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Trade Union Membership and Bonus Payments: German Survey Evidence[*,†]

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Abstract

This study provides the first comprehensive investigation of the relationship between trade union membership and non-performance-oriented bonuses. We expect a positive impact of union membership because members benefit from special entitlements, increased bargaining power and informational advantages. Using data from the German Socio-economic panel (GSOEP), we observe that union members are more likely to receive at least one bonus payment per year, a higher number of bonuses, and a higher amount than comparable non-members. We also observe the positive union membership effect for employees covered by collective bargaining or co-determination via works councils. Employing a novel instrumental variable, we find evidence of a positive effect of union membership on the number and level of bonus payments. Furthermore, higher bonuses do not go along with wage decreases.

Keywords: bonus payments, collective bargaining, GSOEP, trade union membership
JEL Codes: J31, J33, J51, J52

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1 Introduction

Trade unions serve an important role in influencing the labour market and employee outcomes worldwide. However, dwindling union membership numbers raise concerns about their continued value in guaranteeing favourable working conditions and compensation benefits (Jäger et al., 2025). Among these benefits, bonus payments constitute a crucial part of the workers' remuneration package in many countries. In Germany, for instance, employees frequently obtain end-of-year bonuses, such as Christmas pay or a 13^{th} salary. Additionally, employers may provide vacation pay, that is, extra remuneration in addition to paid vacation days, usually during the summer months. These bonuses are generally either flat-rate payments or defined with reference to the monthly salary, but not related to individual performance. According to recent surveys (WSI-Tarifarchiv, 2023, 2024), 53% of employees obtain Christmas pay and 46% a vacation bonus as part of their remuneration packages in Germany. Consequently, bonuses constitute a significant share of labour earnings for many employees. Especially in larger companies, such payments are often determined by collective wage agreements. Therefore, employees whose pay is determined by a collective agreement are more likely to report receiving a Christmas bonus (77%) and a vacation bonus (74%) than employees not covered by such an agreement (42% and 36%) (WSI-Tarifarchiv, 2023, 2024).

While individual staff members have little direct influence on the content of collective bargaining agreements, trade union members may be better able than others to obtain extra payments and to raise their magnitude, possibly in addition to and beyond what is collectively negotiated. For instance, entitlements to extra payments solely for union members may be included in collective wage agreements that generally apply to members and non-members alike. Additionally, members may possess informational advantages regarding the composition of pay in their industry and wield greater bargaining power in individual negotiations with their employer compared to non-members. As a result, we hypothesise that union members obtain more and higher non-performance-oriented bonus payments than comparable non-members. In this paper, we analyse this conjecture using data from the German Socio-Economic-Panel. We focus on non-performance-oriented bonuses for two reasons: First, performance-related pay determined at the firm level, such as profit-sharing, is unlikely to be affected by an individual's union membership. Second, the German Socio-Economic-Panel does not provide sufficient information to analyse the impact of trade union membership on pay related to an individual's performance in the same comprehensive manner as it is feasible for bonus payments that are not directly related to performance measures.

In the context of financial benefits associated with trade union membership, empirical studies focus mostly on overall or hourly wage gaps between members and non-members. The relationship between union membership and non-performance-oriented bonus payments, such

as Christmas and vacation pay, has not received much attention. We enhance the knowledge about this linkage along a number of dimensions: First, if trade unions provide public goods, such as higher wages, to all employees, and membership is voluntary, incentives to free-ride exist, and the question arises why individuals join a trade union. Bonus payments may constitute selective incentives in the spirit of Olson (1971) that can mitigate the free-rider problem. Second, our data allow us to tentatively identify the mechanisms by which trade union membership affects the receipt of bonus payments, namely via special entitlements for members, better information or greater bargaining power. Third, we can differentiate between the role an employee's trade union membership has and the effects of labour market institutions, such as collective bargaining agreements and co-determination.

The surveys that constitute the basis for the German Socio-Economic Panel (GSOEP) have been conducted annually since 1984. In eleven waves, there is information about an individual's union membership status. Ten of them also contain data about the incidence, number, and level of five different bonus components, namely Christmas bonuses, 13^{th} and 14^{th} salaries, vacation bonuses, and a residual category. Our main findings show that union members are more likely to receive at least one bonus payment, report a higher number of bonuses, and obtain a larger amount. Importantly, the results hold true when we control for the existence of collective wage agreements and works councils. This suggests that union membership on the one hand and collective bargaining and co-determination on the other hand play distinct roles in the determination of bonus payments. Furthermore, the initial relationship is not more pronounced in the presence of such institutions, which implies little support for the hypothesis that union members benefit from special entitlements in collective wage agreements. In addition, we identify the positive correlation between union membership and bonuses over a time span of more than thirty years and for various subgroups, such as male and female or blue- and white-collar employees, that are characterised by substantial differences in the degree of unionisation. This is in line with the idea that union members rather gain from individual bargaining power than from collective bargaining on behalf of a particular group of workers. The positive union membership effect is also observable for employees who do not change their employer or occupation. Therefore, it is not primarily due to firm or job characteristics. We further observe that those who join a union profit in terms of bonus payments, whereas quitting has the reverse effect. Because information about how to obtain bonus payments is unlikely to be lost when leaving the union, our findings suggest that the bonus effect is not due to informational advantages of trade union members. Finally, we pursue an instrumental variable (IV) approach to address endogeneity issues. We use a - to the best of our knowledge - new instrument based on political tendencies. The results of the IV analysis align with a positive relationship between union membership and the number and level of bonus payments. To conclude the analysis, we

investigate whether higher bonuses go along with lower wages and, therefore, one remuneration component constitutes a substitute for another. We find no evidence supporting this conjecture.

The remainder of this paper is structured as follows: We discuss related literature in Section 2. In Section 3 we display the institutional background. Additionally, we develop more thoroughly the expectations about the relationship between trade union membership and bonuses sketched above. In Section 4, we present the data and methods used. Section 5 provides the results, and Section 6 summarises our findings.

2 Literature Review

Our paper is related to two broad strands of literature. The first analyses the benefits of union membership. This strand of literature often attempts to provide substance to Mancur Olson's assertion that trade union provide selective incentives, as "they have offered non collective benefits to those who join the union, and denied these benefits to those who did not" (Olson, 1971, p. 72). The second strand deals with the determinants of performance-related pay and bonuses. One of the questions looked at is how trade unions affect the frequency and magnitude of such payments. These contributions pay relatively little attention to non-performance-oriented payments, on which this paper focuses. We outline the main contributions of both strands of literature in turn.

One of the main benefits of union membership can be a wage premium. While there is substantial evidence for the United States and various other countries of such a premium (surveyed recently, for example, by Fang and Hartley (2022) and Brändle (2024)), studies for Germany provide somewhat ambiguous results. While Schmidt and Zimmermann (1991), Fitzenberger et al. (1999), and Goerke and Pannenberg (2004) find no union membership wage premium, Wagner (1991) reports a positive wage effect for blue-collar, though not for white-collar workers in West Germany, while Bonaccolto-Töpfer and Schnabel (2023) document a membership premium using two recent GSOEP waves.

There is widespread evidence that collective bargaining or trade union membership are associated with or even causal for greater fringe benefits, such as health insurance coverage, pension plans or sick leave.[1] Since many of the pertinent studies consider the United States, the data does not allow to clearly distinguish between bargaining coverage and an employee's membership in a trade union. In addition, there is evidence for numerous countries that union representation or membership is associated with more paid vacation and a greater use of such

[1] See, for example, Solnick (1978); Freeman (1981); Miller and Mulvey (1992); Montgomery and Shaw (1997); Budd (2004, 2005), and Knepper (2020).

entitlements.[2] However, extra payments, such as vacation or Christmas pay, or, more generally, non-performance-oriented bonuses have not been considered comprehensively. A partial exception is a study using data from the Mexican Occupation and Employment Survey. Gutiérrez Rufrancos (2019) shows that joining a trade union enhances the probability of obtaining a bonus, which is akin to half of an additional monthly salary, and of having paid holidays. Leaving a trade union is associated with effects in the opposite direction. In sum, there is little systematic evidence on the association between union membership and extra payments which may constitute a private or selective benefit only available to members.

The second strand of literature analyses various types of performance-related pay and the role of trade unions. For the United States, there is evidence of a negative or no relationship between unionisation and the probability of obtaining incentive pay, bonuses or pay supplements (Freeman, 1981; Garen, 1999; MacLeod and Parent, 2000; Geddes and Heywood, 2003; Barkume, 2004).[3] In contrast, the linkage between union coverage and the existence of performance-related pay for Britain is less clear, suggesting variations over time and differences between sectors (Booth and Frank, 1999; Pendleton et al., 2009). Individual union membership, as distinct from bargaining coverage or union representation, has generally not been looked at. Moreover, to the best of our knowledge, no study using German data has explicitly analysed the relationship.

3 Institutional Background and Expectations

3.1 Institutional Background

In 2019, 16% of employees were members of a trade union in Germany. About 75% of them belonged to one of the eight member unions of the German Trade Union Federation (*Deutscher Gewerkschaftsbund, DGB*). Union density has basically halved in the last 35 years and is much lower than bargaining coverage. The latter was about 40% in the private sector in 2019 and almost 90% in the public sector (Ellguth and Kohaut, 2022). While collective bargaining takes place mainly at the industry level, in 2019, 8% of employees were paid according to contracts negotiated at the firm level. Longer-term collective bargaining agreements typically define pay-scales, regulate working time and remuneration principles, and often the duration of paid vacation, fringe benefits as well as the structure of bonus payments. Negotiations about wages

[2] See, for example, Green and Potepan (1988); Green (1997); Ohtake (2003); Buchmueller et al. (2004); Altonji and Usui (2007); Fakih (2014); Glauber and Young (2015); Goerke et al. (2015); Fakih (2018), and Forth and Bryson (2019).

[3] O'Halloran (2013) distinguishes different forms of performance-related pay and finds negative or insignificant correlations with union coverage or union membership in covered firms, with the exception of piece rates. Somewhat comparably, Long and Shields (2005) distinguish different types of performance-related pay for Australia and Canada and document either negative or no correlations with the percentage of the workforce which is unionised.

and possibly bonus levels generally take place annually. Firms not covered by collective agreements determine wages and working conditions individually with their staff. However, in about 50% of the relevant contracts, wages are aligned to a collective agreement (Ellguth and Kohaut, 2020, 2022).

Employed union members commonly pay a membership fee of around 1% of their gross wage. In exchange, trade unions provide strike pay and advice in case of employment-related conflicts, for example, concerning labour, employment protection, social security, and occupational safety law. Trade union lawyers also represent members in legal conflicts. In addition, members obtain information about working conditions and many job-related aspects, such as pay, fringe benefits and health issues. Finally, they can also benefit from financial advantages, such as reduced insurance contribution rates or price reductions for leisure activities.

Employees are generally not obliged to inform the employer about their union membership status. There are some de facto exceptions, as in the case of the car maker Volkswagen, since it directly deducts membership fees from wage payments and transfers them to the trade union, IG Metall, representing workers in Volkswagen plants. Nonetheless, firms are likely to have an idea of whether employees belong to a trade union if they took part in a strike or participated in union meetings. Moreover, if union membership entitles to benefits, such as extra vacation days or bonuses, members are incentivised to reveal their membership status to the employer. Finally, many individuals may strategically use information about their membership status in individual negotiations with the firm to enhance their bargaining power by indicating that they have obtained legal advice from or representation by union officials.

In Germany, collective agreements are legally binding for firms covered by the contract and all members of the trade union concluding it who work in these firms. Non-union members working in companies that have signed the collective bargaining agreement are no signatories of the contract and, therefore, not legally entitled to the bargained wage and the contract's other elements. However, in the vast majority of cases, firms apply the contract to all their employees, irrespective of the union membership status. Since individuals in covered firms cannot be forced to join a trade union or to support it financially, the legal setting implies that non-members free-ride on the higher wages associated with collective bargaining.[4]

Collective bargaining and co-determination are often viewed as the cornerstones of the German industrial relations system (Jäger et al., 2022). Co-determination at plant level takes place via works councils. They can be established in all private-sector firms with at least 5 employees. Since this requires a vote which is not compulsory, works councils exist in less than 10% of all eligible private-sector establishments. Given their prevalence in larger firms, about

[4] Addison et al. (2010), Gürtzgen (2009), and Hirsch and Mueller (2020) provide evidence for a positive wage effect of collective bargaining. Hirsch et al. (2022) further document that around 10% of employees working in covered firms are not paid according to a collective contract.

40% of private-sector employees are subject to this type of co-determination.[5] In consequence, the two pillars of the industrial relations system co-exist especially in large establishments, and more than 80% of the employees in plants with a workforce of more than 500 individuals are covered by a collective bargaining agreement and simultaneously represented by a works council (Ellguth and Kohaut, 2022).

