pay adjustments to the four groups of stakeholders. For this purpose, an initial approach uses cross-sectional survey data from 2020 and examines whether affected firms in innovative and non-innovative industries differ in terms of pay cuts to stakeholders. The results of difference-in-differences regressions show that affected firms in innovative industries have a significantly higher probability of pay cuts, particularly for shareholders and executives, than affected firms in non-innovative industries. A second approach uses balance sheet panel data and determines differences in the impact of affected innovative and non-innovative firms on reductions in personnel expenditures per employee. The findings of difference-in-differences and triple differences estimations indicate that affected innovative firms are more likely to adjust their personnel expenses per employee in general.

In sum, the results show that pay cuts are particularly evident for shareholders and executives, which supports the argument of rigid wages. Innovative firms/industries thus seem to primarily cut the pay of stakeholders where adjustments can be implemented most easily and quickly. However, these adjustments are also reflected, on average, across the entire workforce (personnel expenses per employee). The findings suggest that innovative firms are forced to reduce costs due to financial constraints, while specific characteristics of these firms (e.g., share of specific human capital, generally higher wages) contribute to reduce costs more easily.

Final Remarks

Altogether, this dissertation provides evidence that employee participation, the COVID-19 crisis, and the role of innovation during the pandemic are reducing drivers of compensation. This provides new insights, particularly with regard to executive compensation:

1. Trade unions reduce total and fixed executive compensation via their position on the supervisory board of parity-codetermined firms, whereas performance-related bonus payments are retained.

2. While affected firms cut pay to all internal stakeholders during the COVID-19 pandemic, the likelihood for reductions is highest for executives.

3. Affected firms in innovative industries (compared to firms in non-innovative sectors) cut back on shareholders and executives first, since short-term adjustments are easier to realize for these stakeholders.

Given the increasing number of crises in recent years, these findings are particularly relevant. While the severe consequences of the COVID-19 pandemic require firms to reduce costs, it is crucial that these adjustments are not made at the expense of a single stakeholder group. Rather, a symmetric adjustment seems appropriate to signal the importance of all groups for the company. In addition, innovative firms are more likely to reduce pay, which is potentially a major reason why innovative companies are generally more resilient to crises.

These findings should provide interesting insights for the entire corporate landscape. For example, in future times of crisis, short-term symmetrical adjustments to the compensation of all stakeholders could ensure the long-term success of both innovative and non-innovative firms. In return, a corresponding subsequent increase might be appropriate. Such an approach and the respective role of trade unions remain open for future research.

Although the dissertation contributes to a deeper understanding of the investigated firm-specific drivers (trade unions, the pandemic, and innovation during the crisis) that influence the compensation of different stakeholders, they only cover a limited subset of all driving factors. For instance, the examination of various stakeholder groups could be expanded to current debates on labor market policy (e.g., pay adjustment strategies due to the additional costs of the minimum wage). Similarly, an expansion and comparison of the effects of trade unions and codetermination on payments to different stakeholder groups would be of interest. Moreover, unions appear to be negotiating more aggressively recently. A (re-)examination of the impact on compensation, including additional periods, could provide further insights into how unions are performing (a) during the pandemic, and (b) with (potentially) increasing bargaining power. Finally, the studies on the COVID-19 crisis should be expanded by examining the specific levels of the declines in payments to stakeholder groups. This would enable a more accurate evaluation of a possible convergence of income distribution.

The studies in this dissertation therefore offer both in-depth insights into firm-specific factors influencing compensation and a starting point for further research into other drivers of compensation.

References

Abadie, A. and Cattaneo, M. D. (2018). Econometric Methods for Program Evaluation. *Annual Review of Economics*, *10*(1), 465–503.

Adam, N. A. and Alarifi, G. (2021). Innovation Practices for Survival of Small and Medium Enterprises (SMEs) in the COVID-19 Times: The Role of External Support. *Journal of Innovation and Entrepreneurship*, *10*(1).

Adams-Prassl, A., Boneva, T., Golin, M., and Rauh, C. (2020). Inequality in the Impact of the Coronavirus Shock: Evidence from Real Time Surveys. *Journal of Public Economics*, *189*, 1–33.

Adermon, A., Laun, L., Lind, P., Olsson, M., Sauermann, J., and Sjögren, A. (2022). Earnings Losses and the Role of the Welfare State during the COVID-19 Pandemic: Evidence from Sweden. *IZA Discussion Paper No. 15662.*

Aghion, P., Bergeaud, A., Blundell, R., and Griffith, R. (2017). Innovation, firms and wage inequality. *Working Paper.*

Aghion, P., Bloom, N., Blundell, R., Griffith, R., and Howitt, P. (2005). Competition and Innovation: An Inverted-U Relationship. *The Quarterly Journal of Economics*, *120*(2), 701–728.

