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## A sequential decomposition of the drop in collective bargaining coverage

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Bernd Fitzenberger and Katrin Sommerfeld

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# A Sequential Decomposition of the Drop in Collective Bargaining Coverage

Bernd Fitzenberger\* and Katrin Sommerfeld\*\*

June 2015

**Abstract:** Union representation has been in strong decline in most OECD countries with potentially important consequences for wages. What drives this decline? We try to answer this question by developing and implementing a detailed decomposition approach based on Fairlie (2005). Using linked employer-employee data from the German Structure of Earnings Survey for 2001 and 2006, we document a sharp drop in collective bargaining coverage that amounts to 17 percentage points for males and 20 percentage points for females in West, and eight and 14 percentage points, respectively, in East Germany. We find that neither changes in the characteristics nor changes in the coefficients associated with the characteristics as a whole provide an explanation for the drop in collective bargaining coverage. The drop in coverage is the result of an unexplained time trend.

**Keywords:** Collective bargaining, unions, sequential decomposition

**JEL-Classification:** C21, J51, J52

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# 1 Introduction

Union representation has been in strong decline in most OECD countries (Visser, 2006; Lesch, 2004; OECD, 2004; Card et al., 2003; Schnabel, 2013). It is interesting to see that the same trend affects countries with very different institutional set-ups such as the USA, Canada, the UK, and Germany.<sup>1</sup> This trend may have important consequences. In particular, it may result in lower wage levels and growing wage inequality because unions tend to compress the wage distribution from below.<sup>2</sup> Germany is an interesting case to study because it underwent a remarkable transition from the being considered the “sick man” of Europe to experiencing a “jobs miracle” (European Commission, 2002; Krugman, 2009; Möller, 2010; Dustmann et al., 2014). In Germany, collective agreements dominate the entire process of setting working conditions – not only for union members.

Collective wage agreements in Germany define minimum working standards not only for union members but typically for all employees of a covered establishment. Therefore, coverage rates are much higher than membership rates and more relevant for assessing the range of union representation in the labour market. Just like union membership has dropped, also the share of employees covered by a collective bargaining agreement has also dropped sharply.<sup>3</sup> According to Ellguth and Kohaut (2004, 2014) this share dropped from 70% in 2003 to 60% in 2013 (also see Addison et al., 2010, Antonczyk, Fitzenberger, Sommerfeld, 2010). The strongest decline in coverage on a year-to-year basis seems to have occurred during the first half of the 2000s which is the period we investigate in this paper. Our study analyses the trend during the early 2000s by means of a statistical decomposition analysis. Can

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<sup>1</sup>See e.g. Card et al. (2003, 2004); Fitzenberger et al. (2011); Addison et al. (2010, 2011); Schnabel (2013).

<sup>2</sup>See for literature on the US: Card (1996, 2001); Card et al. (2003, 2004) and for the German case: Fitzenberger, Kohn and Lembcke (2013), Antonczyk, Fitzenberger and Sommerfeld (2010), Burda et al. (2008); Fitzenberger and Kohn (2005); Gerlach and Stephan (2006).

<sup>3</sup>In West Germany, union density among employees dropped from about 30% in 1985 to 20% in 2003 (Fitzenberger et al., 2011, p. 162). For Germany as a whole, Schnabel (2013) reports a continuous decline in union density from 31.2% in 1990, to 24.6% in 2000, and to 18.6% in 2010. A further dimension relates to the membership of firms in employer associations, which reach collective agreements together with unions. Schnabel and Wagner (1996) report for the 1990’s that about 50% of all firms covering about two thirds of all employees in the private sector of the state of Lower Saxony are member in an employer association. Little is known as to whether membership of firms in employer associations has fallen over time.

changes in the composition of the workforce explain this trend (i.e. a characteristics effect)? Or were there large changes in the propensity to work in a covered establishment for certain employee groups (i.e. a coefficients effect)? Or is this a trend that affects all groups of employees alike?

A large part of the variation in collective bargaining coverage is explained by sector affiliation (Fitzenberger et al., 2011; Antonczyk et al., 2010). Thus, the currently observed sectoral shift from manufacturing to services could potentially drive collective bargaining coverage down. Also, collective bargaining coverage varies substantially with firm size (Biebeler and Lesch, 2007; Fitzenberger et al., 2011). Further, age and tenure of an individual employee are positively related with the likelihood of working in a covered establishment. Educational upskilling could reduce union representation over time if higher skilled employees tend to work in non-covered establishments. Further determinants of union membership include risk aversion (Goerke and Pannenberg, 2012) and political attitudes (Biebeler and Lesch, 2007; Fitzenberger et al., 2011; Schnabel and Wagner, 2007).

A few studies have decomposed the drop in union representation over time in Germany, as measured by the drop in union membership (Fitzenberger et al., 2011; Addison et al., 2011; Schnabel and Wagner, 2007). Following the decomposition approach for limited dependent variables introduced by Fairlie (2005), they conclude that changes in the composition of the workforce are not the main driving force of the drop in membership. Rather, the residual effect looms large which contains the changing associations between the covariates and collective bargaining coverage as well as the impact of unobservables.

Our analysis tries to determine in a statistical sense the mechanism through which the reduction in coverage operates. This paper adds to the literature by developing a detailed decomposition approach and applying it to decompose changes in collective bargaining coverage rather than union membership over time. This approach allows separating out the effects of first individual characteristics, second firm characteristics and third industry branch. Also, within the residual effect the method allows separating the effect of a change in the different coefficients from unexplained changes over time. This approach builds on Fairlie (2005) and extends it to distinguish sequentially the contribution the contribution of certain groups of characteristics. This is similar to the approach in Antonczyk et al. (2010, 2009) or

more generally in DiNardo et al. (1996) for the case of continuous dependent variables. To the best of our knowledge, our study is the first to sequentially decompose the drop in union representation.

The second contribution lies in the analysis of union coverage instead of union membership. We use the German Structure of Earnings Survey (GSES), a large and reliable linked employer-employee data set provided by the Research Data Centres of the German Statistical Office. Previous studies on Germany have often used either ALLBUS or SOEP data for union membership or the IAB establishment panel for firm-level analyses. The ALLBUS and the SOEP provide no information on union coverage at the individual or firm level. The IAB establishment panel involves union coverage at the establishment level, information which is self-reported by a firm representative and which has been used in a number of studies for Germany. The GSES data also provides information on coverage at the establishment level, which is arguably more precise than the information in the IAB establishment panel, because the GSES is based on personnel records of the establishment sent directly to the Federal Statistical Office. In this study, almost 1,500,000 full-time employees will be analysed for the years 2001 and 2006. We argue that this time frame is interesting because it is the time during which the German labour market underwent a strong transformation and labour market conditions improved considerably. During the same time, wage inequality increased strongly and the drop in coverage was particularly strong (as measured on an annual basis). Also, considering the time period from 2001 to 2006 leaves out potential effects from the great recession starting in 2007.

Admittedly, the GSES involve less information at the individual level or at the establishment level compared to some of the aforementioned data sets, respectively. Union membership may be associated with employee characteristics (Fitzenberger et al., 2011; Addison et al., 2011; Schnabel and Wagner, 2007), which are not recorded in the GSES. The decline in union membership precedes the decline in union coverage but the two may be related. For instance, unions may find it harder to organize new establishments if membership is low. Thus, a decline in membership may result in a decline of coverage later on. Establishments under distress may opt to drop out of collective bargaining agreements (Addison et al., 2010; Dustmann et al., 2014). Thus, a drop in coverage may be associated with indicators of the development of the establishment over time (e.g. profits, firm



growth) and a weak labor market (e.g. as measured by the local unemployment rate) may be a general indicator of distress (Gürtzgen, 2015). Thus, an analysis based on the GSES should be viewed as a complement rather than a substitute, on the one hand, to the analysis of union membership based on the SOEP or ALLBUS and, on the other hand, to a panel analysis of union coverage based on the IAB establishment panel (possibly augmented by information on individual employees from social security records). The advantages of our analysis based on the GSES are the large sample size and the highly reliable information provided based on personnel records of the establishments. The large sample size of the GSES allows for a detailed sequential decomposition analysis.

Our results based on the GSES show that collective bargaining dropped sharply over the period from 2001 to 2006. While for male employees in West Germany, the drop in the share of employees who work in a covered establishment amounts to about 17 percentage points (ppoints), for West German females the drop amounts to nearly 20 ppoints! For East Germany, the drop in collective bargaining amounts to 8 ppoints for male and 14 ppoints for female employees. The decomposition results show very clearly that only a minor part of the drop in collective bargaining coverage can be explained by the characteristics or their corresponding coefficients, in both West and East Germany. We interpret the complex pattern in East Germany as the results of the ongoing structural adjustment process there. Both for West and East Germany, the drop in coverage is the result of an unexplained time trend. This means that the drop in collective bargaining coverage is not confined to certain industry sectors, to firms of a certain size nor to certain educational groups.

The rest of this article is structured as follows: The next section briefly explains the German institutions that concern collective bargaining. Next, section 3 develops the methodology starting out from the existing decomposition for limited dependent variables and extending it to a sequential decomposition for our case. Then, section 4 describes the data used and descriptive statistics. Section 5 presents the results. Finally, section 6 concludes. An additional appendix provides further details on the empirical analysis.

