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Seeking shelter in times of crisis? unemployment, perceived job insecurity and trade union membership

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Abstract

Do trade unions benefit from economic crises by attracting new members among workers concerned about job security? To address this question, we provide a comprehensive empirical investigation based on panel data from Germany, where workers decide individually on their membership. We analyse whether exogenously manipulated perceptions of job insecurity encourage individuals to join a trade union. Firm-level workforce reductions serve as the first trigger of perceived job insecurity. Regional unemployment rates represent a second source of exogenous variation. Third, we propose a novel identification approach based on plant-closure-induced job losses of other workers in the same region. In each case, we exploit the longitudinal nature of the data to analyse the implications of changes in labour market conditions for changes in union membership using an instrumental variable approach. We find consistently that perceived job insecurity, as triggered by labour market turmoil, increases the likelihood of individual union membership. Analysing data on media coverage about downsizing in a complementary investigation, we add further evidence to the notion of trade unions as beneficiaries of labour market crises. Finally, we consider workers who lose their jobs and find no evidence of adverse effects on union membership among those affected directly by unemployment.

1 | INTRODUCTION

> Why You Should Join AFGE: … By standing together, AFGE members have a stronger voice when defending your pay, retirement and job security. (Quote from the webpage of the American Federation of Government Employees (AFGE), the largest federal employee union in the USA, representing 670,000 workers nationwide and overseas)

> What can the IATSE do for you? … Provide job security by ensuring due process in the event your employer seeks to discipline or fire you. (Quote from the webpage of the International Alliance of Theatrical Stage Employees, Moving Picture Technicians, Artists and Allied Crafts of the United Statess, its territories and Canada (IATSE), with over 150,000 members)

> Better job security: Trade union members are more likely to stay in their jobs longer—on average five years more than non-members. (Quote from the webpage of Unite, the largest trade union in the UK and Ireland, with around 1.4 million members, and their list of '10 good reasons to join Unite')[1]

Crises come and go. Unemployment rates often increase sharply before returning to normal levels. Nevertheless, even if of only a temporary nature, economic crises can trigger long-term implications for society. While a minority of the working population is directly affected, for example, by a job loss, the majority may be indirectly involved in experiencing uncertainty about future employment. Psychological responses, such as fear, concern or stress, even if not justified at the end of the day, can change behaviour. This could explain why economic crises affect health-related behaviour (Ruhm 2000; De Goeij *et al.* 2015), political preferences (Chadi 2015; Gavresi and Litina forthcoming, Runst 2014) and financial decision-making (Malmendier and Nagel 2011; Osili and Paulson 2014), to name just a few prominent examples.

In times of crisis, a particular labour market institution could play an important role in the context of workers' concerns about their employment situation, which arguably has not yet received the attention it deserves: the trade union. The share of workers in unions is still substantial, and collective bargaining represents the most prominent form of wage determination in the OECD (2019). However, union membership has declined in many countries, and recent events seem to have further reduced the attractiveness of union membership. Globalization has augmented the international tradability of labour, whereas digitization has reduced the demand for organized labour. Both trends enhance the substitutability of skilled labour by unskilled labour or even computers. Furthermore, the rise in the prevalence of working from home reduces the opportunities for union representatives to conduct membership campaigns. In light of these developments, it seems paradoxical that unions can still attract large numbers of members, raising the question of whether their role as a security-providing institution could help to solve the puzzle.

In this paper, we investigate comprehensively whether trade unions benefit from labour market crises. We hypothesize that unions become more attractive for workers who perceive a lack of job security and therefore seek shelter in times of uncertainty. Thereby, we postulate the idea of trade unions as the secret beneficiaries of crises that feature rising unemployment. As our introductory quotes show, some union organizations refer to this idea of providing job security to attract new members. However, it is not clear exactly how a trade union can deliver this good. Therefore we discuss the components of job insecurity that could be relevant in this context. First, the probability of a job loss may be reduced by becoming a union member. In this respect, there is empirical evidence from various countries indicating that union members

are better protected against job loss (Freeman 1980; Goerke and Pannenberg 2011; Pierse and McHale 2015; Berglund and Furåker 2016; Ivlevs and Veliziotis 2017; Wang *et al.* 2021). Second, union members could benefit from avoiding increased costs of job loss. Even if a crisis does not change a worker's perceived probability of job loss, it could be that the worker is concerned about potentially more costly implications when having more difficulties in finding an alternative job. Because of deteriorating outside options, the worker may regard the job-protection premium of union membership as more beneficial in times of crisis.

To study individual decision-making regarding union membership empirically, we focus on Germany. The largest economy in Europe is a suitable research objective as Germany has been strongly affected by globalization and has seen a notable decline in union power. While in 1993 about 12.4 million people were members of a trade union, by 2015 this number had declined by 35%. Union density dropped to 16.3% in 2019, although the fall has slowed down considerably in the last decade (OECD 2019; OECD and AIAS 2021). Collective bargaining, mainly at the industry level, determined the pay of more than 80% of the workforce in 1993. The coverage rate has also declined substantially to 57% in 2015 (OECD 2019). Given the difference between union density and collective bargaining coverage, it is easily possible for workers in Germany to have a free ride on the benefits of union bargaining, such as better working conditions or higher wages.

To provide evidence for our hypothesis that an individual has a greater incentive to become a union member if unemployment, and therefore perceived job insecurity, rises, we utilize the German Socio-Economic Panel (SOEP). As one of our main contributions to the empirical research on the benefits of union membership, we address endogeneity issues by applying three different indicators of labour market turmoil as potential sources of exogenous variations in workers' perceptions of job insecurity. Since we restrict our main analyses to workers with a job, the triggers of job insecurity affect not their actual employment status but rather their perceptions. First, we use a cause of job insecurity that occurs when firms carry out workforce reductions.[2] Second, changes in official unemployment rates at the regional level constitute another plausibly exogenous trigger of differences in perceived job insecurity.[3] Third, we focus on the local incidence of plant closures experienced by survey participants other than the worker interviewed and not living in the respondent's household. Based on this novel approach, we can analyse effects due to exogenously triggered manipulations of job security in field data, while benefiting from a high level of immunity towards endogeneity concerns such as reverse causality.[4] Throughout the analysis, we exploit the longitudinal nature of the panel data and analyse changes in union membership due to changes in job insecurity as a result of changing labour market conditions. By considering individual fixed effects, we ensure that the evidence is not affected by time-invariant characteristics, which may differ across individuals and thereby affect the likelihood of being in a union.

As our main identification strategy, we employ the triggers of job insecurity as instrumental variables. After examining the evidence from a reduced-form analysis, we set up a two-stage approach, with job insecurity being the endogenous variable in the second stage that is manipulated via labour market turmoil. We find strong empirical support for the idea that perceived job insecurity positively affects the likelihood of union membership when we use each instrument separately, as well as combinations of instruments, in one of our many robustness checks. To learn more about the underlying channels, we then turn to multifaceted information on the components of job insecurity that we consider as alternative manipulation variables in separate estimations. Using two different variables for job-related insecurity provided by the SOEP, we obtain suggestive evidence that both motives could explain why union membership is an attractive option for workers facing uncertainty: a higher probability of losing the current job, and more difficulties in finding a comparable new one.

We complement our empirical investigation of mechanisms with a media analysis, for which we use data on fluctuations in news coverage of labour market crises between interview dates.

Thereby, we inspect in greater detail a potential channel of how trade unions attract attention and thus new members in the context of economic crises.[5] We first show that short-run variations in media coverage of downsizing activities increase perceived job insecurity. Meanwhile, trade unions seem to benefit, as newspaper articles covering them also become more frequent. Arguably, for workers who feel that their jobs are insecure, raising awareness of trade union activities can induce them to become union members. Therefore the findings from our media analysis strengthen the hypothesis that unions are beneficiaries of perceived job insecurity in times of economic turmoil.

We complete our investigation by also considering workers who lose their jobs. This allows us to assess the relevance of restricting the sample to employed individuals in our main analyses. Frustration about the failure to retain the job might induce some individuals to leave the trade union. However, the main results hold when we expand the data by including workers who cannot report on the security of their jobs because they do not have one. Furthermore, we find no adverse effects of an individual job loss on the likelihood of union membership when we analyse cases of plant closures. Thus we conclude that trade unions benefit when workers feel insecure in times of crisis, with no countervailing evidence indicating that workers leave trade unions in large numbers after losing their jobs.

Our analysis adds to several strands of research. First, we contribute to work on the consequences of economic crises, which so far has turned a blind eye to the role of the trade union as an institution providing shelter. Similar to governments that may benefit from increased popularity if not seen as responsible for the crisis (Okolikj and Quinlan 2016), we show that trade unions could also be among the beneficiaries. As a second contribution, we provide an additional explanation for the attractiveness, and thus the existence, of trade unions by offering an economic justification for membership within an institutional setup for which there is no clear indication of a union membership wage premium. Therefore we contribute to the discussion about the determinants of union membership (e.g. Schnabel and Wagner 2005) and the free-rider paradox, which has attracted the interest of researchers for decades, from early contributions such as Olson (1965) and Booth (1985), to very recent ones such as Murphy (2020). Third, our findings inform research in personnel economics, which discusses policy instruments such as temporary contracts as a way to raise worker effort (Engellandt and Riphahn 2005) at the expense of job satisfaction and perceived job security (Chadi and Hetschko 2016). According to our results, such measures could trigger side effects such as stronger unionization, which may not be considered as desirable by personnel management. Finally, we contribute to research on subjective perceptions by discussing a broad understanding of job insecurity and analysing its multifaceted role for economic decision-making. Given that our results are determined by workers who may believe that they could lose their jobs while actually remaining employed, we show how perceptions of employment instability could be sufficient to determine relevant choices in the labour market. Thereby, we underline the importance of research on such subjective variables (e.g. Clark and Postel-Vinay 2009; Geishecker 2012; Georgieff and Lepinteur 2018).[6]

In the remainder of the paper, we proceed as follows. Section 2 discusses the concept of job insecurity and describes the German institutional context. Subsequently, we present our predictions concerning the impact of different facets of job insecurity on the attractiveness of union membership, and we outline related contributions. In Section 3, we describe the SOEP dataset. We sketch our empirical strategy and present the main set of results in Section 4. A complementary analysis of media coverage on trade unions and downsizing is part of Section 5, where we also study the consequences of individual job loss. In the concluding Section 6, we summarize the findings and discuss their implications. The Appendices contain a sketch of the theoretical model from which we derive the predictions stated in Section 2 (Appendix A), as well as several robustness checks and extensions to which we refer in the main text (Appendix B).

2 | BACKGROUND

2.1 | Job insecurity

To understand how labour market crises could motivate individuals to become union members, it is important to have conceptual clarity regarding job insecurity as the potential mechanism. Previous research on job insecurity does not rely on a consistent understanding and is very complex, given that various disciplines have contributed to the discussion. For instance, as part of a large body of research in management, Greenhalgh and Rosenblatt (1984) provide one conceptual framework that is cited frequently. In economics, researchers rarely discuss job insecurity conceptually. An exception is Geishecker (2010), who points out that economists define job insecurity rather arbitrarily and often focus solely on the job-loss threat. This is true for some of the earlier studies (e.g. Campbell *et al.* 2007) as well as more recent ones (e.g. Caroli and Godard 2016). However, there are a number of contributions where researchers go beyond the job-loss risk and consider the costs of job loss in their definitions (e.g. Schmidt 1999; Manski and Straub 2000; Nickell *et al.* 2002), as a second component of job insecurity. A simple way to operationalize the cost component is to measure the difficulty of finding an alternative job.

Arguably, in an economic crisis, both components of job insecurity are of increasing concern. On the one hand, an economic downturn makes dismissals or redundancies more likely and enhances the probability that workers could lose their current jobs. On the other hand, decreasing employment rates and a reduced number of vacancies make it more difficult to find a job that is equivalent to the current one. Apart from these two components, job-loss risk and costs of job loss, there could also be other aspects of job insecurity that might play a role in our research context. For example, as another job-insecurity component, one could argue that changes in valued features of the job, such as the level of pay (Nickell *et al.* 2002; Gallie *et al.* 2017), could be relevant, but this may be true only for workers in specific labour market contexts. Hence before we introduce predictions, we consider the institutional background, which is also important to understand how individual benefits from trade union membership could emerge when perceived job insecurity increases.

2.2 | Institutional setting

To substantiate the idea that union membership can be particularly beneficial in times of economic crisis, we now describe the institutional framework in which workers decide on membership. The German system of industrial relations is often argued to be based on two features (Jäger *et al.* 2022). First, collective bargaining, mainly at the industry level, determines wages and overall working conditions. This is still the case for a majority of workers in Germany, especially in larger firms (Schnabel 2020). While, formally, collective bargaining agreements are applicable only to trade union members and firms having signed the contract or belonging to an employer association, firms often apply the content of the agreements to most of their workers (Hirsch *et al.* 2022), irrespective of union membership status. Second, works councils constitute a codetermination body at the plant level. They can be elected in private-sector establishments with five or more regular workers, and most large firms in Germany have such an institution. Works councils have information, consultation and codetermination rights. While their influence is most pronounced with regard to personnel policy and social affairs, they can neither bargain over issues dealt with in collective agreements nor call a strike. Hence German works councils differ from plant-specific trade unions in other institutional contexts.

Trade unions provide members with information and training, legal advice and representation in job-related matters, and strike pay and other forms of financial support in times of economic hardship. Employed members generally pay a membership fee of 1% of their gross wage. As

an important aspect for our study on individual decision-making, the German constitution not only guarantees the right to establish and join a trade union but also entitles workers to abstain from membership. Consequently, trade unions can neither force workers to join them nor prevent employers from paying union wages.

As a consequence of these institutional features, and in contrast, for example, to the USA, individual membership and being covered by a collective bargaining agreement are only weakly correlated in Germany. Furthermore, there is no clear evidence of a union membership wage premium in Germany when accounting for observable characteristics (see, for example, Schmidt and Zimmermann 1991; Fitzenberger *et al.* 1999; Goerke and Pannenberg 2004; Bonaccolto-Töpfer and Schnabel 2023). Instead, union members appear to benefit in other ways from their membership; they are, for example, less likely to be dismissed individually, and more likely to obtain severance pay, that is, they are more expensive to dismiss (Goerke and Pannenberg 2004, 2010). This evidence is consistent with the feature that trade unions put a strong emphasis on raising job security for their members.[7] Thereby, unions may refer to job guarantees that could be the result of agreements with employers to increase job security among workers (Bryson *et al.* 2009). To specifically improve the job security of their members, trade unions may offer legal advice and representation in case of a conflict with the employer (Goerke and Pannenberg 2011). In addition, trade unions have also managed to secure higher fringe benefits, for example, related to vacation (Goerke *et al.* 2015). In sum, there is substantial evidence that union members in Germany face better working conditions than non-members, though not necessarily in terms of higher wages, and are better protected against job losses. This suggests that union members have greater incentives to retain their jobs, which could be reflected in the fact that their job tenure usually exceeds that of non-members (Goerke and Pannenberg 2004).

2.3 | Theoretical considerations and previous evidence

From an economic perspective, an individual has an incentive to become or remain a member of a trade union if the expected benefits of membership exceed the costs, that is, primarily the membership fee (Schnabel 2003). While the perception of job insecurity has no direct impact on the fee, it can alter the perceived benefits of trade union membership if the worker is concerned about job security.

First, consider the case of higher job insecurity as a result of an increase in the probability of a job loss. Because union membership is associated with a reduction in the probability of such an event, the gain from membership increases, *ceteris paribus*. Accordingly, this component of job insecurity is likely to enhance the probability that a worker belongs to a union.

Second, higher job insecurity may arise because the probability of finding a new adequate job declines. Such a decline makes union membership more attractive if members are better protected against losing their current jobs and are therefore less likely to be exposed to the consequences of a job loss.

These facets of job insecurity—and in the context of the German industrial relations system, possibly further, for example related to severance pay—suggest a greater attractiveness of union membership if perceived job insecurity increases. Hence we state the following prediction.

Main prediction. If workers are increasingly concerned about job security, then trade union membership becomes more attractive.

We can also focus on the two components of job insecurity that we are able to analyse using the available data.[8]

Subsidiary prediction 1. A higher perceived probability of losing the current job makes trade union membership more attractive.

Subsidiary prediction 2. A lower perceived probability of finding an alternative job makes trade union membership more attractive.