Akerlof, G. A. and Yellen, J. L. (1990). The Fair Wage-Effort Hypothesis and Unemployment. *The Quarterly Journal of Economics*, *105*(2), 255–283.

Akerman, A., Ekholm, K., Persson, T., and Nordström Skans, O. (2022). Sweden's COVID-19 Recession: How Foreign and Domestic Infections Struck against Firms and Workers. *IZA Discussion Paper No. 15408.*

Akosa Antwi, Y., Aouad, M., and Blascak, N. (2023). I've Got 99 Problems But a Bill Ain't One: Hospital Billing Caps and Financial Distress in California. *FRB of Philadelphia Working Paper, No. 23-20.*

Ali, H. (2022a). Corporate Dividend Policy in the Time of COVID-19: Evidence from the G-12 Countries. *Finance Research Letters*, *46*, 1–8.

Ali, H. S. (2022b). The Role of Firm Innovativeness in the Time of Covid-19 Crisis: Evidence from Chinese Manufacturing Firms. *Asian Journal of Technology Innovation*, *30*(3), 689–714.

Allison, P. D. (2009). *Fixed Effects Regression Models.* Thousand Oaks, CA: SAGE publications.

Ammermueller, A., Kuckulenz, A., and Zwick, T. (2009). Aggregate Unemployment Decreases Individual Returns to Education. *Economics of Education Review*, *28*(2), 217–226.

Amore, M. D. (2015). Companies Learning to Innovate in Recessions. *Research Policy*, *44*(8), 1574–1583.

Archanskaia, E., Canton, E., Hobza, A., Nikolov, P., and Simons, W. (2023). The Asymmetric Impact of COVID-19: A Novel Approach to Quantifying Financial Distress across Industries. *European Economic Review*, *158*, 104509.

Archibugi, D., Filippetti, A., and Frenz, M. (2013a). Economic Crisis and Innovation: Is Destruction Prevailing over Accumulation? *Research Policy*, *42*(2), 303–314.

Archibugi, D., Filippetti, A., and Frenz, M. (2013b). The Impact of the Economic Crisis on Innovation: Evidence from Europe. *Technological Forecasting and Social Change*, *80*(7), 1247–1260.

Audretsch, D. B. (1995). Innovation, Growth and Survival. *International Journal of Industrial Organization*, *13*(4), 441–457.

Aw, B. Y., Roberts, M. J., and Winston, T. (2007). Export Market Participation, Investments in R&D and Worker Training, and the Evolution of Firm Productivity. *World Economy*, *30*(1), 83–104.

Banning, K. and Chiles, T. (2007). Trade-offs in the Labor Union-CEO Compensation Relationship. *Journal of Labor Research*, *28*(2), 347–357.

Bastos, P. and Monteiro, N. P. (2011). Managers and Wage Policies. *Journal of Economics and Management Strategy*, *20*(4), 957–984.

Batish, A., Gordon, A., Larcker, D. F., Tayan, B., Watts, E. M., and Yu, C. (2020). Sharing the Pain: How did Boards Adjust CEO Pay in Response to COVID-19? *Rock Center for Corporate Governance at Stanford University Closer Look Series: Topics, Issues and Controversies in Corporate Governance No. CGRP-86.*

Bauer, T., Bonin, H., Goette, L., and Sunde, U. (2007). Real and Nominal Wage Rigidities and the Rate of Inflation: Evidence from West German Micro Data. *The Economic Journal*, *117*(524), F508–F529.

Bebchuk, L. A. and Fried, J. M. (2006). Pay without Performance: Overview of the Issues. *Academy of Management Perspectives*, *20*(1), 5–24.

Becker, G. S. (1962). Investment in Human Capital: A Theoretical Analysis. *Journal of Political Economy*, *70*(5), 9–49.

Becker, G. S. (1964). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. New York, NY: National Bureau of Economic Research.

Beiner, S., Schmid, M. M., and Wanzenried, G. (2011). Product Market Competition, Managerial Incentives and Firm Valuation. *European Financial Management*, *17*(2), 331–366.

Belitz, H. (2022). Research and Development in German Industry: High Intensity, Low Growth. *DIW Weekly Report*, *12*(51/52), 329–338.

Bellani, L., Fazio, A., and Scervini, F. (2021). Collective Negative Shocks and Preferences for Redistribution: Evidence from the COVID-19 Crisis in Germany. *IZA Discussion Paper No. 14969*.