## 2 Institutional Background and Literature

Collective bargaining agreements in Germany are generally negotiated between an employers' association and a union. As an alternative to these forms of collective negotiation, employers and employees can negotiate individual contracts. When a collective agreement is achieved, it applies to all firms who form part of the corresponding employers' association and who operate in the relevant sector and region. On the side of the employees, legally, the collective contract only needs to be applied to union members. However, it is very common that employers pay all employees according to the collective contract.<sup>4</sup> This is because employers want to reduce negotiation costs and to reduce the incentive to become a union member (Fitzenberger et al., 2011). For this reason, collective bargaining coverage is much higher and more relevant than union membership in Germany (Fitzenberger et al., 2013).

The bargaining process can take place on the sectoral or on the firm level, so as to reach more or less centralised results. Sectoral agreements apply to all establishments in the corresponding sector and region and may have to accommodate very different firms in terms of e.g. size and profitability. Meanwhile firm-level agreements can be tailored much more specifically to the single employer. For this reason, it was expected that the firms' need for flexibility might lead to a situation in which the drop in sectoral bargaining is accompanied by a rise in firm bargaining. However, this could not be confirmed empirically (Antonczyk et al., 2010). Rather, the literature finds a stagnation or only a small drop in firm-level bargaining, for both West and East Germany (Ellguth and Kohaut, 2004, 2005, 2007, 2011, 2012, 2013, 2014). Therefore, and because both types of collective bargaining are rather similar, we will not further differentiate between these two types of agreements.

Of course, employers are always free to pay higher wages or premia than the collective agreement requires them to ("favourableness principle" or "Günstigkeitsprinzip" Bosch, 2004). But they may not undercut the collective agreement.<sup>5</sup> In this sense,

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<sup>4</sup>Active discrimination against non-members is forbidden ("Negative Koalitionsfreiheit"), i.e. closed shop or discrimination clauses are forbidden.

<sup>5</sup>One exception that has recently gained importance is opening clauses or hardship clauses which allow lower wages or higher working hours under certain restrictive conditions (Heinbach, 2005, 2006; Heinbach and Schröpfer, 2007; Garloff and Gürtzgen, 2011; Dustmann et al., 2014).

collective agreements define minimum working standards for *all employees* working in a covered establishment (also see Fitzenberger et al., 2013). For this reason, our measure of collective bargaining coverage will reflect whether or not an employee works in an establishment that is covered by collective bargaining (as in Antonczyk et al., 2010).<sup>6</sup>

Finally, the contracts of individually contracted employees often explicitly or implicitly refer to a collective agreement. Put differently, some firms that are not part of an employers' association and for whom the application of a collective agreement is not binding, may still use a collective agreement as a benchmark in their wage setting ("Bezugnahme-Klausel" Hold, 2003, p. 478). Although the application of a collective contract comes into effect voluntarily from the employer's side, they may come to be legally binding under certain conditions (Hold, 2003). Among those employees who work in establishments that are not covered by collective bargaining directly, about half work in establishments that still use the collective contract for orientation (Ellguth and Kohaut, 2004, 2005, 2007, 2011, 2012, 2013, 2014; Addison et al., 2015). For the reasons discussed here, coverage by collective agreements is likely to exceed membership in an employer association (Schnabel and Wagner, 1996).

While this "orientation" towards a collective agreement is of large relevance among German employers, it is naturally difficult to find any precise numbers on its distribution. These numbers are not recorded in the data set that we use. What we will use later in this study is whether or not an employee works in an establishment that is covered by collective bargaining.

What is the extent of union coverage in Germany? Ellguth and Kohaut (2004, 2007, 2014) report a share of covered employees of 70% for West Germany for the year 2003 which dropped to 65% in 2006 and further declined to 60% in 2013. For East Germany, the coverage rate on the employee level was at 54% in 2003 and 47% in 2013 (Ellguth and Kohaut, 2004, 2014). Their results are based on the IAB

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<sup>6</sup>Due to "monopoly representation of industrial unionism" (Hassel, 2007, p. 178) only one union per establishment is allowed to represent all employees. The legal German term is "Grundsatz der Tarifeinheit", see Hold, 2003. Thus, during the time period of our analysis, there may be at most one collective contract per establishment and competition of unions or of different collective contracts is ruled out. The situation has changed in the late 2000's and small, occupation-specific unions play a bigger role today. Today, it is possible to have different collective wage agreements in one firm, which is the issue in the 2014/2015 labor dispute at Deutsche Bahn.

establishment panel and differences to the results obtained from the GSES data are likely due to different response behaviour or different data selection. Based on the same data set, Addison et al. (2010) report a drop of coverage at the employee level from 64.1% in 2000 to 55.8% in 2008 for the whole of Germany.

Naturally, data on coverage at the establishment level reveals very different shares because coverage is strongly related to the size of the establishment. Coverage at the establishment level was reported to be at 48.1% in West Germany in 2000 (Schnabel et al., 2006). When only establishments with ten or more employees are considered, this share increases to 61.7% (ibid.). Meanwhile, Addison et al. (2011) report a drop from 62.5% in 1998 to 51.1% in 2004, whereas Addison et al. (2010) report coverage shares of 49.9% in 2000 and 38.1% in 2008 for entire Germany. Again, it seems that different data sets obtain different coverage shares but they uniformly describe a clear drop. This very sharp drop is to be explained by the following decomposition approach.

A similar picture emerges based on union membership rates which are at a much lower level due to the institutional set-up in Germany as explained above. Fitzenberger et al. (2011) report membership rates of 29.9% in 1985, 26.7% (37.3%) in 1993 and 20.0% (17.5%) in 2003 for West (East) Germany. Based on a different data base, Schnabel and Wagner (2007) reports 32.7% in 1980, 28.7% in 1992, and 21.7% in 2004 for West Germany. For Germany as a whole, Schnabel (2013) reports 24.6% for 2000 and 18.6% for 2010. Irrespective of the data source, all studies confirm a strong drop in union membership.

What explains the drop in union representation? The reduction in the employment rates of full time employees, males, and blue collar workers was expected to lead to a reduction in union membership (Schnabel and Wagner, 2007). By a similar composition argument, the shift in the industry structure towards the service sector was expected to go along with lower union representation because establishments in the service sector are less frequently covered by collective bargaining than in the manufacturing sector (Hassel, 2007). Moreover, firms which become more exposed to international competition may have a growing need for flexibility and might therefore leave the system of collective bargaining (Kohaut and Bellmann, 1997; Bosch, 2004). However, in contrast to these considerations, recent empirical studies do not confirm the expected role of changes in the composition of the workforce

(Schnabel and Wagner, 2007; Fitzenberger et al., 2011; Addison et al., 2011). The two decomposition analyses by Fitzenberger et al. (2011) and Schnabel and Wagner (2007) show that changes in the composition of the workforce – as captured by the characteristics effect in a decomposition following Fairlie (2005) – explain little or hardly anything of the drop in union membership. Instead, Schnabel and Wagner (2007) attribute more than 90% of the drop in union membership to a residual effect which they do not interpret any further. We are aware of only one study that decomposes changes in collective bargaining coverage in Germany which is by Addison et al. (2011). However, this study uses an Oaxaca (1973)-Blinder (1973) type of decomposition which ignores the non-linearity of the dependent variable. The authors find that changes in the coefficients fully explain the drop in collective bargaining coverage and interpret these as behavioural changes.

The present study adds to this literature in two ways. First, we analyse union coverage rather than union membership because this may be the more relevant measure for outcomes like wages. Second, we extend the decomposition approach by Fairlie (2005) to consider in detail the separate contributions of different sets of covariates. This way we address the research question to which extent changes in the composition of first individual characteristics, second firm characteristics and third industry branch have affected the drop in collective bargaining coverage. At the same time, we separate the effects of changes in the three corresponding sets of coefficients from each other and from the residual effect. This methodology is what we turn to next.

### 3 Methodology

Several decomposition procedures have been developed in order to decompose changes in some dependent variable into parts that are attributable to changes in characteristics or in coefficients. The original approach by Oaxaca (1973) and Blinder (1973) applies to the linear regression case. However, when studying changes in collective bargaining coverage, the dependent variable is binary and thus a non-linear parametric model is required. For this case Fairlie (1999, 2005) develops a decomposition approach on which this study builds.

We want to decompose changes in collective bargaining coverage over time. Adapting Fairlie’s method to our application, the decomposition reads:

$$(1) \quad \bar{Y}_{2006} - \bar{Y}_{2001} = \underbrace{\left[ \sum_{i=1}^{N^{06}} \frac{F(X^{06} \hat{\beta}^{06})}{N^{06}} - \sum_{i=1}^{N^{06}} \frac{F(X^{06} \hat{\beta}^{01})}{N^{06}} \right]}_{\text{Residual}} + \underbrace{\left[ \sum_{i=1}^{N^{06}} \frac{F(X^{06} \hat{\beta}^{01})}{N^{06}} - \sum_{j=1}^{N^{01}} \frac{F(X^{01} \hat{\beta}^{01})}{N^{01}} \right]}_{\text{Characteristics}}$$

where  $X$  is the covariates matrix and  $\beta$  is the coefficients vector. The function  $F$  here corresponds to the standard normal cumulative density function, corresponding to a probit model. The shorthand notation 01 refers to the year 2001 and likewise 06 to the year 2006.  $N^{06}$  and  $N^{01}$  denote the sample sizes of the two years. Hats refer to estimated values. The hypothetical value  $F(X^{06} \hat{\beta}^{01})$  estimates the propensity of being covered by collective bargaining for individuals with characteristics from 2006 if they lived in the labour market of 2001. We estimate all the decompositions separately for males and females and for East and West Germany. For all covariates we take differences to their 2001 means within the corresponding subsample (males/ females; East/ West). This allows interpreting changes in the constant as changes over time.