3.2 Expectations

There are various reasons why an individual employee's trade union membership may affect bonus payments. First, some collective agreements contain special regulations only entitling trade union members to extra payments. Second, union members have better information about pay composition and bonuses than non-members. Third, trade union membership enhances individual bargaining power in negotiations with the firm.

Special Entitlements Collective agreements may stipulate that union members obtain special bonus payments or higher amounts than non-members. While such entitlements restricted to union members were ruled illegal by the German Federal Labour Court in 1967, their evaluation has gradually changed in the last two decades. Currently, extra payments to union members can be part of a collective agreement, as long as the contract does not explicitly preclude firms from paying the benefit to non-members as well.

To the best of our knowledge, there is no comprehensive data on the dissemination of extra bonus payments for union members. However, a non-representative study looks at trade unions belonging to the German Trade Union Federation (DGB) and estimates that special entitlements in collective agreements negotiated mainly at the firm level apply to about 600,000 union members, that is, more than 10% of the DGB's membership. Between 40% and 50% of these special entitlements relate to bonuses and around 20% to extra paid leave (Bahnmüller, 2025). Some German trade unions promote such special entitlements on their websites to indicate how attractive becoming a member is (see ver.di (2022)). The subsequent examples illustrate the scope of monetary entitlements solely for members of three unions. The industrial union for mining, energy and the chemical industry states on its website that almost 15% of the members obtain some type of extra benefit (see IGBCE (2020)). The trade unions for the public and the educational sector (ver.di and GEW) have recently negotiated a contract with one of the largest service providers in youth, social and educational work in Germany that includes extra bonus payments for members of €300 and €350 in 2025 and 2026, respectively (GEW, 2024). A third example of special entitlements for bonuses concerns Volkswagen. The car maker

[5]Personnel councils are the public-sector equivalent to works councils and are much more widespread than the latter. Additionally, there is co-determination at the level of the enterprise. It is compulsory in enterprises with at least 500 employees and grants the workforce representation on company boards. Its extent varies with firm size (Addison, 2009; Jäger et al., 2022).

renegotiated its collective agreement at the end of 2024 in the light of stagnating revenues and a decline in sales and profits. The IG Metall, the union bargaining with Volkswagen, agreed to a wage freeze in 2025 and 2026 and a substantial decline in employment. Moreover, it negotiated extra annual bonus payments for its members, amounting to €254 per employee in 2027 and rising to €1271 in 2030 (Kutsche, 2025).

Special entitlements in collective bargaining agreements imply that trade union members are more likely to obtain a bonus payment and to receive bonuses more often. Moreover, these regulations may affect the amount of an existing bonus. Therefore, we expect total payments to be higher. Since such extra bonuses require collective bargaining, coverage by an agreement is a prerequisite for such a type of union membership impact.

Informational Aspects The literature on pay transparency and the gender pay gap emphasises the role of information about the wages of peers (OECD, 2021; Bennedsen et al., 2022). The basic idea is that better information about what others, i.e. male colleagues, earn makes it easier for female employees to obtain comparable wages. An equivalent argument can be made in our context. Trade unions collect information about remuneration and distribute it to employees and, in greater detail, to their members. The research institute of the DGB even runs a continuous online survey to allow for pay comparisons at a very detailed level.[6] Therefore, union members may have better information about the level and composition of remuneration. In consequence, they can more often ask their employer for bonus payments than non-members who are less likely to have the particular knowledge.[7]

Accordingly, we expect trade union members to receive bonus payments more often and a higher number of bonuses than comparable non-members on account of their informational advantage. Whether this line of reasoning applies to the level of payments as well is a priori uncertain. This would require that union members have superior knowledge about the exact magnitude of payments. The informational aspect is less relevant for individuals covered by collective bargaining agreements because they often contain regulations concerning vacation pay, a Christmas bonus, or a 13^{th} salary, likely to be known to all employees.

Individual Bargaining Power While knowledge about potential bonus payments is a prerequisite for demanding them, obtaining them depends on whether an employee wields enough bargaining power in negotiations with the employer. Unions can provide help in these nego-

[6] See the website (in German): https://www.lohnspiegel.de/

[7] Budd (2004, p.598f) labels this the "facilitation effect" of trade unions with reference to health insurance and pension coverage: "By increasing awareness of employee benefits programs and providing representation when necessary, labor unions can facilitate receipt of employee benefits,[...]." In a later paper, the "facilitation effect" is further differentiated, as unions can affect the awareness of regulations or benefits, their affordability to employees, and assure that staff are not affected negatively by claiming their entitlements (Park et al., 2019). Our line of argument focuses on the awareness aspect.

tiations in a variety of ways. First, union officials at the establishment level can advise members on how to best bargain for extra payments, based on the experience of other members. Second, unions provide members with legal and financial guidance, enabling them to take a firmer stance in negotiations with employer representatives. Third, union members can enhance their bargaining power by coordinating their behaviour in negotiations about individual bonuses. Finally, trade unions can support their members if conflicts arise because they ask for extra bonuses or a higher amount. If the ensuing individual bargaining power effect will be stronger or less pronounced in an establishment covered by collective negotiations is difficult to anticipate because individual bargaining power may be enhanced or mitigated by collective negotiation strength.

Overall, given the three mechanisms, we hypothesise that a trade union member has a higher probability of obtaining a bonus payment, receives a larger number of bonuses, and higher total payments than a comparable non-member. A priori, it seems ambiguous if and how collective bargaining alters the impact of union membership on bonus payments.

4 Data and Methods

4.1 Data and Variable Construction

For our empirical investigation, we use the Socio-Economic Panel (GSOEP, version 37), which is an annual representative household panel study of the German population. It commenced in 1984 and by now surveys up to 14,000 households and 30,000 individuals in each wave (The SOEP Group, 2021).

Dependent Variables The information about bonus payments is derived from the subsequent question put to all employees in basically all relevant waves: "Did you receive any of the following bonuses or extra pay from your employer last year? If yes, please state the gross amount." The possible answers are: Christmas bonus, 13^{th} salary, 14^{th} salary, vacation bonus, other bonuses and profit-sharing payments.[8]

We use the answers to establish a number of dependent variables. The dummy variable $B_{i,t}$ measures the incidence of bonus pay and, therefore, takes the value of one if individual i

[8]Christmas and vacation bonuses are voluntary payments. They usually constitute a predetermined percentage of the monthly salary to reward employee loyalty and are frequently restricted by wage agreements or corporate policies. These payments may be subject to certain restrictions concerning, for example, the length of service or repayments if the employee quits. From an accounting perspective, Christmas and vacation bonuses are classified as special payments and are typically discretionary, though legal precedents may allow employees to claim them if provided consistently (*Betriebliche Übung*). 13^{th} and 14^{th} salaries are similar but constitute a part of regular compensation, are computed as a full month's wage and can usually not be reclaimed if the employee leaves the employer (Brumund, 2022; Hensche, 2022; Himmelreicher and Ohlert, 2023; IHK, 2024).

has obtained at least one bonus in year t, and zero otherwise. We denote the number of bonus payments an employee i obtains in year t by $n_{i,t}$. We also consider various dimensions of the magnitude of bonuses. First, we calculate the total amount of bonus payments per annum, $A_{i,t}$, including also cases of no payments, such that the minimum of $A_{i,t}$ is zero. Furthermore, we will look at the average bonus payment, which equals $A^{av}_{i,t} = A_{i,t}/(n_{i,t}) > 0$ for $n_{i,t} > 0$ and $A^{av}_{i,t} = 0$ for $n_{i,t} = 0$. In our empirical analysis, we include the logarithms of $A_{i,t}$ and $A^{av}_{i,t}$. For observations with zero bonus payments, we define the logarithms of $A_{i,t}$ and $A^{av}_{i,t}$ as 0.[9] Finally, we look at the bonus intensity, $I_{i,t} = A_{i,t}/y_{i,t}$, defined as the total amount of bonus payments, $A_{i,t}$, relative to employee i's monthly gross income, $y_{i,t}$.[10] Because the bonus information refers to the previous year, we use the answers from year $t+1$ to construct the bonus variables in t. Moreover, all payments are deflated using the consumer price index with 2010 as the base year.

We consider a large variety of outcomes because their investigation allows us to provide a comprehensive picture of the relationship between union membership and bonus payments. Furthermore, as highlighted in Sub-section 3.2, trade union membership may not affect all outcomes alike. The incidence of bonuses is an important measure because it captures the change in the probability of receiving at least one payment. It allows us to evaluate whether union membership alters access to bonus payments in the first place. Additionally, informational advantages in relation to bonuses that comparable workers obtain may apply to the type of payment, but not necessarily to its amount. It is further conceivable that the bargaining power effect of union membership differs according to whether negotiations take place over a payment per se, or the level of a payment. For these reasons, we pay attention to the number of bonuses and the incidence of particular types. The amount of bonuses is arguably the most important economic measure, as it reflects the monetary value associated with union membership. Finally, the bonus intensity can provide information on whether any membership impact on bonus payments is accompanied by wage adjustments and, therefore, bonuses represent a complement to or substitute for wage increases.

We focus on the Christmas bonus, 13$^{\text{th}}$ and 14$^{\text{th}}$ salary, vacation bonus, and the residual bonus category. We do not consider profit-sharing payments. First, the five types of bonus payments listed above are generally unrelated to performance, distinguishing them from profit-sharing payments. Second, profit sharing is usually applied to the entire firm or all employees of a certain type and, therefore, is less likely to be subject to an individual employee's influence. Third, profit-sharing payments are often intended to align the staff's interests with those of the

[9] Chen and Roth (2024) point out that findings for variables that contain a lot of zeros such as $A_{i,t}$ and require the normalisation of zero amounts can be sensitive to the units in which $A_{i,t}$ is measured. We take up this issue in Sub-section 5.2.

[10] The survey question is: "What did you earn from your work last month? Please state both: gross income, which means income before deduction of taxes and social security and net income, which means income after deduction of taxes, social security, and unemployment and health insurance. If you received extra income such as vacation pay or back pay, please do not include this. Please do include overtime pay."

company and to provide a direct financial incentive for employees to increase the company's profits. Therefore, they differ qualitatively from non-performance-oriented bonuses, such as vacation or Christmas pay. We consider the validity of these arguments in a robustness analysis in Sub-section 5.2.

Independent Variables The main independent variable is a dummy that takes the value one if a respondent reports being a member of a trade union and zero otherwise. The respective question was included at irregular intervals, namely in 1985 and 1989 in former West Germany, in 1990 in Eastern Germany and in 1993, 1998, 2001, 2003, 2007, 2011, 2015, and 2019 throughout the then re-united country.

We include a large set of further control variables. Socio-demographic information relates to gender, the number of children in the household, marital status, age, age squared, years of education, and the federal state of residence. We control for labour market characteristics by including 10 broad industry (based on 1-digit NACE levels) and 9 occupation (ISCO88, 1-digit) dummies, a public sector dummy, as well as controls for company size, tenure, tenure squared and average working hours per week. For a subset of waves with union membership information, namely 2015 and 2019, the GSOEP data contains information on collective wage agreements. Furthermore, in 2001, 2011, and 2019, the GSOEP enquires about the existence of a works council, or its public sector equivalent. Using this information, we create a dummy variable "collectively wage agreement" ($CB_{i,t}$), which is equal to one if the respondent i worked in an establishment covered by collective bargaining in year t, and zero otherwise,[11] and another dummy ($WC_{i,t}$) that takes the value of one if respondent i stated that a works council exists at their place of work in t, and zero otherwise.

Estimation Sample Because the 1990 wave contains no information on bonus payments in Eastern Germany, the estimation sample consists of the remaining ten waves in the GSOEP that include information on union membership. We exclude self-employed respondents and focus on employees between the ages of 15 and 67. After removing 33,923 observations with missing values, we obtain an estimation sample consisting of 71,561 observations and 32,416 individuals. 17,375 of those individuals are observed at least twice, with 2,874 employees who either joined or left a trade union at some stage, and 14,511 who never changed their union status. When taking into account information about collective bargaining coverage, respectively

[11] In 2015, respondents were asked whether they were paid according to a legally binding company wage agreement, a collective wage agreement that was not legally binding, or a legally binding collective wage agreement. They could also indicate that their job was exempt from the collective wage agreement in place where they worked, or that there was no collective wage agreement. In 2019, the questionnaires asked simply whether the respondent was "paid according to a collectively agreed wage agreement." Therefore, the collective bargaining dummy is set equal to one if respondents answered "Yes" in 2019, or gave one of the first three responses in 2015.

works councils, the estimation sample shrinks to 19,058 observations from 14,256 individuals, respectively 25,310 observations from 20,171 individuals. Summary statistics for the estimation sample (Table 1) reveal that union members, when compared to non-members, are more likely to be men and married, to work in the public sector, for larger companies, and in specific industries, like manufacturing, are older and less educated, work longer hours, and have been with the company for a longer time.

