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## Evidence from German Linked-Employer-Employee Data

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**Abstract**

A large number of articles have analysed 'the one constant´ in the economic effects of trade unions, namely that union bargaining reduces employment growth by two to four percentage points per year. Evidence is, however, mostly related to Anglo-Saxon countries. We investigate whether a different institutional setting might lead to a different outcome, making the constant a variable entity. We use linked-employer-employee data for Germany and analyse the effect of collective bargaining coverage on employment growth in German plants. We find a robust and negative correlation between being covered by a sector-wide bargaining agreement or firm-level contract and employment growth per annum of about 0.8 percentage points. Using various approaches, however, we cannot establish a causal interpretation of the effects, suggesting that the cross-section results are driven by selection.

*Keywords:* collective bargaining, employment growth, job flows, trade unions

*JEL code:* J23 J52, J 53, J63

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# 1 Introduction

What are the economic effects of trade unions on employment, i.e. does collective bargaining, in comparison to individual wage determination, reduce employment? Neoclassical theory suggests that if wages equal marginal productivity and trade unions raise wages, labour demand will shrink (Hammermesh 1993). However, if firms and trade unions bargain not only over wages, but also employment, this might increase employment (McDonald and Solow 1981). Furthermore, trade unions could also raise the quality of job matches and reduce turnover, such that the incentives to invest in firm-specific human capital may be larger, thus increasing labour productivity and boosting employment in unionised plants.

Despite this theoretical ambiguity, empirical analyses at first sight provide a clear-cut picture and have uncovered what Addison and Belfield (2004a) refer to as *the one constant* among the economic effects of trade unions: Unionism reduces employment growth. This high-level interpretation of the evidence is based on data primarily from Anglo-Saxon countries, which suggest a reduction of two to four percent per annum. These countries tend to be characterised by a pluralistic system of industrial relations and low collective bargaining coverage in the private sector.[1] Moreover, collective bargaining is rather uncoordinated and primarily takes place at the plant level.

Therefore, in this paper we enquire whether the negative employment effects observed for Anglo-Saxon countries are also present in a more cooperative and corporatist industrial relations system, such as in Germany, where collective bargaining occurs predominantly at the industry level and is rather coordinated. Germany, the largest economy in the European Union and fourth-largest in the world, is an interesting case for several additional reasons. Although collective bargaining coverage has declined over the last decades by about 15 percentage points (Ellguth and Kohaut 2014), the majority of employees are still remunerated in accordance with collective bargaining. Therefore, the aggregate number of jobs not created due to collective bargaining, if the *the one constant* were to exist in Germany as well, would be substantially larger than in economies exhibiting lower collective bargaining coverage. Furthermore, the effects of different levels of collective bargaining can be scrutinised since both sector-level and plant-level bargaining agreements coexist in Germany. Finally, we exploit linked-employer employee panel data, namely the widely used LIAB dataset from the Institute for Employment Research (IAB). This allows us to scrutinise whether the relationship between collective bargaining and employment growth can be interpreted causally.

[1]Australia is somewhat of an exception in the latter regard with a collective bargaining coverage of about 60 % (Visser 2013).

Our baseline findings suggest that collective bargaining is associated with a reduction in employment growth in German plants by 0.8 percentage points per annum, i.e., by less than in those countries for which the *the one constant* has been observed. We obtain similar results for various subsamples; find the results not to be sensitive to alternative empirical approaches with respect to the data; and, importantly, observe no differences with respect to collective negotiations at the plant or sector level. However, when using the time dimension of the data, fixed-effects and difference-in-differences estimates provide no indication that changes in bargaining status affect employment growth, i.e. the differences in employment growth are not caused by the introduction or the abolition of collective bargaining. Furthermore, dynamic panel estimations and instrumental variables techniques provide no basis for a causal interpretation, either. Therefore, our findings suggest that the employment effects associated with collective bargaining in Germany are due to self-selection into bargaining regimes.

After having laid out our motivation, we present the relevant literature in Section 2 and use Section 3 to characterise the institutional setting. Section 4 gives an overview of the data, presents descriptive evidence, and outlines the empirical methods we employ. The basic results as well as findings from various robustness checks are presented in Section 5, while we analyse causality issues in Section 6. Section 7 concludes and puts our findings into perspective.

## 2 Related Literature

**Union Employment Literature:** A number of empirical articles have investigated the effects of unionism on employment growth. This *union employment literature* has so far focussed on the United Kingdom and the United States, and also includes a number of studies for Australia and Canada. In addition, we are aware of one analysis for Norway.[2]

Studies for the UK generally employ data from Workplace Industrial Relations Surveys (WIRS) or Workplace Employee Relations Survey (WERS). A common finding is that employment in unionised plants grows between 2 % to 4 % less per annum than in non-unionised plants.[3] In partial contrast, Machin and Wadhwani (1991) only observe this impact in plants experiencing organisational change and Blanchflower and Burgess (1996) do not find union recognition to be related to the absolute growth rate of employment. Finally, Bryson and Dale-Olsen (2008) cannot discern a correlation between employment growth and various measures of unionism in the private sector, also taking into account the effect of plant closures.

[2] For an overview on other measures of plant performance, see Addison and Belfield (2004b).

[3] See, inter alia, Blanchflower et al. (1991), Blanchflower and Burgess (1996), Booth and McCulloch (1999), Addison et al. (2000), Bryson (2004), Addison and Belfield (2004a) and Bryson and Nurmi (2011).

Turning to the United States, Leonard (1992) uses a cross-section of Californian manufacturing plants for the period 1974 to 1980 and shows that employment in large plants with collective bargaining grows by 2 % to 4 % less than in non-unionised plants. Bronars et al. (1994) base their study on information about collective bargaining agreements provided by the Bureau of Labor Statistics. They find that a 10 % increase in union coverage is associated with a 0.5-1.1 % decrease in employment growth.[4] Newer studies try to establish causal results by employing novel econometric techniques, e.g. a regression discontinuity design which utilises the fact that legal recognition of a trade union according to the National Labor Relations Act requires an election among the workforce. While DiNardo and Lee (2004) find no impact of unionisation on hours of work, the results for nursing homes by Sojourner et al. (forthcoming) are in sharp contrast. Their estimates indicate that hours of work (as a proxy for employment) decline dramatically because of union certification.

Turning to Canada, Long (1993) uses a dataset of 510 plants from 1980 to 1985, and estimates that employment growth in large plants covered by a collective agreement is almost 4 % lower than in uncovered plants. Walsworth (2010) analyses panel data from the Canadian Workplace and Employment Survey and covers the period from 1999 to 2005. The author finds that plants with a majority union grow about 2.2 % less in terms of employment, while other indicators of unionism are not associated with employment growth. In a recent article, Walsworth and Long (2013) update these findings to the years 2001-2006 and find overall smaller effects, which they separate into negative effects for large manufacturing plants and even positive effects for small service sector plants. Lastly, Wooden and Hawke (2000) and Blanchflower and Burgess (1998) use data from the Australian Workplace Industrial Relations Survey (AWIRS). The former estimate a negative impact of union density in private sector plants on employment growth of about 2.5 %, while the latter do not find evidence of a correlation.

All in all, the overwhelming majority of contributions is consistent with the view that annual employment growth is between two and four percentage points lower in unionised plants. Going beyond Anglo-Saxon countries, Bryson and Dale-Olsen (2008) analyse Norwegian linked-employer-employee data over the period from 1997 to 2003. They state that employment growth is about 3-5 % lower in plants in which a union is recognised for the purpose of collective bargaining, compared to non-unionised plants, when correcting for survival bias. However, estimating a dynamic panel-data model and controlling for worker sorting, the study finds a positive effect of union density on both short-term and long-term employment.

[4] Bronars et al. (1994) also provide results for other measures of firm performance as well as a good overview of the early literature on union effects in the United States.

**Evidence for Germany:** For Germany, the country of interest of this study, evidence on the employment effects of collective bargaining is scarce. Empirical work has focussed on plant-level co-determination and occasionally included a dummy variable indicating the existence of collective bargaining as a control variable. Addison and Teixeira (2006), for example, report a negative effect of works councils on employment growth in West Germany using the IAB establishment panel, and an insignificant or positive impact of collective bargaining, depending on the empirical specification. Jirjahn (2010) observes a positive effect of works councils on the basis of data from the Hanover panel when taking endogeneity into account. With regard to collective bargaining, the estimated coefficients are not significantly different from zero when using OLS, and are negative and marginally significant in a treatment effects model that controls for the endogeneity of works councils. A more recent study by Gralla and Kraft (2012) separates the introduction effects from potential selectivity effects of works councils using a difference-in-differences framework. They find positive selection and negative introduction effects of works councils on employment growth and negative but mostly insignificant coefficients for the collective bargaining dummy. These few existing studies have not focused on the question at hand and deliver a blurred picture with respect to whether bargaining coverage in Germany might have similar effects on employment growth as has been detected for Anglo-Saxon countries.

# 3 Institutional Background

In Germany the Collective Agreement Act (Tarifvertragsgesetz, TVG) basically allows firms to choose whether wages and other working conditions are to be determined individually with each employee, locally with a union at the plant level, or centrally by joining an employers' association. In large parts of the economy, especially in the manufacturing sectors, firms belong to an employers' association (Arbeitgeberverband), which bargains with a sectoral union to set minimum working conditions. The outcome of such negotiations are sector- (or industry-)wide multi-employer agreements, from here on labelled *sector-wide bargaining agreements (SBAs).* At the plant level, works councils typically monitor the enforcement of a sector-wide bargaining agreement and provide for an employee voice.[5] Works councils have extensive co-determination rights with respect to personnel policy and although forbidden to bargain over wages, have also been shown to raise them (Addison et al. 2010). Such effects are likely to arise because works councils can

[5]Co-determination at the plant level by works councils covered about 45 % (37 %) of all private sector employees in West (East) Germany in 2010 (Ellguth and Kohaut 2014).

affect pay scales, dismissal behaviour and organisational issues. The consequences which are due to the interaction between sector-wide bargaining agreements and works council activities are also specific to Germany (Brändle 2013). While in decline, this dual system of industrial relations still covers the majority of employees (Addison et al. 2011, Ellguth and Kohaut 2014). This is the case, because collective contracts are usually applied to all employees in a covered firm, not only to union members.[6] Therefore, collective bargaining coverage is much higher than union density, which has declined in recent years, from 25 % in 2000 to 18 % in 2011 (Visser 2013).