Bellemare, M. F. and Wichman, C. J. (2020). Elasticities and the Inverse Hyperbolic Sine Transformation. *Oxford Bulletin of Economics and Statistics*, *82*(1), 50–61.

Bertrand, M. and Mullainathan, S. (2003). Enjoying the Quiet Life? Corporate Governance and Managerial Preferences. *Journal of Political Economy*, *111*(5), 1043–1075.

Bertrand, M. and Schoar, A. (2003). Managing with Style: The Effect of Managers on Firm Policies. *The Quarterly Journal of Economics*, *118*(4), 1169–1208.

Bischof, J., Doerrenberg, P., Rostam-Afschar, D., Simons, D., and Voget, J. (2021). The German Business Panel: Insights on Corporate Taxation and Accounting during the Covid-19 Pandemic. *TRR 266 Accounting for Transparency Working Paper Series No. 46*.

Bloom, N., Eifert, B., Mahajan, A., McKenzie, D., and Roberts, J. (2013). Does Management Matter? Evidence from India. *The Quarterly Journal of Economics*, *128*(1), 1–51.

Bloom, N., Fletcher, R. S., and Yeh, E. (2021). The Impact of COVID-19 on US Firms. *NBER Working Paper Series No. 28314*.

Bloom, N. and Van Reenen, J. (2007). Measuring and Explaining Management Practices across Firms and Countries. *The Quarterly Journal of Economics*, *122*(4), 1351–1408.

BMWi Bundesministerium für Wirtschaft und Energie (2020). Betroffenheit deutscher Unternehmen durch die Corona-Pandemie. `https://www.bmwi.de/Redaktion/DE/Downloads/B/betroffenheit-deutscher-unternehmen-durch-die-corona-pandemie.pdf?__blob=publicationFile&v=4`. Last access: March 23, 2024.

Bonaccolto-Töpfer, M. and Schnabel, C. (2023). Is There a Union Wage Premium in Germany and Which Workers Benefit Most? *Economies*, *11*(2).

Bonsiep, W. (2002). *Strategische Steuerung und die Rollen des mittleren Managements.* Hamburg: Kovač.

Boodoo, M. U. (2018). Do Highly Unionized Companies Compensate Their CEOs Less in Periods of Financial Distress? Evidence from Canada. *Industrial and Labor Relations Review*, *71*(2), 306–328.

Borjas, G. J. (2019). *Labor Economics (ISE)* (8 ed.). New York, NY: McGraw-Hill Education.

Braakmann, N., Eberth, B., and Wildman, J. (2022). Worker Adjustment to Unexpected Occupational Risk: Evidence from COVID-19. *European Economic Review*, *150*, 104325.

Braband, C., Consiglio, V. S., Grabka, M. M., Hainbach, N., and Königs, S. (2022). Disparities in Labour Market and Income Trends during the First Year of the COVID-19 Crisis – Evidence from Germany. *IZA Discussion Paper No. 15475*.

Brodeur, A., Gray, D., Islam, A., and Bhuiyan, S. (2021). A Literature Review of the Economics of COVID-19. *Journal of Economic Surveys*, *35*(4), 1007–1044.

Bruhn, M., Demirguc-Kunt, A., and Singer, D. (2023). Government Support and Firm Performance during COVID-19. *Policy Research Working Paper*, *10641*.

Buddelmeyer, H., Jensen, P. H., and Webster, E. (2010). Innovation and the Determinants of Company Survival. *Oxford Economic Papers*, *62*(2), 261–285.

Böhm, M. J. and Qendrai, P. (2023). System Relevance and Firm Performance due to COVID-19. *German Economic Review*, *24*(4), 349–410.

Campagna, S., Eulerich, M., Fligge, B., Scholz, R., and Vitols, S. (2020). Entwicklung der Wettbewerbsstrategien in Deutschen Börsenorientierten Unternehmen: Der Einfluss der Mitbestimmung auf die Strategische Ausrichtung und deren Performanz. *Mitbestimmungsreport 57*.

Card, D., Lemieux, T., and Riddell, W. C. (2020). Unions and Wage Inequality: The Roles of Gender, Skill and Public Sector Employment. *Canadian Journal of Economics*, *53*(1), 140–174.

Cefis, E., Bartoloni, E., and Bonati, M. (2020). Show Me How to Live: Firms' Financial Conditions and Innovation during the Crisis. *Structural Change and Economic Dynamics*, *52*, 63–81.

Cefis, E. and Marsili, O. (2005). A Matter of Life and Death: Innovation and Firm Survival. *Industrial and Corporate Change*, *14*(6), 1167–1192.