To the best of our knowledge, these predictions have not been analysed comprehensively using representative data, although the notion that union membership is an attractive option for workers seeking shelter has been discussed for quite some time. In an early study, Farber and Saks (1980) look at about 800 workers who took part in National Labor Relations Board elections in the USA. They show that dissatisfaction with job security raises the probability that a worker supports unionization. Findings from small samples of healthcare employees in Sweden and of graduates from a university in Australia reveal no or a positive relationship between job insecurity and union membership (Sverke and Hellgren 2001; Crockett and Hall 1987). Finally, Nätti *et al.* (2005) find a positive correlation for most years in repeated, representative cross-sections of employees in Finland.[9] By and large, these previous studies are consistent with our predictions without being able to deal with questions of causality.

The notion of reverse causality is amplified by research discussing how union membership affects perceived job security. The evidence in this respect appears to be mixed when comparing the findings for Britain (Bender and Sloane 1999) and the USA (Brochu and Morin 2012), although one would expect decreasing job insecurity when workers enter a trade union. In this context, researchers like Guest and Conway (2004) refer to the phenomenon of the dissatisfied union member, which has been discussed intensively in the literature (see Laroche (2016) for a meta-analysis, and Artz and Heywood (2021) and Goerke (2021) for recent surveys). One explanation for this phenomenon could be that trade unions raise expectations. However, several studies question the causal nature of the link between union membership and subjective perceptions, and refer to alternative explanations, such as sorting of dissatisfied workers into unions (see, for example, Bryson *et al.* 2004). The widespread idea that unions might influence their members' perceptions nevertheless provides additional justification for an empirical approach that relies on exogenously triggered changes in perceived job security.

3 | DATA

We use data from the German Socio-Economic Panel (SOEP) study, an annual representative panel survey (see Wagner *et al.* 2007; Goebel *et al.* 2019). Much of the SOEP fieldwork typically takes place towards the end of winter over a period of several weeks. We exploit the long format of SOEP version 33[10] with regional indicators, allowing us to identify each person as an inhabitant of one of Germany's 96 regional policy regions (RORs, *Raumordnungsregion*). On average, these regional clusters have slightly less than one million inhabitants and roughly one hundred SOEP interviewees. At the ROR level, it is possible to link significant numbers of observations in the survey data to indicators of local living conditions, such as the regional labour market situation.

The primary dependent variable in our analysis comes from a 'yes' or 'no' question on whether a respondent is a member of a trade union, which was asked to respondents from the reunited Germany in the SOEP waves of 1993, 1998, 2001, 2003, 2007, 2011 and 2015. The primary variable that we use to measure job insecurity is obtained from an annual battery of questions regarding what might be of concern to people. This question block starts with: 'What is your attitude towards the following areas—are you concerned about them?' The questionnaire provides three categories: 'very concerned', 'somewhat concerned' and 'not concerned at all'. As part of this battery, employed respondents are asked if they worry about their job security. In line with other SOEP-based studies on job insecurity (Geishecker *et al.* 2012; Reichert *et al.* 2015; Reichert and Tauchmann 2017), we focus on this variable, which allows us to test our main prediction based on a broad understanding of job insecurity.

We use two further SOEP variables on job-related insecurity to inspect our subsidiary predictions. First, we exploit information on whether employed respondents expect to lose their jobs in the near future. From 1999 onwards, the SOEP biannually, with the exception

of 2011, asks respondents about the expected probability of a job loss happening within the following two years (in steps of 10%). Second, the SOEP asks respondents each year for an assessment of how easy it would be to find a new job that is at least as good as the current one.

As instrumental variables, we employ three different triggers of job insecurity. Each of them refers to events that took place before the inquiry about union membership. First, we exploit information on past firm-level workforce reductions. Respondents in the SOEP are asked whether the number of employees in their company has changed. If they report a decline, then we classify this as a workforce reduction.[11] To establish the second trigger of job insecurity, we merge the SOEP data with information on regional unemployment rates, which vary between RORs and over time. This information stems from the so-called INKAR dataset.[12] As the third source of perceived job insecurity, we employ information on the sum of job terminations due to plant closures that SOEP interviewees report, who live in the same ROR but are not part of the respondent's household.[13] To provide descriptive information, we visualize aggregated trends as measured by our main job-insecurity variable and each instrumental variable over time in Appendix Figure A2. Perceived job insecurity varies substantially over time, has peaked around 2005, and declined considerably thereafter.

Apart from our main variables of interest, the SOEP offers information on an individual's personal life and job. In regard to the former, we consider age, years of education, the aggregate duration of previous employment and unemployment spells (in years), whether the respondent owns a house or flat, the size of dwelling (living area in square metres), how many household members there are, whether children under the age of 16 are living in the household, whether the respondent has a partner, and marital status. The information on the job includes a tenure variable, log of net earnings, and dummy variables specifying the occupation as well as employment status. We also consider information about firm size (0–19 employees, small company, reference category; 20–199, medium; 200–1999, large; and 2000 or more, very large), industry (NACE-1 level), and whether a respondent works in the public sector (which is possible in each of the NACE-1 level industry sectors).[14]

We restrict our empirical analysis to individuals aged between 18 and 65 who work either full-time or part-time. To focus on a situation in which labour market turbulences affect workers indirectly through their perceptions of job security, but not directly via actual job changes, in our main sample we require that individuals have not recently terminated their job or started a new one. Thereby, we also drop cases of recent within-employer job changes. Furthermore, we exclude individuals in vocational training and self-employment. In a final step, we exclude persons observed only once after the implementation of all restrictions. These observations cannot be used in the fixed effects analyses that we employ throughout.

Appendix Table A1 provides information on all variables in the main data sample, which underlies the first set of results presented in Section 4. It consists of 37,472 observations, of which 8658 are by union members. This results in a share of union members that is comparable to the figures on average union density in Germany as reported by the OECD and AIAS (2021) for the years on which our sample is based. Compared to non-members, union members are slightly older, are more likely to have a full-time job and work in the public sector and very large companies, and also have higher tenure.

There are 5341 observations from individuals who are always observed as union members in the main sample, while 24,937 observations are from workers who are always non-members. This aligns with the idea of a sticky membership choice, as slightly below 20% of the observations come from individuals who change their membership status over time. Among status changers, more than 75% alter their union membership status only once in our sample. Note that the sample size, and hence the number of workers changing membership status, shrinks when we make use of the triggers of job insecurity.

4 | ANALYSIS OF JOB INSECURITY AND UNION MEMBERSHIP

4.1 | Empirical strategy

In a first step, we estimate changes in the likelihood of union membership status (UM_{it}), in response to changes in perceived job insecurity (JI_{it}). Accordingly, we exploit the longitudinal data by running panel analyses that consider individual fixed effects (μ_i). This implies that time-invariant characteristics of individuals (e.g. personality traits) are unable to affect the analysis. In addition to time fixed effects (τ_t) and an error term (ε_{it}), we include successively vectors of time-varying personal characteristics (X'_{it}) and job attributes (Y'_{it}). Our first empirical model is

$$UM_{it} = \mu_i + \tau_t + JI_{it}\,\alpha + X'_{it}\,\beta + Y'_{it}\,\gamma + \varepsilon_{it}. \tag{1}$$

The analysis of model (1) serves as an illustrative starting point, which provides first evidence on our main prediction, but does not cater for the possible endogeneity of job insecurity. Therefore we exploit three separate sources of exogenous variation in a worker's perception of job insecurity as instrumental variables (IV_{it}) in further steps of our analysis. In each case, we first show results for union membership as the dependent variable in a reduced-form analysis, where we replace the independent variable of self-reported job insecurity in model (1) by a trigger of job insecurity. We then employ a two-stage least squares (2SLS) fixed effects approach, where we inspect the manipulation of job insecurity in a first-stage analysis using each trigger as an instrument, completed by a second stage with union membership as the dependent variable. Assuming a valid and strong instrument, our 2SLS model reveals the effect of exogenously manipulated job insecurity ($\widehat{JI}_{it}$) on union membership:

$$JI_{it} = \mu_{1i} + \tau_{1t} + IV_{it}\,\alpha_1 + X'_{it}\,\beta_1 + Y'_{it}\,\gamma_1 + \varepsilon_{1it}, \tag{2a}$$

$$UM_{it} = \mu_{2i} + \tau_{2t} + \widehat{JI}_{it}\,\alpha_2 + X'_{it}\,\beta_2 + Y'_{it}\,\gamma_2 + \varepsilon_{2it}. \tag{2b}$$

Throughout our analysis, we start our presentation with a parsimonious model excluding the vectors of personal and job-related variables (X'_{it} and Y'_{it}), before we consider them step-by-step.[15] Note that we employ linear estimations in our baseline analyses, and thereby assume that changes between ordinal categories of job insecurity have the same meaning across categories. This assumption facilitates the consideration of individual fixed effects in our analyses, and eases the interpretation of the results.[16]

4.2 | Preliminary analyses

Subsequently, we present results from fixed effects estimations of individual union membership in which perceived job insecurity is the right-hand-side variable in our empirical model. This analysis reveals the relationship between changes in perceptions and union membership status without consideration of any exogenous reason for the variation in perceived job insecurity.

Table 1 contains the results from estimating model (1). Column (1) depicts the results from the parsimonious model and contains year and month variables. We add the set of personal variables in column (2) and, furthermore, factors that relate directly to the main job in column (3) (see Appendix Table A2 for complete results). The evidence consistently shows a significantly positive relationship and suggests that increases in perceived job insecurity go along with a higher likelihood of union membership.[17] This is in line with our main prediction.

As considering more and more potentially relevant determinants of union membership does not change the relationship between union membership and job insecurity, we conclude cautiously that there might not be a significant omitted variable bias. To get closer to a causal

TABLE 1 Concerns About Job Security and Union Membership.

N = 37,472	(1)	(2)	(3)
Concerns about job security	0.009***	0.009***	0.008**
	(0.003)	(0.003)	(0.003)
Time variables	Yes	Yes	Yes
Personal variables		Yes	Yes
Job-related variables			Yes

Notes: The table shows results from separate linear regressions with consideration of individual fixed effects. The dependent variable is individual union membership (0 no, 1 yes). The independent variable is concerns about job security (0 not concerned, 1 somewhat concerned, 2 very concerned). Survey waves with union membership information are from 1993, 1998, 2001, 2003, 2007, 2011 and 2015. Time variables include year and month controls. See Appendix Table A1 for information on personal and job-related variables. Robust standard errors are in parentheses.
*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Source: SOEP data (v33).

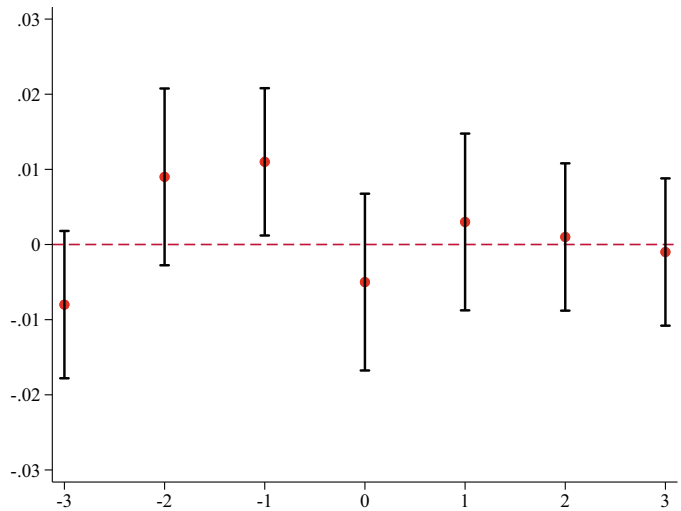

FIGURE 1 Dynamic analysis of concerns about job security and union membership. *Notes*: The illustration shows coefficients from a linear regression with consideration of individual fixed effects. The dependent variable is individual union membership (no 0, yes 1), measured in the current year ($t = 0$). The independent variables are concerns about job security (0 not concerned, 1 somewhat concerned, 2 very concerned) in the form of lag and lead variables, measured from three years earlier ($t = -3$) to three years in the future ($t = 3$). Survey waves with union membership information are from 1993, 1998, 2001, 2003, 2007, 2011 and 2015. The set of control variables includes year and month controls. Robust standard errors are used, and 95% confidence intervals are shown. Source: SOEP data (v33).

interpretation, we vary the timing of job insecurity and expand model (1) by adding lag and lead variables of job insecurity. This allows us to inspect the sequencing between changes in job insecurity over time and switches in union membership status.

Figure 1 illustrates the evidence from this dynamic analysis. It shows a positive relationship of union membership with job insecurity in the previous year ($t = -1$), preceding the observation of a change in union membership ($t = 0$). Interestingly, the result for job insecurity in the same year becomes insignificant in our expanded model with lag and lead variables, while there are also no significant results observed subsequently ($t > 0$). This picture supports the interpretation that workers who experience higher insecurity decide to enter a trade union, and suggests that the finding reported in Table 1 is driven by perceptions that changed already in the past. Nevertheless,

TABLE 2 Workforce Reductions and Union Membership.

$N = 32{,}122$	(1)	(2)	(3)
Panel A: Reduced form—Dependent variable: Union membership			
Firm-level workforce reduction	0.026***	0.025**	0.023***
	(0.004)	(0.004)	(0.004)
Panel B: First stage—Dependent variable: Concerns about job security			
Firm-level workforce reduction	0.015***	0.014***	0.014***
	(0.003)	(0.003)	(0.003)
Panel C: Second stage—Dependent variable: Union membership			
Concerns about job security	0.425***	0.436***	0.443***
	(0.094)	(0.102)	(0.112)
Kleibergen–Paap F-statistic	44.762	39.463	32.673
Time variables	Yes	Yes	Yes
Personal variables		Yes	Yes
Job-related variables			Yes

Notes: Panels A and B show results from separate linear regressions with consideration of individual fixed effects. The dependent variable is individual union membership (0 no, 1 yes) in panel A, and concerns about job security (0 not concerned, 1 somewhat concerned, 2 very concerned) in panel B. The independent variable reflects the occurrence of a firm-level workforce reduction (0 no, 1 yes), taken from the last year with available information prior to the current SOEP interview, with mean 0.28 (standard deviation 0.45). Survey waves with union membership information are from 1993, 1998, 2001, 2003, 2007, 2011 and 2015. Lagged information on workforce reductions comes from 1991, 1996, 1999, 2002, 2004, 2010 and 2013. Panel C shows job insecurity coefficients from instrumental variable analyses with consideration of individual fixed effects. The dependent variable in the second stage is individual union membership. The instrumented variable is concerns about job security. The instrumental variable is firm-level workforce reduction. Time variables include year and month controls. See Appendix Table A1 for information on personal and job-related variables. Robust standard errors are in parentheses. *, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Source: SOEP data (v33).

we have to be cautious with these results from the dynamic analysis, which relies on annually reported job insecurity, whereas union membership status is observed in only one year ($t = 0$). Accordingly, we cannot completely rule out reverse causality.[18]

4.3 | Main analyses

In this subsection, we consider triggers of job insecurity that are exogenous from the perspective of the worker, while we ensure that these refer to incidences that took place before the survey interview on union membership. This increases the probability that the manipulation of job insecurity precedes the potential consequence of changing union membership status. In the first subsubsection, we present our main results, which come from reduced-form as well as 2SLS analyses. They are summarized in separate tables for each trigger.[19] The next subsubsection then discusses the assumptions underlying the causal interpretation.

4.3.1 | Results

As a first trigger of job insecurity and, accordingly, union membership decisions, we consider firm-level workforce reductions. The assumption underlying this analysis (as well as the subsequent analyses based on regional triggers of job insecurity) is that the occurrence of labour market turmoil is not the result of (unobserved) changes in individual-related factors but is instead due to developments that are exogenous from the perspective of the individual worker.

TABLE 3 Regional Unemployment and Union Membership.