Table 1: Sample Overview - TU Members vs. Non-TU Members

	(1)	(2)	(3)	(4)	(5)	(6)
	$TU_{i,t}=0$		$TU_{i,t}=1$			
Panel A: Numerical and Binary Variables						
	Mean	Std. Dev.	Mean	Std. Dev.	Diff. in Means	p-value
female	0.48	0.50	0.32	0.46	-0.17	0.00
age	40.72	11.93	43.23	11.20	2.51	0.00
years of education	12.21	2.64	11.78	2.36	-0.43	0.00
married	0.55	0.50	0.63	0.48	0.07	0.00
children	0.57	0.89	0.56	0.87	-0.02	0.11
average working hours	37.81	12.16	39.75	8.37	1.94	0.00
tenure	9.58	9.59	14.84	11.00	5.25	0.00
public sector	0.25	0.44	0.36	0.48	0.11	0.00
N	57,061		14,500			
Panel B: Categorical Variables (more than 2 levels)						
	N	Pct.	N	Pct.	X-Squared	p-value
Company Size					4,087.7	0.00
< 20	15,353	26.9	1,073	7.4		
20-199	17,125	30.0	3,318	22.9		
200-1999	12,048	21.1	4,083	28.2		
≥ 2000	12,535	22.0	6,026	41.6		
Industry					3,196.8	0.00
Agriculture	830	1.5	72	0.5		
Energy	449	0.8	238	1.6		
Mining	101	0.2	189	1.3		
Manufacturing	13,711	24.0	5,640	38.9		
Construction	3,905	6.8	614	4.2		
Trade	8,883	15.6	1,041	7.2		
Transport	2,262	4.0	1,356	9.4		
Bank, Insurance	2,379	4.2	310	2.1		
Services	23,061	40.4	4,634	32.0		
Other	1,480	2.6	406	2.8		

Notes: This table presents summary statistics for socio-economic and labour market characteristics, using survey weights. The statistics are shown for trade union members in columns (1) and (2) and for non-union members in columns (3) and (4). Column (5) shows the difference in means between columns (1) and (3) and the corresponding p-values are displayed in column (6). Panel A presents summary statistics for numerical and binary variables. Panel B shows results for variables with multiple levels and displays the proportion of each category for union members and non-members. The sample is based on GSOEP data from 1985-2019. To save space, some control variables are in the estimation sample but not shown in the table. Excluded variables are: age squared, tenure squared, 9 occupation dummies (ISCO88, 1-digit), 5 employment status dummies, 16 residence state dummies, and year dummies.

4.2 Methodology

In order to make inferences about the relationship between union membership and bonuses, we employ OLS specifications. The outcome variables of interest are the incidence ($B_{i,t}$), the number ($n_{i,t}$), logged amounts ($A_{i,t}$ and $A^{av}_{i,t}$), and intensity ($I_{i,t}$) of bonuses of individual i in

year t. We extend both models and use the panel structure of the data by including individual fixed effects (FE) to account for time-invariant worker characteristics. In all our specifications, the standard errors are clustered at the individual level unless stated otherwise.

We estimate the following equation:

$$S_{i,t} = \beta_1 + \beta_2 TU_{i,t} + \beta_3 X'_{i,t} + \lambda_i + \lambda_t + \varepsilon_{i,t}, \tag{1}$$

where $S_{i,t}$ stands for the outcome variables $B_{i,t}$, $n_{i,t}$, $log(A_{i,t})$, $log(A^{av}_{i,t})$ and $I_{i,t}$. $TU_{i,t}$ is a dummy variable that indicates trade union membership status, $X'_{i,t}$ is a vector of control variables (see Sub-section 4.1), and λ_i and λ_t are dummies for individual and time FE, respectively. The coefficient of interest is denoted by β_2.[12]

To analyse the outcome variable $n_{i,t}$ in more depth and to account for its non-continuous nature, we additionally estimate a multinomial logit model. This approach enables us to predict the probability of an individual receiving a specific number of bonus payments, given their trade union membership status.

5 Results

In this section, we present our results. Sub-section 5.1 includes descriptive evidence and Sub-section 5.2 the regression results for the outcomes specified in Sub-section 4.2. Sub-section 5.3 examines the FE-models in greater detail. Sub-sections 5.4 and 5.5 scrutinise the potential reasons for an effect of union membership on bonus payments as considered in Sub-section 3.2, by examining employee heterogeneity and the role of labour market institutions. In Sub-section 5.6, we outline the IV-approach. Lastly, Sub-section 5.7 analyses potential substitution effects between bonus payments and base wages.

5.1 Descriptive Evidence

Table 2 depicts the means and standard deviations for all dependent variables defined in Sub-section 4.1 for non-members (in columns 1 and 2) and members (in columns 3 and 4). Column 5 focuses on differences in mean values and column 6 on its statistical significance. Panel A displays the descriptive statistics of the full sample, while Panel B focuses on a conditional sample, namely those individuals who receive at least one bonus.

Panel A of Table 2 shows that union members obtain at least one of the five bonuses with a probability of 83% (complementary probability to Dummy($n_{i,t} = 0$)). This probability is sig-

[12] For robustness purposes, we additionally estimate probit specifications for the outcome variable $B_{i,t}$, including individual FE and correcting for a potential incidental parameter problem (see Fernández-Val (2009)). All results align with the OLS specifications and can be obtained from the authors upon request.

Table 2: Summary Statistics - TU Members vs. Non-TU Members

	(1)	(2)	(3)	(4)	(5)	(6)
	$TU_{i,t}$= 0		$TU_{i,t}$= 1			
	Mean	Std. Dev.	Mean	Std. Dev.	Diff.	p-value
Panel A: Full Sample						
Number of Bonuses						
$n_{i,t}$	1.11	0.91	1.50	0.83	0.39	0.00
Dummy($n_{i,t} = 0$)	0.33	0.47	0.17	0.38	-0.16	0.00
Dummy($n_{i,t} = 1$)	0.25	0.43	0.20	0.40	-0.05	0.00
Dummy($n_{i,t} = 2$)	0.39	0.49	0.59	0.49	0.19	0.00
Dummy($n_{i,t} = 3$)	0.02	0.15	0.04	0.19	0.01	0.00
Dummy($n_{i,t} = 4$)	0.00	0.03	0.00	0.06	0.00	0.01
Dummy($n_{i,t} = 5$)	0.00	0.01	0.00	0.00	0.00	0.08
Level and Intensity of Bonuses (unconditional)						
$A_{i,t}$	1551.80	2195.98	2144.65	2017.78	592.86	0.00
$A^{av}_{i,t}$	944.28	1371.74	1206.36	1132.63	262.08	0.00
$I_{i,t}$	0.59	0.66	0.78	0.59	0.19	0.00
Incidence						
Christmas Bonus	0.39	0.49	0.47	0.50	0.08	0.00
13th Salary	0.25	0.44	0.35	0.48	0.09	0.00
Vacation Bonus	0.43	0.50	0.64	0.48	0.21	0.00
14th Salary	0.02	0.14	0.02	0.13	0.00	0.19
Other Bonus	0.02	0.15	0.02	0.15	0.00	0.83
Observations	57,061		14,500			
Panel B: Conditional Sample ($A_{i,t} > 0$)						
Amount						
Total	2325.26	2329.69	2584.00	1941.70	258.75	0.00
Christmas Bonus	1131.77	1073.95	1339.52	992.06	207.75	0.00
13th Salary	2585.59	1588.61	2453.13	1241.55	-132.47	0.00
Vacation Bonus	780.96	856.74	844.69	817.64	63.72	0.00
14th Salary	3166.10	1784.66	3061.99	1530.93	-104.11	0.41
Other Bonus	2465.95	8668.36	1394.53	2791.18	-1071.42	0.00
Observations	36,245		11,858			

Notes: This table presents summary statistics for the incidence (Dummy($n_{i,t} > 0$)), number ($n_{i,t}$), level ($A_{i,t}$, $A^{av}_{i,t}$) and intensity ($I_{i,t}$) of bonus payments, using survey weights. $A_{i,t}$ indicates the total gross yearly bonus amount, $A^{av}_{i,t}$ the amount per bonus, i.e. $A_{i,t}/n_{i,t}$ and $I_{i,t}$ is the yearly bonus normalised by monthly gross earnings. The bonus amounts are displayed in Euro and deflated using the consumer price index with base year 2010. Panel A shows results for the full sample and Panel B for observations with positive bonus amounts. The statistics are shown for trade union members in columns (1) and (2) and for non-union members in columns (3) and (4). Column (5) shows the difference in means between columns (1) and (3) and the corresponding p-value is shown in column 6. The sample is based on GSOEP data from 1985-2019.

nificantly higher than the corresponding probability of 67% for non-members and indicates an effect at the extensive margin. Moreover, a union member obtains on average 1.5 bonus payments per annum, whereas a non-member receives around 1.1 bonuses. Table 2 further clarifies that the higher average number is due to two features: First, union members are less likely to obtain no bonus at all and, second, more likely to receive exactly two bonuses. Furthermore, union members are paid higher total ($A_{i,t}$) and average ($A^{av}_{i,t}$) bonuses than non-members. These differences are not due to higher wages, which can affect wage-dependent bonuses, as union members report a significantly higher bonus intensity (+0.19), as well. The probabilities of

receiving a Christmas bonus (+8 percentage points), a 13th salary (+9 percentage points), and vacation pay (+21 percentage points) are substantially higher for union members.[13]

To shed light on the effects associated with membership occurring at the intensive margin, Panel B of Table 2 shows differences for the bonus amounts, conditional on positive payments ($A_{i,t} > 0$). On average, union members report higher Christmas (+€207.75) and vacation bonuses (+€63.72) and a lower 13th salary (-€132.47) and smaller other bonuses (-€1071.42).

In line with our expectations, the descriptive evidence suggests that union members obtain bonus payments more often, a higher amount on average and, therefore, a greater amount of bonuses. Additionally, the sum of bonus payments relative to total gross income exceeds the respective fraction for non-members. Finally, the union effect is not the same for all types of bonuses.

One may be concerned that the descriptive evidence presented thus far measures the impact of other labour market institutions correlated with trade union membership, such as collective bargaining or co-determination via works councils. Since information on these institutions is available for subsamples only, we look at the outcome variables depicted in Panel A of Table 2 separately for employees covered by a collective bargaining agreement and those working in an establishment in which a works council exists (see Table A1 in the Appendix). While the differences in outcomes are less pronounced, we still observe that union members receive bonuses more frequently and obtain higher amounts. Therefore, the descriptive evidence suggests that a union membership bonus effect is not due to union members being more often covered by a collective bargaining agreement or represented by a works council than non-members. In Sub-section 5.5, we will further discuss the role of collective bargaining and works council.

5.2 Main Findings

In this sub-section, we analyse whether the tentative conclusions based on the descriptive evidence continue to hold when taking into account other determinants of bonuses and, additionally, time-invariant unobservable characteristics of employees.

Incidence of Bonus Payments Table 3 indicates that the probability of obtaining at least one bonus is about 15% higher for union members than non-members when accounting for time and regional FE. When adding control variables, the difference shrinks to around 5%. In the final specification, including individual FE, the difference is approximately 4%. Since about 70% of all employees receive at least one bonus, this union membership effect is sizeable. Turning to other control variables, the estimates of the model including individual FE (see Table A2, column 2 in the Appendix) suggest that the likelihood of receiving bonuses increases

[13] These numbers are qualitatively comparable, though somewhat lower than those published by trade unions in recent years, based on the non-representative survey 'Lohnspiegel'.

as individuals have more tenure, work more hours, for larger companies, in the public sector, and are full-time employed. Conversely, being married and having more children is negatively associated with receiving bonuses.[14]

Table 3: TU Membership and the Incidence of Bonus Payments

	(1)	(2)	(3)
$TU_{i,t}$	0.148***	0.046***	0.043***
	(0.005)	(0.005)	(0.007)
Residence & Year FE	X	X	X
Other Control Variables		X	X
Individual FE			X
Observations	71,561	71,561	71,561
R^2	0.094	0.217	0.731
Within R^2			0.082

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the incidence of bonus payments ($B_{i,t}$) using OLS models. The observation period ranges from 1985 to 2019. The control variables are the same as displayed in Table 1 and its note. Robust standard errors (clustered at the individual level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

When we separately estimate FE models for each of the five types of bonuses, we find that the probability of receiving such a payment differs between union members and non-members in the case of Christmas and vacation bonuses, with union members being 3.1% and 3.6% more likely to receive them, respectively (see Panel A of Table A3 in the Appendix). For the 13th salary, we observe a marginally significant difference. There is no significant correlation between union membership and the incidence of profit-sharing payments (see the last column of Table A3 in the Appendix). This outcome is consistent with our claim that profit-sharing payments are distinct from the other (less performance-oriented) bonus components and less likely to vary with union membership.