In contrast to Anglo-Saxon countries, only a small minority of (mainly large) firms bargain with unions directly at the firm level (around 3 % of all plants covering around 10 % of all employees); even if they do, they usually have to bargain with sector-union representatives and not with union members at the firm itself. We call these bargaining agreements *firm-level contracts (FLCs).*

As a consequence, several types of bargaining regimes co-exist in Germany: individual wage determination; firm-level contracts, which are quite heterogeneous in their drafting; and (more or less flexible) sector-wide bargaining agreements. Additionally, about 50 % of the firms that are not formally a member of an employers' association refer to sector-wide bargaining agreements when they determine wages and working conditions with their employees individually (so-called Tariforientierung, Ellguth and Kohaut 2014). While signing any collective agreement immediately affects wages and working conditions, replacing it a by individual contracts is much more time-consuming. This is the case because the regulations of a SBA or FLC continue to apply until a new contract has been bargained with each employee, which can take up to several years (so-called Nachwirkungsprinzip, §3.3 and §4.5 TVG). Therefore, leaving collective bargaining is not a method to increase (short-term) flexibility in wage bargaining.

# 4 Data, Descriptive Statistics and Empirical Procedure

## 4.1 Data

**LIAB:** We use the linked-employer-employee dataset (LIAB) from the Institute for Employment Research in Nuremberg (Institut für Arbeitsmarkt- und Berufsforschung, IAB), more precisely the cross-section version 2 (LIAB QM2 9310). The LIAB is created by linking official process-produced individual data from the IAB Employment Histories (IAB

[6] Among others, Fitzenberger et al. (2013) discuss various reasons and consequences of this practice.

EH) with plant-level survey data from the IAB Establishment Panel (IAB EP).[7] We cover the years 2000 to 2010, which approximate the most recent business cycle including data on the great recession. Moreover, there were changes in the sampling design and in the phrasing of the questionnaire of the IAB EP prior to this period.

The IAB EH is based on information from social security records and therefore excludes civil servants, students, and the self-employed, all of whom are not covered by this mandatory insurance scheme. Information comprises, inter alia, age, sex, nationality, occupation, education, and daily wages.[8] We restrict our analysis to individuals who work at least 50 % of the standard working time, earn more than 600 Euros per month, are aged between 15 and 65 and not classified as home workers or helping family members.

The IAB EP is a plant-level survey stratified over 10 plant size classes and 16 industries, based on the population of all plants in Germany with at least one employee subject to social security. Starting in 1993 for West Germany and 1996 for East Germany, sample size has steadily increased to up to 16,000 plants per year. The survey covers about 1 % of all plants and about 7 % of all employees in Germany. It is conducted via personal interviews with senior staff or personnel managers, and has a very high response rate and very low panel attrition. The questionnaire focusses on the plants' personnel structure, development and policy, and offers extensive information on plant characteristics.[9] We restrict our sample to plants with at least five employees subject to social security and to plants where we can observe at least five employees per plant in each year in the IEB. Furthermore, we drop plants from agriculture and mining, public administration, as well as non-profit-organisations.

**Collective Bargaining:** To assess the impact of union bargaining, we use plant-level information and distinguish whether a plant is covered by collective bargaining at the firm level between a sector union and the management of the company (firm-level contract, FLC) or at the sectoral level involving an employers' association (sector-wide bargaining agreement, SBA). Regarding comparability, firm-level contracts are institutionally most similar to the existence of a majority union (United States) or of the recognition for collective bargaining (United Kingdom), while there is no exact match for sector-wide bargaining agreements in the Anglo-Saxon context.[10]

[7] For a more detailed description of the LIAB, see Jacobebbinghaus and Seth (2010).

[8] The information on wages is very exact, but is censored at the upper earnings limit for social security contributions and lacks information on precise individual working time.

[9] For further information on the IAB EP, see Fischer et al. (2009).

[10] The union employment literature employs various measures of union strength, depending on the institutional setting in the country and the datasets available. The most common measures are union density (the share of union members among all employees) (Blanchflower et al. 1991, Machin and Wadhwani 1991, Bronars et al. 1994, Dunne and MacPherson 1994, Addison et al. 2000, Wooden and Hawke 2000, Krol and Svorny 2007, Bryson and Dale-Olsen 2008) or union recognition for collective bargaining

Table 1: Prevalence of Bargaining Regimes: Share of Employees and Number of Plants Covered

| Bargaining Regime | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Individual Wage Determination** | | | | | | | | | | | | |
| Share of Employees (%) | 30.83 | 29.69 | 31.56 | 32.56 | 33.27 | 35.03 | 36.32 | 37.89 | 38.46 | 38.30 | 39.94 | 34.90 |
| No. of Plants | 3,158 | 3,586 | 3,796 | 4,007 | 3,894 | 3,996 | 4,053 | 4,359 | 4,228 | 4,047 | 3,971 | 43,095 |
| **Firm-Level Contract** | | | | | | | | | | | | |
| Share of Employee (%) | 7.34 | 8.42 | 7.13 | 7.82 | 7.42 | 8.01 | 8.08 | 7.49 | 7.70 | 9.69 | 8.33 | 7.94 |
| No. of Plants | 703 | 700 | 662 | 690 | 696 | 769 | 716 | 719 | 696 | 724 | 607 | 7,682 |
| **Sector-wide Bargaining Agreement** | | | | | | | | | | | | |
| Share of Employee (%) | 61.84 | 61.89 | 61.31 | 59.63 | 59.30 | 56.95 | 55.59 | 54.62 | 53.84 | 52.01 | 51.73 | 57.16 |
| No. of Plants | 4,537 | 4,897 | 4,722 | 4,475 | 4,353 | 4,397 | 4,072 | 4,017 | 3,792 | 3,446 | 3,008 | 45,716 |
| Total | | | | | | | | | | | | |
| No. of Plants | 8,398 | 9,183 | 9,180 | 9,172 | 8,943 | 9,162 | 8,841 | 9,095 | 8,716 | 8,217 | 7,586 | 96,493 |

*Note: Employment shares are calculated using representative sample weights.*
*Source: LIAB QM2 9310, Waves 2000 to 2010; own calculations (controlled remote data access via FDZ).*

Table 1 presents the shares of employees and the number of plants covered by different bargaining regimes in our data. We replicate the stylised facts that sector-wide bargaining agreements are still the dominant bargaining regime in terms of employees, covering about 52 % of all employees in 2010, but also that the share of covered employees has steadily fallen by about 10 percentage points during the time span of our sample.[11] The share of employees covered by firm-level contracts has been more stable, such that individual bargaining has become more widespread. Furthermore, it is the case that individual wage determination is more prevalent in smaller plants, which have also predominantly been affected by decentralisation of collective bargaining.

**Employment Growth:** To measure plant-level employment growth, we use the concept of job flows. We compute employment growth rates according to Davis and Haltiwanger (1992) as the difference in the number of employees $x$ in a plant $j$ between year $t$ and year *t-1*, divided by the average number of employees in both years:

$$jgr_{jt} = \frac{x_{jt} - x_{jt-1}}{(x_{jt} + x_{jt-1})/2}$$

Compared to conventional non-standardised growth rates, this measure has the

(Blanchflower et al. 1991, Machin and Wadhwani 1991, Leonard 1992, Blanchflower and Burgess 1998, Booth and McCulloch 1999, Addison and Belfield 2004a, Bryson 2004, Bryson and Dale-Olsen 2008, Bryson and Nurmi 2011), while other authors use variations of these measures.

[11] The share of plants covered has experienced a similar development at a lower level, falling from 51 % in 2000 to only 38 % in 2010. Discrepancies with other findings stem from our sample restriction, i.e. disregarding small plants.

Table 2: Job Growth Rate by Bargaining Regime

| **Bargaining Regime** | Job Reallocation Rate | Job Creation Rate | Job Destruction Rate | Job Growth Rate (unw.) | Job Growth Rate (plant-w.) | Job Growth Rate (empl.-w.) | N. of Obs. |
|---|---|---|---|---|---|---|---|
| Individual Wage | 0.12 | 0.07 | 0.05 | 0.02 | 0.05 | 0.04 | 43,095 |
| Determination | (0.17) | (0.15) | (0.12) | (0.21) | (0.22) | (0.20) | |
| Firm-Level | 0.10 | 0.05 | 0.05 | -0.01 | 0.01 | 0.00 | 7,682 |
| Contract | (0.17) | (0.11) | (0.14) | (0.20) | (0.19) | (0.16) | |
| Sector-wide Bargaining | 0.09 | 0.04 | 0.05 | -0.00 | 0.02 | 0.01 | 45,716 |
| Agreement | (0.14) | (0.11) | (0.11) | (0.17) | (0.18) | (0.15) | |
| Total | 0.10 | 0.05 | 0.05 | 0.01 | 0.03 | 0.02 | 96,493 |
| | (0.16) | (0.13) | (0.12) | (0.19) | (0.20) | (0.17) | |

*Note: Numbers denote means, standard deviations in parentheses; Calculated using representative sample weights which control for plant size.*
*Source: LIAB QM2 9310, waves 2000-2010, own calculations using controlled remote data access via FDZ.*

advantage of being approximately normally distributed inside a (0,2) interval.[12]

Table 2 presents descriptive statistics of job flow rates and especially job growth rates, differentiated by bargaining regime. Employment growth is larger in plants with individual wage determination due to a higher rate of job creation. Furthermore, plants covered by sector-wide bargaining agreements (SBAs) feature the lowest rate of job reallocation. The differences between plants covered by firm-level contracts (FLC) and SBA are fairly small. Indeed, FLC seem to display a somewhat lower growth rate, while job reallocation and job creation is potentially larger. Job destruction is about the same across bargaining regimes. The weighted job growth rates, depicted in the fifth and sixth columns of Table 2, are larger than the unweighted ones because small plants usually have higher job growth rates. The observed patterns, however, do not change.

While these numbers are qualitatively comparable to the ones presented in the union employment literature for Anglo-Saxon countries, they differ quantitatively. In particular, the difference in employment growth rates between unionised plants and non-unionised plants appears to be smaller in Germany. Furthermore, it is noteworthy that there is no discernible correlation between the level of collective bargaining - FLC versus SBA - and employment.