The second term in equation (1) is called the “characteristics effect”, as it represents differences in the outcome variable that are due to the differences in the distributions of  $X$  (Fairlie, 2005, p. 307). The first term in brackets captures those differences that are due to changes in the coefficients and in the constant. In case there were relevant factors which are unobserved to the researcher, the constant would be affected. In this case, also the coefficients could be biased in case the unobservables correlate with the covariates. For this reason, the corresponding first term of the decomposition is usually labelled “residual” term or “unexplained” part (Fairlie, 2005, p.307; Schnabel, Wagner, 2007).

The coefficients  $\hat{\beta}$  are obtained from probit regressions of a collective bargaining dummy on a set of covariates. The covariates can be grouped into three subgroups of interest:

**P: Personal** characteristics of the employee, i.e. age, tenure and education.

**F: Firm** characteristics of the job match, i.e. firm size, region and share of male

employees.

**S: Sector** of the firm, i.e. industry branch.<sup>7</sup>

Next, we extend the decomposition approach in order to consider the contributions of these different sets of characteristics separately. This step requires a matching of the observations for the construction of a hypothetical counterfactual combination.<sup>8</sup> Fairlie (2005, p. 308) suggests matching the observations based on the ranks of the fitted values of the estimated nonlinear functions. In case both subgroups are not of the same size, he further suggests using a random subsample of the larger group. However, this approach does not explicitly take account of the correlations between the covariates and therefore we now develop the approach further (similar to Antonczyk et al., 2010). The following approach is based on the sequential decomposition suggested in DiNardo et al. (1996) and developed further in Chernozhukov et al. (2013) and in Antonczyk et al. (2009, 2010). While all these approaches apply to the case of a continuous dependent variable, we will now translate them to the case of a limited dependent variable based on Fairlie (2005).

Thus, we want to decompose:

$$(2) \quad \bar{Y}^{06} - \bar{Y}^{01} = F(\beta_P^{06}, \beta_F^{06}, \beta_S^{06}, \beta_0^{06}, X_S^{06}, X_F^{06}, X_P^{06}) - F(\beta_P^{01}, \beta_F^{06}, \beta_S^{01}, \beta_0^{01}, X_S^{01}, X_F^{01}, X_P^{01})$$

where  $X_P$ ,  $X_F$  and  $X_S$  denote sets of personal and firm characteristics and the industry sector respectively, and  $\beta_P$ ,  $\beta_F$  and  $\beta_S$  the corresponding coefficients.  $\beta_0$  denotes the constants obtained from the two underlying probit regressions for 2001 and 2006.

We will analyse the contribution of each of the components separately by changing

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<sup>7</sup>The industry sector is of particular interest because collective bargaining is usually negotiated on the industry level, recall section 2. The industry branch classification we use corresponds to the NACE 1 classification on the two-digit level.

<sup>8</sup>Consider as an example changes in the sector composition of the workforce over time. In order to estimate the contribution of only this change on collective bargaining coverage, everything else has to be held constant. In this example, one might want to compare  $(X_S^{06}, X_F^{06}, X_P^{06})$  with this one:  $(X_S^{01}, X_F^{06}, X_P^{06})$ . This would require matching individuals from the year 2006 who have  $(X_F^{06}, X_P^{06})$  with some hypothetical industry sector from the year 2001 ( $X_S^{01}$ ). This is the explanation for why some sort of matching is required.

them step by step as denoted by the following sequence of effects:

$$\begin{aligned}
(3) \\
\Delta^1 &= F(\beta_{\mathbf{P}}^{06}, \beta_F^{06}, \beta_S^{06}, \beta_0^{06}, X_S^{06}, X_F^{06}, X_P^{06}) - F(\beta_{\mathbf{P}}^{01}, \beta_F^{06}, \beta_S^{06}, \beta_0^{06}, X_S^{06}, X_F^{06}, X_P^{06}) \\
\Delta^2 &= F(\beta_P^{01}, \beta_{\mathbf{F}}^{06}, \beta_S^{06}, \beta_0^{06}, X_S^{06}, X_F^{06}, X_P^{06}) - F(\beta_P^{01}, \beta_{\mathbf{F}}^{01}, \beta_S^{06}, \beta_0^{06}, X_S^{06}, X_F^{06}, X_P^{06}) \\
\Delta^3 &= F(\beta_P^{01}, \beta_F^{01}, \beta_{\mathbf{S}}^{06}, \beta_0^{06}, X_S^{06}, X_F^{06}, X_P^{06}) - F(\beta_P^{01}, \beta_F^{01}, \beta_{\mathbf{S}}^{01}, \beta_0^{06}, X_S^{06}, X_F^{06}, X_P^{06}) \\
\Delta^4 &= F(\beta_P^{01}, \beta_F^{01}, \beta_S^{01}, \beta_0^{06}, X_S^{06}, X_F^{06}, X_P^{06}) - F(\beta_P^{01}, \beta_F^{01}, \beta_S^{01}, \beta_0^{01}, X_S^{06}, X_F^{06}, X_P^{06}) \\
\Delta^5 &= F(\beta_P^{01}, \beta_F^{01}, \beta_S^{01}, \beta_0^{01}, \mathbf{X}_{\mathbf{S}}^{06}, X_F^{06}, X_P^{06}) - F(\beta_P^{01}, \beta_F^{01}, \beta_S^{01}, \beta_0^{01}, \mathbf{X}_{\mathbf{S}}^{01}, X_F^{06}, X_P^{06}) \\
\Delta^6 &= F(\beta_P^{01}, \beta_F^{01}, \beta_S^{01}, \beta_0^{01}, X_S^{01}, \mathbf{X}_{\mathbf{F}}^{06}, X_P^{06}) - F(\beta_P^{01}, \beta_F^{01}, \beta_S^{01}, \beta_0^{01}, X_S^{01}, \mathbf{X}_{\mathbf{F}}^{01}, X_P^{06}) \\
\Delta^7 &= F(\beta_P^{01}, \beta_F^{01}, \beta_S^{01}, \beta_0^{01}, X_S^{01}, X_F^{01}, \mathbf{X}_{\mathbf{P}}^{06}) - F(\beta_P^{01}, \beta_F^{01}, \beta_S^{01}, \beta_0^{01}, X_S^{01}, X_F^{01}, \mathbf{X}_{\mathbf{P}}^{01})
\end{aligned}$$

The choice of a sequence is not innocuous because the order matters in any sequential decomposition, i.e. they are path-dependent.<sup>9</sup> We choose this specific sequence of counterfactuals because it reflects the idea that we transfer the individuals from 2006 ‘back in time’ to the year 2001. We argue this is meaningful because this way the first step reflects what the changing labour market remunerations (i.e. coefficients) contributed to the drop in coverage, given the individual characteristics of 2006. Only then, we change the characteristics. The complete sequential decomposition of changes in collective bargaining coverage from 2001 to 2006 can be summarised as:

$$\bar{Y}^{2006} - \bar{Y}^{2001} = \underbrace{\underbrace{\Delta^1}_{\text{Personal}} + \underbrace{\Delta^2}_{\text{Firm}} + \underbrace{\Delta^3}_{\text{Sector}}}_{\text{Coefficients}} + \underbrace{\Delta^4}_{\text{Residual}} + \underbrace{\underbrace{\Delta^5}_{\text{Sector}} + \underbrace{\Delta^6}_{\text{Firm}} + \underbrace{\Delta^7}_{\text{Personal}}}_{\text{Characteristics}}$$

The first term of this detailed decomposition,  $\Delta^1$ , reflects changes in the propensity to work under collective bargaining that are due to changes in the coefficients which

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<sup>9</sup>An exception is an approach by Schwiebert (2015). This approach evaluates the difference in a covariate  $x_k$  at the corresponding marginal effect from a pooled regression. A drawback for the applied work with large data sets is that this approach requires taking all possible pairs between observations of each group. The approach also ignores correlations between characteristics which our approach takes into account.



correspond to personal characteristics. For example, for certain educational groups, if the probability of working under collective contracts changed over time relative to other educational groups, this would be reflected in this first component.

The second term of the detailed decomposition,  $\Delta^2$ , captures changes in the coefficients which correspond to firm characteristics. For example, for employees working in small firms, if the probability of working under collective contracts changed over time relative to large firms, this would be reflected in the second component.

The third term,  $\Delta^3$ , captures changes in the coefficients which correspond to the industry sector. For example, for certain industries, if collective bargaining coverage changed more strongly over time than for other industries, this would be reflected in this third component.

The fourth term,  $\Delta^4$ , captures changes in the constant of the regression model over time. This includes an average time shift that applies to all industries, all firms and all employees. Further, a change in the constant includes changes in all variables that are unobserved to the researcher. Therefore, the fourth component reflects all residual factors.