$N = 29{,}603$	(1)	(2)	(3)
Panel A: Reduced form—Dependent variable: Union membership			
Regional unemployment rate	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)
Panel B: First stage—Dependent variable: Concerns about job security			
Regional unemployment rate	0.028***	0.027***	0.027***
	(0.003)	(0.003)	(0.003)
Panel C: Second stage—Dependent variable: Union membership			
Concerns about job security	0.195***	0.198***	0.202***
	(0.056)	(0.059)	(0.060)
Kleibergen–Paap F-statistic	81.402	78.032	75.876
Time variables	Yes	Yes	Yes
Personal variables		Yes	Yes
Job-related variables			Yes

Notes: Panels A and B show results from separate linear regressions with consideration of individual fixed effects. The dependent variable is individual union membership (0 no, 1 yes) in panel A, and concerns about job security (0 not concerned, 1 somewhat concerned, 2 very concerned) in panel B. The independent variable is the regional unemployment rate from the year prior to the SOEP interview (min 2.3, max 22.3), with mean 9.56 (standard deviation 4.37). Survey waves with union membership information are from 2001, 2003, 2007, 2011 and 2015. Lagged information on regional unemployment rates comes from 2000, 2002, 2006, 2010 and 2014. Panel C shows job insecurity coefficients from instrumental variable analyses with consideration of individual fixed effects. The dependent variable in the second stage is individual union membership. The instrumented variable is concerns about job security. The instrumental variable is firm-level workforce reduction. Time variables include year and month controls. See Appendix Table A1 for information on personal and job-related variables. Robust standard errors are in parentheses.
*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Source: SOEP data (v33).

The reduced-form results in panel A of Table 2 show that the occurrence of a workforce reduction goes along with a significant increase in the probability of being a union member by more than two percentage points, according to column (1). This is equivalent to one-tenth of average union density (see Appendix Table A1). The result hardly changes when successively including personal and job-related variables, as shown in columns (2) and (3). Panels B and C present the results from the 2SLS analysis with firm-level workforce reductions as the instrumental variable. The first-stage effect is significant and strong, as can be seen in the F-statistics. The second stage confirms a significant effect of exogenously modified job insecurity on union membership status. In both cases, adding covariates does not change the finding.

Next, we examine changes in regional unemployment as a factor influencing perceived job insecurity and therefore union membership. The parsimonious model in panel A (column (1)) of Table 3 reveals that an increase in the annual unemployment rate of one percentage point goes along with an increase in the probability of being a union member of half a percentage point. Given a union density of about 23% and the persistence in membership, the increase appears substantial. Similarly, the first-stage results with regional unemployment as the instrument in panel B confirm the idea of a strongly modified perception of job insecurity. The second-stage results in panel C show that exogenously modified job insecurity affects union membership positively. To get an intuition for the effect size, consider a standard deviation shift in the unemployment rate of about four percentage points. This increases job insecurity by roughly 0.1 on the scale from 0 to 2, which translates into an increased probability of union membership by about two percentage points. The findings concerning the regional unemployment rate do not change when we add personal variables (column (2)) and factors that relate to the job (column (3)).

TABLE 4 Job Losses in the Region and Union Membership.

$N = 25{,}410$	(1)	(2)	(3)
Panel A: Reduced form—Dependent variable: Union membership			
Regional job losses due to plant closures	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)
Panel B: First stage—Dependent variable: Concerns about job security			
Regional job losses due to plant closures	0.015***	0.014***	0.014***
	(0.003)	(0.003)	(0.003)
Panel C: Second stage—Dependent variable: Union membership			
Concerns about job security	0.319***	0.323***	0.329***
	(0.107)	(0.110)	(0.112)
Kleibergen–Paap *F*-statistic	25.608	24.364	23.966
Time variables	Yes	Yes	Yes
Personal variables		Yes	Yes
Job-related variables			Yes

Notes: Panels A and B show results from separate linear regressions with consideration of individual fixed effects. The dependent variable is individual union membership (0 no, 1 yes) in panel A, and concerns about job security (0 not concerned, 1 somewhat concerned, 2 very concerned) in panel B. The independent variable is the number of regional job losses due to plant closure reported by other workers of the same ROR in last year's SOEP interview (min 0, max 12), with mean 1.85 (standard deviation 2.15). Survey waves with union membership information are from 1998, 2003, 2007, 2011 and 2015. Lagged information on reported job losses due to plant closure comes from 1997, 2002, 2006, 2010 and 2014. Panel C shows job insecurity coefficients from instrumental variable analyses with consideration of individual fixed effects. The dependent variable in the second stage is individual union membership. The instrumented variable is concerns about job security. The instrumental variable is the number of regional job losses due to plant closure. Time variables include year and month controls. See Appendix Table A1 for information on personal and job-related variables. Robust standard errors are in parentheses.
*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Source: SOEP data (v33).

Finally, we consider the regional number of job losses due to plant closures, as reported by other workers in the same ROR. The results in panel A of Table 4 show that if the number of such job losses increases, then the likelihood of being a trade union member rises as well. The estimated coefficient indicates that two additional cases of plant-closure-induced job losses, as reported by other SOEP respondents living in the same ROR, go along with an increase in the probability of being a union member by one percentage point. The results from the 2SLS analysis with regional plant closures as the instrumental variable substantiate the idea of job insecurity as the mechanism behind the positive impact of labour market turmoil on union membership. As can be seen across the panels, the results are again very similar when we expand the parsimonious model by adding sets of covariates.

4.3.2 | Discussion

Our analysis provides credible evidence on the effect of job insecurity on union membership, as long as the identification assumptions hold. In this subsubsection, we discuss possible violations and concerns, while Appendix B contains supplementary evidence to which we refer below.

Reverse causality

As a possible threat to our exogeneity assumption, changes in unionization could affect labour market conditions that are related to our triggers of job insecurity. One argument in this context could be built upon the idea of the right-to-manage model, according to which unions are able to

affect the employment level, for example by varying wages. Such an employment effect, though, is unlikely to play a role in our analysis, for various reasons.

First, it is not clear whether unionization actually has a negative effect on employment, as indicated, for example, by Machin and Wadhwani (1991) and more recently Frandsen (2021). While Addison and Belfield (2004) draw this conclusion from their analysis of data primarily for Anglo-American countries, Brändle and Goerke (2018) come to a different conclusion for Germany. In a recent study that reveals positive effects of union density on productivity for Norway, Barth *et al.* (2020) point out the vital role of different institutional settings underlying the empirical research on trade unions. Given our focus on the German labour market (see the second subsection of Section 2), it is particularly unclear whether there is a strong link between individual membership and bargaining power for our institutional context. In fact, the notion of (workplace) union density as a driver of both wages and employment may be plausible for other countries (see, for example, Lucifora 1995; Barth *et al.* 2000; Breda 2015), but this cannot be applied to Germany, where individual decisions to join a trade union are unlikely to affect the power of the union at the sectoral level, at which bargaining generally takes place. Second, even if we were willing to assume that stronger unions reduce employment, this effect cannot explain the intense fluctuation observed in the local unemployment data over the years (see Appendix Figure A2). Instead, the negative impact of unions would be expected to develop gradually, while the effects observed in our analysis are determined through relatively quick changes in local labour market conditions over time. As discussed above, joining a trade union can be considered a potentially 'sticky' decision, making it very unlikely that German workers frequently adjust their membership status and affect firm-level policies like workforce adjustments. Third, even if workers become union members with the aim of affecting labour market outcomes, a new union member would be unlikely to achieve this objective because long-term union officials, not the newcomers, fill relevant positions in Germany's worker representation system. Finally, instead of individual determinants, a variety of macroeconomic factors determine changes in regional unemployment rates. Globalization and international economic cycles affect unemployment rates, especially in an export-oriented economy such as Germany, thereby changing the local situation very differently, given the variation in the dependency on export markets across sectors and regions. Another determinant of unemployment rates is labour market policy, which is typically determined at the national level in Germany. Policies like the so-called 'Hartz reforms' can substantially affect regional employment rates, whereas the resulting uncertainties can be seen as exogenous from the individual's perspective. The implementation of the euro as a supranational currency constitutes another policy reform happening during our period of investigation and potentially affecting unemployment rates in Germany.

Therefore there are many institutional reasons to view changes in regional labour market conditions as the result of exogenous influences and not as a consequence of reverse causality in our setting. Our comprehensive set of robustness checks and sensitivity analyses in Appendix B provides empirical evidence that further strengthens this conclusion. For example, one could argue that the plausibility of the exogeneity assumption differs for small firms where workers are more likely able to affect company decisions through their own actions, and for very large firms where trade unions in Germany are more active. Hence, expecting that reverse causality, if relevant in our setting, should vary between small firms and very large firms, we conduct heterogeneity analyses using interactions with firm size indicators, which, however, turn out to be insignificant (see Appendix Table A8). For another check, we control for the lagged trends in union membership at the industry level, without changing the results (see Appendix Table A9).

Omitted variable bias

Another concern for our analysis could be that unobserved factors are related to both changes in unionization and triggers of job insecurity. For example, one may argue that union membership is related to collective bargaining or the existence of a works council in the company. However, these

institutions are strongly related to the size of the firm and hence are considered in our analyses. Furthermore, the main findings do not change when we make use of available information in the SOEP on bargaining agreements and works councils (see Appendix Table A9). We can also add possibly endogenous variables at the individual level, such as household income, which could be affected by local unemployment rates (Kuehnle 2014), and we can add a full set of dummy variables to control for region fixed effects, which are identified via individuals moving from one ROR to another during our investigation period (see Appendix Table A10). For another analysis, we exclude these movers by restricting our sample to individuals who are not observed in multiple regions, which allows us to cluster the standard errors at the regional level. In the course of this analysis, we consider further regional, time-variant variables from the INKAR dataset, such as local taxation levels. This does not change our results, as shown in Appendix Table A11.

IV validity

The assumption underlying our IV analysis could be violated, in that perceived job insecurity is not the only channel through which labour market crises affect union membership. For example, one could argue that other workers' job losses trigger solidarity, so that changes in membership status are not due to one's own job insecurity. If this is true, then one could suspect that altruistic motives play a role if other workers lose their jobs, given that particularly altruistic people may want to show solidarity or even help others by becoming union members. Based on this reasoning, we have the opportunity to inspect this possible channel empirically by exploiting information on positive reciprocity and separating individuals according to their responses. We do not observe any significant interaction effects in separately conducted analyses of union membership, when we interact our triggers of job insecurity with indicators for low, or respectively high, reciprocal attitudes of workers (see Appendix Tables A8). As another possible violation of the validity assumption, one could argue that local labour market turmoil increases the activities of unions whose access to the media allows them to attract new members, perhaps without changing perceived job security. While this suggests examining whether and how media covering labour market turmoil affect job insecurity perceptions, we acknowledge that it is impossible to completely rule out the possibility of alternative channels.

4.4 | Subsidiary predictions

In this subsection, we inspect in more detail our subsidiary predictions, which relate to the probability of a job loss and the ensuing consequences. Using the parsimonious model without personal or job-related variables, we compare first-stage results for each of the three triggers of job insecurity. Thereby, we can learn more about the idea that workforce reductions, regional unemployment rates, and other workers' job losses trigger different forms of job insecurity in significant ways. In a second step, we rely on the insights from this analysis and run additional 2SLS analyses using alternative job-insecurity variables for which there is a strong instrument to present suggestive evidence concerning potential channels.[20]

Table 5 presents first-stage results from our comparative analysis. We start our analysis by employing the indicator capturing job-loss expectations. This measure reflects job insecurity in line with our first subsidiary prediction, as workers may increasingly fear a job loss in times of crisis. Then we employ the indicator that reflects re-employment concerns, measured by an assessment of how easy it would be to find a new job that is at least as good as the current one. This variable captures increased concerns about potential consequences of job loss in line with the second subsidiary prediction. Additionally, we use both measures in two distinct ways, namely linearly and as a dummy variable, the latter of which simplifies the interpretation of the results.

TABLE 5 Analysis of Mechanisms: Alternative First-stage Estimations.

Dependent variable:	Job loss expectations		Re-employment difficulties	
	Linear	Binary	Linear	Binary
	(1)	(2)	(3)	(4)
Panel A				
Firm-level workforce reduction	0.236***	0.037***	0.031***	0.011
	(0.049)	(0.009)	(0.011)	(0.008)
N	20,300	20,300	20,300	20,300
Panel B				
Regional unemployment rate	0.076***	0.012***	0.026***	0.011***
	(0.015)	(0.003)	(0.003)	(0.002)
N	24,342	24,342	24,342	24,342
Panel C				
Regional job losses due to plant closures	0.023	0.004	0.007*	0.003
	(0.017)	(0.003)	(0.004)	(0.003)
N	16,591	16,591	16,591	16,591

Notes: The table shows results from separate linear regressions with consideration of individual fixed effects. The dependent variables are expected chance of job loss in % (column (1)), and at least 50% expected chance of job loss (column (2)), difficulty of finding an alternative job (column (3)), and very high difficulty of finding an alternative job (column (4)). The independent variables are firm-level workforce reductions from the last year with available information prior to the SOEP interview (panel A), regional unemployment rate from the year prior to the SOEP interview (panel B), and number of job losses due to plant closure reported by other workers of the same region in last year's SOEP interview (panel C). See Tables 2–4 for more information on the independent variables and the survey waves used. Note that the sample used across columns is restricted to the years 2001, 2003, 2007 and 2015 (due to restricted availability of job loss expectations in the SOEP data). The set of control variables includes year and month controls. Robust standard errors are in parentheses. *, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Sources: SOEP data (v33), INKAR data.

Panel A of Table 5 displays strong effects of workforce reductions on the perceived risk of a job loss, independent of the definition. Column (2) shows that the incidence of firm-level workforce reductions increases the probability of reporting a 50% or higher chance of a future job loss by 3.7 percentage points. This is a substantial impact, given that on average only a minority of roughly 18% report such severe job-loss risk. For the second job-insecurity measure, indicating the likelihood of finding a comparable new job, the effect of firm-level workforce reductions is not robust.

Panel B of Table 5 shows that a variation in regional unemployment manipulates workers' perceptions of job security significantly, independently of the measure chosen. Just as in the case of workforce reductions, workers report increased job-loss expectation if others lose their jobs (columns (1) and (2)), but, in this case, re-employment concerns are also consistently affected by this particular trigger of job insecurity (columns (3) and (4)). Accordingly, an increase in the unemployment rate of one percentage point goes along with an increase in the probability of finding no alternative job by roughly one percentage point. This is a substantial effect, given that only about 22% of workers report having such bad re-employment prospects.

Panel C of Table 5 shows different results when comparing the two job-insecurity variables, with none of the effects being strong and robust. The effect of other workers' job losses in the same region is only slightly significant for re-employment concerns (column (3)). This means that individuals do not necessarily report a worse re-employment outlook or significantly higher probability of losing their jobs when this happens to other workers in the region; but since they are indeed concerned about job security in general (see Table 4), it rather seems that there are other components of job insecurity at play.

TABLE 6 Analysis of Mechanisms: Alternative Second-stage Estimations.

	Dependent variable: Union membership		
Second stage	(1)	(2)	(3)
Panel A: N = 20,409—Instrumental variable: Firm-level workforce reduction			
Job loss expectations	0.074***	0.074***	0.077**
	(0.028)	(0.028)	(0.031)
Kleibergen–Paap *F*-statistic	24.057	23.470	20.724
Panel B: N = 29,399—Instrumental variable: Regional unemployment rate			
Re-employment difficulties	0.243***	0.244***	0.242***
	(0.068)	(0.070)	(0.069)
Kleibergen–Paap *F*-statistic	73.689	71.558	74.338
Time variables	Yes	Yes	Yes
Personal variables		Yes	Yes
Job-related variables			Yes

Notes: Panels A and B show job insecurity coefficients, each of which is obtained from a separate instrumental variable analysis with consideration of individual fixed effects. The dependent variable in the second stage is individual union membership. In panel A, the instrumented variable is job loss expectations and the instrumental variable is firm-level workforce reduction. In panel B, the instrumented variable is re-employment difficulties and the instrumental variable is the regional unemployment rate. See Tables 2–4 for more information on the variables and the survey waves used. Robust standard errors are in parentheses.
*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Sources: SOEP data (v33), INKAR data.

In a final step, we use a strong instrument for each of the two alternative job-insecurity variables in additional 2SLS analyses. Table 6 presents the results from this exercise for job-loss risk in panel A, using workforce reductions as IV, and re-employment chances in panel B, using regional unemployment as IV. The results are consistent with both of our subsidiary predictions, according to which exogenously triggered fear of a job loss and increased difficulties in finding a comparable job could be relevant motives for trade union membership.[21]

5 | ADDITIONAL ANALYSES

5.1 | Media coverage of labour market turmoil and trade unions

Our results suggest that adverse labour market events, such as plant closures, can manipulate the perception of job insecurity, which then makes union membership attractive for workers seeking shelter. But how do these developments, some of which may have no direct impact on a single worker, translate into abstract fears and concerns that could help trade unions to attract new members? Arguably, a key transmitter of information about labour market events is the media.