**Covariates:** Given the linked-employer-employee characteristic of our data, we include both worker- and plant-level variables to control for differences in observable characteristics. We incorporate individual characteristics aggregated at the plant-level. In particular, we use the share of female workers, and the average employee age and its dispersion in a

[12]For the computation we use the contemporary information from the IAB EP questionnaire on the employment levels of the the last two years.

plant. Additionally, we control for the tenure of the workforce using categorical variables, as well as the share of employees with foreign nationality in a plant. We utilise employee shares, distinguishing between unskilled, skilled and high-skilled workers;[13] blue- and white-collar workers; as well as trainees and part-time workers. We further include the mean of employees' log daily gross earnings and the share of employees with an individual wage censored at the social security contribution ceiling.

Regarding plant-level characteristics, we control for the existence of a works council, alignment to a SBA, the existence of a wage cushion, investment activity, plant age, public or foreign ownership and organisational status (single plant, public listing, public corporation), as well as additional information on the workforce composition (share of open positions, temporary workers, as well as the job churning rate[14]).

We further include characteristics with a high share of item-non-response in some specifications. These variables might have an influence on employment growth, but they reduce sample size. We use the average working time for full-time employees, the share of exports, personnel and turnover outlook, firm-sponsored training, and the existence of overtime. Furthermore, we control for productivity at the plant level by using the log of total investments as well as the share of expansion investments. Additionally, we include dummy variables for the industry, the region, and the year of the observation at the plant level. We offer a complete list of all variables used in the Appendix (see Table 8).

## 4.2 Estimation Procedure

**Empirical Model:** Making use of the panel structure of our linked-employer-employee data, we estimate a linear two-way error-components model in the following (condensed) form:

$$y_{jt} = \beta_k \cdot union_{kjt} + \delta \cdot X'_{jt} + \alpha_j + \mu_t + \epsilon_{jt}$$

where $y_{jt}$ is the employment growth rate for plant $j$ at time $t$, calculated in the manner outlined above and $union_{kjt}$ is our variable of interest, namely a dummy variable taking the value of one when a plant $j$ is covered by a sector-wide bargaining agreement (k=1) or a firm-level contract (k=2) at time $t$ and zero otherwise. We add individual-specific and plant-specific control variables in $X_{jt}$ (as detailed in the previous section), as well as plant size classes, industry and regional fixed effects to our regression. Then, $\alpha_j$ captures plant-specific unobserved heterogeneity (as well as potentially time-invariant control variables), while the unobserved time effect $\mu_t$ is treated as fixed between plants

[13]We use the imputation method supplied by Fitzenberger et al. (2006) to get more and more consistent information.

[14]Calculated as (hires + separations - |hires - separations|) divided by (hires + separations).

and estimated via time dummy variables to cover macroeconomic developments or general time trends. Finally, $\epsilon_{jt}$ represents an idiosyncratic error term. We account for the repeated observation of plants over time using cluster-robust standard errors at the plant level in all our estimations.

**Discussion on Identification:** In Section 5 we determine the parameters $\beta_k$ using pooled ordinary least squares (OLS) as a reference point, since the *union employment literature* often uses cross-sectional data. These estimates ignore unobserved heterogeneity that is simultaneously correlated with collective bargaining coverage and employment growth. To check the robustness of the results, we also used weighted least squares and restrict the sample to balanced panels. As an extension of the OLS model, we also check whether survival bias plays a role by including a first stage estimation of plant survival via a Heckman selection model.

Subsequently, we use static panel estimators to control for time-invariant heterogeneity. These results are presented in Section 6.1. As both the dependent and the independent variable of interest are measured at the plant level, we use a two-way-error component model.[15] Identification in the panel dimension using a within group estimator (or fixed-effects model) relies on changes in the bargaining status of plants. In our sample, ignoring multiple-changes, 1,722 plants (5.91 % of all plants covering 6.46 % of all employees) conclude a collective contract (either SBA or FLC) for the first time, while 2,189 plants (7.91 % of all plants covering 4.16 % of all employees) leave collective coverage. As an extension, we check whether different changes, i.e. an introduction vs. an abolition have different effects using a difference-in-differences framework. This approach also allows us to analyse the effects of sample selection of plants before they change status and of plants that are always covered.

Finally, in Section 6.2 we relax the strict exogeneity assumption, namely that the independent variables of interest (as well as the fixed-effects) are uncorrelated with the time-varying part of the error term: $E[\epsilon_{jt}|union_{kjt}] = 0$. This is done using, first, internal instruments in dynamic panel estimators (GMM-diff and GMM-sys), which also acknowledge the time-dependency of our variables of interest. Second, we use external instruments (two-stage-least-squares estimations) that should account for firm and worker sorting into collective coverage.

[15] It delivers the same results as a three-way-error component model controlling for spell-fixed-effects (Andrews et al. 2006). Also, the correlation between plant size and our variables of interest would bias results if we estimate the effect on the individual level. As a robustness check, we have performed individual-fixed effects estimations using weights that control for plant size, which, in turn, results in the same coefficients as a plant-level estimation.

# 5 The One Constant in Germany

## 5.1 Cross-sectional Evidence

We start by presenting cross-sectional evidence from pooled OLS models similar to the *union employment literature*. The baseline results are accompanied by robustness checks regarding data issues and validity in certain subsamples.

**Baseline Results:** Table 3 presents an overview of the effects of collective bargaining on employment growth in German plants. Due to space limitations we show only the estimated coefficients relating to the variables of interest in the main text, while the entire set of results is reported in the Appendix (see Table 9). Specification (1) presents the raw differences in employment growth between plants with and without union bargaining. It indicates that the unconditional difference in average employment growth between covered and uncovered plants amounts to -2.2 and -2.4 percentage points per year.

Table 3: Collective Bargaining and Employment Growth: Results from Pooled Ordinary Least Squares

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Sector-wide Bargaining Agreement | -0.0219*** | -0.0241*** | -0.0108*** | -0.0078*** | -0.0078*** | -0.0060** |
| | (0.0013) | (0.0015) | (0.0021) | (0.0021) | (0.0024) | (0.0024) |
| Firm-Level Contract | -0.0243*** | -0.0296*** | -0.0163*** | -0.0105*** | -0.0078** | -0.0073** |
| | (0.0024) | (0.0025) | (0.0029) | (0.0029) | (0.0032) | (0.0031) |
| Firm-Level Variables | No | No | Some | Some | Some | All |
| Individual-Level Variables | No | No | No | Yes | Yes | Yes |
| Dummy Variables | No | Yes | Yes | Yes | Yes | Yes |
| N. of Observations | 96493 | 96493 | 96493 | 96493 | 65249 | 65249 |
| N. of Clusters | 26525.00 | 26525.00 | 26525.00 | 26525.00 | 18583.00 | 18583.00 |
| F-Statistic | 149.66 | 37.62 | 57.64 | 77.72 | 62.16 | 73.03 |
| R squared | 0.00 | 0.01 | 0.04 | 0.10 | 0.12 | 0.14 |
| Aikaike Criterion | -47085.42 | -48097.71 | -50954.25 | -57255.14 | -46090.19 | -47577.20 |

*Note: Standard errors clustered at the plant level in parentheses; dummy variables: plant size classes, industries, regions and years; other control variables: as Table 9 in the Appendix; significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: LIAB QM2 9310, Waves 2000 to 2010; own calculations (controlled remote data access via FDZ).*

Across specifications, the differences in coefficients can be interpreted as capturing only the direct or also the indirect effects of collective bargaining on employment growth. In specification (2), we add dummy variables for plant size, industry, region, and years: the results do not change qualitatively. However, when introducing plant-level control variables in specification (3) and plant-level averages of individual-level control variables in specification (4), this reduces the coefficients of interest to -0.8 percentage points and -1.1 percentage points, respectively for SBAs and FLCs. Specification (6) furthermore incorporates observation-sensitive plant-level control variables, while specification (5) checks for sample selection by running the model of specification (4) on the sample of specification (6). While there is no evidence of such selection issues with regard to SBAs, a comparison of specifications (4) and (5) cannot completely rule out this possibility for FLCs. The inclusion of further plant-level control variables in specification (6) reduces the quantitative impact of collective bargaining on employment growth to about -0.6 percentage points and -0.7 percentage points per annum.

The explanatory power of the model is quite good. While the inclusion of plant-level variables influences the coefficients of interest most, the inclusion of plant-level averages of individual covariates adds to the R squared and further improves the model, which is an advantage of using linked employer-employee data. As the coefficients of interest shrink with the inclusion of covariates, this indicates that plant- and worker-sorting on observables play a role in explaining differences in employment growth between covered and uncovered plants.

In summary, when using a comparable methodology to that which has predominantly been employed in the *union employment literature*, we also observe a negative correlation between collective bargaining and employment growth in Germany. Interestingly, the effect does not appear to depend on the collective bargaining regime. Moreover, it is much smaller than the impact found for Anglo-Saxon countries. This suggests that *the one constant* is substantially lower in the more cooperative industrial relations system of Germany than in Anglo-Saxon countries, if such a statement is feasible for a constant, at all.

**Data Issues:** In our panel, large plants are over-represented. To ensure external validity of our results we have also estimated weighted regressions. First, we use plant weights, that is the inverse sampling probability for each plant according to its plant size class, region and economic sector. Second, we employ observation weights, that is the number of employees at each plant. Third, we combine both approaches and multiply the number of employees at each plant by the representative survey weight. The estimated coefficients (*not documented*) are similar to those depicted in Table 3. More specifically, they suggest that the effect of SBAs on employment growth tends to be more pronounced for large plants, while the effects of FLCs might be larger in small plants.

Furthermore, we have verified whether the use of an unbalanced panel drives the results. Accordingly, we have consecutively restricted our data to plants that stay in the sample for at least (a) two consecutive years, (b) about half the observation period, and (c) to plants which we observe for the whole observation period (fully balanced panel).[16]

[16]The number of observations drops by about 10 %, 50 %, and 90 %, respectively.

The results original hold, except for the effect of SBAs in the medium-term sample and for the effect of FLCs in the balanced panel. In both cases, the coefficients are negative, but insignificant.

Finally, we have checked whether using yearly employment levels instead of retrospective information in the recent wave, which is subject to small inconsistencies, makes a difference. This robustness check restricts the sample to plants with two consecutive observations. Re-estimating the model on this restricted sample does not change our results.