Number of Bonus Payments Table 4 (Panel A) shows that a union member attains on average 0.09 more bonuses per year when accounting for observable and time-invariant unobservable individual characteristics. To take into consideration explicitly the count-structure of the dependent variable, we also estimate a Poisson model. It generates findings comparable to the OLS specification (see Table A4 in the Appendix). Comparing the findings depicted in Table 4 (Panel A) with the descriptive evidence (Table 2) clarifies that a substantial part of the raw difference of 0.4 bonuses is due to the fact that other determinants of bonuses vary between members and non-members. Nonetheless, having 0.09 more bonuses per year, given an average number of 1.2 bonuses in the entire sample, constitutes an economically relevant rise of 7.5%.

[14]Coefficients for industries, occupations, residence, and years are not displayed in Table A2 in the Appendix. We find a higher incidence of bonus pay in manufacturing and banking-related industries, in high-skilled white-collar occupations, in Western Germany, and in earlier survey years. In all upcoming tables, we only show the trade union coefficients of interest, to save space. The full outputs can be obtained from the authors upon request.

Table 4: TU Membership and the Number of Bonus Payments

Panel A: OLS Specifications

	(1)	(2)	(3)
	$n_{i,t}$		
$TU_{i,t}$	0.324***	0.109***	0.086***
	(0.010)	(0.010)	(0.014)
Residence & Year FE	X	X	X
Other Control Variables		X	X
Individual FE			X
Observations	71,561	71,561	71,561
R^2	0.13429	0.26518	0.74603
Within R^2			0.11079

Panel B: Multinominal Logit Model

	(1)	(2)
	Change Log-Odds	Marginal Effect
$n_{i,t} = 0$		-0.056***
		(0.000)
$n_{i,t} = 1$	0.272***	0.010***
	(0.013)	(0.004)
$n_{i,t} = 2$	0.395***	0.044***
	(0.014)	(0.004)
$n_{i,t} = 3$	0.310***	0.001***
	(0.002)	(0.000)
$n_{i,t} = 4$	0.310***	0.000***
	(0.000)	(0.000)
$n_{i,t} = 5$	0.430***	0.000***
	(0.000)	(0.000)
Observations	71,561	71,561

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the number of bonus payments ($n_{i,t}$). Panel A presents OLS specifications, while Panel B presents results from a multinomial logit model. The control variables are the same as displayed in Table 1 and its note. The observation period ranges from 1985 to 2019. Robust standard errors (clustered at the individual level) are shown in parentheses.

* p < 0.1, ** p < 0.05, *** p < 0.01

A multinomial logit model (Table 4, Panel B) reveals that the "number effect" is non-linear. More precisely, the probabilities of receiving no bonus are 5.6% lower for union members than non-members, while the probabilities of having exactly one, respectively two and three bonuses are about 1%, respectively 4.4% and 0.1%, higher. Estimating a linear probability model (see Table A5 in the Appendix) yields comparable findings. The results are, moreover, consistent with the descriptive evidence - with the exception of the probability of obtaining exactly one bonus.

All in all, we obtain robust evidence of a positive, albeit non-linear relationship between an employee's union membership and the number of bonus payments received.

Amount of Bonus Payments Table 5 documents our findings relating to the various indicators of the level of bonus payments. Columns 1-3 show that a union member obtains a significantly higher amount of bonus payments than a non-member. Columns 4-6 and 7-9 furthermore clarify that union members receive a higher payment per bonus and relative to their monthly income. The finding concerning the intensity suggests that bonus payments and wages are no full complements in that membership has an impact on bonuses and wages of equal (percentage) magnitude. In this case, the bonus intensity, $I_{i,t}$, would not vary with union membership.

Often, estimated coefficients for explanatory variables in specifications with logged values of dependent variables are interpreted as percent changes. However, in our specification we assume that $log(A_{i,t} = 0) = 0$ and $log(A^{av}_{i,t} = 0) = 0$. Wooldridge (2016, p. 171) highlights that using $\log(1+y)$ and interpreting the estimates as if the variable were $\log(y)$ is only acceptable when the data for y contains relatively few zeros, which is not the case in our sample (see Sub-section 5.1). Furthermore, Chen and Roth (2024) demonstrate that the magnitude of the estimated coefficients for right-hand-side variables, such as the union membership dummy,

Table 5: TU Membership and the Level of Bonus Payments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variables	$log(A_{i,t})$			$log(A^{av}_{i,t})$			$I_{i,t}$		
$TU_{i,t}$	1.28***	0.379***	0.336***	1.16***	0.336***	0.309***	0.141***	0.042***	0.046***
	(0.037)	(0.036)	(0.052)	(0.034)	(0.033)	(0.049)	(0.007)	(0.007)	(0.010)
Residence & Year FE	X	X	X	X	X	X	X	X	X
Other Control Variables		X	X		X	X		X	X
Individual FE			X			X			X
Observations	71,561	71,561	71,561	71,561	71,561	71,561	71,561	71,561	71,561
R^2	0.109	0.273	0.759	0.100	0.261	0.752	0.091	0.202	0.704
Within R^2			0.101			0.092			0.062

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the level of bonus payments, based on OLS models. The outcome $log(A_{i,t})$ (columns 1-3) indicates the logarithm of the total gross yearly bonus amount, $log(A^{av}_{i,t})$ (columns 4-6) is the logarithm of the amount per bonus, i.e. $A_{i,t}/n_{i,t}$ and $I_{i,t}$ (columns 7-9) is defined as the yearly bonus normalised by monthly gross earnings. The observation period ranges from 1985 to 2019. The control variables are the same as displayed in Table 1 and its note. Robust standard errors (clustered at the individual level) are shown in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

may be sensitive to such a transformation of the dependent variable because the normalisation creates an arbitrary distance between zeros and the lowest (positive) bonus amounts, which depends on the unit of measurement.[15]

To provide treatment effects that are interpretable as percentage changes, Chen and Roth (2024) suggest using a Poisson quasi-maximum likelihood estimator.[16] When utilising this estimator for $A_{i,t}$ and $A^{av}_{i,t}$ as outcomes, the estimated coefficients in the FE specifications (see columns 2 and 4 in Table A6 in the Appendix) translate into an increase for trade union members of exp(0.089) - 1 = 9.3% in $A_{i,t}$ and exp(0.078) -1 = 8.1% in $A^{av}_{i,t}$.

Given an average total amount of bonus payments of €1552 for an employee who does not belong to a trade union (see Table 2, Panel A), the difference between members and non-members equals around €144 (0.093 x €1552). To put this number into perspective, we can note that a total premium of €144 equals about 50% of the trade union membership fee of one percent of the gross income of an average employee in our sample who earns about €29,200 annually. Concerning the average amount per bonus, our estimates suggest an increase for union members by €76 (0.081 x €944).

It should be noted that the aggregate bonus measure calculated using a quasi-Poisson regression includes both an extensive and intensive margin effect. Looking merely at the extensive margin, an increase in the likelihood of 4.3% of receiving a bonus would imply a gain

[15] If we change the units of measurement from €1 to €1,000 or to €0.01, i.e., cents, the estimated coefficients and, hence, the percentage variations change drastically. For instance, the respective coefficients for $log(A_{i,t})$ denote at 0.055 for bonuses measured in €1,000 and 0.535 for bonuses expressed in cents.

[16] Chen and Roth (2024) list two other objectives with different solutions when dealing with logged data that contains many zeros. First, capture concave preferences for the outcome of interest. Second, compare the magnitude of the extensive and intensive margins. In this study, the primary objective is to determine percentage changes in $A_{i,t}$ and $A^{av}_{i,t}$ in order to ascribe a more precise monetary value to the trade union premium.

for union members of €67, given the average bonus pay for non-members of €1552.[17] When restricting the sample to observations that have positive bonus outcomes, we find positive and significant coefficients in specifications with the total amount of bonuses ($log(A_{i,t}|A_{i,t} > 0)$) and the average bonus level ($log(A^{av}_{i,t}|A^{av}_{i,t} > 0)$) as dependent variables (see Table A7 in the Appednix). Based on the FE specification, the estimated coefficient of 0.033 for $log(A_{i,t}|A_{i,t} > 0)$ implies a premium of about €70 at the intensive margin, given total bonus payments of €2325 for non-members (see Table 2, Panel B, conditional sample). Consequently, our results indicate that both the extensive and intensive margins contribute to the overall premium. The sum of the union membership 'premia' at the extensive and intensive margin (€67 + €70) is quite close to the value suggested by the (combined) Poisson estimator (€144).[18]

When we look at the different types of bonuses, the OLS models including individual FE indicate that union members are paid higher Christmas and vacation bonuses and a larger 13th salary than non-members (see Panel B of Table A3 in the Appendix). The results are consistent with findings reported above that union members benefit from a first or second bonus, because a 14th salary or other bonuses are more likely to constitute a third or fourth bonus for which we observe no difference between union members and non-members.[19] Again, the specifications with profit-sharing payments as dependent variable display insignificant estimated coefficients for the union membership dummy.

In sum, our analysis provides strong evidence that trade union members obtain bonus payments more often than comparable non-members and that they are paid higher levels. For the remainder of the paper, we will focus on three outcomes, namely the probability of receiving any bonus, $B_{i,t}$, the number of bonuses, $n_{i,t}$, and the amount, $log(A_{i,t})$. We do so because our above analyses clarify that these three dependent variables fully reflect the consequences of union membership on bonus payments.[20] For $log(A_{i,t})$, we provide findings from linear estimations, as we are subsequently interested primarily in the question of whether there exists a positive correlation with membership but not its quantitative strength.[21]

[17] In an alternative specification, we use the probability of obtaining at least the average bonus as an outcome and obtain similar results. The findings can be obtained upon request. This also applies to all estimates subsequently referred to in the main text but documented neither in the text nor the appendix.

[18] We note the limitations associated with such two-part specifications and logged transformed outcomes highlighted by recent literature (Chen and Roth, 2024; Mullahy and Norton, 2024). Hence, the results on the strength of extensive and intensive margins should be viewed as suggestive.

[19] For instance, in the group of individuals reporting exactly two bonus payments, 14th salaries (other bonuses) only appear in 2.7% (1.3%) of the cases.

[20] Furthermore, we estimate a) specifications for the main outcome variables considered so far and include survey weights and b) the subsequent specifications for outcome variables $A^{av}_{i,t}$ and $I_{i,t}$. The results are qualitatively comparable with previous findings.

[21] Note that the significance levels remain similar regardless of whether we employ linear or Poisson models.

5.3 Taking a closer look at the FE results

In our presentation of results, we have focused on FE models. The interpretation of the estimated coefficients relies on the assumption that a change in an individual's union membership status over time gives rise to a variation in bonus payments. This starting point deserves scrutiny for at least two reasons: First, it is conceivable that when individuals join or leave a trade union, they also change their employer or job. If a firm or occupation change results in a variation in bonus payments, the estimated trade union membership coefficient may partially capture the features of the new enterprise or profession. In the specifications considered thus far, we have accounted for this possibility indirectly by including linear and quadratic tenure indicators as covariates. Second, the bonus impact of joining a trade union may differ from the impact of leaving it. The models estimated up to now presume a symmetrical effect. If that assumption is not justified, the estimated coefficient on the union membership dummy is likely to understate the impact of one type of change and exaggerate the effects of the other. To cater for both possibilities, we take a closer look at individuals who change their firm or occupation on the one hand and at those who join or leave a trade union on the other hand.

Switching the Firm or Occupation We define a firm switch dummy, which equals 1 if the reported years of tenure do not correspond to the previous interview's tenure plus the number of years that have passed since then.[22] Furthermore, if the 4-digit ISCO classification differs from the previously reported one, the occupation switch dummy is set to 1. Using these classifications, we observe 8,979 firm and 17,137 occupation switches.[23] 1,024 (1,758) of the employer (occupation) changes take place during a time period during which an individual also alters the union membership status. Since we observe 3,728 changes in union status, a sizeable fraction of them occurs at about the same time as a firm or occupation switch takes place.[24]

To disentangle the effects due to a variation in union membership status from the impact of firm or occupation changes, we pursue a number of approaches: First, when estimating the relationship between union membership and the incidence of bonus payments, $B_{i,t}$, the number of bonuses, $n_{i,t}$, and the amount, $log(A_{i,t})$, we exclude those observations from the sample for which we observe a change in the employer or occupation between two waves containing information on union membership. Including only firm stayer observations (Table 6, Panel

[22] To estimate the exact passage of time, we additionally use information on the interview month. This requirement reduces the number of observations by 402.