Cefis, E. and Marsili, O. (2006). Survivor: The Role of Innovation in Firms' Survival. *Research Policy*, *35*(5), 626–641.

Cefis, E. and Marsili, O. (2012). Going, Going, Gone. Exit Forms and the Innovative Capabilities of Firms. *Research Policy*, *41*(5), 795–807.

Cefis, E. and Marsili, O. (2019). Good Times, Bad Times: Innovation and Survival over the Business Cycle. *Industrial and Corporate Change*, *28*(3), 565–587.

Chyz, J. A., Eulerich, M., Fligge, B., and Romney, M. A. (2023). Codetermination and Aggressive Reporting: Audit Committee Employee Representation, Tax Aggressiveness, and Earnings Management. *Journal of International Accounting, Auditing and Taxation*, *51*.

Conchon, A. (2011). Board-level Employee Representation Rights in Europe: Facts and Trends. *European Trade Union Institute Report 121*.

Czarnitzki, D. and Kraft, K. (2004). Innovation Indicators and Corporate Credit Ratings: Evidence from German Firms. *Economics Letters*, *82*, 277–384.

Czarnitzki, D. and Kraft, K. (2010). On the Profitability of Innovative Assets. *Applied Economics*, *42*, 1941–1953.

D'Amore, R., Iorio, R., and Lavadera, G. L. (2017). Exploring the Relationship Between Human Capital and Innovation at the Firm Level: A study on a Sample of European Firms (No. 144). *CELPE-Centre of Labour Economics and Economic Policy, University of Salerno, Italy.*

de Uña-Álvarez, J., Martínez-Senra, A. I., Otero-Giráldez, M. S., and Quintás, M. A. (2023). Cox Regression with Doubly Truncated Responses and Time-Dependent Covariates: The Impact of Innovation on Firm Survival. *Journal of Applied Statistics*, *51*(4), 1–13.

DGB Deutscher Gewerkschaftsbund (2007a). DGB Einschaltung - November 2007. Ergebnisse einer Repräsentativen Erhebung - Tabellarische Übersichten. https://www.dgb.de/themen/++co++mediapool-6996ee254eef2af9e47c682450ce11d4. Last access: March 23, 2024.

DGB Deutscher Gewerkschaftsbund (2007b). Hohen Managergehältern Einhalt Gebieten! https://www.dgb.de/presse/++co++d6950e00-155d-11df-4ca9-00093d10fae2. Last access: March 23, 2024.

DGB Deutscher Gewerkschaftsbund (2017). Empfehlungen des DGB zur Regulierung der Vorstandsvergütung. https://www.dgb.de/themen/++co++d342e3de-5011-11e7-aa53-525400e5a74a. Last access: March 23, 2024.

Diekhof, J., Krieger, B., Licht, G., Rammer, C., Schmitt, J., and Stenke, G. (2021). The Impact of the Covid-19 Crisis on Innovation: First In-sights from the German Business Sector. *ZEW-Kurzexpertise*, *21*.

DiNardo, J., Hallock, K., and Pischke, J.-S. (1997). Unions and Managerial Pay. *Working Paper 6318*.

Dopson, S. and Stewart, R. (1990). What is Happening to Middle Management? *British Journal of Management*, *1*(1), 3–16.

Dyballa, K. and Kraft, K. (2020). How Do Labor Representatives Affect Incentive Orientation of Executive Compensation? *CESifo Economic Studies*, *66*(1), 60–90.

Edmans, A., Gabaix, X., and Jenter, D. (2017). Executive Compensation: A Survey of Theory and Evidence. *The Handbook of the Economics of Corporate Governance*, *1*, 383–539.

Eulerich, M., Fligge, B., and Imdieke, A. J. (2022). Does Codetermination Reduce Shareholder Value? Board-Level Employee Representation, Firms' Market Value, and Operational Performance. *Working Paper*.

Fabbri, F. and Marin, D. (2016). What Explains the Rise in Executive Pay in Germany? A Panel Data Analysis for 1977-2009. *The Scandinavian Journal of Economics*, *118*(2), 235–263.

Fackler, D., Schnabel, C., and Stegmaier, J. (2024). Personnel Adjustments during the Covid-19 Pandemic: Did Co-Determination Make a Difference? *Journal for Labour Market Research 2024*, *58*(1), 1–10.

Fairlie, R. and Fossen, F. M. (2022). The Early Impacts of the COVID-19 Pandemic on Business Sales. *Small Business Economics*, *58*(4), 1853–1864.

Fernandes, N., Ferreira, M. A., Matos, P., and Murphy, K. J. (2013). Are U.S. CEOs Paid More? New International Evidence. *The Review of Financial Studies*, *26*(2), 323–367.