The fifth component,  $\Delta^5$ , captures changes in the industry composition of the workforce. For example, if there was a trend towards tertiarization and collective bargaining coverage in the service sector differed from that in the manufacturing sector, this compositional effect would be reflected in this fifth component.

The sixth component,  $\Delta^6$ , captures changes in the composition of firms. For example, if there was a trend towards larger firms and if larger firms had different propensities to be covered by collective bargaining than smaller firms, then this would be reflected in this sixth component.

The seventh component,  $\Delta^7$ , captures changes in the composition of employees. For example, if there was a trend towards educational upskilling and if highly educated employees displayed lower probabilities of collective bargaining than lower educated employees, then this would be reflected in this seventh component.

All seven components add up to the total change in collective bargaining coverage over time as given by the difference between the average predicted values from the

conditional models (see eq. 3).<sup>10</sup>

Up until step 4 it is sufficient for the implementation of the procedure to plug in certain coefficients from 2001 together with the individual observations from 2006. Then, for the fifth step it is necessary to simulate for the individuals from 2006 who work in firms in 2006, in which industry sectors they would have worked in 2001. This is implemented by kernel matching based on the normal Gaussian kernel. Similarly, for the sixth step it is necessary to match the individual employees from 2006 to some firms and industry sectors in 2001. Again, this is implemented by Gaussian kernel matching.

The crucial assumption that underlies the estimation of a hypothetical counterfactual distribution is that a change in the covariates  $X$  does not affect the parameters of the conditional distribution model given  $X$  (e.g. Chernozhukov et al., 2013; Antonczyk et al., 2010). Put differently, the decomposition approach ignores general equilibrium effects. This is similar to other decomposition methods in the literature (e.g. DiNardo et al., 1996).<sup>11</sup> This means that if changes in the characteristics cause the coefficients to change or *vice versa*, this interrelation could not be detected by the decomposition approach.<sup>12</sup>

Another caveat to the standard Fairlie method refers to the fact that the residual effect does not differentiate further between the impact of coefficients and of the constant (Schnabel and Wagner, 2007). This point is addressed by our approach because changes in the coefficients are separated from changes in the constant.

Finally, as explained above, sequential decompositions are path-dependent. Therefore, the order will be reversed later to test for robustness (see the additional appendix for details).

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<sup>10</sup>Also see the discussion in Fortin et al. (2011, p. 52).

<sup>11</sup>For an overview see Fortin et al. (2011).

<sup>12</sup>Consider the example of a rise in the relative wages of high-skilled employees which causes the supply of high-skilled to increase. An example of the opposite direction of the effect would be the case of a rising supply of high-skilled which causes a reduction of their relative wages. These types of indirect effects would be ignored by the decomposition approach employed here.

## 4 Data and Descriptive Statistics

Our analysis uses the 2001 and 2006 waves of the German Structure of Earnings Survey (GSES, “Verdienststrukturerhebung”).<sup>13</sup> This is a large mandatory linked employer-employee data set (LEED) consisting of repeated cross-sections. There exist comparable data sets in other EU countries, such as the Spanish Earnings Structure Survey used e.g. by de la Rica et al. (2010). As data are reported by the personnel departments of the establishments, such variables like coverage by collective bargaining, industry sector, firm size, wage payments, and hours worked are very reliable.<sup>14</sup> The data involve a random draw among all establishments with at least ten employees. The advantage of linked employer-employee data is the joint availability of highly reliable firm-level and individual-specific data.<sup>15</sup> The disadvantage of this specific data set is that it consists of repeated cross-sections rather than a panel. We still use it because of its way of measuring collective bargaining coverage.

We limit our sample to establishments in the private sector which operate in those industries that are available in both years.<sup>16</sup> We limit our sample to prime aged employees in Germany who work full time.<sup>17</sup> The final sample includes for 2001 more than 400,000 employees in West Germany and about 125,000 employees in East Germany (see Table 1). In 2006, there are more than 700,000 employees in West Germany and 210,000 in East Germany. All observations are weighted by the

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<sup>13</sup>Data access is provided by the research data centres of the Federal Statistical Office and the statistical offices of the “Länder”. These also provide metadata, see [www.forschungsdatenzentrum.de/bestand/gls/index.asp](http://www.forschungsdatenzentrum.de/bestand/gls/index.asp). The quality report to this data set can be found at [www.destatis.de/DE/Publikationen/Qualitaetsberichte/VerdiensteArbeitskosten/Gehaltlohn.pdf](http://www.destatis.de/DE/Publikationen/Qualitaetsberichte/VerdiensteArbeitskosten/Gehaltlohn.pdf). Both sources last retrieved on 16. Feb. 2015. Also see the data documentation for this article.

<sup>14</sup>The number of observations increases substantially from 2001 to 2006. This is likely due to the fact that thanks to the electronic data transfer, many firms in 2006 voluntarily provided data on all of their employees rather than just reporting the data for a random selection of employees.

<sup>15</sup>For example, the ALLBUS data set does not contain industry sector since 1994 (Biebeler and Lesch, 2007). The SOEP survey does not ask for coverage by collective bargaining. Even if it did, respondents would not know whether their colleagues are paid by a collective contract and there would be the risk of a large measurement error.

<sup>16</sup>This excludes the educational and the health sector.

<sup>17</sup>More precisely, we drop employees who are younger than 25 years of age or older than 55, as well as employees currently in vocational training or who work in old-age part time, as in Antonczyk et al., 2010.

inverse sampling probability reported with the data. Table 2 provides definitions of the variables available in our data.

In the data, it is reported for every individual employee whether she is covered by sectoral level bargaining, firm level bargaining or individual bargaining. We combine sectoral and firm level bargaining into just one category of collective bargaining (see section 2). Next, we define an employee as covered by collective bargaining as soon as she works in a covered establishment, i.e. an establishment with a minimum number of individually-covered employees.<sup>18</sup> This definition takes account of the fact that generally collective bargaining coverage defines minimum standards for *all* employees working in a covered establishment. Note that we still analyse shares of covered individuals and not of covered firms (as done in Addison et al., 2010, 2011; Schnabel et al., 2006). This allows filtering out effects of changes in individual-specific characteristics, such as increases of the educational attainment. Table 1 reports the shares of covered employees. The figures show the sharp drop in coverage over the course of only five years. This holds for both, males and females. While for males, coverage dropped from 70.3% (43.1%) in 2001 to 53.4% (35.5%) in 2006 in West (East) Germany, for females the shares are 65.9% (49.8%) in 2001 and 45.9% (35.8%) in 2006. Thus, coverage dropped by 8-17 percentage points (ppoints) for males and by 14-20 ppoints for females.

Compared to the literature on Germany, the coverage reported in the GSES is lower. A different level of coverage can partly be explained by a different data selection. We exclude not only the public sector but also the entire health and education sector. Furthermore, the literature reports a smaller drop in coverage over time. We think that the coverage variable in the GSES is more reliable than self-reported coverage in non-mandatory surveys. Despite these differences, there is a consensus in the literature that a sizeable decline in coverage by collective bargaining occurred during the 2000s. We try to explain this drop by the following decomposition approach.

Table A.1 and A.4 in the additional appendix display further descriptive statistics. On average, females are younger, have less tenure, and work in smaller establishments, compared to males. Tables 3 and 6 show the differences in coverage between

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<sup>18</sup>We define an establishment as covered if at least one percent of employees are paid according to a collective agreement.

different groups. While in West Germany, the medium-skilled show the highest coverage in 2001 and also for males in 2006, coverage in East Germany is highest for the low-skilled in 2001 and also for low-skilled males in 2006. In contrast, coverage in 2006 in both West and East Germany is highest for high-skilled females. Among the federal states North Rhine-Westphalia (NRW), Bavaria, Saxony-Anhalt, and Berlin start out with a high level of coverage in 2001 and experience a very sharp drop in 2006 by 17 ppoints and more. As expected, coverage generally increases with establishment size (with the exception that in 2006 the largest coverage rate among females in West Germany is found for the second largest group of establishments because the largest establishments show a very large drop). Regarding the differences in coverage across industries, coverage is large for electricity, gas, water (in West Germany), mining and quarrying, manufacturing of transport equipment, post and telecommunications, finance and insurance, and coke, chemicals (in East Germany). The industries with the lowest coverage are data processing (in West Germany), real Estate (in East Germany), and research, other services. The general descriptive findings are in line with the results reported by Ellguth and Kohaut (2011) for 2010. There are some minor differences in the ranking of industries between West and East Germany. Furthermore, the drop in coverage is much more uniform across industries in West Germany compared to East Germany. The sector of data processing in fact experienced an increase in coverage in both East and West Germany. For East Germany, there are a number of further cases where coverage increases over time (electricity, gas, water shows the strongest increase and the level in 2006 in East Germany is higher than in West Germany). The largest drop in both West and East Germany occurs in the post and telecommunications sector (from more than 90% down to somewhere around 50%) which is most likely related to the liberalisation and privatisation in these industries.

## 5 Results

First, we discuss the estimated probit regressions of coverage by collective bargaining on the observed covariates of the employees. Second, we present and discuss the detailed decomposition results which are based on the estimated probit regressions.