**Effect Heterogeneity:** When analysing labour market institutions, especially in the industrial relations literature, effect heterogeneity is a major concern. Institutions often have different effects in different environments and their impact may interact with the effects of other institutions. Therefore, we have looked at the employment effects of collective bargaining separately for the private and public sector, Western and Eastern Germany, manufacturing and services sectors, as well as for exporting and medium-sized companies.

Table 4 summarises the results for the OLS estimations, comparable to specification (4) of Table 3. In the public sector, collective bargaining is conducted between sector-level unions and the federal government or an association of the German federal states. Hence, bargaining takes place at a more centralised level than is the case for the private sector. We find that collective bargaining is not associated with lower employment growth in covered plants in the public sector.[17] Additionally, is has been argued that industrial relations institutions have a stronger impact in regions and sectors where unions are traditionally strong (Kohaut and Schnabel 2003). This is particularly the case in manufacturing and in Western Germany, while unions were rendered ineffective during the German Democratic Republic in Eastern Germany. We find, however, no support for this suggestion. The coefficients of our variables of interest do not, with one exception, differ significantly from each other in the respective subsamples. Lastly, we analyse two special groups of plants. First, exporting plants are, on the one hand, more exposed to international competition and might, therefore, be more severely affected by higher collectively bargained wages. On the other hand, exporting plants are usually more productive than non-exporting plants and might therefore be better able to cope with higher wages. Our findings suggest that the two potential effects cancel out in the case of industry-wide bargaining (SBA), while the second argument may dominate in plants which bargain at the enterprise level (FLC).

[17] In the IAB EP the public sector is narrowly defined by industry classification as plants belonging to the public administration. We additionally view plants (1) with either a budget as business volume, (2) which identify themselves as public corporations, or (3) employ public servants ('Beamte') as belonging to a widely defined public sector. For these plants, collective coverage is higher than for the whole sample, at about 60 %. Because of the wide definition of the public sector, we can observe, however, enough uncovered observations.

Table 4: Collective Bargaining and Employment Growth: Overview on Subsamples, OLS Results

| | Public Sector | | Region | | Sector | | Others | |
|---|---|---|---|---|---|---|---|---|
| | Yes | No | West Germany | East Germany | Manufacturing | Services | Exporting Firms | 20-200 Employees |
| Sector-wide Bargaining Agreement | 0.0043 | -0.0100*** | -0.0093*** | -0.0104*** | -0.0081*** | -0.0067** | -0.0062* | -0.0094*** |
| | (0.0095) | (0.0022) | (0.0027) | (0.0035) | (0.0032) | (0.0028) | (0.0037) | (0.0029) |
| Firm-Level Contract | -0.0061 | -0.0084*** | -0.0111*** | -0.0135*** | -0.0061 | -0.0123*** | -0.0014 | -0.0126*** |
| | (0.0109) | (0.0030) | (0.0036) | (0.0045) | (0.0038) | (0.0041) | (0.0040) | (0.0042) |
| Firm-Level Variables | Some | Some | Some | Some | Some | Some | Some | Some |
| Individual-Level Variables | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Dummy Variables | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N. of Observations | 11312 | 85181 | 62254 | 34239 | 40773 | 55720 | 26583 | 46350 |
| N. of Clusters | 3181 | 23956 | 18474 | 8266 | 10625 | 16298 | 8711 | 13509 |
| F-Statistic | 6.45 | 77.47 | 50.79 | 38.63 | 46.96 | 41.90 | 32.69 | 43.84 |
| R squared | 0.05 | 0.12 | 0.10 | 0.11 | 0.14 | 0.09 | 0.17 | 0.12 |

*Note: Standard errors clustered at the plant level in parentheses; dummy variables: plant size classes, industries, regions and years; other control variables: as in specification (4) of Table 9; significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: LIAB QM2 9310, Waves 2000 to 2010; own calculations (controlled remote data access via FDZ).*

Second, we look at medium-sized plants. On the one hand, these plants are of particular interest to policy makers favouring the German 'Mittelstand'. On the other hand, collective coverage increases with plant size, such that medium-sized plants do not suffer from a potential common support problem. We see that the effects of collective bargaining on employment growth tend to be slightly stronger for medium-sized plants than they are for the whole sample, a result that differs from the recent findings by Walsworth and Long (2013) for Canada.

The findings depicted in Table 4 indicate that collective bargaining is consistently associated with a reduction in employment growth in the case of industry-level negotiations (SBA) by about 0.8 percentage points. The effects of firm-level contracts (FLC) are estimated slightly less precisely for the various subsamples, but indicate a comparable quantitative effect. The only exception is the public sector, for which we observe no collective bargaining effect on employment growth.

## 5.2 Robustness Checks

There are a number of issues we have put aside, thus far. First, involving trade unions in the determination of wages and working conditions may affect the profitability and, hence, longevity of plants. Second, collective bargaining coverage may imply binding or non-binding constraints on working conditions. Third, collective negotiations can have different effects if they co-exist with plant-level co-determination. Subsequently, we report the findings of robustness checks concerned with these concerns.

**Plant Closures:** If union bargaining (negatively) influences employment growth, this is likely to have a (positive) effect on plant closures. As a consequence, measuring employment growth on a panel of surviving plants may bias upwards the estimated coefficients (Blanchflower et al. 1991, Bryson 2004). We therefore follow an approach used by Bryson and Nurmi (2011) to model sample selection, controlling for plant survival using a two-step Heckman selection model.

In the panel version of the IAB EP, we can observe if and when plants cease to operate. This is the case for 1,557, or 1.7 %, of all plants in our sample.[18] We adjust the estimates of our pooled OLS regression by a selection equation estimating the probability of survival using a linear probability model. We estimate survival and employment growth jointly by maximum likelihood, weighted by the sampling probability from the first stage

[18]These can be distinguished among the larger group of plants vanishing from the sample due to other reasons, e.g. a refusal to answer the questionnaire. The IAB samples substituting plants that match those leaving the panel in terms of plant size and industry.

(Heckman 1979). Identification relies on the restriction that plants founded after 1990 are less likely to survive, but if they do, their employment growth does not systematically differ from older plants (Gürtzgen 2010).[19]

Table 5: Collective Bargaining and Employment Growth: Controlling for Firm Survival

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Job Growth Rate | | | | | | |
| Sector-wide Bargaining Agreement | -0.0223*** | -0.0241*** | -0.0116*** | -0.0078*** | -0.0082*** | -0.0062*** |
| | (0.0013) | (0.0014) | (0.0021) | (0.0021) | (0.0024) | (0.0023) |
| Firm-Level Contract | -0.0242*** | -0.0285*** | -0.0164*** | -0.0105*** | -0.0083*** | -0.0074** |
| | (0.0023) | (0.0024) | (0.0028) | (0.0028) | (0.0031) | (0.0031) |
| First Stage: Firm Survival | | | | | | |
| Sector-wide Bargaining Agreement | -0.0156 | -0.0522** | -0.0492 | -0.0814** | -0.0847* | -0.0780* |
| | (0.0220) | (0.0240) | (0.0335) | (0.0339) | (0.0450) | (0.0455) |
| Firm-Level Contract | 0.0227 | -0.0904** | -0.0468 | -0.0606 | -0.1126* | -0.1152* |
| | (0.0398) | (0.0422) | (0.0480) | (0.0482) | (0.0632) | (0.0640) |
| Share of old Plants by District | 0.2796*** | 0.1498 | 0.0833 | 0.0733 | 0.1056 | 0.1148 |
| | (0.0499) | (0.1214) | (0.1233) | (0.1249) | (0.1718) | (0.1730) |
| Share of Trainees | 0.1690 | 0.2482* | 0.0446 | 0.0412 | 0.1415 | 0.0729 |
| | (0.1213) | (0.1410) | (0.1344) | (0.2194) | (0.3453) | (0.3539) |
| Firm-Level Variables | No | No | No | Some | Some | All |
| Individual-Level Variables | No | No | Yes | Yes | Yes | Yes |
| Dummy Variables | No | Yes | Yes | Yes | Yes | Yes |
| $\rho$ | -0.0144 | -0.0151*** | -0.0198*** | -0.0199*** | -0.0215*** | -0.0367*** |
| | (0.0107) | (0.0039) | (0.0038) | (0.0038) | (0.0067) | (0.0089) |
| $\sigma$ | -1.6845*** | -1.6898*** | -1.7044*** | -1.7386*** | -1.7932*** | -1.8045*** |
| | (0.0082) | (0.0082) | (0.0083) | (0.0083) | (0.0095) | (0.0095) |
| N. of Observations | 96451 | 96451 | 96451 | 96451 | 65284 | 65284 |
| N. of Cluster | 26659.00 | 26659.00 | 26659.00 | 26659.00 | 18721.00 | 18721.00 |
| Chi squared | 313.59 | 1224.38 | 2733.70 | 5162.74 | 4078.89 | 5398.71 |
| $\rho$ | -0.01 | -0.02 | -0.02 | -0.02 | -0.02 | -0.04 |

*Note: Standard errors clustered at the plant level in parentheses; dummy variables: plant size classes, industries, regions and years; other control variables: as in specification (4) of Table 9; significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: LIAB QM2 9310, Waves 2000 to 2010; own calculations (controlled remote data access via FDZ).*

The results from Table 5 indicate that there might exist a (negative) selection of plants covered by a sector-wide bargaining agreement into survival. In our preferred specification (4), which includes all control variables available for the entire sample, plants covered by a SBA have a 8.3 % lower probability to survive into the next panel year. We can see correlated error terms (significant rho), non-independent equations (significant Wald-tests), and a quite large selection term. However, controlling for plant survival does not change the coefficients of collective bargaining in the employment equation. They are still significantly different from zero and similar in magnitude to the pooled OLS results.

[19]For simplicity, we only do this for plants covered by a SBA. For plants covered by a FLC, identification relies on the functional form assumption, i.e. should not be regarded as causal.

Therefore, negative employment effects of collective bargaining are not driven by more frequent closures of covered plants, but by reduced employment growth in continuing plants.