To investigate this hypothesis, we merge self-collected data on news coverage with the SOEP dataset to inspect two empirical relationships. First, we follow similar research (Garz 2012) by analysing whether media reports on downsizing are capable of raising concerns about job security of those workers who continue to be employed. Second, we inspect whether trade unions benefit from additional media coverage about their activities when more reports on labour market turbulences enhance the perception of job insecurity. By using interview dates in our main SOEP sample, we compare participants who are interviewed after having experienced a couple of days with either good or bad news regarding current economic conditions. Thus

we rely on a methodological approach using interview-date identification strategies to gather quasi-experimental evidence on short-term variations in subjective perceptions (e.g. Berger 2010; Metcalfe *et al.* 2011; Goebel *et al.* 2015; Schüller 2016).

We measure the intensity of labour market turmoil via the number of news reports on downsizing. The idea is that when a firm reduces its workforce, this can affect unemployment rates but also attract media attention. As for other media-based analyses (e.g. Lamla and Lein 2015; Chadi and Krapf 2017; Murphy 2020), the data collection takes place via LexisNexis, which allows news coverage to be quantified on a daily basis.[22] Running its search engine with German translations of the terms downsizing (*Arbeitsplatzabbau*) and trade unions (*Gewerkschaften*), LexisNexis determines the number of daily news reports that include these terms. Appendix Figure A3 displays the media data by exemplarily showing numbers of reports for the first 100 days of 2007. Figure A3(a) hardly suggests any link between the two in the raw data, which, however, may be simply due to heterogeneity in news reports across weekdays. To prepare the data for the analysis, it appears useful to aggregate coverage over seven days. Figure A3(b) presents the data after such a week-based aggregation. It shows that increased coverage on downsizing seems to go along with more reports on trade unions.

Table 7 presents the results of our two-step regression analysis. Panel A shows how concerns about job security, as reported by SOEP participants on the interview date, are affected by media coverage on downsizing in the seven days before the interview. Using our empirical approach with consideration of individual fixed effects, we find that increases in such media coverage lead to higher job insecurity. This finding is robust across specifications when adding more and more variables to the model. Panel B shows how the media indicator capturing coverage on downsizing predicts coverage on trade unions in significant ways. For this analysis, we collapse the data onto the interview-date level. We consider year effects throughout the analysis, and successively add variables for the month and weekday of the interview.

The conclusion from our media analysis is straightforward. While adverse labour market conditions can trigger concerns regarding job security, trade unions benefit in terms of increased media coverage. This relationship between the two types of news coverage is strong, as there is on average more than one additional report on trade unions for every additional media report on downsizing (see panel B of Table 7). This finding gives further credence to the interpretation of trade unions as potential beneficiaries of crises.

5.2 | Job loss and union membership

Trade unions could benefit from labour market crises, as job insecurity experienced by workers makes membership more attractive. However, a possible negative implication is left out by design in our main analysis of employed individuals. In fact, some workers may experience no gain in actual job security after entering the trade union. Instead, they could be very disappointed when they lose their job and thus have reason to terminate their union membership. As previous studies document a strong relationship between perceptions of job insecurity and actual outcomes (Stephens 2004; Dickerson and Green 2012), lower perceived job security empirically goes along with a higher probability of actual job loss. If losing a job, in turn, reduces the likelihood of union membership, then the overall picture of unions as the beneficiaries of crises might change.

To provide a more comprehensive picture, we subsequently inspect the role of actual job losses. First, we modify the analysis by expanding the data sample with cases of individuals who become unemployed. In Appendix B, we provide details and present the results in Table A12. All three job-insecurity triggers continue to increase the probability of union membership. This can be interpreted as the first evidence that actual job losses do not trigger a sizeable number of trade

TABLE 7 Media Coverage on Downsizing and Trade Unions.

	(1)	(2)	(3)
Panel A: N = 37,472—*Dependent variable: Concerns about job security*			
Media coverage on downsizing	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)
Time variables	Yes	Yes	Yes
Personal variables		Yes	Yes
Job-related variables			Yes
Panel B: N = 1724—*Dependent variable: Media coverage on trade unions*			
Media coverage on downsizing	1.533***	1.823***	1.825***
	(0.476)	(0.414)	(0.415)
Year variables	Yes	Yes	Yes
Month variables		Yes	Yes
Day-of-the-week variables			Yes

Notes: Panel A shows results from separate linear regressions with consideration of individual fixed effects, using the sample as illustrated in Appendix Table A1 (based on survey years 1993, 1998, 2001, 2003, 2007, 2011 and 2015). The dependent variable is concerns about job security. Time variables include year and month controls. See Table A1 for information on personal and job-related variables. Panel B shows results from separate linear regressions using a date-based dataset for all SOEP interview dates in the sample as illustrated in Table A1 (with survey years 1993, 1998, 2001, 2003, 2007, 2011 and 2015). The dependent variable is the sum of news articles on trade unions (*Gewerkschaften*) over the seven days prior to the interview date (min 12, max 887), with mean 210.67 (standard deviation 132.57). The independent variable in both panels is the sum of news articles on downsizing (*Arbeitsplatzabbau*) over the seven days prior to the interview date (min 0, max 44), with mean 6.18 (standard deviation 6.29) in panel A. Robust standard errors are in parentheses. *, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Sources: SOEP data (v33), LexisNexis.

union membership terminations. The finding is not consistent with the notion that unions are the beneficiaries of a crisis only as long as we focus on the employed.

To get more direct evidence on how a job loss could affect union membership, we conduct a difference-in-differences (DiD) analysis. We focus on job terminations due to plant closures, relying on the idea that they are exogenous from the individual's perspective. Specifically, we inspect a sample of employed workers, in line with our main data sample restrictions, and observe the same workers two years later. Some workers (serving as a quasi-treatment group) report to have experienced a job loss due to plant closure, while the rest continue to be employed throughout the two-year time period (serving as a quasi-control group). As discussed in the literature on individual implications of plant closures (e.g. Chadi and Hetschko 2018), a time frame of two years helps to minimize the role of anticipation and foreknowledge among workers who in the year before the event could already be affected in one way or another.

The dependent variable is the change in union membership, which implies that we have to construct a new dataset by considering lagged information, as the time span between two SOEP waves with union membership status is usually more than two years.[23] We first inspect all directions of possible changes in union membership, which could imply a union entry (change in status: 1) as well as a union exit (change in status: −1) or no change (change in status: 0). In steps two and three, we then use binary variables to estimate the likelihood of a possible union exit (0 no, 1 yes), conditional on being a union member at the beginning of the time window, and a possible union entry (0 no, 1 yes), conditional on not being a member before.

The results in Table 8 indicate that job losses due to plant closures do not impair trade union membership. The coefficients in panel A are all positive and weakly significant. As can be seen in panel C, this is driven by workers who are not union members and whose union entry becomes more likely when they lose their job due to a plant closure. In line with our main findings, this

TABLE 8 Job Loss and Union Membership.

	(1)	(2)	(3)
Panel A: N = 29,474—Dependent variable: Change in union membership			
No restriction on union status			
Job loss due to plant closure	0.037*	0.038*	0.038*
	(0.022)	(0.022)	(0.022)
Panel B: N = 6819—Dependent variable: Union exit			
Only union members			
Job loss due to plant closure	0.026	0.024	−0.005
	(0.056)	(0.057)	(0.057)
Panel C: N = 22,655—Dependent variable: Union entry			
Only non-union members			
Job loss due to plant closure	0.042**	0.038*	0.046**
	(0.021)	(0.021)	(0.021)
Time variables	Yes	Yes	Yes
Personal variables		Yes	Yes
Job-related variables			Yes

Notes: Panel A (B, C) shows results from separate linear regressions using a sample of workers observed in 1996, 1999, 2001, 2005, 2009 or 2013 who are either union members or not (who are union members, who are not union members) and two years later regarding their union membership status. To determine union membership status in those SOEP waves without the question on union membership, information from the most recent SOEP wave before is used. For the analysis of workers in 1996 (1999, 2001, 2005, 2009, 2013), information on union membership comes from 1993 (1998, 2001, 2003, 2007, 2011). The dependent variable in panel A is the change in individual union membership (−1 exit, 0 no change, 1 entry) when comparing the situation two years later with the current situation (mean – 0.01, standard deviation 0.30). The dependent variable in panel B is union exit (0 no, 1 yes), with mean 0.20 (standard deviation 0.40). The dependent variable in panel C is union entry (0 no, 1 yes), with mean 0.05 (standard deviation 0.22). The independent variable in all three panels is the incidence of a job termination due to plant closure reported two years later (0 no, 1 yes), with mean 0.01 (standard deviation 0.09) in panel A. Numbers of cases of job termination due to plant closure are 242 in panel A, 51 in panel B, 191 in panel C. Time variables include year and month controls. See Appendix Table A1 for information on personal and job-related variables. Robust standard errors are in parentheses.
*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Source: SOEP data (v33).

could be due to the experience of job insecurity. Furthermore, by focusing on trade union members only in panel B, we do not find evidence that they are significantly more likely to end their membership after a job loss due to a plant closure. Considering the full set of covariates, the coefficient even becomes slightly negative (see column (3) in panel B).

In Appendix B, we complement the analysis of job losses with an alternative approach where we combine the DiD analysis with a matching technique (see Appendix Table A13). We also consider data on job loss expectations, which enables us to control for anticipation effects that are possible even two years in advance, as indicated by research on lead effects prior to a plant closure (Wunder and Zeydanli 2021). We find no evidence for negative effects of job loss on union membership in any of our additional analyses. This supports the idea that trade unions may be beneficiaries of labour market turbulences, even if considering the selection of workers out of the labour market through actual job losses.[24]

6 | CONCLUSION

In this paper, we use German panel data to investigate comprehensively whether perceived job insecurity, as a necessary implication of crises in the labour market, increases the attractiveness of

trade union membership. We first establish predictions on the potential benefits of union membership for workers perceiving job insecurity. We then conduct an extensive empirical investigation of workers exposed to different triggers of job insecurity. More precisely, we consider workforce reductions in the respondent's firm, regional changes in the unemployment rate, and the occurrence of job terminations due to plant closures. The evidence strongly supports the view that workers could become union members when experiencing greater job insecurity. Furthermore, our evidence indicates that both the probability of losing one's job and the ensuing consequences matter for the union membership decision.

We conduct two additional analyses into the possible role of trade unions as beneficiaries of labour market crises. First, we scrutinize a particularly important transmitter of abstract fears today. Our analysis of media data shows that news coverage about downsizing is not only capable of triggering concerns about job security among workers, but also goes along with a significant increase in media coverage on trade unions. Our findings lead to an intriguing conclusion on how unions benefit from developments in the labour market, such as layoffs, which they certainly argue they are fighting against. This conclusion manifests itself in our final analysis of plant closures in which we find no evidence that losing a job reduces the probability of union membership. If anything, there is evidence that some workers join a union. This complements our broad investigation, from which we conclude that unions can attract new members in times of crisis, while they do not lose members for whom the threat of a job loss becomes a reality.

Our paper has implications for policymakers and trade unions. Economic crises appear to have consequences even for those who are not affected directly by, for example, losing their jobs, but who may adjust their economic choices due to perceiving uncertainty. For policy-making in times of crisis, this suggests taking a comprehensive perspective on the behavioural responses in the broader population that may be exposed to uncertainty. For labour market policymakers attempting to put pressure on workers by abandoning employment protection, our finding of positive effects on union membership points to unintended consequences. Similarly, other institutions that promise to provide shelter during times of uncertainty may join trade unions in the role as beneficiaries of crises, indicating possible avenues for further research.

A further implication from our investigation may be that there is some good news for unions in times of bad news for workers. By emphasizing their role as institutions providing shelter and relying on the increased media coverage during labour market crises, trade unions could successfully attract new members. Furthermore, long-term trends such as globalization and digitization, which make employment relations less stable and more insecure, may further boost the attractiveness of becoming a trade union member, thereby compensating the unions for possible disadvantages caused by those developments. In line with this perspective, we observe a slowdown in the decline in union density in Germany since the Great Recession. The flip side of the coin is that if trade unions manage to make jobs more secure and higher levels of job security are tantamount to lower incentives to join a trade union, then our findings also imply that more successful trade unions will face increasingly greater obstacles in recruiting new members. In other words, the very success of trade unions could be a reason for their decline.

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NOTES

[1] For these quotes, see www.afge.org/common-pages/we-are-afge-d9, www.legacy.iatse.net/organize/us-organizing and www.unitetheunion.org/media/1733/ten-good-reasons-june-18.pdf (all accessed 8 May 2023).

[2] With this approach, we take up an idea by Reichert and Tauchmann (2017), who conduct SOEP-based research using workforce reductions as a trigger of perceived job insecurity to study health consequences.

[3] The idea of using changes in regional labour market conditions as an exogenous source of variation in individual perceptions of economic conditions goes back to Lusardi (1997). See Reichert *et al.* (2015) and Chadi *et al.* (2019) for more recent studies based on this approach.

[4] There is a large body of research on the implications of job termination for the individual worker based on the incidence of a plant closure. For exemplary studies based on SOEP data, see, for example, Kassenboehmer and Haisken-DeNew (2009), Schmitz (2011), Kunze and Suppa (2017), Odermatt and Stutzer (2019), and Chadi and Hetschko (2021). Some studies analyse the implications of another person's job loss and focus on plant closures experienced by the spouse as an exogenous incidence (Marcus 2013; Nikolova and Ayhan 2019). To the best of our knowledge, we are the first to shift the trigger event further away from the individual to other workers in the same region, thereby increasing the exogenous nature of the incidence.

[5] This analysis is inspired by research on economic decision-making following events that are covered in the news media. See, for example, Gallagher (2014), who shows how the coverage of floods increases purchases of flood insurances in regions that are unaffected by the actual disaster. In a recent study on the determinants of union membership, Murphy (2020) exploits data on the incidence of news stories covering allegations against teachers, which increases demand for legal insurance as provided by teacher trade unions. For a comprehensive review of the economic research on media and how it can shape individual beliefs, see DellaVigna and La Ferrara (2015).

[6] In a similar fashion, numerous studies show how the subjective variable of job satisfaction relates to subsequent job changes, which are more likely to happen, the less satisfied workers report to be (e.g. Clark 2001; Shields and Price 2002; Delfgaauw 2007; Lévy-Garboua *et al.* 2007; Sousa-Poza and Sousa-Poza 2007; Böckerman and Ilmakunnas 2009; Green 2010). For job insecurity, previous studies have pointed out the importance of such subjective assessments in predicting household consumption behaviour (Stephens 2004; Benito 2006), residence decisions (Becker *et al.* 2010) and future wage outcomes (Campbell *et al.* 2007).

[7] The main German trade union federation, DGB, to which about 75% of all union members in Germany belong, lists eight reasons for joining on its homepage. The first refers to the legal protection offered to union members, for example, in case of (dismissal) disputes with the employer. See https://www.dgb.de/service/mitglied-werden/index.html (in German; accessed 9 May 2023).

[8] We can derive our predictions from a simple model of trade union membership (see Appendix A). To focus the exposition, we refrain from developing it here.

[9] In this context, Sverke and Goslinga (2003) find that job insecurity is positively related to the intention of leaving the union for a sample of members in Belgium and Italy, whereas no such correlation can be observed for the Netherlands and Sweden.

[10] See doi:10.5684/soep.v33 (accessed 8 May 2023).

[11] The English translation of the original SOEP question is: 'How was it in the previous twelve months in the company where you currently work: has the number of employees increased, decreased or remained the same?' While the respective question is not part of each SOEP wave, it is possible to use all the relevant waves with information on union membership by using lagged information on workforce reductions. In particular, we use lagged information in 1993 that stems from the 1991 interview, in 1998 from the 1996 interview, in 2001 from 1999, in 2003 from 2002, in 2007 from 2004, and in 2011 from 2010. In the case of 2007, we have to take the information from three years back because the SOEP does not include data on workforce reductions in the waves of 2005 and 2006. See Appendix B for a discussion of sensitivity analyses regarding sample issues, the results of which are in Table A3.

[12] INKAR data can be found on the internet (www.inkar.de) and are provided by Germany's Federal Office for Building and Regional Planning. In our analysis, we employ the information on regional unemployment rates from the year prior to the enquiry about union membership in the SOEP. Since regional unemployment rates are available only from 1998 onwards, we utilize all relevant SOEP waves from 2001 onwards.