[23] Firm switchers in our sample have on average shorter tenure (5.37 vs. 13.1 years), are less likely to be married (57% vs. 65%), work similar hours per week (37.5 vs. 37.8), and are more likely to be female (50% vs. 47%) than those who never switch firms. Concerning occupations, the differences in characteristics are negligible with the exception of occupation switchers who are less likely to be female (45% vs. 50%) than non-switchers.

[24] Given that the union membership question is asked on average every three to four years, an individual who has changed the firm (or occupation) during the relevant time period may have switched the firm (occupation) multiple times or at a different point in time than joining or leaving the trade union.

A, columns 1-3) and occupation stayer observations (Table 6, Panel A, columns 4-6) in our main estimations, the estimated coefficients for the union membership dummy remain positive and significant in all the specifications. Importantly, the coefficients do not differ statistically from those reported in Tables 3, 4 and 5. This indicates that the estimated union membership coefficient in the FE models does not capture firm or occupation effects on bonus payments.

Table 6: TU Membership and Bonus Payments: Switching Firms or Occupations

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variables	$B_{i,t}$	$n_{i,t}$	$log(A_{i,t})$	$B_{i,t}$	$n_{i,t}$	$log(A_{i,t})$
Panel A						
Sub-Sample	Firm Stayer			Occupation Stayer		
$TU_{i,t}$	0.031***	0.069***	0.254***	0.028***	0.061***	0.226***
	(0.008)	(0.016)	(0.056)	(0.009)	(0.018)	(0.066)
Observations	62,180	62,180	62,180	54,022	54,022	54,022
R^2	0.796	0.814	0.797	0.817	0.836	0.820
Within R^2	0.068	0.104	0.084	0.070	0.106	0.090
Panel B:						
Sub-Sample	Union Joiner			Union Leaver		
$TU_{i,t}$	0.045***	0.074***	0.362***	0.055***	0.128***	0.416***
	(0.013)	(0.026)	(0.093)	(0.013)	(0.026)	(0.097)
Observations	63,641	63,641	63,641	64,122	64,122	64,122
R^2	0.748	0.763	0.775	0.746	0.761	0.773
Within R^2	0.076	0.103	0.094	0.083	0.111	0.100

Notes: The Table shows the relationship between trade union membership ($TU_{i,t}$) and the incidence, number and level of bonus payments in different sub-samples using OLS specifications. Panel A includes samples restricted to observations without a change in firm (columns 1-3) or occupation (columns 4-6). Panel B displays results for sub-samples where trade union leavers (columns 1-3) or joiners (columns 4-6) are excluded. Additional control variables are the same as displayed in Table 1 and its note. All specifications include individual FE. The observation period ranges from 1985 to 2019. Robust standard errors (clustered at the individual level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Second, we estimate our main specifications by adding the above-defined firm or occupation switcher dummy (see Table A8 in the Appendix). Subsequently, we also include an interaction term for trade union membership and a recent firm or occupation switch. All specifications show that the estimated union membership coefficients remain significantly positive and do not change in magnitude when controlling for a recent firm or occupation switch. Additionally, the estimated coefficients for the interaction terms are insignificant in all of the specifications. These results support our conclusion that union membership changes do not capture the impact of firm or occupation switches.

Third, we estimate models that use worker-in-firm FE. To do so, we assign each employee a unique ID as long as they remain with the same company. This approach enables us to account for unobserved firm characteristics specific to a worker within a firm that may be relevant even after the initial switch. Fourth, instead of using occupation and industry dummies at the 1-digit level, as we do in our main specifications reported on in Sub-section 5.2, in separate specifications, we include 363 4-digit occupation and 59 2-digit industry dummies to cater for the possibility of unobserved occupation and industry characteristics. Finally, to rule out any longer-lasting switching effects, we focus on samples that are restricted to workers who stay

within the same firm or the same occupation in all of their interviews. In all specifications outlined in this paragraph, the estimated coefficients on the union membership dummy remain positive, significant and comparable in magnitude to the main coefficients displayed in Tables 3 to 5. The findings reported in this paragraph also imply that time-invariant firm characteristics are unlikely to alter the relationship between union membership and bonus payments.

All in all, the various approaches employed to separate the impact of trade union membership changes from the potential effects of firm or occupation switches suggest that the estimated coefficients in the FE model actually describe the consequence of joining or leaving a trade union. Because information advantages due to union membership may be more pronounced for individuals who change their occupation or employer than for employees who remain in well-established working environments, the findings suggest that informational aspects are not decisive for the bonus effect of trade union membership.

Joining versus Leaving the Union To determine if the trade union effect on bonus payments is symmetric, we create two sub-samples: First, we estimate our main specification using a 'Joining' sample, which excludes any employees who quit the union during the observation period. Similarly, in the 'Leaving' sample, all 'Joiners' into the union are removed.[25] Accordingly, the variation in trade union membership in the joining (leaving) sample results from switching from a non-member (member) status to being a member (non-member).[26] We observe similar numbers of entries (1,850) and exits (1,878). Overall, we end up with 63,641 (64,122) observations in the joining (leaving) sample.

The results for entering versus leaving the union reveal significant and positive coefficients in all sub-samples and for all bonus outcomes (see Table 6, Panel B). Furthermore, the coefficients do not statistically differ across the two sub-groups, indicating a symmetric trade union effect. In addition, we conduct the same regressions conditionally on observations with no firm change. Table A9 in the Appendix confirms previous findings with significant and positive estimated coefficients in both sub-samples and for all the bonus outcomes.

Given the scarcity of studies on the impact of union membership on non-performance-oriented bonus payments, it is noteworthy that Gutiérrez Rufrancos (2019), utilising Mexican data, also finds symmetric entry and exit effects on bonus payments for a different industrial relations system.

[25] Joiners in our sample have on average shorter tenure (11.2 vs. 12.2 years), are less likely to be married (62% vs. 67%), work fewer hours per week (38.8 vs. 39.8), and are more likely to be female (44% vs. 38%) than trade union leavers. The first two differences could be attributed to age differences between joiners and leavers (41.1 vs. 42.8 years old). Other observable characteristics show no difference between the sub-samples. Those that never switch union status are on average employed 10.3 years, 41.4 years old, married 62% of the time, work 37.5 hours per week, and with a probability of 48.5% female.

[26] Furthermore, we assume no change in union membership in the first period to maintain a large number of observations. Excluding the first period produces qualitatively comparable findings.

In Sub-section 3.2, we have argued that union members obtain more bonus payments because of special entitlements, since they are better informed and have greater individual bargaining power. While a positive joining effect can be associated with all channels, this may not be true for individuals who leave the union. More specifically, information acquired during membership is less likely to be forgotten once an employee has given up membership. Therefore, the findings depicted in Table 6, Panel B, suggest that the bonus effect of trade union membership is not due to informational advantages.

5.4 Effect Heterogeneity

In this section, we present findings for different sub-groups and consider heterogeneity over time. By doing so, we can shed further light on the mechanisms by which union membership affects bonus payments. If unionisation differs among groups, as indicated by their respective union densities, or over time, and there is a positive correlation between union strength and bonus outcomes, this observation would be consistent with an impact of special entitlements. This is the case because unions are more likely to negotiate extra payments for the predominant group of their members and in times, in which unions are stronger. If trade union membership enhances individual bargaining power and, thereby, bonus payments, we expect no pronounced effect heterogeneity because unions will provide help in negotiations for all members alike and in years with both high and low union density. Similarly, the informational situation is less likely to cause effect heterogeneity because unions generally make information about pay conditions available to their entire membership.

In Germany, males and full-time workers are more likely to be union members than females and part-time workers. Similarly, unionisation is higher among blue-collar, public sector and older workers than among white-collar employees, employees in the private sector and for younger individuals. Historically, union density was higher in the eastern part of the country and has declined over time.[27]

In consequence, we estimate the relationship between union membership and the incidence of bonus payments, $B_{i,t}$, the number of bonuses, $n_{i,t}$, and the amount, $log(A_{i,t})$, separately for males and females, workers who are younger, respectively, equal to or older than the median age of the sample (42 years), full-time and part-time employees, blue- and white-collar workers, those working in the public and the private sector and for residents of western and eastern Germany. We base these estimations on the main sample (see Tables 3 to 5), which is split in line with the subgroups listed above and present findings from FE specifications. To ex-

[27]The union density in our sample is 26% (14%) for males (females), 17% (23%) for younger (older) employees, 21% (7%) for full-time (part-time) workers, 27% (17%) for blue-collar (white-collar) workers, 27% (18%) for the public (private) sector, around 20% in eastern and western Germany. It has fallen from 30% in 1985 to 16% in 2019.

amine the relationship over time, we distinguish between four time spans and estimate a less demanding specification based on interaction terms rather than sub-samples.

Table A10 in the Appendix documents the findings for the subgroup analyses. The estimated coefficients are always positive, but occasionally lose statistical significance especially in smaller subgroups (e.g. part-time, eastern Germany). Therefore, virtually all union members obtain bonuses more often, receive a greater number of bonuses and a higher amount. Additionally, the estimated coefficients are usually not statistically different across subgroups, with the partial exception of younger and older and blue- and white-collar employees. Furthermore, the findings depicted in Table A11 in the Appendix indicate that the relationship does not change over time, as all the interaction coefficients remain insignificant. Consequently, there is no straightforward correlation between the strength of unions among the subgroups and over time, as measured by union density, and the bonus effects. This result aligns with findings by Bonaccolto-Töpfer and Schnabel (2023) who observe that wage premia are not greater for occupations and workers that make up the core of union members. Furthermore, our findings suggest that higher bonus payments for union members are not primarily due to special entitlements. Instead, the heterogeneity analysis is compatible with the hypothesis that union membership can increase the individual bargaining power of employees or provides valuable information.

5.5 The Role of Collective Bargaining and Works Councils

The specifications estimated thus far incorporate information neither about collective bargaining nor works councils as the respective questions are only included in the GSOEP sporadically. Because collective bargaining and co-determination are likely to affect the extent of bonus payments, the initial estimates may be biased. Moreover, one mechanism - special entitlements negotiated for union members only - requires collective bargaining. Finally, the descriptive evidence (see Table A1 in the Appendix) indicates that collective bargaining and co-determination at the establishment-level may weaken the bonus effect of trade union membership.

In order to take such concerns into consideration, we subsequently present results for samples in which information about union membership and collective bargaining coverage for the years 2015 and 2019, and membership and the existence of a works councils in the years 2001, 2011, and 2019 is available. Furthermore, to add robustness and analyse the effect of the combined existence of collective bargaining co-determination, we use a sample including the survey years 2011, 2015 and 2019. We impute data on collective bargaining in 2011 and works council in 2015 for respondents who did not change jobs between the interview years. The former information is from the 2015 survey, while the latter is from the 2016 survey. To account for occupational and industry-specific differences in more detail, we furthermore

include 4-digit occupation and 2-digit industry controls. Given the restricted data availability, we focus on cross-sectional OLS specifications.[28]

In Sub-section 3.1, we document that collective bargaining and works councils coexist in most large firms. Therefore, we also present findings for sub-samples of employees working in establishments with fewer than and 2000 or more employees covering the whole observation period. This makes it possible to indirectly analyse the impact of the combined existence of both institutions over a longer time horizon and in FE specifications.

When re-estimating the cross-sectional models depicted in Tables 3 to 5 for the smaller sub-sample including information about collective bargaining, we obtain qualitatively the same findings as for the main sample (see Table 7, Panel A, columns 1, 4 and 7). Union membership is associated with a higher incidence of and more frequent and higher bonus payments. Moreover, all dimensions of bonus pay are positively correlated with collective bargaining coverage (columns 2, 5 and 8). When adding the information about collective bargaining, the estimated union membership coefficients shrink in size. This finding is consistent with the expectation that collective bargaining mitigates the union membership effect to some extent. Columns 3, 6, and 9 of Table 7, Panel A, clarify that the relationship between trade union membership and bonus payments does not differ between employees working in covered and non-covered establishments, as the interaction terms remain insignificant in all specifications.

The findings for the sample including information about works councils (Panel B of Table 7) are qualitatively similar to the ones for collective bargaining. Works councils are positively associated with bonus payments. However, the union membership effect does not differ for employees working in co-determined establishments and those without a works council.[29]

Finally, in the specifications that directly control for the combined existence of works council and collective bargaining, based on the sample with imputed information on these institutions and more detailed industry and occupation controls (see Table A12 in the Appendix), we also observe significantly positive estimated coefficients for the union membership dummy.