Filippetti, A. and Archibugi, D. (2011). Innovation in Times of Crisis: National Systems of Innovation, Structure, and Demand. *Research Policy*, *40*(2), 179–192.

Fitzenberger, B., Kohn, K., and Lembcke, A. C. (2013). Union Density and Varieties of Coverage: The Anatomy of Union Wage Effects in Germany. *Industrial and Labor Relations Review*, *66*(1), 169–197.

FitzRoy, F. and Kraft, K. (2005). Co-Determination, Efficiency and Productivity. *British Journal of Industrial Relations*, *43*(2), 233–247.

Fonseca, T., de Faria, P., and Lima, F. (2019). Human Capital and Innovation: The Importance of the Optimal Organizational Task Structure. *Research Policy*, *48*(3), 616–627.

Fontana, R. and Nesta, L. (2009). Product Innovation and Survival in a High-Tech Industry. *Review of Industrial Organization*, *34*(4), 287–306.

Franz, W. and Pfeiffer, F. (2006). Reasons for Wage Rigidity in Germany. *Labour*, *20*(2), 255–284.

Freeman, R. B. (1976). Political Economy: Some Uses of the Exit-Voice Approach. *American Economic Association*, *66*(2), 361–368.

Freeman, R. B. and Medoff, J. L. (1984). *What Do Unions Do?* New York, NY: Basic Books.

Frölich, M. and Sperlich, S. (2019). *Impact Evaluation: Treatment Effects and Causal Analysis*. Cambridge University Press.

Gabaix, X. and Landier, A. (2008). Why Has CEO Pay Increased So Much? *The Quarterly Journal of Economics*, *123*(1), 49–100.

Gabaix, X., Landier, A., and Sauvagnat, J. (2014). CEO Pay and Firm Size: An Update after the Crisis. *Economic Journal*, *124*(574), F40–F59.

Giebel, M. and Kraft, K. (2019). External Financing Constraints and Firm Innovation. *Journal of Industrial Economics*, *67*(1), 91–126.

Giebel, M. and Kraft, K. (2023). The Effect of Subsidies on R&D in the Financial Crisis—The Role of Financial Constraints of Firms and Banks. *Industrial and Corporate Change*, DOI: `https://doi.org/10.1093/icc/dtad071`.

Gomez, R. and Tzioumis, K. (2006). What Do Unions Do To CEO Compensation? *CEP Discussion Paper*, *720*.

Gorton, G. and Schmid, F. A. (2004). Capital, Labor, and the Firm: A Study of German Codetermination. *Journal of the European Economic Association*, *2*(5), 863–905.

Grabka, M. M. (2021). Income Inequality in Germany Stagnating over the Long Term, but Decreasing Slightly during the Coronavirus Pandemic. *DIW Weekly Report*, *11*(17/18), 125–133.

Greene, W. H. (2020). *Econometric Analysis* (8th ed.). Pearson.

Grund, C. and Walter, T. (2015). Management Compensation and the Economic Crisis: Longitudinal Evidence from the German Chemical Sector. *Review of Managerial Science*, *9*(4), 751–777.

Gunnigle, P., Lavelle, J., and Monaghan, S. (2013). Weathering the Storm? Multinational Companies and Human Resource Management through the Global Financial Crisis. *International Journal of Manpower*, *34*(3), 214–231.

Gupta, J., Gregoriou, A., and Ebrahimi, T. (2018). Empirical Comparison of Hazard Models in Predicting SMEs Failure. *Quantitative Finance*, *18*(3), 437–466.

Hall, B. H. and Lerner, J. (2010). The Financing of R&D and Innovation. In B. H. Hall and N. Rosenberg (Eds.), *Handbook of the Economics of Innovation*, volume 1 (pp. 609–639). Amsterdam: Elsevier B.V.

Hauser, R. (2013). Did Dividend Policy Change During the Financial Crisis? *Managerial Finance*, *39*(6), 584–606.

Holmstrom, B. and Milgrom, P. (1987). Aggregation and Linearity in the Provision of Intertemporal Incentives. *Econometrica*, *55*(2), 303–328.

Hottenrott, H. and Peters, B. (2012). Innovative Capability and Financing Constraints for Innovation: More Money, More Innovation? *The Review of Economics and Statistics*, *94*(4), 1126–1142.

Huang, Q., Jiang, F., Lie, E., and Que, T. (2017). The Effect of Labor Unions on CEO Compensation. *Journal of Financial and Quantitative Analysis*, *52*(2), 553–582.