## 5.1 Probit Results

We estimate flexible probit regressions by gender, year, and region. The detailed coefficient estimates and average marginal effects are reported in the additional appendix (Tables A.2, A.3, A.5, A.6). Most results are fairly similar for the different genders, years, and regions. Our discussion will describe the qualitative nature of the results and highlight some important differences.

While *education* plays only a small role in West Germany, coverage is U-shaped in education for 2001 in East Germany, where the high-skilled actually show a higher coverage than the medium-skilled. In 2006, coverage falls with higher education in East Germany.<sup>19</sup>

The association of *age* with coverage is significantly negative or insignificant, and the association of *tenure* with coverage is positive. This is consistent with coverage being higher among older workers. Similarly, the literature reports higher levels of union membership among older employees (Fitzenberger et al., 2011) and higher levels of membership in employer associations among older firms (Schnabel and Wagner, 1996).

The association of *firm size* with collective bargaining coverage is strongly positive and significant, both statistically and economically. The effect is similar to membership in employer associations being larger among larger firms (Schnabel and Wagner, 1996). In our analysis, there are strong differences between small and large firms for all cases in 2001. For example, employees working in establishments with 10 to 99 employees in West Germany are about 45 pp points less likely to be covered by collective bargaining in 2001 than employees working in establishments with 2000 employees or more (the reference group). However, these differences are reduced over time and we observe even some changes in the ranks, as in 2006 firms with 1000 to 1999 employees show the highest coverage.

For West Germany in both years and for East Germany in 2006, the *share of male employees* shows a strong positive association with coverage. However, this

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<sup>19</sup>Incidentally, when the education variable is missing, coverage is lowest. This may be related to the reliability of the reporting to the Federal Statistical Office and to the fact that coverage is determined at the firm level in the following sense: We suspect that uncovered firms have less 'rules' to follow and, therefore, have less 'sophisticated' personnel records.

does not hold for East Germany in 2001. The finding may indicate that collective bargaining is more strongly male dominated in West Germany (see discussion in Fitzenberger et al., 2011) and that there is a convergence of East Germany to West German patterns.

There are some differences in coverage across German *regions* and the ranking of *regions* changes over time. While North Rhine-Westphalia (NRW) has a high coverage level in 2001, coverage falls there below the level of all other West German states in 2006. The same holds for Berlin in the East German sample. We cannot explain these changes.

There are also noticeable differences across *industries* (note that the omitted category refers to manufacturing of metals). The finance and insurance industry shows very high coverage in all cases, in the order of 20 to 45 ppoints above the omitted category. Also, manufacturing of coke and chemicals shows high coverage in all cases. There are also some remarkable differences. For instance real estate shows a very low coverage in all regions in 2001 but only for West Germany in 2006. Turning to the changes over time, the ranking of industries changes little for West Germany and much more so for East Germany. A noticeable change in both West and East Germany involves the strong increase in coverage for data processing and information systems. In East Germany, coverage in real estate increases strongly over time.

Summing up, there are some noticeable changes in the coefficients over time regarding firm size and industries. These changes could drive to some extent the observed decline in aggregate coverage, an issue which would show up in the coefficients effects. Therefore, we now turn to the detailed decomposition analysis.

## 5.2 Sequential Decomposition Results

The benchmark decomposition results are reported in Tables 4 and 7. The upper parts of the tables involve a simple decomposition into only two components, the residual (coefficients) and the characteristics effect. The lower parts involve the detailed decomposition into seven components, as described in section 3. The overall decline in coverage, that is to be decomposed, amounts to -16.9 (-8.4) ppoints

for males in West (East) Germany and to -19.9 (-13.9) ppoints for females in West (East) Germany.<sup>20</sup>

The simple decomposition shows that for West Germany more than 90% of the decline are explained by the residual effect. For East Germany, the residual effect amounts to more than 100% for both, females and males. The residual effect includes changes in the coefficients and in the intercept. For West Germany, only 8% (males) to 9% (females) are explained by changes in the composition of the workforce (characteristics effect). For East Germany, the characteristics effect amounts to -20% for females and -24% for males, meaning that in the East the changing characteristics worked against a drop in collective bargaining coverage. For West Germany these results are in line with the recent literature on union coverage which documents a minor role of the characteristics effect (Addison et al., 2011; Antonczyk et al., 2011; Fitzenberger et al., 2011; Schnabel and Wagner, 2007).

The sequential decomposition further decomposes the residual effect and the characteristics effect, leaving the size of these total effects unchanged. The first three components correspond to the coefficients for the personal characteristics ( $\Delta_1$ ), firm characteristics ( $\Delta_2$ ), and for industry affiliation ( $\Delta_3$ ). For West Germany, all of these contribute very little to the drop in coverage (the effects contribute at most 2.6% and for males the industry coefficients would even have implied an increase in coverage). For East Germany,  $\Delta_1$  and  $\Delta_2$  also do not contribute in a sizeable way to the drop in coverage while the industry coefficients effect  $\Delta_3$  would have implied a notable increase in coverage.

Turning to the three different characteristics effects, these also contribute in a minor way to the drop in coverage for West Germany. Most importantly, changes in the industry structure,  $\Delta_5$ , explain about 11% of the drop in coverage. Changes in the firm characteristics,  $\Delta_6$ , contribute a smaller share of 5% for males and 2% for females. Changes in personal characteristics,  $\Delta_7$ , counteract the decline in coverage to a small extent. Again, for East Germany, the results are more complex and the contribution of some of the sequential effects is quite large. Here, changes in the industry structure, explain a major part of the drop in coverage ( $\Delta_5$ : 23% for males

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<sup>20</sup>The estimation of the sequential procedure is computationally involved and one run takes about six days. This is why we cannot provide bootstrapped standard errors. The calculations are carried out on a PC in Wiesbaden at the Federal Statistical Office.



and 6% for females) while changes in firm characteristics ( $\Delta_6$ ) would have implied a sizeable *increase* in coverage (54% for males and 29% for females). Changes in personal characteristics ( $\Delta_7$ ) contribute little. We argue that the compensating firm and industry characteristics effects in East Germany still reflect the ongoing structural adjustment process of the East German economy. On the one hand, firm characteristics change in a way that would increase coverage. On the other hand, industry changes counteract the firm characteristics effect in a way to reduce coverage in East Germany. Both together may reflect strong structural changes in the East German economy.

The component of the residual effect associated with the change in the intercept (constant,  $\Delta_4$ ) contributes most to the aggregate drop in coverage. This effect reflects the unexplained time trend, i.e. the change in coverage that affects all groups of workers and firms alike, including changes in unobserved covariates. The residual component  $\Delta_4$  amounts to -16 (14) pppts or 95% (168%) for males in West (East) Germany and to -17 (19) pppts or 85% (136%) for females in West (East) Germany. Thus, despite sizeable changes in slope coefficients and characteristics, the overall drop in coverage remains unexplained reflecting changes in the intercept. For instance, this means that the notable differences in the change in coverage across industries (or other subgroups) discussed in section 4 do not drive the aggregate drop in coverage. The drop in coverage has basically affected all groups of employees, albeit to a varying degree. Put differently, the change in coverage for the employee with average characteristics in 2001 (this is what  $\Delta_4$  estimates) almost coincides with (even exceeds) the overall drop in coverage for West Germany (East Germany), i.e. the noticeable differences in the change in coverage (coefficients effect) and the noticeable changes in characteristics almost cancel each other out. For instance, note that not all industries experience a decline in coverage relative to the omitted category. In other words, different industry coefficients in West Germany compensate each other, resulting in a industry coefficients effect that is close to zero. This finding is in contrast to the notion that the drop in coverage is associated with a decline of employment in high-coverage industries or with certain large industries dropping out of collective bargaining.

These results are in line with the literature on coverage (mostly for West Germany) which also documents the dominating role of the residual effect (Addison

et al., 2011; Antonczyk et al., 2011).<sup>21</sup> Recent decomposition analysis of the decline of union *membership* have also found a minor role of the characteristics effect (Fitzenberger et al., 2011; Schnabel and Wagner, 2007). In contrast, earlier studies find a noticeable role of changes in characteristics (Fitzenberger et al., 1999; Beck and Fitzenberger, 2004). Taking an intermediate position, Biebeler and Lesch (2007) argue that workers' preferences play an important role in explaining the drop in union membership. There is more of a consensus for coverage implying that changes in the composition of the workforce are not the main factor of the drop in coverage. Our sequential approach adds to this literature by showing that not the slope coefficients *per se* but changes in the constant or in unobservables can fully rationalise the drop in coverage.

Which factors could be driving the strong unexplained reduction in coverage ( $\Delta_4$ ) which is very similar for both males and females and even higher in East Germany than in West Germany? Dustmann et al. (2014) argue that Germany was increasing in the late 1990s and the early 2000s the flexibility of its labour market in order to cope with the high unemployment rate and to improve its competitiveness. During this time period wage inequality increased strongly (see also Antonczyk, 2011) and a sizeable share of firms opted out of collective bargaining with the goal to increase wage flexibility at the firm level. Furthermore, wage inequality increased more strongly among covered firms during the early 2000s, thus wage setting under collective bargaining became much more responsive to the conditions at the firm level (Dustmann et al., 2014).