**Institutional Diversity**: First, we extend our analysis to differentiate not only by the level of bargaining (individual vs. firm-level vs. sector-level), but also by different groups of plants regarding the exact wage-setting regime. Plants covered by a collective agreement can only conform to the minimum standards negotiated in collective bargaining or pay an additional wage cushion. Plants belonging to the latter group could be affected differently by collectively bargained wages and exhibit higher or lower employment growth. The left part of Table 6 summarises these robustness checks, regarding the exact institutional setting, comparable to specification (4) of Table 3.

Table 6: Collective Bargaining and Employment Growth: Robustness Checks: Institutional Diversity

| Wage Cushion and Orientation | | | Works Council | |
|---|---|---|---|---|
| | | | Yes | No |
| SBA paying Minimum Conditions | -0.0076*** | Sector-wide Bargaining Agreement | -0.0074** | -0.0088*** |
| | (0.0021) | | (0.0035) | (0.0027) |
| SBA with Wage Cushion | -0.0084*** | | | |
| | (0.0021) | | | |
| FLC paying Minimum Conditions | -0.0111*** | Firm-Level Contract | -0.0117*** | -0.0075 |
| | (0.0032) | | (0.0039) | (0.0055) |
| FLC with Wage Cushion | -0.0096** | | | |
| | (0.0040) | | | |
| Orientation to a SBA | 0.0008 | | | |
| | (0.0019) | | | |
| Firm-Level Variables | Some | | Some | Some |
| Individual-Level Variables | Yes | | Yes | Yes |
| Dummy Variables | Yes | | Yes | Yes |
| N. of Observations | 96493 | | 38394 | 58099 |
| N. of Clusters | 26525.00 | | 10487 | 17218 |
| F-Statistic | 76.57 | | 26.53 | 58.72 |
| R squared | 0.10 | | 0.09 | 0.11 |

*Note: Standard errors clustered at the plant level in parentheses; dummy variables: plant size classes, industries, regions and years; other control variables: as in specification (4) of Table 9; significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: LIAB QM2 9310, Waves 2000 to 2010; own calculations (controlled remote data access via FDZ).*

The effects turn out to be very robust. For both bargaining regimes the estimated coefficients of the two respective groups of plants, those just adhering to minimum conditions and those paying wage cushions, are not significantly different from each other and from the coefficients of one variable capturing both groups in the previous regressions. The results suggest that once the wage is included as a covariate, it is not its actual magnitude, but coverage by the ‘collective bargaining institution´ per se which is correlated with lower employment growth. This interpretation is consistent with the insignificance of the estimated coefficient for the variable indicating that an uncovered plant voluntarily pays collectively bargained wages, but is legally able to deviate ('orientation´), as depicted in the fifth row of the left part of Table 6.

In addition to collective bargaining, works councils play an important role in the German system of industrial relations and the literature predicts interaction effects between both institutions: While sector-wide bargaining agreements can limit the need for works councils to redistribute rents (Hübler and Jirjahn 2003), this does not have to be the case for firm-level contracts (Brändle 2013). Our results in Table 6 reveal quite similar associations between collective bargaining and employment growth for plants with and without a works council. Albeit the coefficient of FLCs is not significant in the subsample of plants without a works council, it is not statistically different from the coefficient in the subsample of plants with a works council. The coefficients for SBAs are also not statistically different from each other.

For this section, we therefore conclude that the negative relationship between collective bargaining and employment growth of about 0.8 percentage points per year is neither due to survival bias, nor other institutional features of the German system of industrial relations – be it the existence of wage cushions or of works councils.

# 6 Establishing Causality

## 6.1 (No) Short-Run Effects of Changes in Collective Coverage

In this section, we exploit the panel dimension of the data. We look at whether changes in collective bargaining status are associated with changes in employment growth. After discussing identification issues, we present results from different panel estimations and conditional difference-in-differences regressions.

**Identification Issues:** Suppose that a collective bargaining agreement is established or terminated in year $t$ and we observe a change in the employment growth rate prior and subsequent to year $t$. Then, the estimated coefficients of the variables indicating the collective bargaining regime can be interpreted as identifying a causal effect of collective negotiations, if any further changes affecting employment growth in the plant under consideration are due to alterations in control variables in a fixed-effects specification. Institutionally, however, a change in coverage status is a complex process and may take time. On the one hand, if a collective contract is concluded, bargained wages and working conditions are likely to primarily affect future outcomes. On the other hand, if a collective contract is terminated, institutional regulations, especially after-effects clauses

(*Nachwirkungsprinzip*, see Section 3), prevent wages and working conditions from being altered for up to several years. Therefore, doubts may arise as to whether a within group estimator is sufficient to identify causality, since it mainly captures short-term effects and does not differentiate between introducing and abolishing collective coverage.

We pursue alternative approaches to overcome this problem. First, we use the lags of our main independent variables, i.e. we analyse whether a change in the bargaining status in the past has an effect on recent employment growth. Second, we analyse changes in collective bargaining coverage using dummy variables identifying plants that have introduced or terminated collective bargaining at one point of time during our observation period and then interact this information with the actual application of collective contracts (difference-in-differences approach). This allows us to control for selection effects of a change in bargaining status, and also to differentiate between introducing and abolishing collective coverage (Gralla and Kraft 2012).

**Panel Estimations:** Next, we present the results from a fixed-effect estimator. The coefficients of interest are shown in columns (1) and (2) of Table 7. We find that the effects of collective bargaining on employment growth are not statistically different from zero. Therefore, we obtain no evidence that changes in collective bargaining coverage cause a reduction in employment growth in the short-run.

We have also estimated random-effects models and correlated random effects models (*results available upon request*). In the random effects model, the coefficients are similar to the OLS case. However, we have to reject the Sargan-Hansen tests of overidentifying restrictions and, therefore, cannot rule out biased coefficients due to a correlation between the residuals and the set of independent variables. As a potential correction for bias in the random-effects model, we have used a correlated random effects model to relax the strict assumption of uncorrelated heterogeneity and observables. We do so by introducing the means of the time-variant characteristics as further control variables (Mundlak 1978). Regarding the coefficients of our variables of interest, the time-variant parts are insignificant, while the Mundlak terms are significantly different from zero and about the same size as in the random-effects models. By interpreting the correlated random effects model coefficients, we may conclude that the 'true coefficients´ are driven by between group differences, and not caused by within group variation in the data.

As a further potential remedy for identification in the panel dimension, we included lagged values of the independent variables into the fixed-effects models. This could accommodate for the fact that collective contracts take time to have an impact when first signed, and, until their employment consequences have evaporated, when terminated. The results (*available upon request*) show that the coefficients remain statistically zero, except for the third lag for SBAs and the forth lag of FLCs. These results are, however, not robust enough to infer a causal effect.

In sum, estimation via panel estimators indicates that there is at least no short-run causal effect of a change in collective coverage on employment growth. Also, these estimates may, at least partly, be driven by sample selection, i.e. the differences between the OLS and the panel estimators are caused by differences between plants that are always covered and plants that are never covered.

Table 7: Collective Bargaining and Employment Growth: Results from Panel Estimations

| Method | Fixed Effects | | Difference-in-Differences | |
|---|---|---|---|---|
| Variables | (1) | (2) | (3) | (4) |
| Sector-wide Bargaining Agreements | 0.0009 | 0.0016 | | |
| | (0.0035) | (0.0041) | | |
| Firm-Level Contract | -0.0023 | -0.0024 | | |
| | (0.0050) | (0.0050) | | |
| DiD-Treatment Group Effect | | | -0.0082* | -0.0068 |
| | | | (0.0046) | (0.0047) |
| DiD-Treatment Effect | | | -0.0035 | 0.0021 |
| | | | (0.0060) | (0.0069) |
| Always Covered by SBA | | | | -0.0115*** |
| | | | | (0.0024) |
| Firm-Level Variables | No | Some | Some | Some |
| Individual-Level Variables | No | Yes | Yes | Yes |
| Dummy Variables | No | Yes | Yes | Yes |
| N. of Observations | 96493 | 96493 | 38459 | 82045 |
| N. of Clusters | 26525.00 | 26525.00 | 11606.00 | 23988.00 |
| F-statistic | . | . | 39.56 | 64.74 |
| R squared (within) | 0.00 | 0.13 | 0.12 | 0.11 |
| $\rho$ | 0.49 | 0.72 | | |

*Note: Standard errors clustered at the plant level in parentheses; dummy variables: plant size classes, industries, regions and years; other control variables: as in specification (4) of Table 9; significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: LIAB QM2 9310, Waves 2000 to 2010; own calculations (controlled remote data access via FDZ).*

**Difference-in-Differences Estimations:** In the difference-in-differences approach, we only look at plants that first conclude a collective agreement and disregard the termination of collective contracts as well as plants that have changed bargaining status multiple times.[20] We present two models, depending on whether we disregard all plants that are covered by a collective contract throughout the entire observation period or whether we take this group into consideration using an additional dummy variable (Gralla and Kraft 2012). Following Imbens and Wooldridge (2009), we discern two effects: a time-invariant

[20]This avoids putting the introduction and the abolition of a collective contract council quantitatively on the same level, as it happens in fixed-effects or first-differences models. For an easier implementation we only present results for SBAs.

dummy variable captures the selection (treatment group effect) into the treatment group of those plants which at some point of time conclude a sector-wide bargaining agreement for the first time. The variable of interest captures the exposure to the 'treatment' indicating whether the plant was covered by a sector-wide bargaining agreement in period $t$ (treatment effect). The control group are those plants that always bargain individually with each employee throughout the observation period.

Our findings, depicted in the right part of Table 7, show that there exists a potentially negative selection into collective bargaining. The treatment group effect is significantly different from zero in column (3), which means that plants that introduce collective bargaining have a lower employment growth than uncovered plants before the treatment happens, i.e. when they are still uncovered. This effect vanishes, however, when we include plants that are always covered in column (4). From this model we see that plants that are always covered are also characterised by significantly smaller employment growth, when compared to plants which never have a collective contract. Turning to the actual treatment effect, we do not find significant results. Therefore, the findings from difference-in-differences specifications suggest that there is no causal effect of establishing or abolishing a collective contract on employment growth, but that the negative correlation observed in OLS-specifications represents, at least partly, a selection effect. Finally, we also performed a similar analysis using plants that have abolished a collective contract. No significant results were identified here, either (*results available upon request*).