[13] To establish this indicator, we consider cases of plant-closure-induced job losses reported by other workers in their previous year's SOEP interview, and exclude observations of plant closures reported by other household members. We restrict cases to the time window between last year's interview and the second-to-last year's interview, which ensures that other workers' job losses took place in the past and within a fixed time frame of about one year. Because information on plant closures is included in all SOEP waves since 2001, and in the waves prior to 1999, we cannot make use of the SOEP wave of 2001 when using our regional job-loss indicator. Further, we cannot use the 1993 wave for this analysis, because of a territorial reform of regions in Germany during the mid-1990s that prevents us from observing individuals in the same ROR when using data from both 1993 and years after the reform. Finally, since our indicator relies on absolute numbers of cases, we also consider relative definitions of plant-closure cases in additional analyses. While using such instruments results in qualitatively the same findings, we note that our IV definition allows for the strongest manipulation of job insecurity.

[14] We consider missing values in these three cases (concerning firm size, industry and public sector) via a dummy indicator throughout our analyses to avoid losing sizeable numbers of observations.

[15] Both vectors of variables include factors that may not be exogenous. For instance, changes in someone's marital status or earnings level could be relevant for union membership choices and related to the independent variable at the same time. Hence we conduct additional analyses to inspect the relevance of our decisions on covariates for the results. This shows that our findings are insensitive to the inclusion or exclusion of covariates. Nevertheless, we consistently rely on the parsimonious models when interpreting the evidence from our analyses.

[16] There are discussions of the cardinality assumption underlying the use of linear estimation methods when analysing life satisfaction (Ferrer-i-Carbonell and Frijters 2004) and job insecurity (Georgieff and Lepinteur 2018) as dependent variables. While researchers usually conclude that interpreting an ordinal-scaled variable as cardinal has no bearing on the results, we employ non-linear estimation methods in Appendix B to check our first-stage evidence based on a binary version of the job insecurity variable, just as we check the reduced-form results for union membership in the same way. The results in Tables A4 and A5 confirm both our first-stage results for job insecurity and the reduced-form results for trade union membership. While there is a lack of methodological alternatives to the 2SLS fixed effects approach underlying our IV analyses, we interpret the evidence from our non-linear estimation checks as supportive of the conclusion in the literature, according to which the linearity assumption hardly matters for the results in our context. Note that we are able to re-run our 2SLS fixed effects analysis using a binary variant of the job insecurity variable instead of treating concerns as cardinal. While this reduces the statistical power underlying the IV analysis in comparison to our baseline approach, the findings remain the same.

[17] We confirm the insights from our preliminary analysis by employing a binary indicator for job insecurity, given that other studies treat this variables as categorical (see, for example, Clark *et al.* 2010; Knabe and Rätzel 2011). When we use two dummy variables for 'somewhat concerned' and 'very concerned' about job security, we find that both are positively related to trade union membership but only the latter is statistically significant.

[18] Another limitation of the dynamic analysis is the sample size ($N = 16{,}335$), which is much smaller than in our main dataset, as each individual is required to respond in the questionnaire in all three years before and after the year with the union question, hence seven years in a row. Based on a larger sample using only one lagged job insecurity variable, we confirm our conclusion that the link between union membership and job insecurity is rather driven by past perceptions, less so by the currently reported job insecurity. When we modify this analysis by using binary variables for being 'very concerned' about job security, we come to the same conclusion.

[19] Table notes contain additional descriptive information on key variables if those are not part of the main data sample illustrated in Table A1. Since it is technically possible to employ several instruments at the same time, we conduct supplementary 2SLS analyses. In Appendix B, we discuss these analyses in more detail, including limitations. Specifically, our multiple instruments analyses are based on smaller samples, which goes along with less statistical power. Nevertheless, the results shown in Table A6 provide further support for our main conclusions.

[20] We are cautious with our conclusions in this analysis of different channels, given that the subjective variables constitute proxies for the different forms of job insecurity that we discussed in the first subsection of Section 2. Accordingly, the variables may capture similar perceptions to some extent and could be related to each other, thus preventing us from clearly disentangling the different components of job insecurity. Therefore the following IV analysis deviates from an ideal where each instrument affects exclusively only one particular channel at a time.

[21] In Appendix B, we come to a similar conclusion when we conduct interaction analyses using factors that are related to the components of job insecurity. The results can be found in Table A7.

[22] LexisNexis contains major German publications (e.g. *Die Welt*, *Der Spiegel*) that are included with their print and online products in addition to agency reports and other sources of news media information. To avoid an arbitrary decision, our analysis considers all news media sources combined that are available in this data bank.

[23] To establish the dataset used in this DiD analysis of changes in union membership status, we consider all the available SOEP waves with union membership information in our main data sample. In contrast to our main analysis, the SOEP wave of 1993, which was the first year in which the SOEP enquired union membership from all Germans after reunification, is used solely to have information on union membership status prior to a possible job loss, as reported in the next SOEP wave with union membership information conducted in 1998. To establish two-year time windows, we focus on the SOEP waves of 1996, 1999, 2001, 2005, 2009 and 2013 in our analysis, which is two years prior the SOEP waves of 1998, 2001, 2003, 2007, 2011 and 2015 with union membership information. To establish union membership status at the beginning of the two-year time window, we always use the most recent information (see the notes in Table 8 for details).

[24] There is another potential selection effect, which deserves attention when using panel survey data, that could be due to non-response. We discuss this issue in Appendix B, where we also present results from additional analyses. They indicate that our main findings are not plagued by such sample selection (see Table A14).

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APPENDIX A

In this appendix, we sketch a model of trade union membership to derive the predictions stated in the final subsection of Section 2. The framework incorporates essential features of the German industrial relations system. In particular, we assume that unions can neither force workers to join by establishing closed shops, nor prevent employers from paying collectively bargained wages to non-members. In consequence, all workers of a firm covered by a collective agreement receive the same wage, irrespective of their individual union membership status. The same applies for workers of uncovered establishments.

Let a worker's utility U^i be given by

$$U^i + i \times M = p^i\, u\left(w^i\right) + \left(1 - p^i\right)\, u\left(L^i\right) + i \times M. \tag{A1}$$

The index (and indicator variable) i can take two values. If $i = 1$ (0), then the individual is (is not) a union member. A member retains the current job with probability p^1, $0 < p^1 < 1$, and then continues to obtain an income w^1, which consists of the wage w paid to all workers, less the

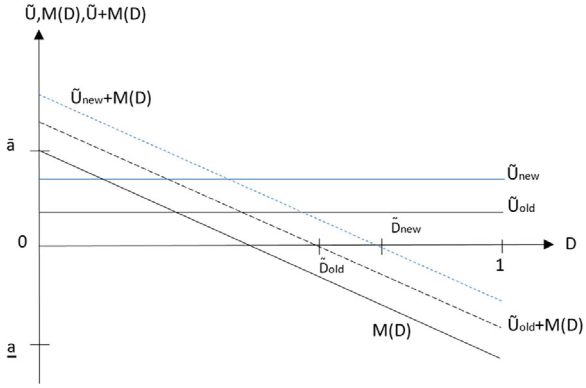

FIGURE A1 Union membership equilibrium.

union membership fee. Denoting the respective percentage by f, $0 < f < 1$, so $w^1 = w(1-f)$, the resulting utility of a union member in the current job is given by $u(w(1–f))$. The probability of losing the current job is $1-p^1$. In this case, a union member obtains a utility level $u\left(L^1\right)$. We assume that utility u increases in its arguments.

A job loss can result in unemployment, and $u\left(L^1\right)$ may then reflect the utility due to the receipt of unemployment benefits. In a more general sense, it may also incorporate non-monetary components, which affect the wellbeing of unemployed workers relative to that of employed individuals. Alternatively, the loss of the current job could imply that the union member finds a less-well-paid job elsewhere, and the difference between w^1 and L^1 would then primarily reflect the wage loss due to a job change. Our analytical framework is a static one to simplify the exposition. We could also interpret it in a dynamic sense. In this case, the utility from the current job, $u\left(w^1\right)$, would include the expected payoff from promotions, while $u\left(L^1\right)$ excludes these future benefits. Irrespective of the exact interpretation, the utility if losing the current job is lower than if keeping it, implying that $u\left(w^1\right) > u\left(L^1\right)$ holds.

A worker who does not belong to the trade union retains the current job with probability p^0. In line with the empirical evidence that union members are better protected against a job loss (Freeman 1980; Goerke and Pannenberg 2011; Pierse and McHale 2015; Berglund and Furåker 2016; Ivlevs and Veliziotis 2017; Wang *et al.* 2021), we assume that $p^1 > p^0 > 0$ holds true. Furthermore, in the absence of a membership wage premium, a non-member also obtains the wage $w^0 = w$, but pays no membership fee. Finally, the utility in case of not keeping the current job, $u\left(L^0\right) < u(w)$, can be interpreted in the same way as for union members.

As a final element, there is an additional gain (or loss) from membership M. This payoff can arise because members contribute to the political and economic objectives of trade unions (Ebbinghaus *et al.* 2011) or because unions provide members with excludable goods (Booth and Chatterji 1995). Individuals differ in this payoff, for example, due to differences in attitudes towards unions or the evaluation of the good. For simplicity, M is distributed uniformly on the interval $[\underline{a}, \bar{a}]$. If $\underline{a} < 0$ holds, then the least union-affine individual would, *ceteris paribus*, incur a utility loss if belonging to a union.

Figure A1 depicts the gain from membership, M, as a function of union density, $M = M(D)$, where $D \in [0, 1]$. The first individual to join the union is the one characterized by the highest gain, $a = \bar{a}$. Therefore the $M(D)$ curve is downward-sloping in the $M - D$ space. Furthermore, the horizontal line describes the difference $\tilde{U} := U^1 - U^0$, that is, the gain (or loss) from membership, which is independent of union density. In Figure A1, we assume the difference to be positive and denote it by $\tilde{U}_{\text{old}}$ for the initial values of p^i and L^i. If the sum $\tilde{U} + M(D)$, as indicated by the dotted line in Figure A1, is positive, then an individual will benefit from union membership. The

equilibrium level of union membership, $\tilde{D}_{\text{old}}$, is defined by a payoff $M(D)$ such that the net gain from membership is zero:

$$\tilde{U} + M\left(\tilde{D}_{old}\right) = p^1 u\left(w^1\right) + \left(1 - p^1\right)\ u\left(L^1\right) - \left\{p^0\ u\left(w^0\right) + \left(1 - p^0\right)\ u\left(L^0\right)\right\} + M\left(\tilde{D}_{old}\right) = 0. \tag{A2}$$

Given $M(D) = \bar{a} - D(\bar{a} - \underline{a})$, $w = w^0$ and $w^1 = w(1-f)$, we have

$$\frac{d\tilde{D}}{dp^1} = -\frac{\frac{\partial(\tilde{U}+M(\tilde{D}))}{\partial p^1}}{\frac{\partial(\tilde{U}+M(\tilde{D}))}{\partial \tilde{D}}} = \frac{u(w(1-f)) - u\left(L^1\right)}{\bar{a} - \underline{a}} > 0. \tag{A3}$$

Hence equilibrium density $\tilde{D}$ rises from $\tilde{D}_{\text{old}}$ to $\tilde{D}_{\text{new}}$ if the probability p^1 increases that a union member retains the current job. This outcome occurs because the utility differential $\tilde{U}$ rises (from $\tilde{U}_{\text{old}}$ to $\tilde{U}_{\text{new}}$). The theoretical prediction is consistent with the empirical claim that better employment protection for union members makes membership more likely.

An equal-sized increase in p^1 and p^0, that is, a fall in perceived job insecurity, reduces equilibrium density, assuming the utility when losing the job to be the same for members and non-members ($L^1 = L^0$):

$$\left.\frac{d\tilde{D}}{dp^1}\right|_{\substack{dp^1 = dp^0 \\ L^1 = L^0}} = \frac{u(w(1-f)) - u\left(L^1\right) - \left\{u(w) - u\left(L^0\right)\right\}}{\bar{a} - \underline{a}} = \frac{u(w(1-f)) - u(w)}{\bar{a} - \underline{a}} < 0.$$

Equation (A4) establishes the following prediction.

Subsidiary prediction 1. A higher perceived probability of losing the current job makes trade union membership more attractive.

If wages are the same for union members and non-members, while only the former pay a membership fee, wf, then union members will incur a smaller decline in utility when losing the current job than non-members. If the probability rises that such an event occurs, membership becomes more attractive because the utility reduction can be mitigated by joining a trade union. The utility differential $\tilde{U}$ rises (from $\tilde{U}_{\text{old}}$ to $\tilde{U}_{\text{new}}$).

Note that the restriction $L^1 = L^0$ holds if unemployment benefits are a function of the gross wage and therefore will be the same for two individuals who obtained the same wage before the job loss. Moreover, membership fees are usually just a small fixed amount in case of unemployment, or can even be suspended completely. If $u\left(L^i\right)$ describes the utility obtained in another job or of not being promoted, then union members will continue to pay the membership fee and $L^1 = L^0(1-f)$ will apply, given the assumption that union membership does not affect the wage in another job. In this case, the numerator of equation (A4) continues to be negative, and the prediction holds for this modified setting, also for a linear utility function, as

$$u(w(1-f)) - u\left(L^1\right) - \left\{u(w) - u\left(L^0\right)\right\} = w(1-f) - L^0(1-f) - w + L^0 = -f\left(w - L^0\right) < 0.$$

The more concave the utility function, the more likely it becomes that the sign in equation (A4) will be reversed. For a logarithmic utility function, $u(w(1–f)) = \log(w(1–f)) = \log w + \log(1–f)$, the expression in equation (A4) is zero.

Turning to the next prediction, an equal-sized increase in the utility level obtained if not retaining the current job lowers union density:

$$\left.\frac{d\tilde{D}}{du\left(L^1\right)}\right|_{du\left(L^1\right) = du\left(L^0\right)} = \frac{p^0 - p^1}{\bar{a} - \underline{a}} < 0. \tag{A5}$$

Equation (A5) establishes the following prediction.

Subsidiary prediction 2. A lower perceived probability of finding an alternative job makes trade union membership more attractive.

Because non-members incur this decline in utility with a greater probability ($p^1 > p^0$), the gain from membership rises and we observe a shift from $\tilde{U}_{\text{old}}$ to $\tilde{U}_{\text{new}}$.

Finally, if both aspects of higher job insecurity—a greater probability of a job loss and a larger utility reduction in case of such an event—give rise to more pronounced incentives to join a trade union, then we can summarize these insights as follows.

Main prediction. If workers are increasingly concerned about job security, then trade union membership becomes more attractive.

APPENDIX B

This appendix contains supplementary material and results. First, we visualize various pieces of data in Figures A2 and A3. We also provide descriptive information on the main data sample in Table A1. Furthermore, Table A2 depicts the complete estimation results with all covariates for the analyses in column (3) of Table 1 and each panel A of Tables 2–4. Moreover, this appendix discusses additional sensitivity analyses and robustness checks, which are presented in Tables A3–A14.