Hud, M. and Hussinger, K. (2015). The Impact of R&D Subsidies During the Crisis. *Research Policy*, *44*(10), 1844–1855.

Imbens, G. W. and Wooldridge, J. M. (2009). Recent Developments in the Econometrics of Program Evaluation. *Journal of Economic Literature*, *47*(1), 5–86.

Jäger, S., Noy, S., and Schoefer, B. (2022). What Does Codetermination Do? *ILR Review*, *75*(4), 857–890.

Jebran, K. and Chen, S. (2022). Corporate Policies and Outcomes during the COVID-19 Crisis: Does Managerial Ability Matter? *Pacific Basin Finance Journal*, *73*, 1–21.

Jensen, M. C. and Meckling, W. H. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics*, *3*(4), 305–360.

Jensen, M. C. and Murphy, K. J. (1990). Performance Pay and Top-Management Incentives. *Journal of Political Economy*, *98*(2), 225–264.

Jirjahn, U. (2011). Ökonomische Wirkungen der Mitbestimmung in Deutschland: Ein Update. *Schmollers Jahrbuch*, *131*(1), 3–57.

Jäger, S., Schoefer, B., and Heining, J. (2021). Labor in the Boardroom. *The Quarterly Journal of Economics*, *136*(2), 669–725.

Kampkötter, P. (2015). Non-Executive Compensation in German and Swiss Banks before and after the Financial Crisis. *The European Journal of Finance*, *21*, 1297–1316.

Kampkötter, P. and Sliwka, D. (2011). Die Wirkung der Finanzkrise auf Bonuszahlungen in deutschen Banken und Finanzdienstleistungsinstitutionen. In M. Osterloh and K. Rost (Eds.), *Der Anstieg der Management-Vergütung: Markt oder Macht?*, Sonderband 1/2011 "Die Unternehmung" (pp. 152–165). Baden-Baden: Nomos.

Kerr, W. R. and Nanda, R. (2015). Financing Innovation. *Annual Review of Financial Economics*, *7*, 445–462.

Khan, K., Liu, S., Xiong, B., Zhang, L., and Li, C. (2022). Innovation to Immune: Empirical Evidence From COVID-19 Focused Enterprise Surveys. *Frontiers in Psychology*, *13*.

Kilincarslan, E. (2021). Smoothed or not Smoothed: The Impact of the 2008 Global Financial Crisis on Dividend Stability in the UK. *Finance Research Letters*, *38*, 1–12.

Kouser, R., Luqman, R., Yaseen, A., and Azeem, M. (2015). Dividend Payout Policy and Financial Crisis: Evidence from the Life Cycle Theory. *Pakistan Journal of Commerce and Social Sciences*, *9*(2), 583–597.

Kraft, K. and Ugarković, M. (2006). Gesetzliche Mitbestimmung und Kapitalrendite. *Jahrbücher für Nationalökonomie und Statistik*, *226*(5), 588–604.

Kramarsch, M. H. (2004). *Aktienbasierte Managementvergütung* (2nd ed.). Stuttgart: Schäffer-Poeschel.

Krieger, K., Mauck, N., and Pruitt, S. W. (2021). The Impact of the COVID-19 Pandemic on Dividends. *Finance Research Letters*, *42*, 1–7.

Kumar, S. and Zbib, L. (2022). Firm Performance during the Covid-19 Crisis: Does Managerial Ability Matter? *Finance Research Letters*, *47*.

Kyrdoda, Y., Balzano, M., and Marzi, G. (2023). Learn to Survive Crises: The Role of Firm Resilience, Innovation Capabilities and Environmental Dynamism. *Technology in Society*, *74*, 102285.

Lahr, H. and Mina, A. (2020). Endogenous Financial Constraints and Innovation. *Industrial and Corporate Change*, *30*(3), 587–621.

Lee, N., Sameen, H., and Cowling, M. (2015). Access to Finance for Innovative SMEs since the Financial Crisis. *Research Policy*, *44*(2), 370–380.

Lenihan, H., McGuirk, H., and Murphy, K. R. (2019). Driving Innovation: Public Policy and Human Capital. *Research Policy*, *48*(9).

Lin, C., Schmid, T., and Sun, Y. (2019). Conflict or Collusion?: How Employees in the Boardroom Affect Executive Compensation. *Working Paper*.

Liu, C. (2023). Can Water Resource Tax Reform Improve the Environmental Performance of Enterprises? Evidence from China's High Water-Consuming Enterprises. *Frontiers in Environmental Science*.

Mahaboob, S. A. (2022). The Effect of Covid 19 on Workers Compensation Evidence from GCC Countries. *Journal of Business Strategy Finance and Management*, *4*(1), 52–65.