To conclude, static panel data models and their extensions do not allow us identify a causal effect of collective bargaining on employment growth in German plants. Instead, the (relatively small) differences observed in OLS-specifications are potentially caused by selection bias. We can identify some of this bias by selection on observables and time-invariant heterogeneity. The results, however, might still suffer from endogeneity stemming from time-variant heterogeneity.

## 6.2 Discussion on Long-Term Causal Effects

**Dynamic Panel Estimations:** We have also employed dynamic panel models using GMM-Diff estimators, in particular a simple Arellano and Bond (1991) estimator, as well as heteroskedasticity-robust two-step estimators. The Arellano-Bond tests find that the inclusion of a lagged dependent variable is appropriate, but the Sargan-Hansen test for the instrument moment conditions are usually rejected. The coefficients of the collective bargaining variables are insignificant. When treating the bargaining coverage as endogenous and instrumenting it with its second lags, the size of the coefficients and the significance levels of both types of collective contracts are larger, but the Sargan-Hansen test is still rejected. The same holds when using the Blundell and Bond (1998) GMM-SYS estimator.

**Instrumental Variables Estimations:** An alternative approach to identifying causal effects is the use of instrumental variables to generate local average treatment effects. We augment the static model by including *external* instruments $Z_{jt}$ which inhibit an (exogenous) variation with the independent variables of interest $union_{kjt}$, but for which $E(\epsilon_{jt}|Z_{jt} = 0)$ holds, i.e. the instruments are not systematically correlated with the (remaining) error term.[21] Endogeneity mainly stems from worker and firm sorting. Worker sorting occurs, for example, if low productivity workers have an incentive to sort into collectively covered plants (Bryson and Dale-Olsen 2008). Firm sorting happens, for example, if plants with good (or bad) business conditions are systematically more or less likely to bargain collectively (Gürtzgen 2009).

To tackle this problem, the literature has used several different instrumental variables when analysing the economic effects of collective bargaining, such as average collective bargaining coverage at the industry level (Bryson 2004), historical values of regional trade union membership (Antonczyk 2011), the average age of plants at the local (district) level (Gürtzgen 2010), the share of apprentices at the plant level, the existence of working-time accounts, the remuneration of overtime, and the share of trainees taken-over. We tried all these potential variables, but they either fail to be uncorrelated with employment growth, or there is no significant correlation between the potential instruments and the bargaining coverage of a plant.[22]

To sum up, none of the potential instrumental variables survive the estimations as valid. Therefore, we have to acknowledge the fact that the instrumental variables used so far in the literature do not allow for a causal interpretation of the negative correlation between collective bargaining and employment growth.

# 7 Conclusion

In a frequently cited paper, Addison and Belfield (2004a) argue that *one constant* characterises the relationship between unionism and establishment performance: Annual employment growth is significantly lower in unionised plants, relative to their non-unionised counterparts. Most of the analyses which induce Addison and Belfield (2004a) to coin *the one constant* relate to Anglo-Saxon countries and rely on cross-sectional evidence from firm-level data sets.

[21] Methodologically, an estimation of a system of equations is needed, either using 2SLS/GMM or fixed effects, depending on the existence of variation over time in the instrumental variables.

[22] Estimations have been performed using the *(xt)ivreg2* command by Baum et al. (2007). The employed tests are Kleibergen-Paap (2006) statistics and Sargan-Hansen tests.

In this paper, we focus on Germany, the largest economy in Europe and a country with extraordinary labour market performance in recent years. By looking at this country, we can complement the literature with evidence from a more corporatist industrial relations system and a situation where collective bargaining coexists at the sector level for more than 50 % of all employees and additionally at the firm level for a sizeable minority of plants. We can utilise the linked-employer-employee data set (LIAB) from the Institute for Employment Research (IAB), which allows us to investigate the relationship between collective bargaining and employment growth, to check whether it depends on the degree of bargaining centralization and coordination, and to tackle the issue of causality in a variety of ways.

Using primarily the cross-sectional variation, we observe that annual employment growth in plants covered by collective bargaining is about 0.8 percentage points less than in uncovered plants, controlling for a host of firm- and workforce-specific determinants. This effect is remarkably robust, since it can be found in various subsamples, when taking into account the (1) endogeneity of firm survival, (2) over-representation of larger plants in the data set, (3) existence of works councils, (4) and also when allowing for the fact that collective agreements may not be binding. Interestingly, we do not find differences between sector-wide bargaining agreements and firm-level contracts.

Although the estimated employment growth differs widely between 3 percentage points for Anglo-Saxon countries and 0.8 percentage points for Germany, the subsequent back-of-the-envelope calculations put this differential into perspective. Employee bargaining coverage in Germany was about 60 % in 2010 (see Table 1), while the figures are more like 20 % in Anglo-Saxon countries. Taking the absolute number of jobs not created in covered plants would then be broadly the same between Germany and a (hypothetical) similarly sized Anglo-Saxon country.[23] Alternatively, we can relate collective bargaining effects to absolute employment growth rates of about 2 % annually over the period under investigation in Germany (see Table 2). A collective bargaining difference of 0.8 percentage points then implies that employment in covered plants grew by about 40 % less than in the entire economy. Assuming a union effect of three percentage points in Anglo-Saxon countries, the average employment growth would have to be around 7.5 %, for the relative difference to be the same. Creating methodologically and quantitatively comparable evidence across countries on the employment effects of collective bargaining may, hence, constitute a topic for future analysis. Moreover, the illustrative computations clarify that quantitative differences in *the one constant* across countries cannot automatically justify normative conclusions.

[23]The employment growth differential is about 2.5 (= 2/0.8) to 5 (= 4/0.8) times as large as the difference in coverage rates.

Going beyond the vast majority of studies on the employment effects of unionism for Anglo-Saxon countries, our data also allows us to investigate whether the observed correlation can be interpreted causally. Only if that were the case, could *the one constant* justify policy consequences. This, however, proves to be difficult. Within-variation fails to identify a significant (short-term) causal effect from changing bargaining status, while possible instrumental variables and dynamic panel estimations cannot be applied due to rejections in state-of-the-art test procedures. Although identifying causal effects is furthermore hampered by the institutional features of the German industrial relations system, insights from difference-in-differences and (correlated) random effects models suggest, if anything, the existence of (negative) selection into collective bargaining, both on observable and unobservable characteristics. Consequently, we observe a negative correlation, but find no causal effect of collective bargaining on employment growth in Germany. More robust evidence on the (non-)existence of causal effects of collective bargaining certainly belongs to the list of imminent research questions.

In summary, *the one constant* observed for the United States, the United Kingdom, Canada and Australia appears to be much smaller in a more corporatist economy such as Germany. In the cross-section, we find a robust negative correlation between being a plant covered by a collective bargaining contract and its employment growth per annum of 0.8 percentage points. This disparity may be, for example, due to different industrial relations systems, different objectives of trade unions, or the different time periods studied. Our various robustness checks, however, do not provide indications of the cause of the cross-country discrepancies. This diversity across countries and industrial relation systems also represents a topic for future research.

# References

**Addison, John T. and Clive R. Belfield**, "Unions and Employment Growth: The One Constant?," *Industrial Relations*, 2004a, *43* (2), 305–323.

_ **and** _ , "Unions and Establishment Performance: Evidence from the British Workplace Industrial/Employee Relations Surveys," in Phanindra V. Wunnava, ed., *The Changing Role of Unions - New Forms of Representation*, Armonk. New York: M.E. Sharpe, 2004b, pp. 281–319.

**Addison, John. T. and Paulino Teixeira**, "The Effect of Works Councils on Employment Change," *Industrial Relations*, 2006, *45* (1), 1–25.

**Addison, John T., Paulino Teixeira, and Thomas Zwick**, "German Works Councils and the Anatomy of Wages," *Industrial and Labor Relations Review*, 2010, *63* (2), 247–270.

_ , **W. Stanley Siebert, Joachim Wagner, and Xiangdong Wei**, "Worker Participation and Firm Performance: Evidence from Germany and Britain," *British Journal of Industrial Relations*, 2000, *38* (1), 7–48.

**Addison, J.T., A. Bryson, P. Teixeira, and André Pahnke**, "Slip Sliding Away: Further Union Decline in Germany and Britain," *Scottish Journal of Political Economy*, 2011, *58* (4), 490–518.

**Andrews, Martyn, Thorsten Schank, and Richard Upward**, "Practical Fixed-Effects Estimation Methods for the Three-Way Error-Components Model," *The Stata Journal*, 2006, *6* (4), 461–481.

**Antonczyk, Dirk**, "Using Social Norms to Estimate the Effect of Collective Bargaining on the Wage Structure," *Discussion Paper, Albert Ludwigs University Freiburg*, 2011.

**Arellano, Manuel and Stephen Bond**, "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, 1991, *58*, 277–297.

**Baum, Christopher. F., Mark. E. Schaffer, and Steven Stillman**, "Enhanced Routines for Instrumental Variables/Generalized Method of Moments Estimation and Testing," *Stata Journal*, 2007, *7*, 465–506.

**Blanchflower, David G. and Simon M. Burgess**, "Job Creation and Job Destruction in Great Britain in the 1980s," *Industrial and Labor Relations Review*, 1996, *50* (1), 17–38.

_ **and** _ , "New Technology and Jobs: Comparative Evidence from a Two Country Study," *Economics of Innovation and New Technology*, 1998, *5* (2-4), 109–138.

_ , **Neil Millward, and Andrew J. Oswald**, "Unionism and Employment Behaviour," *The Economic Journal*, 1991, *101* (407), 815–834.

**Blundell, Richard and Stephen Bond**, "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models," *Journal of Econometrics*, 1998, *87 (1)*, 115–143.

**Booth, Alison L. and Andrew McCulloch**, "Redundancy Pay, Unions and Employment," *Manchester School*, 1999, *67* (3), 346–366.

**Brändle, Tobias**, "Works Council Behaviour and Flexible Collective Bargaining Agreements," *IAW Discussion Paper No. 96*, 2013.

**Bronars, Stephen G., Donald R. Deere, and Joseph S. Tracy**, "The Effects of Unions on Firm Behaviour: An Empirical Analysis Using Firm Level Data," *Industrial Relations*, 1994, *33* (4), 426–451.

**Bryson, Alex**, "Unions and Employment Growth in British Workplaces during the 1990s: A Panel Analysis," *Scottish Journal of Political Economy*, 2004, *51* (4), 477–506.