### 5.3 Robustness Check

In order to check for robustness of our results, we now reverse the direction of the decomposition. The simple decomposition into only two effects now reads:

$$(4) \quad \bar{Y}_{2006} - \bar{Y}_{2001} = \underbrace{\left[ \sum_{i=1}^{N^{06}} \frac{F(X^{06} \hat{\beta}^{06})}{N^{06}} - \sum_{i=1}^{N^{01}} \frac{F(X^{01} \hat{\beta}^{06})}{N^{06}} \right]}_{\text{Characteristics}} + \underbrace{\left[ \sum_{i=1}^{N^{01}} \frac{F(X^{01} \hat{\beta}^{06})}{N^{06}} - \sum_{j=1}^{N^{01}} \frac{F(X^{01} \hat{\beta}^{01})}{N^{01}} \right]}_{\text{Residual}}$$

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<sup>21</sup>See Antonczyk et al., 2011 for a decomposition of coverage at the employee level and Addison et al., 2011 for a decomposition of coverage at the establishment level.

For the counterfactual used for the decomposition in the previous section, the characteristics  $X$  from 2006 were evaluated at the coefficients from 2001, so far. Now, for the counterfactual the characteristics  $X$  from 2001 are evaluated at the coefficients from 2006, see equation (4). The detailed sequential decomposition now starts from individuals in 2006 evaluated at coefficients from 2006, and then first changes the personal characteristics (matching firm and industry from 2006), next the firm characteristics (still matching the industry from 2006), and finally the industry. Then, we transfer the hypothetical observations from 2001 ‘back in time’ by using the 2001 coefficients. The additional appendix [equation (A.1)] shows the detailed sequential decomposition in reversed order.

The results of this reversed decomposition analysis are reported in Tables 5 and 8. It is astonishing that the results of this simple decomposition remain nearly identical as compared to the original ordering for West Germany. For East Germany, the residual component becomes even much stronger but some of the other sequential effects change. The residual effect (constant,  $\Delta_{rev}^4$ ) fully explains the drop in coverage. In all cases, except for females in West Germany, this unexplained time trend would have predicted an even higher drop in coverage than observed because the contribution in these cases is above 100% [this is 107% (195%) for males in West (East) Germany and 151% for females in East Germany]. The higher contribution of the unexplained time trend here [see equation (A.1)] compared to section 5.2 [see equation (3)] implies that either changes in characteristics or changes in coefficients from 2001 to 2006 have worked partly against the drop in coverage. Furthermore, our findings for the coefficients effects typically show a small contribution for West Germany but a noticeable contribution for East Germany in the case of firm coefficients,  $\Delta_{rev}^6$ . In East Germany, the firm coefficients contribute to a rising tendency in coverage. As for the characteristics effects, all three are almost negligible for West Germany. In contrast, for East Germany we find compensating effects between strong positive personal and industry characteristics ( $\Delta_{rev}^1$  and  $\Delta_{rev}^3$ , personal characteristics and industries change in a way that would predict an increase in coverage) and negative firm characteristics ( $\Delta_{rev}^2$ , firms change in a way that would predict a drop in coverage). These strong and compensating characteristics suggest that, evaluated at 2006 coefficients, the changes in characteristics imply a stronger impact on coverage compared to section 5.2. Recall that in all cases the characteristics effect as a whole does not provide an important

contribution to explain the drop in coverage. Thus, despite the differences in the detailed decomposition results, the robustness analysis confirms the main finding above, namely, that the unexplained time trend basically fully explains the drop in coverage.

## 6 Conclusions

In Germany, as in most industrialised countries, union representation has been in strong decline. This is reflected not only in the drop in union membership but also in the drop in coverage by collective bargaining. This trend is important as it is likely to translate into higher wage inequality (Card, 2001; Card et al., 2003; Antonczyk et al., 2010; Dustmann et al., 2014; Addison et al., 2014).

This study investigates the drop in coverage for the case of Germany during the early 2000s. We develop and implement a sequential decomposition approach that extends upon Fairlie (2005) by using a well defined sequence of counterfactuals. This allows gaining further insight on which of the covariates from the individual or firm level dominate. Our study is the first one developing and applying a sequential decomposition approach to the drop in collective bargaining coverage.

The empirical analysis uses linked employer-employee data from the German Structure of Earnings Survey (GSES, “Verdienststrukturerhebung”) comparing 2001 and 2006. The advantages of the GSES are the large sample size and the highly reliable information provided based on personnel records of the establishments. Our data show that the share of male employees working in covered firms dropped from 70% (44%) in 2001 to about 53% (36%) in 2006 for West (East) Germany. Even more so, among female employees coverage dropped from about 66% (50%) in 2001 to 46% (36%) in 2006 for West (East) Germany.

The decomposition results clearly show that only a minor part of the drop in collective bargaining coverage can be explained by changes in the characteristics or their corresponding slope coefficients. While the development of collective bargaining over time varies substantially between different industries and groups of firms, these differences do not fully explain the drop in coverage because relative gains and losses cancel out. Instead, unexplained changes over time drive the re-

sult. This means that the drop in collective bargaining coverage is not confined to certain industries, to establishments of a certain size, nor to certain educational groups of employees. Nevertheless, we find strong evidence for different trends in coverage across industries and groups of firms. These differences are particularly strong in the case of East Germany where firm characteristics change in a way that reduces coverage whereas changes in industries and personal characteristics would have implied increasing coverage. Altogether these effects may reflect strong ongoing structural changes in the East German economy. These findings would be compatible with growing heterogeneity of industries and firms (Card et al., 2013).

There are a number of caveats regarding our analysis. First, it should be kept in mind that we only observe whether firms explicitly state that they adhere to a collective contract. This may include firms who are not legally required to do so and this may exclude firms that are merely “oriented” towards a collective contract. A natural next step for research would thus be to analyse whether selectivity into collective bargaining coverage has changed over time (Gürtzgen, 2015). Second, a limitation of any decomposition method is that it does not allow causal conclusions and that it ignores general equilibrium effects. Instead, the method points to which are the more important factors associated (if any) with the drop in coverage by collective bargaining – a contribution that we consider important. Third, the GSES data we use involve less information at the individual level or at the establishment level compared to some of the data sets used in the literature. Thus, our analysis based on the GSES should be viewed as a complement rather than a substitute, on the one hand, to the analysis of union membership based on the SOEP or ALLBUS and, on the other hand, to a panel analysis of union coverage based on the IAB establishment panel. Furthermore, the GSES data allow for a distinction between firm-level and sectoral-level bargaining contracts which may be explored in future work.

The findings presented here call for further research. What are the unobserved drivers and mechanisms which lead to the drop in coverage? Because a drop in coverage is observed in many countries (e.g. Visser, 2006) and because we find a strong unexplained time trend, could there be a universal explanation, e.g. a response to the globalisation of economic activity? As there exists only a small and loosely related literature on this hypothesis (Neumayer and de Soysa, 2006), we leave this question to future research.

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## Appendix

Table 1: Shares of Employees Regarding Coverage by Collective Bargaining

West Germany				
Year	Males		Females	
	2001	2006	2001	2006
Covered	70.29 %	53.42 %	65.85 %	45.91 %
Not covered	29.71 %	46.58 %	34.15 %	54.09 %
No. of observations	311,054	517,969	101,992	184,247
East Germany				
Year	Males		Females	
	2001	2006	2001	2006
Covered	43.84 %	35.51 %	49.76 %	35.79 %
Not covered	56.16 %	64.49 %	50.24 %	64.21 %
No. of observations	84,186	140,374	41,762	72,658

*All statistics are weighted by the inverse sampling probability.*

Table 2: Definition of Variables

Label	Description
Individual level	
Low education	Low level of education: no training beyond a school degree
Medium education	Intermediate Level of education: vocational training
High education	High level of education: university or university of applied sciences
Education n/a	Missing information on the education level
Age	Age in years
Tenure	Tenure in years
Firm level	
10 - 99 employees	Firm has between 10 and 99 employees
100 - 199 employees	Firm has between 100 and 199 employees
200 - 999 employees	Firm has between 200 and 999 employees
1000 - 1999 employees	Firm has between 1000 and 1999 employees
More than 2000 employees	Firm has more than 2000 employees
Share of male employees	Share of male employees, ranges between 0 and 1
West:	
Schleswig-Holstein, HH	Firm is located in Schleswig Holstein or Hamburg
Lower Saxony, Bremen	Firm is located in Lower Saxony or Bremen
NRW	Firm is located in North Rhine-Westphalia
Hesse	Firm is located in Hesse
RLP, Saarland	Firm is located in Rhineland-Palatinate or Saarland
Baden-Württemberg	Firm is located in Baden-Württemberg
Bavaria	Firm is located in Bavaria
East:	
Berlin	Firm is located in Berlin
Brandenburg, Meck-Pom	Firm is located in Brandenburg or Mecklenburg-West Pomerania
Saxony	Firm is located in Saxony
Saxony-Anhalt	Firm is located in Saxony-Anhalt
Thuringia	Firm is located in Thuringia
Sector:	
Mining, quarrying	Mining and quarrying
Manufact: Food	Manufacture of food products, beverages and tobacco
Manufact: Textiles	Manufacture of textile and textile products, leather and leather products
Manufact: Wood	Manufacture of wood and wood products
Publishing, printing	Publishing, printing and reproduction of recorded media
Manufact: Coke, chemicals	Manufacture of coke, refined petroleum products and nuclear fuel; chemicals and chemical products
Manufact: Rubber, plastic	Manufacture of rubber and plastic products
Manufact: Non-metallic	Manufacture of other non-metallic mineral products
Manufact: Metals	Manufacture of basic metals; fabricated metal products, except from machinery and equipment
Manufact: Machinery	Manufacture of machinery and equipment
Manufact: Electr. machinery	Manufacture of electrical machinery and apparatus
Manufact: Electr. equipment	Manufacture of electrical & optical equipment; radio, TV, & communication equipment & apparatus
Manufact: Instruments	Manufacture of medical, precision and optical instruments, watches and clocks
Manufact: Transport	Manufacture of transport equipment
Manufact: n.e.c.	Manufacture not elsewhere classified
Electricity, gas, water	Electricity, gas and water supply
Construction	Construction
Auto sales, repair	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
Wholesale trade	Wholesale trade and commission trade except for motor vehicles and motorcycles
Retail trade	Retail trade, except from motor vehicles and motorcycles; repair of personal and household goods
Hotels, restaurants	Hotels and restaurants
Transport	Land, water and air transport
Auxiliary transport	Supporting and auxiliary transport activities; activities of travel agencies
Post, telecommunications	Post and telecommunications
Finance, insurance	Financial intermediation, insurance and pension funding, except compulsory social security
Real estate	Real estate activities; renting of machinery and equipment without operator
Data processing	Data processing and information systems
Research, other services	Research and development and other services