Makni, M. S. (2023). Analyzing the Impact of COVID-19 on the Performance of Listed Firms in Saudi Market. *Technological Forecasting and Social Change*, *187*, 122171.

Miller, M. H. and Rock, K. (1985). Dividend Policy under Asymmetric Information. *The Journal of Finance*, *40*(4), 1031–1051.

Mincer, J. (1974). *Schooling, Experience, and Earnings.* New York, NY: Columbia University Press.

Mintzberg, H. (2010). *Managen.* Offenbach: GABAL Verlag.

Mora, R. and Reggio, I. (2015). didq: A Command for Treatment-Effect Estimation under Alternative Assumptions. *The Stata Journal*, *15*(3), 796–808.

Mundlak, Y. (1978). On the Pooling of Time Series and Cross Section. *Econometrica*, *46*(1), 69–85.

Murphy, K. J. (2013). Executive Compensation: Where We Are, and How We Got There. In G. M. Constantinides, M. Harris, and R. M. Stulz (Eds.), *Handbook of the Economics of Finance*, volume 2 (pp. 211–356). Amsterdam: Elsevier B.V.

Neal, D. and Rosen, S. (2000). Theories of the Distribution of Earnings. In A. B. Atkinson and F. Bourguignon (Eds.), *Handbook of Income Distribution*, volume 1 (pp. 379–428). Amsterdam: Elsevier B.V.

Nguyen, X. M. and Tran, Q. T. (2016). Dividend Smoothing and Signaling Under the Impact of the Global Financial Crisis: A Comparison of US and Southeast Asian Markets. *International Journal of Economics and Finance*, *8*(11), 118–123.

Olden, A. and Møen, J. (2022). The Triple Difference Estimator. *Econometrics Journal*, *25*(3), 531–553.

Özşuca, E. A. (2023). Firm Survival in Times of Crisis: Do Innovation and Financing Constraints Matter? Insights from the COVID-19 Pandemic. *Eastern European Economics*, *61*(5), 421–456.

Park, M. (2021). Unionized Employees' Influence on Executive Compensation: Evidence from Korea. *British Journal of Industrial Relations*, *59*(4), 1049–1083.

Paunov, C. (2012). The Global Crisis and Firms' Investments in Innovation. *Research Policy*, *41*(1), 24–35.

Pianta, M. and Tancioni, M. (2008). Innovations, Wages, and Profits. *Journal of Post Keynesian Economics*, *31*(1), 101–123.

Protogerou, A., Caloghirou, Y., and Vonortas, N. S. (2017). Determinants of Young Firms' Innovative Performance: Empirical Evidence from Europe. *Research Policy*, *46*(7), 1312–1326.

Raith, M. (2003). Competition, Risk, and Managerial Incentives. *American Economic Review*, *93*(4), 1425–1436.

Rathnayaka, I. W., Khanam, R., and Rahman, M. M. (2023). The Economics of COVID-19: A Systematic Literature Review. *Journal of Economic Studies*, *50*(1), 49–72.

Reddemann, S., Basse, T., and Von Der Schulenburg, J. M. G. (2010). On the Impact of the Financial Crisis on the Dividend Policy of the European Insurance Industry. *Geneva Papers on Risk and Insurance: Issues and Practice*, *35*(1), 53–62.

Renaud, S. (2007). Dynamic Efficiency of Supervisory Board Codetermination in Germany. *Labour*, *21*(4–5), 689–712.

Roper, S. and Turner, J. (2020). R&D and Innovation After COVID-19: What Can we Expect? A Review of Prior Research and Data Trends After the Great Financial Crisis. *International Small Business Journal: Researching Entrepreneurship*, *38*(6), 504–514.

Sam-Aggrey, H. (2009). Differences in the Characteristics of Innovative and Non-Innovative Manufacturing Plants. *Innovation Analysis Bulletin (Statistics Canada)*, *11*(1), 3–6.

Schmidt, K. M. (1997). Managerial Incentives and Product Market Competition. *Review of Economic Studies*, *64*, 191–213.

Schultz, T. W. (1961). Investment in Human Capital. *The American Economic Review*, *51*(1), 1–17.

Schunck, R. (2013). Within and Between Estimates in Random-Effects Models: Advantages and Drawbacks of Correlated Random Effects and Hybrid Models. *The Stata Journal*, *13*(1), 65–76.

Shen, H., Fu, M., Pan, H., Yu, Z., and Chen, Y. (2020). The Impact of the COVID-19 Pandemic on Firm Performance. *Emerging Markets Finance and Trade*, *56*(10), 2213–2230.