In particular, in Table A3, we investigate whether results are driven by particular survey waves, as we omit waves from years characterized by exceptional economic circumstances, such as the aftermath of German reunification, or for which data availability differs from that of other waves. In Tables A4 and A5, we examine alternatives to the linear fixed effects estimator, and document

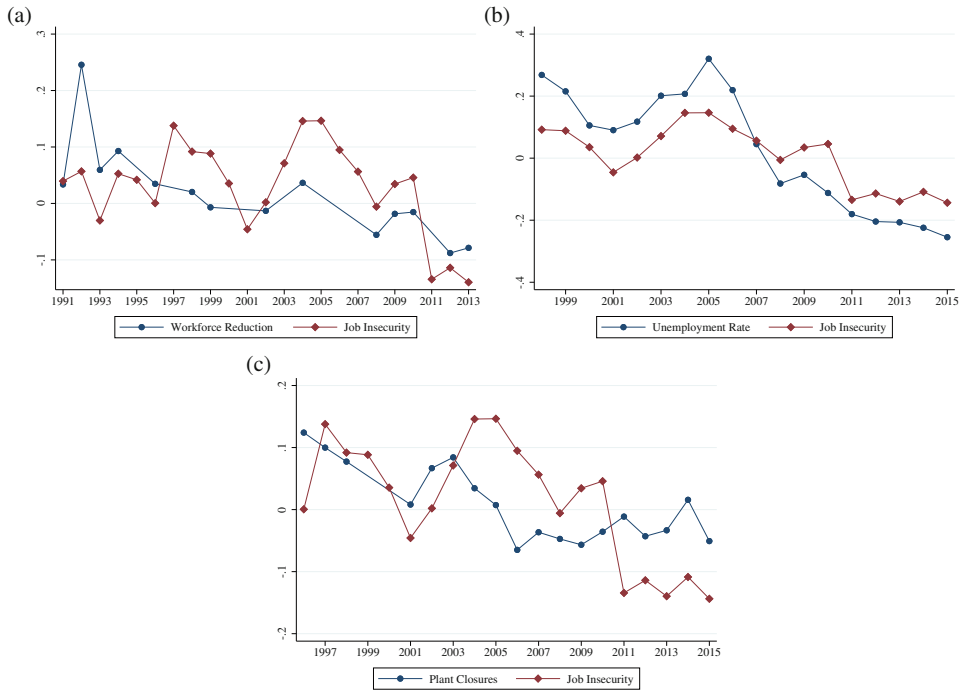

FIGURE A2 Triggers of job insecurity and concerns about job security over the years. *Notes*: (a) Average probability of a firm-level workforce reduction per year. (b) Average unemployment rate at the regional level per year (divided by 10 for illustration purposes). (c) Average number of job losses due to regional plant closures (divided by 10 for illustration purposes). Each panel also displays the average concerns about job security (0 not concerned, 1 somewhat concerned, 2 very concerned). All variables used are based on the raw SOEP data and are de-meaned. Source: SOEP data (v33), INKAR data.

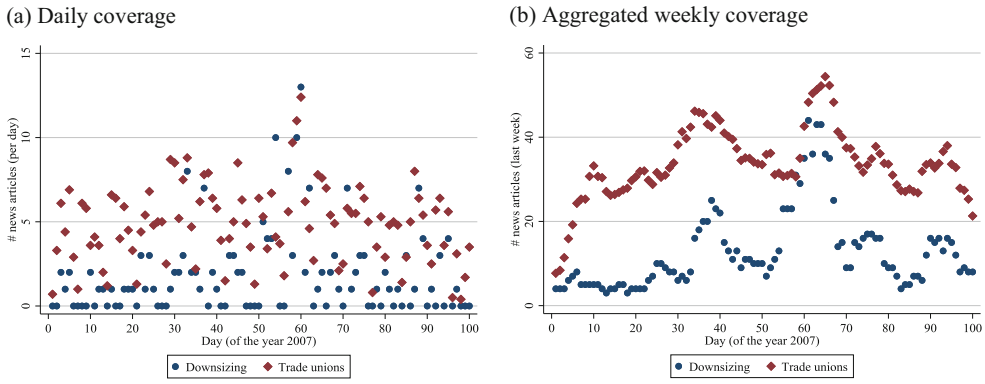

FIGURE A3 Media coverage on downsizing and trade unions (example). *Notes*: (a) Media coverage on downsizing and trade unions is defined as the sum of news articles on each of the first hundred days of the year 2007. (b) Media coverage on downsizing and trade unions is defined as the sum of news articles over the last seven days for each of the first hundred days of the year 2007. Note that the number of news articles on trade unions has been divided by 10 for illustration purposes in each case. Source: LexisNexis.

findings from linear random effects, conditional logit random effects, and conditional logit fixed effects specifications. In Table A6, we provide results from additional 2SLS analyses, in which we consider perceptions of job insecurity as the potential channel for increased union membership, whereas multiple triggers of job insecurity serve as instrumental variables at the same time. In Tables A7 and A8, we allow for the possibility that the triggers of job insecurity affect different groups of individuals or firms differently by using various factors related to job insecurity and by using information on individuals' pro-social attitudes as well as firm size. Tables A9 and A10 incorporate additional covariates, namely indicators of union density trends, collective bargaining agreements, the presence of a works council in the establishment, health, household income, and region. In Table A11, we further scrutinize the role of regional aspects by excluding individuals moving from one ROR to another, and by subsequently incorporating regional-level covariates, which could be related to union membership and the economic situation. Finally, this appendix provides separate discussions of the results from complementary analyses, which address the role of individual job loss in union membership decisions indirectly in Table A12, and directly based on a matching approach in Table A13. We conclude with an analysis of possible selection bias related to survey non-response, the results of which are in Table A14.

Sample restrictions

In Table A3, we inspect the sensitivity of our reduced-form results as reported in the main body of the paper by excluding specific survey waves. This is motivated by the conjecture that responses in some waves may be affected by features that could play a particular role for our findings.

For workforce reductions, as our first trigger of job insecurity, we present the results in panel A of Table A3. In column (1), we drop the earliest SOEP wave with data from 1993. Reductions in a firm's workforce were observed two years before in 1991, which was shortly after German reunification. In column (2), we drop data from the 2007 survey wave, for which we use a three-year lag of the information on workforce reductions as an exception to the rule. Both these data issues are not relevant for the other two triggers of job insecurity, namely the two regional crisis indicators. This is because the respective samples commence much later than 1990, implying that German reunification is of no immediate concern and because there is no differential lag between the information on union membership and regional features. We check the sensitivity of the main results for our two regional crisis indicators in panels B and C by excluding survey waves collected in particular economic contexts. We omit the wave of 2003 (column (1)), which was at the time of the implementation of the 'Hartz' labour market reforms and political debates

TABLE A1 Statistics for Main Data Sample.

	Full sample	Not union member	Union member	Min	Max
Personal variables					
Female	0.46	0.49	0.33	0	1
Age	43.67	43.38	44.64	18	65
Children in household	0.67	0.68	0.66	0	9
No partnership	0.13	0.13	0.12	0	1
Partnership, not married	0.17	0.18	0.14	0	1
Married	0.70	0.69	0.74	0	1
Household members	2.92	2.92	2.93	1	13
Homeowner	0.54	0.54	0.52	0	1
Living area in square metres	106.22	107.73	101.18	8	470
Education years	12.44	12.56	12.04	7	18
Employment experience	20.69	20.09	22.69	0	53.2
Unemployment experience	0.41	0.43	0.32	0	24
Job-related variables					
Full-time job	0.78	0.75	0.87	0	1
Regular part-time job	0.19	0.21	0.13	0	1
Irregular part-time job	0.03	0.04	0.01	0	1
Tenure	13.05	12.05	16.38	0	50.9
Log net earnings	7.22	7.18	7.35	2.71	10.02
White collar	0.58	0.62	0.43	0	1
Blue collar	0.33	0.29	0.44	0	1
Civil servant	0.09	0.08	0.13	0	1
Small company	0.20	0.24	0.07	0	1
Medium company	0.29	0.31	0.24	0	1
Large company	0.23	0.22	0.29	0	1
Very large company	0.25	0.21	0.39	0	1
Firm size missing	0.01	0.02	0.01	0	1
Public sector	0.30	0.28	0.37	0	1
Private sector	0.68	0.70	0.61	0	1
Sector missing	0.01	0.01	0.01	0	1
Agriculture, energy, mining	0.03	0.03	0.03	0	1
Manufacturing	0.19	0.17	0.24	0	1
Construction	0.12	0.12	0.14	0	1
Trade	0.13	0.14	0.07	0	1
Transport	0.05	0.04	0.09	0	1
Bank, insurance	0.04	0.05	0.02	0	1
Services	0.37	0.39	0.33	0	1
Industry missing	0.07	0.07	0.06	0	1
Concerns about job security	0.63	0.61	0.69	0	2
not concerned at all	0.49	0.50	0.46	0	1
somewhat concerned	0.39	0.39	0.40	0	1
very concerned	0.12	0.11	0.15	0	1
N	37,472	28,814	8658		

Source: SOEP data (v33).

TABLE A2 Union Membership and Job Insecurity: Complete Results.

	(1)	(2)	(3)	(4)
Survey year controls—Reference category: 2015				
Year: 1993	0.126*	0.149*		
	(0.065)	(0.082)		
Year: 1998	0.064	0.077		0.082
	(0.051)	(0.063)		(0.065)
Year: 2001	0.051	0.064	0.071	
	(0.042)	(0.052)	(0.046)	
Year: 2003	0.034	0.046	0.052	0.052
	(0.036)	(0.045)	(0.040)	(0.046)
Year: 2007	0.013	0.020	0.011	0.027
	(0.024)	(0.030)	(0.027)	(0.031)
Year: 2011	−0.005	−0.003	0.000	0.002
	(0.012)	(0.015)	(0.013)	(0.015)
Survey month controls—Reference category: September–December				
Month: January	0.016	0.022	0.003	−0.004
	(0.015)	(0.019)	(0.015)	(0.020)
Month: February	0.017	0.021	0.000	−0.010
	(0.014)	(0.018)	(0.014)	(0.019)
Month: March	0.010	0.012	0.005	−0.010
	(0.013)	(0.018)	(0.014)	(0.018)
Month: April	0.004	0.007	−0.002	−0.020
	(0.014)	(0.018)	(0.014)	(0.019)
Month: May	0.013	0.022	0.004	−0.002
	(0.014)	(0.019)	(0.015)	(0.019)
Month: June	0.001	0.008	−0.009	−0.016
	(0.014)	(0.019)	(0.015)	(0.019)
Month: July	0.008	0.002	−0.004	−0.014
	(0.015)	(0.020)	(0.016)	(0.021)
Month: August	0.013	0.013	0.012	−0.003
	(0.017)	(0.022)	(0.018)	(0.022)
Age controls—Reference category: 18–22				
Age: 23–27 years	0.008	0.009	−0.014	0.015
	(0.021)	(0.027)	(0.025)	(0.030)
Age: 28–31 years	0.038	0.035	0.014	0.050
	(0.024)	(0.031)	(0.028)	(0.034)
Age: 32–35 years	0.053*	0.049	0.036	0.064
	(0.028)	(0.034)	(0.032)	(0.040)
Age: 36–38 years	0.065**	0.059	0.052	0.065
	(0.031)	(0.038)	(0.035)	(0.044)
Age: 39–42 years	0.063*	0.059	0.049	0.069
	(0.034)	(0.041)	(0.039)	(0.049)
Age: 43–45 years	0.069*	0.066	0.050	0.068
	(0.038)	(0.046)	(0.042)	(0.055)

TABLE A2 (Continued)

	(1)	(2)	(3)	(4)
Age: 46–48 years	0.071*	0.070	0.052	0.077
	(0.041)	(0.049)	(0.045)	(0.060)
Age: 49–52 years	0.080*	0.082	0.058	0.083
	(0.045)	(0.053)	(0.050)	(0.066)
Age: 53–56 years	0.094*	0.093	0.076	0.091
	(0.049)	(0.059)	(0.054)	(0.073)
Age: 57–61 years	0.098*	0.098	0.083	0.097
	(0.055)	(0.065)	(0.060)	(0.081)
Age: 62–65 years	0.109*	0.105	0.095	0.103
	(0.061)	(0.072)	(0.066)	(0.090)
Children in household	−0.001	0.001	−0.004	−0.001
	(0.004)	(0.004)	(0.004)	(0.004)
Partnership status—Reference category: No partnership				
Partner, not married	−0.001	0.003	−0.001	0.006
	(0.008)	(0.010)	(0.009)	(0.011)
Married	0.005	0.006	−0.002	0.012
	(0.010)	(0.012)	(0.011)	(0.013)
Household members	0.003	0.003	0.005	0.000
	(0.003)	(0.004)	(0.004)	(0.004)
Homeowner	−0.010	−0.017**	−0.003	−0.009
	(0.007)	(0.009)	(0.009)	(0.010)
Living area	0.000	0.000	−0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Education years	−0.005	−0.007**	0.002	−0.009**
	(0.003)	(0.003)	(0.007)	(0.004)
Employment experience	−0.001	0.001	0.002	0.001
	(0.003)	(0.004)	(0.003)	(0.004)
Unemployment experience	−0.003	−0.010	0.006	0.003
	(0.006)	(0.008)	(0.007)	(0.009)
Employment status—Reference category: Regular full-time job				
Regular part-time job	0.001	−0.008	0.010	0.006
	(0.009)	(0.010)	(0.010)	(0.010)
Irregular part-time job	−0.015	−0.021	0.001	−0.009
	(0.014)	(0.016)	(0.014)	(0.016)
Tenure	0.003***	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Log net earnings	0.021***	0.010	0.021***	0.024***
	(0.007)	(0.008)	(0.008)	(0.009)
Occupation—Reference category: Civil servant				
White collar	0.020	0.003	0.018	−0.052
	(0.031)	(0.039)	(0.037)	(0.044)
Blue collar	0.036	0.015	0.024	−0.047
	(0.032)	(0.041)	(0.038)	(0.045)

TABLE A2 (Continued)

	(1)	(2)	(3)	(4)
Firm size—Reference category: Small company				
Medium company	0.023***	0.032***	0.001	0.009
	(0.007)	(0.008)	(0.008)	(0.009)
Large company	0.036***	0.046***	0.012	0.020*
	(0.009)	(0.011)	(0.009)	(0.011)
Very large company	0.047***	0.060***	0.019*	0.027**
	(0.009)	(0.011)	(0.010)	(0.012)
Firm size missing	−0.012	−0.026	−0.024	−0.034
	(0.024)	(0.033)	(0.025)	(0.026)
Sector—Reference category: Private sector				
Public sector	0.026***	0.022**	0.019**	0.017
	(0.008)	(0.010)	(0.009)	(0.011)
Sector missing	0.018	−0.036	0.011	−0.041
	(0.024)	(0.028)	(0.024)	(0.027)
Industry—Reference category: Agriculture, energy, mining				
Manufacturing	0.011	0.022	0.027	−0.005
	(0.019)	(0.021)	(0.020)	(0.022)
Construction	0.004	0.016	0.023	−0.000
	(0.020)	(0.022)	(0.021)	(0.023)
Trade	−0.000	0.007	0.026	−0.007
	(0.020)	(0.022)	(0.021)	(0.023)
Transport	0.023	0.052*	0.013	0.022
	(0.025)	(0.028)	(0.027)	(0.029)
Bank and insurance	−0.015	−0.004	0.024	−0.004
	(0.026)	(0.030)	(0.026)	(0.032)
Services	0.004	0.013	0.030	0.011
	(0.019)	(0.021)	(0.020)	(0.021)
Industry missing	−0.001	0.001	0.020	−0.010
	(0.021)	(0.023)	(0.021)	(0.023)
Concerns about job security	0.008**			
	(0.003)			
Firm-level workforce reduction		0.023***		
		(0.004)		
Regional unemployment rate			0.005***	
			(0.001)	
Regional job losses due to plant closures				0.005***
				(0.001)
N	37,472	32,122	29,603	25,410

Notes: These are the complete results corresponding to column (3) in Tables 1, 2, 3 and 4. Robust standard errors are in parentheses.
*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Sources: SOEP data (v33), INKAR data.

TABLE A3 Union Membership and Triggers of Job Insecurity: Different Samples.

	(1)	(2)	(3)
Panel A			
Firm-level workforce reduction	0.017***	0.026***	0.027***
	(0.004)	(0.005)	(0.005)
N	29,265	26,350	28,916
Survey wave excluded	1993	2007	2015
Panel B			
Regional unemployment rate	0.006***	0.005***	0.005***
	(0.002)	(0.002)	(0.002)
N	22,071	24,602	26,264
Survey wave excluded	2003	2011	2015
Panel C			
Regional job losses due to plant closures	0.005***	0.005***	0.005***
	(0.002)	(0.001)	(0.001)
N	18,312	20,623	22,169
Survey wave excluded	2003	2011	2015

Notes: The table shows results from separate linear regressions with consideration of individual fixed effects. The dependent variable is individual union membership (0 no, 1 yes). The independent variables are firm-level workforce reductions from the last year with available information before the SOEP interview (panel A), regional unemployment rate from the year prior to the SOEP interview (panel B), and the number of job losses due to plant closure reported by other workers of the same region in last year's SOEP interview (panel C). See Tables 2–4 for more information on the independent variables and the survey waves used. The set of control variables includes year and month controls. Robust standard errors are in parentheses.
*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Sources: SOEP data (v33), INKAR data.

surrounding the reforms. We also drop the wave of 2011 (column (2)), which was the peak of the euro crisis that followed a major banking crisis. Finally, we re-estimate the model for all three triggers of job insecurity without the SOEP wave of 2015 (column (3) across panels). This was a time in which Germany's labour market was doing particularly well ('German job miracle').