FE specifications differentiating establishments according to the number of employees confirm the interpretation that being unable to explicitly control for the existence of a works council or collective bargaining coverage does not substantially affect our results. We find no significant difference across firm size categories (1-19, 20-199, 200-1999 and $\geq$ 2000) (see Table A13 in the Appendix). Given that in the restricted samples used for the specifications

[28] In the sub-sample including information on collective bargaining (works-council), we observe 1.3 (1.25) observations per person on average (vs 2.2 in the full sample). Furthermore, for 4,802 (4245) individuals with observations in more than one survey year, 374 (410) join or leave the union, 1,012 (609) have a different collective bargaining (works council) outcome, and 99 (117) display a change in both variables at the same time.

[29] In additional specifications, we test whether including respondents working in companies with fewer than 5 employees affects these results because the relevant law states that works councils can be established in establishments with five or more members of staff. In a further specification, we focus on the private sector and exclude public sector employees from the sample. The estimated coefficients for the trade union membership dummy remain qualitatively unaffected.

Table 7: TU Membership and Bonus Payments - The Role of Institutions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Collective Bargaining									
Dependent Variables	$B_{i,t}$			$n_{i,t}$			$log(A_{i,t})$		
$TU_{i,t}$	0.061***	0.021**	0.043*	0.153***	0.086***	0.065*	0.513***	0.204***	0.240
	(0.010)	(0.010)	(0.023)	(0.019)	(0.018)	(0.036)	(0.080)	(0.077)	(0.165)
$CB_{i,t}$		0.249***	0.252***		0.412***	0.409***		1.89***	1.89***
		(0.008)	(0.009)		(0.014)	(0.015)		(0.061)	(0.063)
$TU_{i,t} \times CB_{i,t}$			-0.029			0.026			-0.045
			(0.025)			(0.040)			(0.181)
Observations	19,058	19,058	19,058	19,058	19,058	19,058	19,058	19,058	19,058
R^2	0.141	0.187	0.187	0.169	0.212	0.212	0.174	0.221	0.221
Panel B: Works Council									
Dependent Variables	$B_{i,t}$			$n_{i,t}$			$log(A_{i,t})$		
$TU_{i,t}$	0.050***	0.035***	0.065***	0.116***	0.086***	0.082**	0.402***	0.281***	0.469***
	(0.008)	(0.008)	(0.020)	(0.015)	(0.015)	(0.034)	(0.058)	(0.058)	(0.140)
$WC_{i,t}$		0.121***	0.125***		0.239***	0.238***		0.980***	1.002***
		(0.009)	(0.009)		(0.016)	(0.016)		(0.062)	(0.064)
$TU_{i,t} \times WC_{i,t}$			-0.036*			0.005			-0.229
			(0.021)			(0.038)			(0.152)
Observations	25,310	25,310	25,310	25,310	25,310	25,310	25,310	25,310	25,310
R^2	0.187	0.194	0.194	0.233	0.241	0.241	0.233	0.242	0.242

Notes: This table shows the moderating role of collective bargaining ($CB_{i,t}$) and works council ($WC_{i,t}$) in the relationship between trade union membership ($TU_{i,t}$) and the incidence, number and level of bonus payments using OLS specifications. Panel A presents results for a sample that includes information about collective bargaining, while in Panel B we analyse the role of works council. The survey years cover 2015 and 2019 for samples comprising collective bargaining information and 2001, 2011, 2019 when information on works council is included. The models include the set of control variables displayed in Table 1 and its note. Robust standard errors (clustered at the individual level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

documented in Table 7, smaller companies are substantially less likely to be covered by wage agreements and have a works council (28% and 7%) than larger companies (73% and 91%), the additional estimates further mitigate concerns that the trade union coefficients solely capture the effect of these institutions.

In sum, the results for the sub-samples containing information about labour market institutions in Germany suggest that the union membership effect on bonus pay is an individual one. Again, this is in line with the idea that union membership affects bonus payments via individual bargaining power. Moreover, if higher bonus pay for union members resulted primarily from special entitlements for members in collective bargaining agreements, we would expect that union members obtain greater bonus pay especially if working in firms covered by such agreements. This, however, is not the case. Finally, the informational channel is less likely to be relevant for employees covered by collective bargaining or working in an establishment with a works council because these institutions likely provide all employees with information about bonus payments. This implies that the union membership effect should be lower for employees covered by collective bargaining or co-determination via works councils. Since we do not observe such a difference, our findings do not support the view that informational advantages give rise to higher bonus payments for union members.

5.6 Instrumental Variable Approach

So far, we have presented correlation results. Accounting for individual FE and including information on labour market institutions makes it less likely that our findings are subject to an omitted variable bias. However, there may be time-variant factors, such as work effort or management performance, that are associated with union membership and bonus pay. Moreover, we have argued that more lavish bonus pay for union members may induce employees to join such a labour organisation. To cater for these kinds of endogeneity concerns, it would be desirable to consider the consequences of an exogenous variation in the likelihood of union membership. For the Unites States, for example, certification elections have been employed to determine the impact of unionisation (DiNardo and Lee, 2004; Sojourner et al., 2015). In Norway, a change in the tax treatment of membership fees altered the costs of belonging to a trade union and has been interpreted as the cause of an exogenous variation in union membership (Barth et al., 2020; Dodini et al., 2023). In Germany, there are no certification elections, nor has there been an encompassing change in membership costs. Therefore, we address endogeneity concerns by instrumenting trade union membership.

Our instrument is based, first, on the close relationship between the Social Democratic Party (SPD) and trade unions in Germany. To illustrate this connection, we refer to the feature that throughout its history, the chairperson of the German Trade Union Federation (DGB) was a member of the SPD. Moreover, the largest group of union members in the German parliament (*Bundestag*) traditionally belongs to the SPD. Second, there also is a relatively close association between the environmental party, the *Greens*, and trade unions. For instance, Frank Bsirske, the former chairman of ver.di (the second largest trade union in the DGB), subsequently became a member of the German Bundestag for the Greens. The political connection with SPD and Greens is also reflected in the GSOEP data used in this study, which provides information on personal political tendencies. Respondents were asked which party they lean toward. 67% of trade union members in our sample who responded to the question favoured Social Democrats or Greens; among non-members, this percentage drops to about 50%.

We define our instrument by leveraging opinion polls regarding political tendencies. Specifically, in Germany, the *Sunday question* (see Dimap (2023)) enquires which political party a respondent would vote for if a general election were conducted the following Sunday. It serves as a barometer of current political party popularity and aids in forecasting election outcomes. The information is available on a frequent basis for each of the 16 federal states from 1998 onward, reducing our sample to 38,181 observations. We make use of this information and define the aggregate instrument $z_{i,r,t-1}$ as the average poll results for the SPD and the Greens in the individual's residence state r prior to the interview year, i.e. in $t-1$. The intuition behind the instrument is that when public opinion in a given residence-state supports the left-leaning parties, such as the SPD and the Greens, this may increase the likelihood of individuals joining

a union. Importantly, the exclusion restriction requires that, conditional on other covariates, the aggregate political tendencies have no direct effect on individual bonuses. Given that the *Sunday question* is an opinion barometer at a specific point in time, we argue that a direct effect on individual bonus payments or on new regulations that affect wages is rather unlikely.

Because the main explanatory variable in our setup, trade union membership, is binary, traditional 2SLS models may misspecify the first stage. Therefore, we apply a three-stage estimator (see Wooldridge (2010) and Adams et al. (2009); Dom (2019) for empirical applications) based on the following steps: First, we estimate a probit model with trade union membership on the left and the instrument $z_{i,r,t-1}$ plus the set of control variables $X'_{i,t}$ (see Sub-section 4.1) on the right side of the equation. In the second stage, we regress the trade union membership dummy on the fitted probabilities of stage one and $X'_{i,t}$. Last, we estimate the third stage of the model by regressing the bonus outcomes on the predicted values of the second stage and $X'_{i,t}$. Due to the sample limitation and the demanding IV specification, we focus on cross-sectional models.

Table 8: TU Membership and Bonus Payments in Germany - IV Estimates

	(1)	(2)	(3)	(4)
Dependent Variables	$TU_{i,t}$	$B_{i,t}$	$n_{i,t}$	$log(A_{i,t})$
	Probit	OLS	OLS	OLS
	First Stage	Third Stage		
$z_{i,r,t-1}$	0.0124***			
	(0.0039)			
$TU_{i,t}$		0.016	0.2193**	0.7926*
		(0.058)	(0.1062)	(0.4423)
Observations	38,181	38,181	38,181	38,181
R^2		0.176	0.208	0.219
F-Statistics	10.08			
LR-Test (p-value)	0.0003			

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the incidence, number and size of bonus payments by instrumenting $TU_{i,t}$ with the *Sunday Question* poll result of SPD and Greens on the residence-state-year level. Column 1 shows the first stage results using a probit model, while columns 2 to 4 indicate the third stage results of the 3-step procedure applying linear specifications Wooldridge (2010). The observation period ranges from 1998 to 2019. The models include the set of control variables displayed in Table 1 and its note. Robust standard errors (clustered at the instrument level) are shown in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

In column 1 of Table 8 we present the first stage and in columns 2-4 the third stage for the bonus outcomes $B_{i,t}$, $n_{i,t}$ and $log(A_{i,t})$. The estimated coefficient for the first stage is significant and exhibits the expected, positive sign, indicating that when the SPD and the Greens are supported more strongly in a given state in the year prior to the interview, individuals are more likely to be a trade union member. Moreover, the F-statistic is above the conventional critical threshold of 10.[30] Finally, the findings in the third stage confirm the positive relationship

[30] Given that the literature - to the best of our knowledge - is unclear about the appropriate critical value in probit first-stage estimations, we also tested the linear specification and discovered a similar F statistic exceeding 10. Furthermore, the Likelihood Ratio (LR) test indicates that the instrument is not weak.

between trade union membership and the number and size of bonus payments. The estimated coefficient concerning the incidence shows the expected sign but is not statistically significant.

When the results are compared to specifications using the same sample but the trade union dummy instead of the instrument (see Table A14 in the Appendix), the estimated coefficients for the level and number of bonus payments are smaller, while the coefficient size for the incidence is similar. All estimated coefficients are statistically significant. These results suggest that our baseline estimates for the level and number of bonus payments may be conservative estimates of the true treatment effects. Unaccounted firm-related characteristics and individual characteristics that correlate with union membership and lower bonus payments, for instance, could be captured in the initial trade union coefficient and produce such a downward bias.

To assess the sensitivity of our findings, we additionally include individual fixed effects in our estimations. The findings indicate a significant first stage and positive but statistically insignificant findings for the second stage. Furthermore, in additional specifications, we lag the poll results by one further year. With this, we account for potential reverse causality between the instrument and the endogenous variable, as union membership may influence people's (recent) political opinions. In this specification, we suspect that the current membership status is unrelated to the poll result two years ago. The findings are qualitatively similar to our main findings, but the instrument is weaker, with smaller F-statistics. Last, we run a placebo test, in which we use the incidence and size of profit-sharing payments as outcome. Given the lack of a correlation (see Table A3 in the Appendix), we expect no significant effect in the robustness test. This is indeed the case as we observe no significant relationship between the poll result and either outcome in the second stage.[31]

Overall, because we find weaker results, depending on the estimation strategy and instrument specification, we cannot establish a causal relationship between union membership and bonus payments. However, considering that statistical insignificance could also be due to sample restrictions, consistent positive coefficients in all of the specifications supply additional robustness for our baseline findings.

5.7 Bonuses: A substitute for wages?

Our findings indicate a positive effect of trade union membership on bonuses. However, higher bonus payments may come along with lower wages. The findings for the intensity measure are suggestive of such an effect (see Table 5). If higher bonus payments for members are a substitute for wages or wage increases, the evaluation of the union membership bonus effect would likely be different than if both remuneration components constitute complements or are unrelated. In particular, it would no longer be certain to what extent extra bonus payments could

[31] All of these additional robustness tests can be obtained upon request.

actually pay for the monetary costs of belonging to a trade union. Moreover, a substitutive relationship between bonuses and wages would not be compatible with the hypothesis that union membership enhances individual bargaining power and thereby results in greater bonus payments.

To address this issue, we investigate the correlation between bonus payments and wages. If bonus payments and wages are substitutes, we expect the estimated coefficient for wages in a model with the amount of bonuses as the left-hand side variable to be negative. Such a negative relationship will be observable, especially for union members. The results in Table 9 do not indicate a substitutive relationship, as the estimated coefficients are positive and significant for both sub-groups.