Sidorkin, O. and Srholec, M. (2014). Surviving the Times of Crisis: Does Innovation Make a Difference? *International Journal of Technological Learning, Innovation and Development*, *7*(2), 124–146.

Simonsohn, U., Simmons, J. P., and Nelson, L. D. (2020). Specification Curve Analysis. *Nature Human Behaviour*, *4*(11), 1208–1214.

Singh, P. and Agarwal, N. C. (2002). Union Presence and Executive Compensation: An Exploratory Study. *Journal of Labor Research*, *23*(4), 631–646.

Smith, A. (1976). *An Inquiry into the Nature and Causes of the Wealth of Nations, Volume 1.* Eds.: R. H. Campbell, A. S. Skinner and W. B. Todd. Oxford: Clarendon Press. First published in 1776.

Sonenshine, R., Larson, N., and Cauvel, M. (2016). Determinants of CEO Compensation before and after the Financial Crisis. *Modern Economy*, *7*(12), 1455–1477.

Staiger, D. and Stock, J. H. (1997). Instrumental Variables Regression with Weak Instruments. *Econometrica*, *65*, 557–586.

Stehrer, R., Bykova, A., Jäger, K., Reiter, O., and Schwarzhappel, M. (2019). Industry Level Growth and Productivity Data with Special Focus on Intangible Assets: Report on Methodologies and Data Construction for the EU KLEMS Release 2019.

Stuart, E. A., Huskamp, H. A., Duckworth, K., Simmons, J., Song, Z., Chernew, M. E., and Barry, C. L. (2014). Using Propensity Scores in Difference-in-Differences Models to Estimate the Effects of a Policy Change. *Health Services and Outcomes Research Methodology*, *14*(4), 166–182.

Subramaniam, M. and Youndt, M. A. (2005). The Influence of Intellectual Capital on the Types of Innovative Capabilities. *Source: The Academy of Management Journal*, *48*(3), 450–463.

Sun, X., Li, H., and Ghosal, V. (2020). Firm-Level Human Capital and Innovation: Evidence from China. *China Economic Review*, *59*, 101388.

Ugur, M. and Vivarelli, M. (2021). Innovation, Firm Survival and Productivity: The State of the Art. *Economics of Innovation and New Technology*, *30*(5), 433–467.

Vedder, R. and Gallaway, L. (2002). The Economic Effects of Labor Unions Revisited. *Journal of Labor Research*, *23*(1), 105–130.

Vemala, P., Nguyen, L., Nguyen, D., and Kommasani, A. (2014). CEO Compensation: Does Financial Crisis Matter? *International Business Research*, *7*(4), 125–131.

Vitols, S. (2008). Beteiligung der Arbeitnehmervertreter in Aufsichtsratsausschüssen: Auswirkungen auf Unternehmensperformanz und Vorstandsvergütung. *Hans-Böckler-Stiftung Arbeitspapier Nr. 163*.

Wilson, R., Pryymachenko, Y., Abbott, J. H., Dean, S., Stanley, J., Garrett, S., Mathieson, F., Dowell, A., and Darlow, B. (2023). A Guideline-Implementation Intervention to Improve the Management of Low Back Pain in Primary Care: A Difference-in-Difference-in-Differences Analysis. *Applied Health Economics and Health Policy*, *21*(2), 253–262.

Wing, C., Simon, K., and Bello-Gomez, R. A. (2018). Designing Difference in Difference Studies: Best Practices for Public Health Policy Research Keywords. *Annual Review of Public Health*, *39*, 453–469.

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data* (2nd ed.). Cambridge/ London.

Wooldridge, J. M. (2020). *Introductory Econometrics: A Modern Approach* (7th ed.). Boston, MA: Cengage Learning.

Yu, H., Peng, F., Yuan, T., Li, D., and Shi, D. (2023). The Effect of Low-Carbon Pilot Policy on Low-Carbon Technological Innovation in China: Reexamining the Porter Hypothesis Using Difference-in-Difference-in-Differences Strategy. *Journal of Innovation and Knowledge*, *8*(3), 100392.

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Hiermit erkläre ich an Eides statt, dass ich die Dissertation selbstständig verfasst und alle in Anspruch genommenen Quellen und Hilfen in der Dissertation vermerkt habe. Die den herangezogenen Werken wörtlich oder sinngemäß entnommenen Stellen sind als solche gekennzeichnet. Diese Dissertation ist weder in der gegenwärtigen oder in einer anderen Fassung oder in Teilen an der TU Dortmund noch an einer anderen Hochschule in Zusammenhang mit einer staatlichen oder akademischen Prüfung bereits vorgelegt worden.

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Tobias Hemker