Inspection of Table A3 reveals that excluding any of the SOEP waves as outlined above has no substantive impact on our main findings. In each case, we observe a significantly positive effect of the triggers of perceived job insecurity on union membership.

Alternative estimation methods

In Tables A4 and A5, we check the sensitivity of our reduced-form and first-stage results by employing methods other than the preferred linear fixed effects estimations. For this purpose, we first repeat the reduced-form analyses based on linear fixed effects estimations as shown in the main body of the paper for all three triggers of job insecurity by running (i) linear random effects estimations, (ii) conditional logit random effects estimations, and (iii) conditional logit fixed effects estimations. The results in Table A4 demonstrate consistently that triggers of job insecurity appear to increase the likelihood of union membership.

In a second step, we inspect the role of the linearity assumption for our first-stage evidence. As an alternative to our main job-insecurity variable with all three ordinal categories, we generate a dummy variable that reflects whether or not a respondent is highly concerned about job security. Using this binary outcome as the dependent variable, we conduct first-stage analyses for all three triggers of job insecurity by running (i) linear random effects estimations, (ii) linear fixed effects estimations, (iii) conditional logit random effects estimations,

TABLE A4 Alternative Methods (I): Reduced-form estimations.

	Individual random effects model (1)	Conditional logit random effects model (2)	Conditional logit fixed effects model (3)
Panel A: N = 32,122			
Firm-level workforce reduction	0.046***	0.720***	0.375***
	(0.004)	(0.052)	(0.060)
Panel B: N = 29,603			
Regional unemployment rate	0.005***	0.093***	0.121***
	(0.001)	(0.016)	(0.035)
Panel C: N = 25,410			
Regional job losses due to plant closures	0.003**	0.060***	0.097***
	(0.001)	(0.021)	(0.027)

Notes: The table shows results from separate estimations: linear regressions with consideration of individual random effects in column (1), conditional logit random effects estimations in column (2), and conditional logit fixed effects estimations in column (3). The dependent variable is individual union membership (0 no, 1 yes). The independent variables are firm-level workforce reductions from the last year with available information before the SOEP interview (panel A), regional unemployment rate from the year prior to the SOEP interview (panel B), and the number of job losses due to plant closure reported by other workers of the same region in last year's SOEP interview (panel C). See Tables 2–4 for more information on the independent variables and the survey waves used. The set of control variables includes year and month controls. In column (1), robust standard errors are in parentheses. In columns (2) and (3), bootstrapped standard errors are in parentheses.
*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Sources: SOEP data (v33), INKAR data.

TABLE A5 Alternative Methods (II): First-stage Estimations.

	Individual random effects model (1)	Individual fixed effects model (2)	Conditional logit random effects model (3)	Conditional logit fixed effects model (4)
Panel A: N = 32,122				
Firm-level workforce reduction	0.045***	0.030***	0.566***	0.349***
	(0.004)	(0.005)	(0.052)	(0.053)
Panel B: N = 29,603				
Regional unemployment rate	0.008***	0.013***	0.099***	0.139***
	(0.001)	(0.002)	(0.007)	(0.023)
Panel C: N = 25,410				
Regional job losses due to plant closures	0.005***	0.005***	0.063***	0.057***
	(0.001)	(0.002)	(0.012)	(0.021)

Notes: The table shows results from separate estimations: linear regressions with consideration of individual random effects and fixed effects in columns (1) and (2), respectively, and conditional logit random effects and fixed effects estimations in columns (3) and (4), respectively. The dependent variable is being very concerned about job security (0 no, 1 yes). The independent variables are firm-level workforce reductions from the last year with available information before the SOEP interview (panel A), regional unemployment rate from the year prior to the SOEP interview (panel B), and the number of job losses due to plant closure reported by other workers of the same region in last year's SOEP interview (panel C). See Tables 2–4 for more information on the independent variables and the survey waves used. The set of control variables includes year and month controls. In columns (1) and (2), robust standard errors are in parentheses. In columns (3) and (4), bootstrapped standard errors are in parentheses.
*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Sources: SOEP data (v33), INKAR data.

and (iv) conditional logit fixed effects estimations. Table A5 shows that all triggers of job insecurity increase the likelihood of having great concerns about job security, irrespective of the method.

2SLS analyses with multiple instrumental variables

In Table A6, we present the results from employing a different variant of the 2SLS analysis. In particular, we re-run our 2SLS analysis, where we consider concerns about job security as the potential channel for increased union membership, and use two triggers of job insecurity as instrumental variables at the same time. Running such 2SLS analyses informs us about the robustness of our main finding, based on the use of a single instrument, and allows for over-identification tests, as long as the statistical power of the instrumental variable analysis is sufficient. This is a particular issue here given that the sample size shrinks when using several instrumental variables simultaneously. As in our main analysis, we apply panel analyses that consider individual fixed effects, in addition to time fixed effects, and we successively add variables reflecting personal characteristics as well as job-related factors.

TABLE A6 Union Membership and Job Insecurity: 2SLS Analysis Using Multiple IVs.

	Dependent variable: Union membership		
Second stage	(1)	(2)	(3)
Panel A: N = 24,071—Instrumental variables: Firm-level workforce reduction & Regional job losses due to plant closures			
Concerns about job security	0.347***	0.357***	0.364***
	(0.087)	(0.092)	(0.098)
Kleibergen–Paap *F*-statistic	20.972	19.421	17.501
Hansen J-statistic p-value	0.775	0.856	0.820
Panel B: N = 25,338—Instrumental variables: Firm-level workforce reduction & Regional unemployment rate			
Concerns about job security	0.250***	0.254***	0.260***
	(0.064)	(0.068)	(0.070)
Kleibergen–Paap *F*-statistic	36.331	33.767	31.089
Hansen J-statistic p-value	0.224	0.190	0.171
Panel C: N = 21,550—Instrumental variables: Regional unemployment rate & Regional job losses due to plant closures			
Concerns about job security	0.225***	0.228***	0.240***
	(0.077)	(0.081)	(0.085)
Kleibergen–Paap *F*-statistic	20.803	19.420	18.421
Hansen J-statistic p-value	0.932	0.892	0.909
Time variables	Yes	Yes	Yes
Personal variables		Yes	Yes
Job-related variables			Yes

Notes: Panels A, B and C show job insecurity coefficients, each of which is obtained from a separate instrumental variable analysis with consideration of individual fixed effects. The dependent variable in the second stage is individual union membership. The instrumented variable is concerns about job security. The instrumental variables in panel A are firm-level workforce reduction and regional job losses due to plant closures. The instrumental variables in panel B are firm-level workforce reduction and the regional unemployment rate. The instrumental variables in panel C are the regional unemployment rate and the number of job losses due to plant closure reported by other workers of the same region. See Tables 2–4 for more information on the variables and the survey waves used. Robust standard errors are in parentheses.

*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.

Sources: SOEP data (v33), INKAR data.

In line with our first-stage results shown in the main body of the paper, the results regarding *F*-statistics in Table A6 underline the effective manipulation of workers' perceptions, independent of the trigger and the set of variables used in the specifications, although statistical power is generally lower in comparison. Hansen *J*-statistics for the over-identification tests do not reject the orthogonality assumption, indicating appropriateness of the instrumental variables in each case. According to the second-stage results, perceived job insecurity significantly affects the likelihood of being a member of a union, confirming our main finding.

Interaction analyses

In the following, we incorporate interactions between triggers of job insecurity and indicators of subgroups in the model with union membership as the dependent variable. First, we make use of several objective factors that could be related to job insecurity. Specifically, we focus on subgroups that can be characterized by having particularly high or respectively low chances of retaining their jobs in times of crisis. Then we consider subgroups, which are likely to differ in the intensity of the concerns about the consequences of a job loss. If estimated coefficients differ systematically between subgroups, then this interaction analysis could potentially allow us to draw further conclusions regarding our predictions (see the final subsection of Section 2). Table A7 shows the results from our analyses of interactions using factors related to components of job insecurity.

TABLE A7 Analysis of Effect Heterogeneity (I): Factors Related to Job Insecurity.

Interaction variable:	Marginal employment (1)	Civil servant status (2)	Below median age (3)	High level of education (4)
Panel A: N = 32,122				
Firm-level workforce reduction	0.026***	0.028***	0.018***	0.033***
	(0.004)	(0.005)	(0.006)	(0.006)
Interaction effect	−0.034	−0.028*	0.017**	−0.017*
	(0.023)	(0.017)	(0.008)	(0.009)
Panel B: N = 29,603				
Regional unemployment rate	0.005***	0.006***	0.004**	0.005***
	(0.001)	(0.001)	(0.002)	(0.002)
Interaction effect	−0.001	−0.003	0.002*	−0.000
	(0.003)	(0.004)	(0.001)	(0.002)
Panel C: N = 25,410				
Regional job losses due to plant closures	0.005***	0.004***	0.005***	0.006***
	(0.001)	(0.001)	(0.002)	(0.002)
Interaction effect	−0.011**	0.006	−0.001	−0.003
	(0.005)	(0.005)	(0.002)	(0.002)

Notes: The table shows results from separate linear regressions with consideration of individual fixed effects. The dependent variable is individual union membership (0 no, 1 yes). The independent variables are firm-level workforce reductions from the last year with available information prior to the SOEP interview (panel A), regional unemployment rate from the year prior to the SOEP interview (panel B), and number of job losses due to plant closure reported by other workers of the same region in last year's SOEP interview (panel C). See Tables 2–4 for more information on the independent variables and the survey waves used. The interaction variables are being marginally employed as opposed to being regularly employed (column (1)), being a civil servant as opposed to being a blue-collar or white-collar worker (column (2)), being below median age, i.e. younger than 44, as opposed to being at least 44 (column (3)), and having above median years of education, i.e. at least 12 years of education, as opposed to having fewer than 12 years of education (column (4)). The set of control variables includes year and month controls. Robust standard errors are in parentheses.
*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Sources: SOEP data (v33), INKAR data.

First, we consider different forms of employment. The probability of job loss is arguably higher for individuals in atypical employment than for workers who have a regular part-time or full-time job and enjoy better job protection. Hence the gain from union membership for the atypically employed may be higher than for individuals in regular employment. Column (1) of Table A7 provides no evidence in favour of the idea that workers with an exceptionally high risk of job loss are more likely to become union members in times of labour market turmoil, as none of the interactions between the trigger variable and the subgroup dummy are positive. In panel C, we even observe a significantly negative interaction effect for the third trigger of job insecurity.

Second, we use the information on occupations to identify individuals with a high probability of retaining their job. Civil servants can be demoted or dismissed only under exceptional circumstances in Germany. Their perceived job insecurity can be associated with being assigned another job, possibly in a different location or institution. Hence we would expect that the fear of job loss does not apply to civil servants to the same extent as other workers. The results in panel A of Table A7 indicate that variations in the risk of job loss could play a role in explaining union membership decisions, given that civil servants do not respond to workforce reductions as others do. Yet the interaction effect in column (2) is not robust across panels and hence other triggers of job insecurity.

Third, we scrutinize the role of age. The economic consequences of not retaining one's job are arguably much more severe for younger workers than their older counterparts. Empirical research shows that lifetime earnings losses after job displacements are substantial, especially if they occur during recessions (Davis and Von Wachter 2011; Schmieder *et al.* 2023). Thus we would expect stronger effects of job-insecurity triggers on union membership among younger workers, since the earlier one becomes a member, the more economic benefits one will receive in the long run. Column (3) of Table A7 provides some support for the idea that perceived job insecurity constitutes an important determinant of union membership, particularly for younger workers, although the evidence is not consistent across all three triggers.

Fourth, we conduct an interaction analysis based on different levels of education. The idea is that highly educated individuals have on average lower costs of job loss than low-educated individuals, given that the highly educated have more attractive alternative options. Column (4) of panel A in Table A7 shows that the positive effect of firm-level workforce reductions on union membership is indeed smaller for the highly educated. However, no such interaction can be observed for the other two triggers of job insecurity in panels B and C. Hence the differentiation by education provides no clear-cut evidence.

In conclusion, our interaction analyses for the different triggers of job insecurity do not provide a distinct picture. Since none of the factors related to job insecurity reveals a consistent interaction pattern, the analyses do not seem to produce clear-cut conclusions. Nevertheless, as we cannot reject either one of our predictions, we cautiously conclude from our analysis in Table A7 that both forms of job insecurity—namely, workers' fears of not retaining the job and worries about the resulting consequences—could be relevant for their decisions regarding trade union membership.

Table A8 presents results from further interaction analyses, conducted in the same vein as the ones shown in Table A7, focusing on two different aspects of individual workers and their employers. First, we use information on characteristic attitudes of workers to inspect whether more or less pro-social types are particularly attracted by union membership in times of labour market crises. This addresses the idea that altruistic motives could play a role if other workers lose their jobs, so that pro-social types of individuals aim to help others by becoming union members. We use a multi-item module on positive reciprocity from the 2010 SOEP survey and impute the data onto other years. We thereby lose some observations of individuals who did not participate in the survey year 2010. We then separate individuals according to their responses into very high reciprocal and very low reciprocal types by averaging responses on a scale from 1 to 7 across all three items used by the SOEP to measure positive reciprocal attitudes. To identify

TABLE A8 Analyses of Effect Heterogeneity (II): Reciprocity and Firm Size.

Interaction variable:	Low reciprocity (1)	High reciprocity (2)	Small company (3)	Very large company (4)
Panel A				
Firm-level workforce reduction	0.031***	0.027***	0.028***	0.027***
	(0.007)	(0.006)	(0.005)	(0.005)
Interaction effect	−0.010	−0.003	−0.013	−0.004
	(0.010)	(0.012)	(0.009)	(0.009)
N	24,124	24,124	32,122	32,122
Panel B				
Regional unemployment rate	0.005***	0.006***	0.005***	0.006***
	(0.002)	(0.002)	(0.001)	(0.002)
Interaction effect	0.002	−0.001	0.002	−0.001
	(0.002)	(0.002)	(0.001)	(0.002)
N	23,214	23,214	29,603	29,603
Panel C				
Regional job losses due to plant closures	0.006***	0.004***	0.005***	0.004***
	(0.002)	(0.002)	(0.001)	(0.001)
Interaction effect	−0.002	0.002	−0.002	0.001
	(0.003)	(0.003)	(0.002)	(0.003)
N	20,304	20,304	25,410	25,410

Notes: The table shows results from separate linear regressions with consideration of individual fixed effects. The dependent variable is individual union membership (0 no, 1 yes). The independent variables are firm-level workforce reductions from the last year with available information before the SOEP interview (panel A), regional unemployment rate from the year prior to the SOEP interview (panel B), and the number of job losses due to plant closure reported by other workers of the same region in last year's SOEP interview (panel C). See Tables 2–4 for more information on the independent variables and the survey waves used. The interaction variables in columns (1) and (2) reflect low (lowest tertile) and high (highest tertile) reciprocal attitudes, as determined by responses to a three-question survey module that starts with: 'To what degree do the following statements apply to you personally?' The items are: (i) 'If someone does me a favour, I am prepared to return it'; (ii) 'I go out of my way to help somebody who has been kind to me before'; (iii) 'I am ready to undergo personal costs to help somebody who helped me before'. The scale ranges from 1 ('does not apply to me at all') to 7 ('applies to me perfectly'). The interaction variables in columns (3) and (4) reflect small (fewer than 20 workers) and very large (at least 2000 workers) companies. The set of control variables includes year and month controls. Robust standard errors are in parentheses. *, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Sources: SOEP data (v33), INKAR data.

different types according to pro-social attitudes, we use the average to determine the highest and lowest tertiles of individuals within our population, based on the main data sample. Columns (1) and (2) of Table A8 do not reveal any significant interaction between job-insecurity triggers and reciprocal attitudes of workers. Thus we obtain no evidence that altruistic motives stimulate union membership in times of labour market crises.

A final interaction analysis concerns the role of the employer. Depending on the trigger of job insecurity, the implications for union membership could vary with firm size. One could argue that in the case of workforce reductions, the exogeneity assumption is less plausible for a small firm compared to a larger firm where it is less likely for a worker to affect company decisions through their own actions. Vice versa, one could argue that in the case of region-based triggers of job insecurity, a very large company could be more likely to play a role in determining regional indicators such as unemployment rates. The analysis presented in columns (3) and (4) of Table A8 reveals no significant effect for any of the interactions between firm size categories and triggers of job insecurity. Hence our findings are robust across firm sizes.