Table 9: Substitution Effects? Members versus Non-Members

	(1)	(2)	(3)	(4)
Dependent Variable		$log(A_{i,t})$		
$TU_{i,t}$		0		1
log(wages)	1.30***	0.771***	1.42***	1.06***
	(0.040)	(0.062)	(0.109)	(0.164)
Individual FE		X		X
Observations	57,061	57,061	14,500	14,500
R^2	0.28042	0.77355	0.22807	0.78277
Within R^2		0.09952		0.11514

Notes: This table shows the relationship between wages and the level of bonus payments, based on OLS models. Columns 1 and 2 display the results for trade union non-members and columns 3 and 4 for members. The observation period ranges from 1985 to 2019. Other control variables are the same as displayed in Table 1 and its note. Robust standard errors (clustered at the individual level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

To further analyse potential substitution effects, we employ a matching strategy and compare trade union members to their nearest non-union neighbour. This reduces the number of observations to 29,000 because we only consider one match per observed trade union member. We then estimate a counterfactual wage for the member, based on the wage of the closest (non-member) match, and calculate a wage markup. In the restricted sample, we find an average logged wage premium of around 0.01, which translates into 1% higher base wages for union members, which equals approximately €290.[32] Consequently, the bonus premium of roughly €144 (see Sub-section 5.2) accounts for 34% of the overall premium (€434). Finally, we include the individual wage markup into the main regression. If substitution effects are important, the observed bonus amounts will be lower as the wage markup increases.

The findings documented in Table 10 show that the markup is positively associated with bonus payments in specifications without individual fixed effects (column 2). This suggests complementary effects rather than substitution effects. In the FE specification (column 4), we

[32]Bonaccolto-Töpfer and Schnabel (2023) estimate a union wage markup of 2.6%, based on SOEP data for the survey years 2015 and 2019. This difference to our result may, inter alia, be due to the different period of observation, the wage measure, the use of an (probably imputed) indicator of co-determination in the regressions, and the different estimation approaches.

see no significant link between wages and bonus payments. The findings are also consistent with alternative specifications in which we utilise a regression-based approach to calculate the counterfactual wages and markups for trade union members.

Table 10: TU Membership and the Level of Bonus Payments - Matching Approach

	(1)	(2)	(3)	(4)
Dependent Variable		$log(A_{i,t})$		
$TU_{i,t}$	0.325***	0.320***	0.261***	0.263***
	(0.039)	(0.039)	(0.069)	(0.069)
Wage Markup		0.146***		0.032
		(0.033)		(0.036)
Individual FE			X	X
Observations	29,000	29,000	29,000	29,000
R^2	0.210	0.211	0.795	0.795
Within R^2			0.103	0.103

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the level of bonus payments. The markup indicates the difference between the counterfactual non-member wage and the actual wage of trade union members using a matching procedure. The estimations are based on OLS models. The observation period ranges from 1985 to 2019. The control variables are the same as displayed in Table 1 and its note. Robust standard errors (clustered at the individual level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Overall, there is no evidence of a substitutive relationship between bonus payments and wages. Since this finding is compatible with all mechanisms hypothesised to cause a positive impact of union membership on bonus payments, it does not provide additional information in this regard.

6 Summary

This study adds to the existing literature on union membership and wages in Germany by shedding light on one component that is frequently included in the wage package, namely, non-performance-oriented bonus payments. We observe a bonus premium for union members for a variety of outcomes. In the main estimates including individual FE, trade union members are 8% more likely to report a bonus in the first place, report 0.09 more bonus payments, and receive 9% higher bonus payments on average. Our IV estimations show that the amount and number of bonus payments are positively correlated with trade union membership. Furthermore, the relationship is not stronger for workers covered by collective wage agreements. Hence, we discover little evidence that members benefit from special regulations that affect bonus payments. Additionally, both entering and exiting the union explain the underlying relationship, which does not support the notion that union members benefit from informational advantages. We also find comparable results across sub-groups, which differ in their degree of unionisation. This aligns with the idea that the membership effect is due to increased individual bargaining power, as unions assist all of their members equally in negotiations about bonus payments with their employer.

In the main estimations, the rise in bonus payments for union members equals about €144, which amounts to around 50% of the membership fee of an employee with average income. We also observe that bonus payments are correlated positively with wages and they do not seem to constitute a substitute for higher wages. Moreover, the bonus premium accounts for about one-third of the overall union membership premium. Therefore, the bonus effect is quantitatively sizeable. Accordingly, extra bonus payments are a real benefit of being a member of a trade union in Germany.

An encompassing analysis of the impact of trade union membership on non-performance-oriented bonuses has, to the best of our knowledge, not been undertaken for other countries. The feature that it can be observed irrespective of whether there is collective bargaining or co-determination at the establishment level clarifies that the bonus effect is not conditional on two central elements of the German industrial relations systems. This suggests that it can also be present in other countries. An investigation of this conjecture is a topic for future research.

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A Appendix

Table A1: Summary Statistics - Relevance of Labour Market Institutions

	(1)	(2)	(3)	(4)	(5)	(6)
	$TU_{i,t}=0$		$TU_{i,t}=1$			
	Mean	Std. Dev.	Mean	Std. Dev.	Diff.	p-value
Panel A: Employees Subject to Collective Bargaining						
Number of Bonuses						
$n_{i,t}$	1.02	0.81	1.28	0.87	0.26	0.00
Dummy($n_{i,t}=0$)	0.30	0.46	0.24	0.43	-0.06	0.00
Dummy($n_{i,t}=1$)	0.40	0.49	0.27	0.45	-0.13	0.00
Dummy($n_{i,t}=2$)	0.28	0.45	0.45	0.50	0.17	0.00
Dummy($n_{i,t}=3$)	0.02	0.14	0.03	0.16	0.01	0.19
Dummy($n_{i,t}=4$)	0.00	0.02	0.00	0.06	0.00	0.17
Dummy($n_{i,t}=5$)	0.00	0.00	0.00	0.00	0.00	
Level of Bonuses						
$A_{i,t}$	1534.74	1969.66	2054.33	2111.19	519.58	0.00
$A_{i,t}^{av}$	1069.73	1238.81	1244.31	1168.85	174.58	0.00
$I_{i,t}$	0.56	0.57	0.67	0.58	0.11	0.00
Observations	8,225		2,394			
Panel B: Employees Working in Establishments with a Works Council						
Number of Bonuses						
$n_{i,t}$	1.15	0.89	1.38	0.87	0.23	0.00
Dummy($n_{i,t}=0$)	0.29	0.46	0.22	0.41	-0.08	0.00
Dummy($n_{i,t}=1$)	0.29	0.46	0.22	0.42	-0.07	0.00
Dummy($n_{i,t}=2$)	0.38	0.49	0.52	0.50	0.14	0.00
Dummy($n_{i,t}=3$)	0.03	0.17	0.03	0.18	0.00	0.68
Dummy($n_{i,t}=4$)	0.00	0.03	0.00	0.06	0.00	0.23
Dummy($n_{i,t}=5$)	0.00	0.00	0.00	0.00	0.00	
Level of Bonuses						
$A_{i,t}$	1870.49	2607.72	2077.81	1988.49	207.32	0.00
$A_{i,t}^{av}$	1180.04	1853.01	1205.61	1121.03	25.58	0.44
$I_{i,t}$	0.63	0.63	0.69	0.56	0.06	0.00
Observations	10,793		3,900			

Notes: This table presents summary statistics for the incidence (Dummy($n_{i,t}>0$)), number ($n_{i,t}$), level ($A_{i,t}$, $A_{i,t}^{av}$) and intensity ($I_{i,t}$) of bonus payments, using survey weights. The bonus amounts are displayed in Euro and deflated using the consumer price index with base year 2010. The statistics are shown for non-members in columns (1) and (2) and members of a trade union in columns (3) and (4). Column (5) shows the difference in means between columns (1) and (3) and the corresponding p-value (column 6). We restrict the sample to employees who are subject to collective bargaining in Panel A and those employed by a company with a works council in Panel B. The survey years cover 2015 and 2019 for samples comprising collective bargaining information (Panel A) and 2001, 2011, 2019 when information on works council is included (Panel B).

Table A2: TU Membership and the Incidence of Bonuses

	(1)	(2)
(Intercept)	0.472***	
	(0.040)	
$TU_{i,t}$	0.046***	0.043***
	(0.005)	(0.007)
Female	0.030***	
	(0.005)	
Number of Children	-0.010***	-0.009***
	(0.002)	(0.003)
Married	0.006	-0.017**
	(0.005)	(0.008)
Age	0.007***	0.0007
	(0.001)	(0.002)
Age Squared	-0.0001***	-0.0001***
	(1.56×10^{-5})	(2.44×10^{-5})
Years of Education	0.0002	0.002
	(0.001)	(0.005)
Public Sector	0.136***	0.075***
	(0.006)	(0.009)
Tenure	0.017***	0.005***
	(0.0006)	(0.0009)
Tenure Squared	-0.0003***	-0.0001***
	(0.00002)	(0.00003)
Avg. Working Hours	-0.0007**	0.0009**
	(0.0003)	(0.0004)
Regular Part-Time	-0.062***	-0.045***
	(0.007)	(0.010)
Vocational Training	-0.058***	-0.058***
	(0.010)	(0.016)
Marginal, Irregular Part-Time	-0.391***	-0.302***
	(0.011)	(0.018)
Sheltered Workshop	-0.275***	-0.145
	(0.059)	(0.247)
Company Size 20-199	0.097***	0.085***
	(0.006)	(0.008)
Company Size 200-1999	0.161***	0.122***
	(0.006)	(0.010)
Company Size $\geq$ 2000	0.151***	0.143***
	(0.006)	(0.010)
Industry FE	X	X
Occupation FE	X	X
Residence FE	X	X
Year FE	X	X
Individual FE		X
Observations	71,561	71,561
R^2	0.217	0.731
Within R^2		0.082

Notes: This table is based on OLS models and presents the coefficients of the relationship between trade union membership ($TU_{i,t}$) and the incidence of bonus payments ($B_{i,t}$). The observation period ranges from 1985 to 2019. Robust standard errors (clustered at the individual level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A3: TU Membership and Bonus Payments - Bonus Components

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variables	Christmas Bonus	Vacation Bonus	13th Salary	14th Salary	Other Bonus	Profit Sharing
Panel A - Incidence						
$TU_{i,t}$	0.031***	0.036***	0.015*	0.002	0.004	-0.0005
	(0.009)	(0.009)	(0.008)	(0.002)	(0.003)	(0.005)
Observations	71,561	71,561	71,561	71,561	71,561	71,561
R^2	0.646	0.709	0.682	0.667	0.506	0.663
Within R^2	0.017	0.091	0.049	0.015	0.004	0.027
Panel B - Levels						
$TU_{i,t}$	0.220***	0.229***	0.117**	0.012	0.028	-0.021
	(0.062)	(0.054)	(0.059)	(0.016)	(0.019)	(0.038)
Observations	71,561	71,561	71,561	71,561	71,561	71,561
R^2	0.646	0.720	0.690	0.672	0.494	0.691
Within R^2	0.018	0.087	0.051	0.014	0.004	0.031

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the incidence (Panel A) and level (Panel B) of bonus payments based on OLS models. The bonus variable is divided into its five bonus components (columns 1-5). In addition, the effects on profit-sharing outcomes are included in column 6. The observation period ranges from 1985 to 2019. The models include the set of control variables displayed in Table 1 and its note. All specifications include individual FE. Robust standard errors (clustered at the individual level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A4: TU Membership and the Number of Bonuses - Poisson Regression

	(1)	(2)
	Poisson Regression	
$TU_{i,t}$	0.070***	0.067***
	(0.007)	(0.011)
Individual FE		X
Observations	71,561	71,561
Squared Correlation	0.260	0.580

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the number of bonus payments ($n_{i,t}$) using Poisson regressions. The observation period ranges from 1985 to 2019. The model includes the same set of control variables as displayed in Table 1 and its note. Robust standard errors (clustered at the individual level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A5: TU Membership and the Number of Bonuses - LPM

	(1)	(2)	(3)	(4)
Dependent Variables: Number of Bonuses...	> 0	> 1	> 2	> 3
$TU_{i,t}$	0.043***	0.034***	0.009***	0.001
	(0.007)	(0.008)	(0.003)	(0.001)
Observations	71,561	71,561	71,561	71,561
R^2	0.731	0.705	0.554	0.490
Within R^2	0.082	0.091	0.008	0.002

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the number of bonus payments ($n_{i,t}$) using linear probability models. The observation period ranges from 1985 to 2019. The model includes the same set of control variables as displayed in Table 1 and its note. All specifications include individual FE. Robust standard errors (clustered at the individual level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A6: TU Membership and Bonus Levels - Poisson QML Estimates

	(1)	(2)	(3)	(4)
Dependent Variables:	$A_{i,t}$		$A^{av}_{i,t}$	
$TU_{i,t}$	0.042***	0.089***	0.023*	0.078***
	(0.012)	(0.016)	(0.013)	(0.016)
Individual FE		X		X
Observations	71,561	71,561	71,561	71,561
Squared Correlation	0.256	0.723	0.172	0.711