Table 3: Descriptive statistics: Collective bargaining coverage in subgroups, West

Label	Males			Females		
	2001 Share	2006 Share	2006-2001 $\Delta$ Share	2001 Share	2006 Share	2006-2001 $\Delta$ Share
Individual level						
Low education	0.715	0.550	-0.165	0.705	0.524	-0.181
Medium education (Reference)	0.726	0.571	-0.155	0.676	0.485	-0.192
High education	0.707	0.568	-0.139	0.636	0.485	-0.151
Education n/a	0.441	0.244	-0.197	0.433	0.235	-0.198
Firm level						
10 - 99 employees	0.456	0.292	-0.246	0.428	0.248	-0.180
100 - 199 employees	0.668	0.467	-0.201	0.604	0.431	-0.173
200 - 999 employees	0.808	0.614	-0.194	0.759	0.551	-0.208
1000 - 1999 employees	0.900	0.788	-0.112	0.884	0.735	-0.149
More than 2000 employees (Reference)	0.964	0.810	-0.154	0.943	0.670	-0.273
Schleswig-Holstein, HH	0.582	0.478	-0.104	0.571	0.433	-0.138
Lower Saxony, Bremen	0.748	0.611	-0.137	0.708	0.502	-0.206
NRW (Reference)	0.735	0.528	-0.207	0.704	0.448	-0.256
Hessen	0.656	0.506	-0.150	0.602	0.442	-0.160
RLP, Saarland	0.718	0.590	-0.128	0.688	0.534	-0.154
Baden-Württemberg	0.661	0.498	-0.163	0.611	0.460	-0.151
Bavaria	0.718	0.546	-0.172	0.668	0.449	-0.219
Mining, quarrying	0.947	0.775	-0.172	0.925	0.627	-0.298
Manufact: Food	0.671	0.390	-0.281	0.560	0.331	-0.229
Manufact: Textiles	0.784	0.494	-0.290	0.712	0.390	-0.322
Manufact: Wood	0.699	0.495	-0.204	0.666	0.490	-0.176
Publishing, printing	0.717	0.509	-0.208	0.632	0.503	-0.129
Manufact: Coke, chemicals	0.896	0.835	-0.061	0.773	0.732	-0.041
Manufact: Rubber, plastic	0.664	0.432	-0.232	0.578	0.412	-0.166
Manufact: Non-metallic	0.834	0.502	-0.332	0.776	0.477	-0.299
Manufact: Metals (Reference)	0.695	0.501	-0.194	0.648	0.525	-0.123
Manufact: Machinery	0.738	0.652	-0.086	0.755	0.599	-0.156
Manufact: Electr. machinery	0.789	0.603	-0.186	0.720	0.550	-0.170
Manufact: Electr. equipment	0.793	0.463	-0.330	0.730	0.383	-0.347
Manufact: Instruments	0.620	0.505	-0.115	0.550	0.452	-0.098
Manufact: Transport	0.938	0.820	-0.118	0.922	0.751	-0.171
Manufact: n.e.c.	0.687	0.441	-0.246	0.594	0.371	-0.223
Electricity, gas, water	0.960	0.886	-0.074	0.919	0.881	-0.038
Construction	0.696	0.511	-0.185	0.663	0.505	-0.158
Auto sales, repair	0.689	0.445	-0.244	0.655	0.406	-0.249
Wholesale trade	0.500	0.311	-0.189	0.496	0.279	-0.217
Retail trade	0.644	0.382	-0.262	0.754	0.379	-0.375
Hotels, restaurants	0.587	0.458	-0.129	0.569	0.468	-0.101
Transport	0.551	0.377	-0.174	0.600	0.473	-0.127
Auxiliary transport	0.610	0.301	-0.309	0.662	0.366	-0.294
Post, telecommunications	0.952	0.497	-0.455	0.906	0.429	-0.477
Finance, insurance	0.907	0.802	-0.105	0.918	0.804	-0.114
Real estate	0.579	0.263	-0.316	0.502	0.241	-0.261
Data processing	0.300	0.424	0.124	0.277	0.349	0.072
Research, other services	0.339	0.430	0.091	0.343	0.322	-0.021
Overall	0.703	0.534	-0.169	0.659	0.459	-0.199

*All statistics are weighted by the inverse sampling probability.*

Table 4: Decomposition results, West

Component	Males		Females	
	Value	Percent	Value	Percent
Difference in coverage 2001-2006	-0.169	100 %	-0.199	100 %
Residual effect (incl. coeff. effect)	-0.148	87.8 %	-0.178	89.3 %
Characteristics effect	-0.021	12.2 %	-0.021	10.7 %
$\Delta^1$ Personal coefficients	-0.002	1.0 %	-0.002	1.2 %
$\Delta^2$ Firm coefficients	-0.001	0.5 %	-0.005	2.6 %
$\Delta^3$ Industry coefficients	0.014	-8.2 %	-0.002	1.0 %
$\Delta^4$ Constant / Residual effect	-0.160	94.5 %	-0.168	84.5 %
$\Delta^5$ Industry (characteristics)	-0.019	11.0 %	-0.022	11.1 %
$\Delta^6$ Firm characteristics	-0.009	5.2 %	-0.005	2.3 %
$\Delta^7$ Personal characteristics	0.007	-4.0 %	0.005	-2.7 %
No. of observations	829,023		286,239	

*Results show the sequential decomposition of the change in collective bargaining coverage from 2001 to 2006 as explained in section 3.*

*All statistics are weighted by the inverse sampling probability.*

Table 5: Sensitivity check: Decomposition in reversed order, West

Component	Males		Females	
	Value	Percent	Value	Percent
Difference in coverage 2001-2006	-0.169	100 %	-0.199	100 %
Residual effect (incl. coeff. effect)	-0.162	95.6 %	-0.182	91.8 %
Characteristics effect	-0.007	4.4 %	-0.016	8.2 %
$\Delta_{rev}^1$ Personal characteristics	-0.009	5.1 %	0.003	-1.3 %
$\Delta_{rev}^2$ Firm characteristics	0.001	-0.6 %	-0.003	1.8 %
$\Delta_{rev}^3$ Industry (characteristics)	0.000	-0.2 %	-0.015	7.7 %
$\Delta_{rev}^4$ Constant / Residual effect	-0.192	107.6 %	-0.189	95.2 %
$\Delta_{rev}^5$ Industry coefficients	0.005	-2.8 %	-0.006	2.9 %
$\Delta_{rev}^6$ Firm coefficients	0.013	-7.8 %	0.012	-5.9 %
$\Delta_{rev}^7$ Personal coefficients	0.003	-1.4 %	0.001	-0.4 %
No. of observations	829,023		286,239	

*Results show the sequential decomposition of the change in collective bargaining coverage from 2001 to 2006 as explained in section 5.3.*

*All statistics are weighted by the inverse sampling probability.*

Table 6: Descriptive statistics: Collective bargaining coverage in subgroups, East