_ **and Harald Dale-Olsen**, "A Tale of Two Countries: Unions, Closures and Growth in Britain and Norway," *CEP Discussion Paper No. 0867*, 2008.

_ **and Satu Nurmi**, "Private Sector Employment Growth, 1998-2004: A Panel Analysis of British Workplaces," *Cambridge Journal of Economics*, 2011, *35* (1), 85–104.

**Davis, Steven and John Haltiwanger**, "Gross Job Creation, Gross Job Destruction and Employment Reallocation," *Quarterly Journal of Economics*, 1992, *107* (3), 819–864.

**DiNardo, John and David S. Lee**, "Economic Impacts of New Unionization on Private Sector Employers: 1984-2001," *Quarterly Journal of Economics*, 2004, *119* (4), 1383–1442.

**Dunne, Timothy and David A. MacPherson**, "Unionism and Gross Employment Flows," *Southern Economic Journal*, 1994, *60* (3), 727–738.

**Ellguth, Peter and Susanne Kohaut**, "Tarifbindung und betriebliche Interessenvertretung: Aktuelle Ergebnisse aus dem IAB-Betriebspanel 2013," *WSI-Mitteilungen*, 2014, *4*, 286–295.

**Fischer, Gabriele, Florian Janik, Dana Müller, and Alexandra Schmucker**, "The IAB Establishment Panel – Things Users Should Know," *Schmollers Jahrbuch*, 2009, *129* (1), 133 – 148.

**Fitzenberger, Bernd, Aderonke Osikominu, and Robert Völter**, "Imputation Rules to Improve the Education Variable in the IAB Employment Subsample," *Schmollers Jahrbuch*, 2006, *126* (3), 405–436.

_ **, Karsten Kohn, and Alexander C. Lembcke**, "Union Density and Varieties of Coverage: The Anatomy of Union Wage Effects in Germany," *Industrial and Labor Relations Review*, 2013, *66 (1)*, 169–197.

**Gralla, Rafael and Kornelius Kraft**, "Separating Introduction Effects from Selectivity Effects: The Differences in Employment Patterns of Co-Determined Firms," *IZA Discussion Paper No. 7022*, 2012.

**Gürtzgen, Nicole**, "Rent-Sharing and Collective Bargaining Coverage: Evidence from Linked-Employer-Employee Data," *The Scandinavian Journal of Economics*, 2009, *111* (2), 323–349.

_ , "Rent-Sharing and Collective Wage Contracts: Evidence from German Establishment-Level Data," *Applied Economics*, 2010, *42* (22), 2835–2854.

**Hammermesh, Daniel S.**, *Labor Demand*, Princeton University Press: Princeton, New Jersey, 1993.

**Hübler, Olaf and Uwe Jirjahn**, "Works Councils and Collective Bargaining in Germany: The Impact on Productivity and Wages," *Scottish Journal of Political Economy*, 2003, *50* (4), 471–491.

**Heckman, James**, "Sample Selection Bias as a Specification Error," *Econometrica*, 1979, *47* (1), 153–161.

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

**Jacobebbinghaus, Peter and Stefan Seth**, "Linked Employer-Employee Data from the IAB: LIAB Cross-sectional Model 2 1993-2008 (LIAB QM2 9308)," *FDZ Datenreport, 05/2010 (en)*, 2010.

**Jirjahn, Uwe**, "Works Councils and Employment Growth in German Establishments," *Cambridge Journal of Economics*, 2010, *34* (3), 475–500.

**Kohaut, Susanne and Claus Schnabel**, "Zur Erosion des Flächentarifvertrags: Ausmaß, Einflussfaktoren und Gegenmaßnahmen," *Industrielle Beziehungen*, 2003, *12* (2), 193–219.

**Krol, Robert and Shirley Svorny**, "Unions and Employment Growth: Evidence from State Economic Recoveries," *Journal of Labor Research*, 2007, *28* (3), 525–535.

**Leonard, Jonathan S.**, "Unions and Employment Growth," *Industrial Relations*, 1992, *31* (1), 80–94.

**Long, Richard J.**, "The Effect of Unionization on Employment Growth of Canadian Companies," *Industrial Relations*, 1993, *46* (4), 691–703.

**Machin, Stephen J. and Sushil Wadhwani**, "The Effects of Unions on Organisational Change and Employment," *The Economic Journal*, 1991, *101* (407), 835–854.

**McDonald, Ian M. and Robert M. Solow**, "Wage Bargaining and Employment," *American Economic Review*, 1981, *71* (5), 896–908.

**Mundlak, Yair**, "On the Pooling of Time Series and Cross Section Data," *Econometrica*, 1978, *46 (1)*, 69–95.

**Sojourner, Aaron J., Brigham R. Frandsen, Robert J. Town, David C. Grabowski, and Michelle M. Chen**, "Impacts of Unionization on Employment, Product Quality and Productivity: Regression Discontinuity Evidence from Nursing Homes," *Industrial & Labor Relations Review*, forthcoming.

**Visser, Jelle**, "ICTWSS: Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts in 34 countries between 1960 and 2012, Version 4 – April 2013, Amsterdam Institute for Advanced Labour Studies (AIAS) University of Amsterdam," 2013.

**Walsworth, S. and R. J. Long**, "Is the Union Employment Suppression Effect Diminishing? Further Evidence from Canada," *Relations Industrielles / Industrial Relations*, 2013, *67 (4)*, 654–680.

**Walsworth, Scott**, "Unions and Employment Growth: The Canadian Experience," *Industrial Relations*, 2010, *49* (1), 142–156.

**Wooden, Mark and Anne Hawke**, "Unions and Employment Growth: Panel Data Evidence," *Industrial Relations*, 2000, *39* (1), 88–107.

# A Appendix

## A.1 Tables

Table 8: Operationalisation and Summary Statistics of Covariates

| **Variable** | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| Variables of Interest | | | | |
| Job reallocation rate | 0.0929 | 0.1447 | 0 | 1.9431 |
| Job creation rate | 0.0567 | 0.1308 | 0 | 1.9273 |
| Job destruction rate | 0.0362 | 0.0891 | 0 | 1.9431 |
| Job growth rate | 0.0206 | 0.1708 | -1.9431 | 1.9273 |
| Sector-wide Bargaining Agreement | 0.57 | 0.49 | 0 | 1 |
| Firm-Level Contract | 0.08 | 0.27 | 0 | 1 |
| Collective Bargaining (SBA or FLC) | 0.65 | 0.48 | 0 | 1 |
| Introduction of a SBA at some Point (Treatment Group) | 0.11 | 0.31 | 0 | 1 |
| After Introduction of a SBA (Treatment) | 0.06 | 0.23 | 0 | 1 |
| Individual Characteristics (Plant-level Averages) | | | | |
| Female Employees | 0.44 | 0.29 | 0 | 1 |
| Employees with Foreign Origin | 0.07 | 0.11 | 0 | 1 |
| Empl. with Tenure <3 Years | 0.26 | 0.20 | 0 | 1 |
| Empl. with Tenure 3 to 5 Years | 0.15 | 0.15 | 0 | 1 |
| Empl. with Tenure 5 to 10 Years | 0.22 | 0.19 | 0 | 1 |
| Empl. with Tenure 10 to 15 Years | 0.13 | 0.16 | 0 | 1 |
| Empl. with Tenure 15 to 20 Years | 0.06 | 0.11 | 0 | 1 |
| Empl. with Tenure >20 Years | 0.05 | 0.10 | 0 | 1 |
| Average Employee Age | 40.61 | 4.63 | 18.90 | 63 |
| Employee Age Dispersion | 10.80 | 1.96 | 0.58 | 21.32 |
| Flexible Employees | 0.13 | 0.18 | 0 | 1 |
| Trainees | 0.05 | 0.08 | 0 | 1 |
| Skilled Employees | 0.59 | 0.27 | 0 | 1 |
| Highly-Skilled Employees | 0.09 | 0.15 | 0 | 1 |
| Blue-Collar Workers | 0.34 | 0.31 | 0 | 1 |
| Part-Time Employees | 0.26 | 0.26 | 0 | 1 |
| Average Gross Daily Wage | 71.87 | 31.85 | 1.19 | 178.04 |
| Dispersion of Gross Daily Wage | 0.06 | 0.10 | 0 | 1 |
| Firm Level Characteristics | | | | |
| Works Council | 0.50 | 0.50 | 0 | 1 |
| Orientation to SBA | 0.18 | 0.39 | 0 | 1 |
| Existence of Wage Cushion | 0.33 | 0.47 | 0 | 1 |
| Share of Vacancies | 0.01 | 0.05 | 0 | 1 |
| Share of Temporary Workers | 0.06 | 0.13 | 0 | 1 |
| Churning Rate | 0.06 | 0.16 | 0 | 13.01 |
| Investment Activity | 0.77 | 0.42 | 0 | 1 |
| New Technical Assets | 0.73 | 0.45 | 0 | 1 |
| Firm Age (up to 20 Years) | 16.59 | 5.78 | 0 | 20 |
| New Firm (Founded after 1990) | 0.31 | 0.46 | 0 | 1 |
| Public Ownership | 0.07 | 0.26 | 0 | 1 |
| Foreign Ownership | 0.08 | 0.27 | 0 | 1 |
| Single Firm | 0.59 | 0.49 | 0 | 1 |
| Listed Company | 0.96 | 0.58 | 0 | 2 |
| Public Sector | 0.14 | 0.34 | 0 | 1 |
| Average Standard Working Time* | 38.61 | 2.31 | 4 | 70 |
| Log. of Total Investments* | 9.64 | 5.78 | 0 | 22.45 |
| Share of Expansion Investments* | 0.22 | 0.33 | 0 | 1 |
| Share of Exports* | 0.13 | 0.26 | 0 | 1 |
| Firm-Sponsored Training* | 0.76 | 0.43 | 0 | 1 |
| Overtime Dummy* | 0.77 | 0.42 | 0 | 1 |
| Rising Turnover Outlook* | 0.31 | 0.46 | 0 | 1 |
| Rising Employment Outlook* | 0.18 | 0.38 | 0 | 1 |
| Dummy variables | | | | |
| Sector: | 9 dummy variables for different industries (approx. Nace1) | | | |
| Region: | 12 dummy variables for German Laender (some combined) | | | |
| Firm size: | 5 dummy variables for different firm size classes | | | |
| Year: | 11 dummy variables for each year | | | |