Further covariates

Tables A9 and A10 present results from additional reduced-form analyses, for which we expand the empirical model by adding variables beyond those used in the main analysis. Specifically, we continue exploiting the SOEP data by considering potentially relevant, albeit endogenous factors, which could be influenced by triggers of job insecurity and possibly affect union membership separately. We always add variables separately to the most parsimonious model with controls only for time fixed effects, but the results hardly change when we add the sets of variables reflecting personal characteristics and job-related factors.

We first examine the possible role of two institutional aspects at the firm level, both of which could be related to union density. As discussed in the second subsection of Section 2 on the institutional setting in the German labour market, there could be a works council at the company of the worker. Another institutional aspect of possible relevance in our context is the existence of a collective bargaining agreement, so that a worker gets paid the collectively agreed wage level. The SOEP irregularly contains questions about these institutional aspects, implying that variables are not initially available to us for all the SOEP waves that we use in our sample. Accordingly, we have to impute the information from those SOEP waves with the works council survey question (2001, 2006, 2011 and 2016). We proceed in the same way when exploiting the responses from survey waves with a question on collectively agreed wages (1995, 2014 and 2015). In both cases, we use the information on job changes and tenure to condition on those individuals who are most likely observed in the same company when transferring the institutional information to other SOEP waves. The results in Table A9 support our main finding, as the effect of the job insecurity triggers

TABLE A9 Union Membership and Triggers of Job Insecurity: Further Covariates (I).

Additional covariates:	Works council (1)	Collective bargaining (2)	Union density trend (3)
Panel A			
Firm-level workforce reduction	0.012***	0.020***	0.016***
	(0.004)	(0.006)	(0.005)
N	27,241	18,508	27,341
Panel B			
Regional unemployment rate	0.007***	0.005***	0.005***
	(0.002)	(0.002)	(0.002)
N	28,633	14,310	27,539
Panel C			
Regional job losses due to plant closures	0.005***	0.005***	0.004***
	(0.001)	(0.002)	(0.001)
N	23,456	13,451	23,959

Notes: The tale shows results from separate linear regressions with consideration of individual fixed effects. The dependent variable is individual union membership. See Tables 2–4 for more information on the independent variables and the survey waves used. The set of control variables includes year and month controls. In column (1), a variable reflecting the existence of a works council in the worker's firm is added. In column (2), a variable reflecting the existence of collective bargaining agreement in the worker's firm is added. In column (3), a variable on the change in the share of union membership at the worker's industry level (NACE-2) is added. Robust standard errors are in parentheses.

*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.

Sources: SOEP data (v33), INKAR data.

on union membership is robust when including covariates reflecting the existence of a works council in column (1), and a collective bargaining agreement in column (2). Note that regarding the potential effects of these institutional variables on union membership, our analyses reveal that only the works council variable is consistently significant. It is not clear how to interpret this, given that union members often initiate works council elections. Hence the variable may be endogenous. But even in this specification, the effect of all three job-insecurity triggers remains significant across panels.

In a third specification, we add a variable that reflects the lagged trend in union membership. The idea here is to capture potential changes in the power of trade unions, which could affect wages and hence employment. To find out more, we determine a proxy for union density, as measured by the share of union members at the industry level (NACE-2) in the SOEP data. We then compare the current level with the level in the previous SOEP wave that includes union membership information, which gives us a trend. Across all three panels, the effects of the job insecurity triggers on union membership are robust, according to column (3) in Table A9.

In another step, we examine the role of two factors in people's lives that are plausibly affected by economic crises and which hypothetically could also be relevant for decisions on union membership. One is the health status of the worker, for which we make use of information on the number of doctor visits reported for the last three months before the interview. Another factor is the level of household income. As can be seen in columns (1) and (2) of Table A10, adding these covariates does not change our findings.

In a final step, we add a set of dummy variables reflecting the region where the respondent lives at the time of the SOEP interview. Adding ROR variables to the model is technically possible,

TABLE A10 Union Membership and Triggers of Job Insecurity: Further Covariates (II).

Additional covariates:	Doctor visits (1)	Household income (2)	Region (ROR) (3)
Panel A			
Firm-level workforce reduction	0.017***	0.027***	0.017***
	(0.004)	(0.005)	(0.004)
N	29,264	30,906	29,265
Panel B			
Regional unemployment rate	0.005***	0.006***	0.006***
	(0.001)	(0.002)	(0.002)
N	29,603	28,328	29,603
Panel C			
Regional job losses due to plant closures	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)
N	25,409	24,358	25,410

Notes: The table shows results from separate linear regressions with consideration of individual fixed effects. The dependent variable is individual union membership. See Tables 2–4 for more information on the independent variables and the survey waves used. Note that only survey waves since 1998 are used in column (3) (due to restricted availability of ROR indicators in the SOEP data). The set of control variables includes year and month controls. In column (1), a variable on the number of doctor visits reported for the last three months is added. In column (2), a variable reflecting log household income is added. In column (3), a set of variables reflecting the region (ROR level) is added. Robust standard errors are in parentheses.
*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Sources: SOEP data (v33), INKAR data.

given that some workers move between regions over time, which could in principle play a role in the analysis of union membership. This group of movers includes two groups of workers: (i) workers who changed region in the year prior to the SOEP interview, but who did not change the employer, in order to fulfil our restriction on workers without a recent job change; and (ii) workers who changed region and the company but did so prior to the interview of the previous year, so that the criterion of no recent job change is fulfilled. Column (3) of Table A10 shows that the results are robust when we consider region fixed effects.

Regional analysis

Table A11 provides additional evidence on the role of regional aspects, for which we exclude movers between regions from the sample. Thanks to this sample restriction, it is technically possible to cluster the standard errors at the ROR level and to thereby consider the dataset's hierarchical nature. In the course of this regional analysis, we use the INKAR dataset, which contains further time-varying information on regions, besides the unemployment rates that we use as a trigger of perceived job insecurity. We consider various potentially relevant variables at the regional level that could be related to both unionization and local economic conditions. In particular, local policymakers could affect unemployment rates through economically relevant decisions, which may not be independent of individuals in their region. One could think about policies induced by local initiatives of citizens to invest more in leisure opportunities, such as sports clubs and swimming pools. Such actions may be correlated with changes in unemployment rates and changes in people's affinity for trade unions. Another idea could be that thanks

TABLE A11 Union Membership and Triggers of Job Insecurity: Regional Analysis.

	(1)	(2)	(3)	(4)
Panel A: $N = 26{,}250$				
Firm-level workforce reduction	0.018***	0.018***	0.017***	0.017***
	(0.004)	(0.004)	(0.004)	(0.004)
Panel B: $N = 26{,}531$				
Regional unemployment rate	0.007***	0.006***	0.007***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)
Panel C: $N = 22{,}820$				
Regional job losses due to plant closures	0.005***	0.005***	0.005***	0.005***
	(0.002)	(0.002)	(0.002)	(0.002)
Time variables	Yes	Yes	Yes	Yes
Personal variables		Yes	Yes	Yes
Job-related variables			Yes	Yes
Regional variables				Yes

Notes: The table shows results from separate linear regressions with consideration of individual fixed effects. The dependent variable is individual union membership. See Tables 2–4 for more information on the variables and the survey waves used. Note that only survey waves since 1998 are used (due to restricted availability of ROR indicators in the SOEP data). Individuals who were observed in multiple regions during the period of investigation are excluded from the analysis. Regional variables at the ROR level are: (i) building permits for new dwellings (*Baugenehmigungen für neue Wohnungen*) per 1000 inhabitants; (ii) number of university students (*Studierende an wissenschaftlichen Hochschulen und Fachhochschulen*) per 1000 inhabitants; (iii) total migration (*Binnenwanderungssaldo insgesamt*) per 1000 inhabitants; (iv) internal migration (*Zuzüge*) per 1000 inhabitants; (v) residents (*Einwohner*) per square kilometre; (vi) local business tax revenues (*Gewerbesteuer*) per inhabitant; and (vii) proportion of socially insured female employees in all socially insured employees (*Anteil der weiblichen sozialversicherungspflichtig Beschäftigten an den sozialversicherungspflichtig Beschäftigten*). Region-clustered standard errors are in parentheses.

*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.

Sources: SOEP data (v33), INKAR data.

to higher tax revenues, people's desire to participate in unions as a form of social activity may be lower because they then have better-funded alternatives.

The reduced-form results in Table A11 confirm the main findings for all three triggers of job insecurity when we exclude movers and cluster the standard errors at the regional level. As shown in column (4), considering further data at the ROR level from the INKAR dataset as covariates does not change the results. Note that when we add regional variables separately instead of combining them, the findings also hold, and the same is true when we rely on the most parsimonious model with controls only for time fixed effects. While we cannot rule out that these additional regional variables are endogenous, similar to the individual-level variables analysed in Tables A9 and A10, adding them without an impact on the results increases our confidence regarding the main findings.

Additional analyses on job loss and union membership

Table A12 presents the results from an analysis that allows assessing the role of actual job losses experienced by the worker interviewed in the SOEP. To address this issue, we modify the reduced-form analysis as discussed in the main body of the paper by employing a larger dataset. It also includes individuals who have recently lost their jobs and are unemployed. For this purpose, we relax restrictions on employment status and avoid using variables in the model that provide information only for employed individuals. Table A12 shows the results for all three triggers of job insecurity across panels. All triggers consistently increase the probability of union membership. The results hardly differ from those presented in the main body of the paper. This indicates that the restriction on employed individuals does not affect our findings.

Table A13 shows the results from another analysis focusing on a possible role that job losses could play in our research context. In line with the DiD analysis discussed in the main body of the paper (second subsection of Section 5), we identify changes in workers' union membership status after a job loss due to plant closure, which we compare to workers who stay in their jobs.

TABLE A12 Union Membership and Triggers of Job Insecurity: Non-employed Included.

	(1)	(2)	(3)
Panel A: $N = 43{,}979$			
Firm-level workforce reduction	0.029***	0.027***	0.027***
	(0.004)	(0.004)	(0.004)
Panel B: $N = 54{,}013$			
Regional unemployment rate	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)
Panel C: $N = 44{,}558$			
Regional job losses due to plant closures	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)
Time variables	Yes	Yes	Yes
Personal variables		Yes	Yes
Job-related variables			Yes

Notes: The table shows results from separate linear regressions with consideration of individual fixed effects. The dependent variable is individual union membership. See Tables 2–4 for more information on the variables and the survey waves used. The set of job-related variables differs from the set used in the main analysis, as earnings and tenure are not included, whereas variables on recent job changes and job terminations are considered in this analysis of union membership among both employed and non-employed workers. Robust standard errors are in parentheses.

*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.

Sources: SOEP data (v33), INKAR data.

TABLE A13 Job Loss and Union Membership: Matching Analysis.

	(1)	(2)	(3)	(4)
Panel A: Dependent variable: Change in union membership				
No restriction on union status				
Job loss due to plant closure	0.036	0.036*	0.039*	0.039*
	(0.022)	(0.021)	(0.022)	(0.020)
N	29,474	29,474	25,618	25,618
Panel B: Dependent variable: Union exit				
Only union members				
Job loss due to plant closure	0.002	0.002	−0.032	−0.032
	(0.059)	(0.041)	(0.058)	(0.040)
N	6819	6819	5652	5652
Panel C: Dependent variable: Union entry				
Only non-union members				
Job loss due to plant closure	0.046**	0.046**	0.039*	0.039**
	(0.021)	(0.019)	(0.022)	(0.019)
N	22,655	22,655	19,966	19,966
Time variables	Yes	Yes	Yes	Yes
Personal variables	Yes	Yes	Yes	Yes
Job-related variables	Yes	Yes	Yes	Yes
Job loss expectations			Yes	Yes
All variables used as covariates		Yes		Yes

Notes: Panels A, B and C show results from separate linear regressions using a sample of workers observed in 1996, 1999, 2001, 2005, 2009 or 2013 who are either union members or not (panel A), who are union members (panel B), or who are not union members (panel C), and two years later regarding their union membership status. To determine union membership status in those SOEP waves without the question on union membership, information is used from the most recent prior SOEP wave. The dependent variable in panel A is the change in individual union membership (−1 exit, 0 no change, 1 entry) when comparing the situation two years later with the current situation. The dependent variable in panel B is union exit (0 no, 1 yes). The dependent variable in panel C is union entry (0 no, 1 yes). The independent variable in all three panels is the incidence of a job termination due to plant closure reported two years later (0 no, 1 yes). Time variables include year and month controls. See Table A1 for information on personal and job-related variables. All variables are used to match individual observations across workers who lose their jobs due to plant closure (treatment) and those who do not lose their jobs (control). In columns (3) and (4), job loss expectations are considered in addition. Regression analyses are carried out without (with) inclusion of the variables used for the matching procedure in columns (1) and (3) (columns (2) and (4)). Robust standard errors are in parentheses.

*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.

Source: SOEP data (v33).

To inspect a methodological alternative, we here employ a non-parametric variant of the DiD analysis, as presented in Table 8, by using entropy balancing. This method allows us to perfectly match the average characteristics of individual observations in a treatment group (job loss due to plant closure) and a control group (no job loss). Specifically, the available characteristics of the treatment group, prior to the event of a plant-closure-induced job loss, and the control group of workers staying in their jobs are aligned based on the same covariates as used in our main analysis, that is, personal and job-related variables (see Table A1).

The results of Table A13 confirm the findings presented in Table 8. First, we use the aforementioned variables for the matching procedure, and we then run a regression either without variables (column (1)) or with variables (column (2)). The results show a weakly significant, positive effect on union membership. It is driven by workers not in the union at the beginning of the time window, as shown in panel C of Table A13.

Expanding the analysis, we also consider the available information on job loss expectations in the SOEP. This variable informs us about possible differences regarding foreknowledge of a plant closure, which allows us to control for possible anticipation effects. The corresponding results in columns (3) and (4) of Table A13 confirm our conclusions.

Analyses on non-response

Table A14 presents results from reduced-form analyses aimed at finding out whether survey non-response could be relevant. Investigating the role of perceived job insecurity in union membership decisions is possible only via survey data. However, the disadvantage of such data is that it is not necessarily representative of the entire population, despite all the efforts of the survey organizers to guarantee representativeness. A lack of representativeness could be an issue for the interpretation of results if specific types of individuals do not participate in surveys at all. There

TABLE A14 Analysis of Non-response.

	Dependent variable: Union membership (1)	Dependent variable: Panel exit next year (2)
Panel A		
Firm-level workforce reduction	0.027***	0.007
	(0.006)	(0.004)
Union membership		0.002
		(0.006)
Interaction: Union membership × Firm-level workforce reduction		−0.002
		(0.007)
N	29,790	32,122
Panel B		
Regional unemployment rate	0.006***	0.005***
	(0.002)	(0.001)
Union membership		−0.021
		(0.014)
Interaction: Union membership × Regional unemployment rate		0.002
		(0.001)
N	28,237	29,603
Panel C		
Regional job losses due to plant closures	0.006***	0.002*
	(0.002)	(0.001)
Union membership		−0.004
		(0.008)
Interaction: Union membership × Regional job losses due to plant closures		0.003*
		(0.002)
N	22,046	25,410

Notes: The table shows results from separate linear regressions with consideration of individual fixed effects. In column (1), the dependent variable is individual union membership (0 no, 1 yes), and SOEP survey weights are used. In column (2), the dependent variable is panel exit in the following survey year (0 no, 1 yes). See Tables 2–4 for more information on the independent variables and the survey waves used. The set of control variables includes year and month controls. Robust standard errors are in parentheses.
*, **, *** indicate levels of significance $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.
Sources: SOEP data (v33), INKAR data.

could also be an issue if specific types of individuals do not participate on a routine basis, and drop out of an ongoing panel survey after some participations.

To address the issue of non-response, we first consider the available SOEP survey weights and repeat our main analysis. The results hardly change, as can be seen in column (1) of Table A14. In column (2), we address the issue of attrition bias by running fixed effects regression with panel exit in the next survey year as the dependent variable. The idea of this analysis is to find out whether union members are less likely to drop out of the ongoing panel survey during times of labour market crisis, compared to non-members, which could imply an overestimation of the positive effects for trade union membership in our analysis. However, we find no evidence for panel exits becoming less likely for union members in the case of labour market turbulences. There is even some evidence in panel C for a weakly significant increase in the probability of union members leaving the panel when more plant-closure-induced job losses of other workers in the region occur. If anything, this would point to an underestimation of the positive effects of labour market turmoil for union membership in our main analysis.