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and $A_{i,t}$ and $A^{av}_{i,t}$ using Poisson quasi-maximum likelihood regressions. The observation period ranges from 1985 to 2019. The models include the set of control variables displayed in Table 1 and its note. Robust standard errors (clustered at the individual level) are shown in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Table A7: TU Membership and Bonus Levels - Conditional on Positive Bonuses

	(1)	(2)	(3)	(4)
Dependent Variables:	$log(A_{i,t})$		$log(A^{av}_{i,t})$	
Sub-Sample:	$A_{i,t} > 0$			
$TU_{i,t}$	0.049***	0.033**	0.028***	0.023*
	(0.011)	(0.015)	(0.010)	(0.014)
Individual FE		X		X
Observations	48,103	48,103	48,103	48,103
R^2	0.414	0.843	0.413	0.846
Within R^2		0.162		0.167

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the level of bonus payments, $log(A_{i,t})$ and $log(A^{av}_{i,t})$, based on OLS models. The sample is conditional on positive bonus amounts, i.e. $A_{i,t} > 0$. The observation period ranges from 1985 to 2019. The control variables are the same as displayed in Table 1 and its note. Robust standard errors (clustered at the individual level) are shown in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Table A8: TU Membership and Bonus Payments - Firm and Occupation Switcher

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variables:		$B_{i,t}$			$n_{i,t}$			$log(A_{i,t})$	
Panel A: Firm Switcher									
$TU_{i,t}$	0.043***	0.043***	0.044***	0.087***	0.087***	0.088***	0.339***	0.339***	0.343***
	(0.007)	(0.007)	(0.007)	(0.015)	(0.015)	(0.015)	(0.053)	(0.053)	(0.054)
Firm Switcher		0.020***	0.020***		0.029**	0.030**		0.145***	0.148***
		(0.007)	(0.007)		(0.012)	(0.013)		(0.049)	(0.052)
$TU_{i,t}$ × Firm Switcher			-0.0005			-0.006			-0.026
			(0.015)			(0.028)			(0.108)
Observations	71,159	71,159	71,159	71,159	71,159	71,159	71,159	71,159	71,159
R^2	0.731	0.731	0.731	0.747	0.747	0.747	0.760	0.760	0.760
Within R^2	0.082	0.082	0.082	0.111	0.111	0.111	0.101	0.101	0.101
Panel B: Occupation Switcher									
$TU_{i,t}$	0.043***	0.043***	0.046***	0.087***	0.087***	0.093***	0.339***	0.339***	0.352***
	(0.007)	(0.007)	(0.008)	(0.015)	(0.015)	(0.015)	(0.053)	(0.053)	(0.056)
Occ. Switcher		-0.0003	0.001		0.008	0.012		0.010	0.019
		(0.004)	(0.005)		(0.008)	(0.009)		(0.030)	(0.035)
$TU_{i,t}$ × Occ. Switcher			-0.007			-0.018			-0.041
			(0.009)			(0.017)			(0.064)
Observations	71,159	71,159	71,159	71,159	71,159	71,159	71,159	71,159	71,159
R^2	0.731	0.731	0.731	0.747	0.747	0.747	0.760	0.760	0.760
Within R^2	0.082	0.082	0.082	0.111	0.111	0.111	0.101	0.101	0.101

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the incidence, number and level of bonus payments based on OLS models. The switcher dummy indicates, whether the individual changed the firm (Panel A) or occupation (Panel B) compared to the previous interview. The observation period ranges from 1985 to 2019. The control variables are the same as displayed in Table 1 and its note. All specifications include individual FE. Robust standard errors (clustered at the individual level) are shown in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Table A9: Switching Union Status - Robustness Test

	(1)	(2)	(3)	(4)	(5)	(6)
Sub-Sample	Union Joiner			Union Leaver		
Dependent Variables:	$B_{i,t}$	$n_{i,t}$	$log(A_{i,t})$	$B_{i,t}$	$n_{i,t}$	$log(A_{i,t})$
TU_{it}	0.029**	0.045	0.258**	0.046***	0.124***	0.363***
	(0.013)	(0.028)	(0.101)	(0.014)	(0.028)	(0.103)
Observations	55,627	55,627	55,627	56,030	56,030	56,030
R^2	0.812	0.813	0.828	0.810	0.812	0.827
Within R^2	0.065	0.099	0.080	0.070	0.105	0.084

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the incidence, number and level of bonus payments based on OLS models. The samples are restricted to observations with no firm switch. We show results for sub-samples from which trade union leavers (columns 1-3) or joiners (columns 4-6) are excluded. The observation period ranges from 1985 to 2019. The control variables are the same as displayed in Table 1 and its note. All estimations include individual FE. Robust standard errors (clustered at the individual level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A10: TU Membership and Bonus Payments - Effect Heterogeneity

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variables:	$B_{i,t}$	$n_{i,t}$	$log(A_{i,t})$	$B_{i,t}$	$n_{i,t}$	$log(A_{i,t})$
Gender	Male			Female		
$TU_{i,t}$	0.046***	0.081***	0.370***	0.033***	0.087***	0.242***
	(0.009)	(0.019)	(0.070)	(0.011)	(0.023)	(0.079)
Observations	37,529	37,529	37,529	34,032	34,032	34,032
R^2	0.723	0.737	0.746	0.739	0.753	0.770
Within R^2	0.089	0.112	0.102	0.083	0.115	0.109
Age	Age < 42			Age ≥ 42		
$TU_{i,t}$	0.042***	0.088***	0.333***	0.019*	0.037*	0.147*
	(0.011)	(0.022)	(0.076)	(0.011)	(0.022)	(0.082)
Observations	36,703	36,703	36,703	34,858	34,858	34,858
R^2	0.766	0.780	0.792	0.787	0.798	0.811
Within R^2	0.064	0.079	0.085	0.085	0.109	0.101
Working Hours	Part-time			Full-Time		
$TU_{i,t}$	0.052	0.109	0.259	0.044***	0.088***	0.347***
	(0.055)	(0.102)	(0.352)	(0.007)	(0.015)	(0.054)
Observations	6,345	6,345	6,345	65,216	65,216	65,216
R^2	0.854	0.867	0.880	0.728	0.744	0.752
Within R^2	0.069	0.064	0.076	0.058	0.095	0.070
Occupation	Blue-Collar			White-Collar		
$TU_{i,t}$	0.065***	0.128***	0.504***	0.030***	0.062***	0.227***
	(0.011)	(0.022)	(0.080)	(0.010)	(0.019)	(0.072)
Observations	23,396	23,396	23,396	48,165	48,165	48,165
R^2	0.762	0.771	0.790	0.749	0.765	0.772
Within R^2	0.072	0.077	0.086	0.086	0.132	0.105
Sector	Private			Public		
$TU_{i,t}$	0.047***	0.092***	0.373***	0.034***	0.071***	0.231***
	(0.009)	(0.018)	(0.068)	(0.012)	(0.023)	(0.084)
Observations	52,095	52,095	52,095	19,466	19,466	19,466
R^2	0.749	0.764	0.775	0.766	0.798	0.789
Within R^2	0.080	0.086	0.092	0.099	0.262	0.137
Residence Area	Western Germany			Eastern Germany		
$TU_{i,t}$	0.047***	0.087***	0.370***	0.028	0.085***	0.222*
	(0.008)	(0.016)	(0.058)	(0.018)	(0.032)	(0.116)
Observations	55,514	55,514	55,514	16,047	16,047	16,047
R^2	0.734	0.745	0.760	0.728	0.752	0.756
Within R^2	0.087	0.112	0.108	0.076	0.113	0.086

Notes: The table shows the relationship between trade union membership ($TU_{i,t}$) and the incidence, number and level of bonus payments in different sub-samples using OLS specifications. It highlights differences in gender, age, part-time employment (working below 20 hours per week), occupation, sector, and residence area. Additional control variables are the same as displayed in Table 1 and its note. All estimations include individual FE. The observation period ranges from 1985 to 2019. As exception, for eastern Germany the sample only starts in 1993. Robust standard errors (clustered at the individual level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A11: TU Membership and Bonus Payments - Effect Heterogeneity Over Time

	(1)	(2)	(3)
Dependent Variables:	$B_{i,t}$	$n_{i,t}$	$log(A_{i,t})$
$TU_{i,t}$	0.034***	0.114***	0.331***
	(0.011)	(0.025)	(0.084)
$TU_{i,t}$ × 1990-1999	0.005	-0.030	-0.025
	(0.011)	(0.025)	(0.082)
$TU_{i,t}$ × 2000-2009	0.020	-0.017	0.071
	(0.013)	(0.028)	(0.096)
$TU_{i,t}$ × 2010-2019	0.004	-0.056*	-0.051
	(0.016)	(0.033)	(0.119)
Observations	71,561	71,561	71,561
R^2	0.731	0.746	0.759
Within R^2	0.082	0.111	0.101

Notes: The table shows the relationship between trade union membership ($TU_{i,t}$) and the incidence, number and level of bonus payments interacted with different time spans using OLS specifications. The baseline category is the time before 1990. Additional control variables are the same as displayed in Table 1 and its note. All estimations include individual FE. The observation period ranges from 1985 to 2019. Robust standard errors (clustered at the individual level) are shown in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Table A12: TU Membership and Bonus Payments - Sample with Imputations for Collective Bargaining and Works Council

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variables:		$B_{i,t}$			$n_{i,t}$			$log(A_{i,t})$	
$TU_{i,t}$	0.063***	0.023**	0.020*	0.147***	0.075***	0.069***	0.532***	0.216***	0.189**
	(0.011)	(0.011)	(0.011)	(0.020)	(0.019)	(0.019)	(0.082)	(0.080)	(0.080)
$CB_{i,t}$		0.214***	0.164***		0.381***	0.282***		1.68***	1.20***
		(0.010)	(0.015)		(0.018)	(0.026)		(0.076)	(0.107)
$WC_{i,t}$		0.059***	0.017		0.119***	0.034		0.505***	0.098
		(0.012)	(0.017)		(0.022)	(0.029)		(0.091)	(0.125)
$WC_{i,t} \times CB_{i,t}$			0.085***			0.170***			0.811***
			(0.020)			(0.034)			(0.144)
Observations	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478
R^2	0.190	0.227	0.228	0.218	0.256	0.258	0.219	0.260	0.262

Notes: This table shows the moderating role of collective bargaining ($CB_{i,t}$) and works council ($WC_{i,t}$) in the relationship between trade union membership ($TU_{i,t}$) and the incidence, number and level of bonus payments using OLS models. The survey years cover 2011, 2015 and 2019. We impute data on collective wage agreements in 2011 and the prevalence of a works council in 2015. The former information is from the 2015 survey, while the later is from the 2016 survey. We control for occupations at the 4-digit ISCO-level and industry at the 2-digit NACE-level. Apart from industry and occupation controls, the models include the set of control variables displayed in Table 1 and its note. Robust standard errors (clustered at the individual level) are shown in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Table A13: TU Membership and Bonus Payments - The Role of Company Size

	(1)	(2)	(3)
Dependent Variables:	$B_{i,t}$	$n_{i,t}$	$log(A_{i,t})$
$TU_{i,t}$	0.052***	0.102***	0.416***
	(0.010)	(0.021)	(0.078)
$TU_{i,t}$ × 1-19	0.006	0.0004	0.010
	(0.022)	(0.041)	(0.159)
$TU_{i,t}$ × 20-199	-0.013	-0.018	-0.118
	(0.014)	(0.028)	(0.105)
$TU_{i,t}$ × 200-1999	-0.021*	-0.037	-0.168*
	(0.013)	(0.026)	(0.094)
Observations	71,561	71,561	71,561
R^2	0.731	0.746	0.759
Within R^2	0.082	0.111	0.101

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the incidence, number and level of bonus payments in different samples using OLS specifications. For the interaction terms the largest company size category serves as the baseline category (2000 or more employees). The observation period ranges from 1985 to 2019. The models include individual FE and the same set of control variables as displayed in Table 1 and its note. Robust standard errors (clustered at the individual level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A14: TU Membership and Bonus Payments - OLS Estimates in IV Sample

	(1)	(2)	(3)
Dependent Variables:	$B_{i,t}$	$n_{i,t}$	$log(A_{i,t})$
	Probit	OLS	OLS
$TU_{i,t}$	0.064***	0.142***	0.530***
	(0.005)	(0.011)	(0.038)
Observations	38,181	38,181	38,181
R^2	0.178	0.211	0.222

Notes: This table shows the relationship between trade union membership ($TU_{i,t}$) and the incidence, number and size of bonus payments using OLS models. The observation period ranges from 1998 to 2019 as in the IV sample. The models include the set of control variables displayed in Table 1 and its note. Robust standard errors (clustered at the instrument level) are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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