Note: 96,493 Observations; * 65,249 Observations

Table 9: Collective Bargaining and Employment Growth: Results from Ordinary Least Squares

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Sector-wide Bargaining Agreement | -0.0219*** | -0.0241*** | -0.0108*** | -0.0078*** | -0.0078*** | -0.0060** |
| | (0.0013) | (0.0015) | (0.0021) | (0.0021) | (0.0024) | (0.0024) |
| Firm-Level Contract | -0.0243*** | -0.0296*** | -0.0163*** | -0.0105*** | -0.0078** | -0.0073** |
| | (0.0024) | (0.0025) | (0.0029) | (0.0029) | (0.0032) | (0.0031) |
| Works Council | | | -0.0295*** | -0.0151*** | -0.0182*** | -0.0191*** |
| | | | (0.0018) | (0.0018) | (0.0021) | (0.0021) |
| Orientation to a SBA | | | -0.0025 | 0.0008 | 0.0010 | -0.0003 |
| | | | (0.0020) | (0.0019) | (0.0021) | (0.0020) |
| Wage Cushion | | | -0.0018 | -0.0005 | -0.0000 | -0.0017 |
| | | | (0.0017) | (0.0016) | (0.0019) | (0.0019) |
| Share of Vacancies | | | 0.1272*** | 0.0197 | 0.0185 | -0.0421 |
| | | | (0.0250) | (0.0242) | (0.0287) | (0.0287) |
| Share of Temp Workers | | | 0.0368*** | -0.0569*** | -0.0222* | -0.0199* |
| | | | (0.0083) | (0.0087) | (0.0117) | (0.0114) |
| Churning Rate | | | 0.0032 | -0.0711*** | -0.0686*** | -0.0660*** |
| | | | (0.0077) | (0.0098) | (0.0129) | (0.0126) |
| Investment Activity | | | 0.0337*** | 0.0344*** | 0.0328*** | 0.0001 |
| | | | (0.0016) | (0.0016) | (0.0018) | (0.0060) |
| Modern Technical Assets | | | 0.0173*** | 0.0150*** | 0.0142*** | 0.0111*** |
| | | | (0.0014) | (0.0013) | (0.0015) | (0.0015) |
| Firm Age | | | -0.0058*** | -0.0028*** | -0.0029*** | -0.0026*** |
| | | | (0.0003) | (0.0003) | (0.0003) | (0.0003) |
| New Firm (after 1990) | | | -0.0358*** | -0.0210*** | -0.0209*** | -0.0201*** |
| | | | (0.0029) | (0.0029) | (0.0032) | (0.0031) |
| Public Ownership | | | -0.0082*** | -0.0040 | -0.0077 | -0.0063 |
| | | | (0.0030) | (0.0030) | (0.0053) | (0.0052) |
| Foreign Ownership | | | -0.0094*** | -0.0100*** | -0.0084*** | -0.0082*** |
| | | | (0.0029) | (0.0028) | (0.0029) | (0.0029) |
| Single Firm | | | 0.0034** | 0.0082*** | 0.0090*** | 0.0093*** |
| | | | (0.0015) | (0.0014) | (0.0017) | (0.0017) |
| Listed Company | | | -0.0096*** | -0.0041*** | -0.0084*** | -0.0101*** |
| | | | (0.0014) | (0.0014) | (0.0016) | (0.0016) |
| Public Sector Plant | | | 0.0137*** | 0.0183*** | 0.0110* | 0.0116* |
| | | | (0.0031) | (0.0031) | (0.0063) | (0.0061) |
| Female Employees | | | | 0.0106*** | 0.0034 | 0.0013 |
| | | | | (0.0038) | (0.0043) | (0.0043) |
| Foreign origin | | | | -0.0359*** | -0.0398*** | -0.0344*** |
| | | | | (0.0102) | (0.0114) | (0.0112) |
| Tenure: $<$ 3 years | | | | -0.2707*** | -0.2736*** | -0.2588*** |
| | | | | (0.0127) | (0.0147) | (0.0144) |
| Tenure: 3 to 5 years | | | | -0.3912*** | -0.3980*** | -0.3774*** |
| | | | | (0.0123) | (0.0142) | (0.0139) |
| Tenure: 5 to 10 years | | | | -0.3812*** | -0.3914*** | -0.3668*** |
| | | | | (0.0118) | (0.0137) | (0.0134) |
| Tenure: 10 to 15 years | | | | -0.3659*** | -0.3796*** | -0.3544*** |
| | | | | (0.0119) | (0.0137) | (0.0135) |
| Tenure: 15 to 20 years | | | | -0.3548*** | -0.3681*** | -0.3427*** |
| | | | | (0.0122) | (0.0141) | (0.0138) |
| Tenure: over 20 years | | | | -0.3871*** | -0.4020*** | -0.3693*** |
| | | | | (0.0130) | (0.0150) | (0.0147) |
| Mean Employee Age | | | | -0.0021*** | -0.0013*** | -0.0009*** |
| | | | | (0.0002) | (0.0002) | (0.0002) |
| Std.Dev Employee Age | | | | 0.0007* | 0.0006 | 0.0005 |
| | | | | (0.0004) | (0.0004) | (0.0004) |
| Other Employees | | | | 0.0092 | 0.0111 | 0.0124 |
| | | | | (0.0080) | (0.0095) | (0.0093) |
| Trainees | | | | -0.1073*** | -0.0873*** | -0.0759*** |
| | | | | (0.0127) | (0.0149) | (0.0145) |

... Table 9 continued ...

| | | | | | | |
|---|---|---|---|---|---|---|
| Qualification: Skilled | | | | -0.0055* | -0.0047 | -0.0038 |
| | | | | (0.0030) | (0.0033) | (0.0032) |
| Qualification: High-Skilled | | | | 0.0022 | 0.0026 | -0.0041 |
| | | | | (0.0062) | (0.0083) | (0.0081) |
| Status: Blue-Collar Worker | | | | 0.0010 | -0.0056 | -0.0043 |
| | | | | (0.0041) | (0.0047) | (0.0046) |
| Status: Part-Time Worker | | | | 0.0224*** | 0.0132** | 0.0140** |
| | | | | (0.0052) | (0.0064) | (0.0062) |
| Mean of gross daily wages | | | | 0.0004*** | 0.0005*** | 0.0003*** |
| | | | | (0.0001) | (0.0001) | (0.0001) |
| Employees at s.s.contribution limit | | | | -0.0506*** | -0.0574*** | -0.0499*** |
| | | | | (0.0126) | (0.0150) | (0.0149) |
| Working Time | | | | | | -0.0002 |
| | | | | | | (0.0005) |
| Log. of total investments | | | | | | 0.0019*** |
| | | | | | | (0.0005) |
| Share of expansion investments | | | | | | 0.0232*** |
| | | | | | | (0.0022) |
| Share of Exports | | | | | | -0.0079** |
| | | | | | | (0.0035) |
| Firm-sponsored Training | | | | | | 0.0077*** |
| | | | | | | (0.0018) |
| Overtime Dummy | | | | | | 0.0004 |
| | | | | | | (0.0017) |
| Rising Turnover Outlook | | | | | | 0.0505*** |
| | | | | | | (0.0017) |
| Rising Employment Outlook | | | | | | 0.0140*** |
| | | | | | | (0.0022) |
| Constant | 0.0185*** | 0.0025 | 0.0625*** | 0.3520*** | 0.3414*** | 0.3110*** |
| | (0.0010) | (0.0040) | (0.0069) | (0.0164) | (0.0191) | (0.0274) |
| Dummy Variables | No | Yes | Yes | Yes | Yes | Yes |
| N. of Observations | 96493 | 96493 | 96493 | 96493 | 65249 | 65249 |
| N. of Clusters | 26525.00 | 26525.00 | 26525.00 | 26525.00 | 18583.00 | 18583.00 |
| F-Statistic | 149.66 | 37.62 | 57.64 | 77.72 | 62.16 | 73.03 |
| R squared | 0.00 | 0.01 | 0.04 | 0.10 | 0.12 | 0.14 |
| Aikaike Criterion | -47085.42 | -48097.71 | -50954.25 | -57255.14 | -46090.19 | -47577.20 |

*Note: Standard errors clustered at the plant level in parentheses; dummy variables: plant size classes, industries, regions and years; significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: LIAB QM2 9310, Waves 2000 to 2010; own calculations (controlled remote data access via FDZ).*

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[published as: Hillesheim, I. and M. Mechtel (2013). How Much Do Others Matter? Explaining Positional Concerns for Different Goods and Personal Characteristics. *Journal of Economic Psychology* 34, 61-77.]

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[published as: Arnold, D. (2013). Benefit Morale and Cross-Country Diversity in Sick Pay Entitlements. *Kyklos* 66, 27-45.]

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[published as: Goerke, L. (2013). Relative Consumption and Tax Evasion. *Journal of Economic Behavior & Organization* 87, 52-65.]

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[published as: Mertins, V., A.B. Schote and J. Meyer (2013). Variants of the Monoamine Oxidase A Gene (MAOA) Predict Free-riding Behavior in Women in a Strategic Public Goods Experiment. *Journal of Neuroscience, Psychology, and Economics* 6, 97-114.]

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[published as: Chadi, A. (2014). Regional Unemployment and Norm-Induced Effects on Life Satisfaction. *Empirical Economics* 46, 1111-1141.]

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[published as: Chadi, A. (2013). Third Person Effects in Interview Responses on Life Satisfaction. *Journal of Applied Social Science Studies* (*Schmollers Jahrbuch*) 133, 323-333.]

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[published as: Chadi, A. (2013). The Role of Interviewer Encounters in Panel Responses on Life Satisfaction. *Economics Letters* 121, 550-554.]

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[published as: Mechtel, M. (2014). It's the occupation, stupid! Explaining candidates' success in low-information elections. *European Journal of Political Economy* 33, 53-70.]

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[forthcoming as: Mertins, V. and W. Hoffeld. Do Overconfident Workers Cooperate Less? The Relationship between Overconfidence and Cooperation in Team Production. *Managerial and Decision Economics*.]

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[published as: Goerke, L. (2015). Income Tax Buyouts and Income Tax Evasion. *International Tax and Public Finance* 22, 120-143.]

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