Label	Males			Females		
	2001 Share	2006 Share	2006-2001 $\Delta$ Share	2001 Share	2006 Share	2006-2001 $\Delta$ Share
Individual level						
Low education	0.601	0.425	-0.177	0.583	0.389	-0.194
Medium education (Reference)	0.434	0.364	-0.070	0.502	0.367	-0.135
High education	0.520	0.397	-0.123	0.556	0.423	-0.133
Education n/a	0.314	0.244	-0.070	0.385	0.256	-0.129
Firm level						
10 - 99 employees	0.242	0.188	-0.053	0.269	0.163	-0.106
100 - 199 employees	0.489	0.331	-0.149	0.524	0.330	-0.194
200 - 999 employees	0.703	0.520	-0.184	0.721	0.502	-0.219
1000 - 1999 employees	0.872	0.720	-0.152	0.879	0.675	-0.204
More than 2000 employees (Reference)	0.905	0.692	-0.214	0.895	0.652	-0.243
Berlin	0.600	0.378	-0.222	0.644	0.370	-0.274
Brandenburg, Meck-Pom (Reference)	0.393	0.341	-0.052	0.493	0.358	-0.135
Saxony	0.416	0.384	-0.032	0.438	0.385	-0.053
Saxony-Anhalt	0.408	0.322	-0.086	0.521	0.352	-0.170
Thuringia	0.383	0.323	-0.059	0.396	0.295	-0.101
Mining, quarrying	0.840	0.745	-0.095	0.843	0.899	0.056
Manufact: Food	0.499	0.332	-0.168	0.404	0.239	-0.165
Manufact: Textiles	0.468	0.242	-0.226	0.338	0.109	-0.229
Manufact: Wood	0.358	0.324	-0.034	0.347	0.323	-0.023
Publishing, printing	0.584	0.330	-0.254	0.566	0.304	-0.262
Manufact: Coke, chemicals	0.838	0.638	-0.200	0.769	0.602	-0.167
Manufact: Rubber, plastic	0.382	0.209	-0.173	0.292	0.181	-0.112
Manufact: Non-metallic	0.415	0.415	-0.000	0.618	0.365	-0.253
Manufact: Metals (Reference)	0.342	0.239	-0.103	0.308	0.223	-0.086
Manufact: Machinery	0.454	0.225	-0.229	0.438	0.247	-0.191
Manufact: Electr. machinery	0.623	0.465	-0.157	0.508	0.410	-0.098
Manufact: Electr. equipment	0.574	0.169	-0.405	0.521	0.180	-0.340
Manufact: Instruments	0.411	0.253	-0.158	0.257	0.184	-0.073
Manufact: Transport	0.800	0.653	-0.147	0.736	0.589	-0.147
Manufact: n.e.c.	0.351	0.117	-0.235	0.333	0.080	-0.253
Electricity, gas, water	0.736	0.907	0.171	0.729	0.921	0.192
Construction	0.321	0.306	-0.015	0.334	0.337	0.003
Auto sales, repair	0.301	0.083	-0.218	0.241	0.062	-0.179
Wholesale trade	0.444	0.274	-0.170	0.512	0.250	-0.262
Retail trade	0.503	0.354	-0.149	0.592	0.339	-0.253
Hotels, restaurants	0.445	0.284	-0.161	0.454	0.341	-0.112
Transport	0.422	0.371	-0.052	0.562	0.564	-0.001
Auxiliary transport	0.376	0.169	-0.206	0.552	0.274	-0.278
Post, telecommunications	0.946	0.574	-0.372	0.948	0.528	-0.420
Finance, insurance	0.903	0.736	-0.168	0.945	0.783	-0.162
Real estate	0.240	0.394	0.155	0.245	0.248	0.003
Data processing	0.450	0.403	0.047	0.432	0.399	-0.032
Research, other services	0.266	0.429	0.163	0.370	0.308	-0.062
Overall	0.438	0.355	-0.083	0.500	0.358	-0.140
No. of observations	84,186	140,374		41,762	72,658	

*All statistics are weighted by the inverse sampling probability.*

Table 7: Decomposition results, East

Component	Males		Females	
	Value	Percent	Value	Percent
Difference in coverage 2001-2006	-0.084	100 %	-0.139	100 %
Residual effect (incl. coeff. effect)	-0.104	123.8 %	-0.167	119.9 %
Characteristics effect	0.020	-23.8 %	0.028	-19.9 %
$\Delta^1$ Personal coefficients	0.001	-1.0 %	0.001	-0.5 %
$\Delta^2$ Firm coefficients	0.008	-9.4 %	-0.001	0.8 %
$\Delta^3$ Industry coefficients	0.029	-34.0 %	0.023	-16.2 %
$\Delta^4$ Constant / Residual effect	-0.142	168.2 %	-0.189	135.8 %
$\Delta^5$ Industry (characteristics)	-0.020	23.3 %	-0.008	6.1 %
$\Delta^6$ Firm characteristics	0.046	-54.3 %	0.041	-29.3 %
$\Delta^7$ Personal characteristics	-0.006	7.2 %	-0.005	3.2 %
No. of observations	224,560		114,420	

*Results show the sequential decomposition of the change in collective bargaining coverage from 2001 to 2006 as explained in section 3.*

*All statistics are weighted by the inverse sampling probability.*

Table 8: Sensitivity check: Decomposition in reversed order, East

Component	Males		Females	
	Value	Percent	Value	Percent
Difference in coverage 2001-2006	-0.084	100 %	-0.139	100 %
Residual effect (incl. coeff. effect)	-0.112	132.7 %	-0.178	127.9 %
Characteristics effect	0.028	-32.7 %	0.039	-27.9 %
$\Delta_{rev}^1$ Personal characteristics	0.039	-46.3 %	0.036	-26.0 %
$\Delta_{rev}^2$ Firm characteristics	-0.028	33.4 %	-0.027	19.4 %
$\Delta_{rev}^3$ Industry (characteristics)	0.017	-19.8 %	0.029	-21.2 %
$\Delta_{rev}^4$ Constant / Residual effect	-0.164	194.5 %	-0.210	151.4 %
$\Delta_{rev}^5$ Industry coefficients	0.013	-15.8 %	0.010	-7.4 %
$\Delta_{rev}^6$ Firm coefficients	0.038	-45.6 %	0.023	-16.3 %
$\Delta_{rev}^7$ Personal coefficients	0.000	-0.3 %	-0.000	0.2 %
No. of observations	224,560		114,420	

*Results show the sequential decomposition of the change in collective bargaining coverage from 2001 to 2006 as explained in section 5.3.*

*All statistics are weighted by the inverse sampling probability.*



# Additional Appendix

Note: If accepted for publication, this additional Online-Appendix is not part of the printed version of the paper.

## Description of sequential decomposition in reversed order for robustness analysis in section 5.3:

$$\begin{aligned} \Delta_{rev}^1 &= F(\beta_P^{06}, \beta_F^{06}, \beta_S^{06}, \beta_0^{06}, X_S^{06}, X_F^{06}, \mathbf{X}_P^{06}) - F(\beta_P^{06}, \beta_F^{06}, \beta_S^{06}, \beta_0^{06}, X_S^{06}, X_F^{06}, \mathbf{X}_P^{01}) \\ \Delta_{rev}^2 &= F(\beta_P^{06}, \beta_F^{06}, \beta_S^{06}, \beta_0^{06}, X_S^{06}, \mathbf{X}_F^{06}, X_P^{01}) - F(\beta_P^{06}, \beta_F^{06}, \beta_S^{06}, \beta_0^{06}, X_S^{06}, \mathbf{X}_F^{01}, X_P^{01}) \\ \Delta_{rev}^3 &= F(\beta_P^{06}, \beta_F^{06}, \beta_S^{06}, \beta_0^{06}, \mathbf{X}_S^{06}, X_F^{01}, X_P^{01}) - F(\beta_P^{06}, \beta_F^{06}, \beta_S^{06}, \beta_0^{06}, \mathbf{X}_S^{01}, X_F^{01}, X_P^{01}) \\ \Delta_{rev}^4 &= F(\beta_P^{06}, \beta_F^{06}, \beta_S^{06}, \beta_0^{06}, X_S^{01}, X_F^{01}, X_P^{01}) - F(\beta_P^{06}, \beta_F^{06}, \beta_S^{06}, \beta_0^{01}, X_S^{01}, X_F^{01}, X_P^{01}) \\ \Delta_{rev}^5 &= F(\beta_P^{06}, \beta_F^{06}, \beta_S^{06}, \beta_0^{01}, X_S^{01}, X_F^{01}, X_P^{01}) - F(\beta_P^{06}, \beta_F^{06}, \beta_S^{01}, \beta_0^{01}, X_S^{01}, X_F^{01}, X_P^{01}) \\ \Delta_{rev}^6 &= F(\beta_P^{06}, \beta_F^{06}, \beta_S^{01}, \beta_0^{01}, X_S^{01}, X_F^{01}, X_P^{01}) - F(\beta_P^{06}, \beta_F^{01}, \beta_S^{01}, \beta_0^{01}, X_S^{01}, X_F^{01}, X_P^{01}) \\ \Delta_{rev}^7 &= F(\beta_P^{06}, \beta_F^{01}, \beta_S^{01}, \beta_0^{01}, X_S^{01}, X_F^{01}, X_P^{01}) - F(\beta_P^{01}, \beta_F^{01}, \beta_S^{01}, \beta_0^{01}, X_S^{01}, X_F^{01}, X_P^{01}) \end{aligned}$$

Table A.1: Descriptive statistics, West

Label	Males				Females			
	2001		2006		2001		2006	
	Mean	Stdd.	Mean	Stdd.	Mean	Stdd.	Mean	Stdd.
Individual level								
Low education	0.144	(0.351)	0.122	(0.327)	0.188	(0.391)	0.152	(0.359)
Medium education (Reference)	0.677	(0.468)	0.650	(0.477)	0.664	(0.473)	0.636	(0.481)
High education	0.111	(0.315)	0.124	(0.330)	0.065	(0.246)	0.085	(0.278)
Education n/a	0.068	(0.252)	0.104	(0.306)	0.083	(0.276)	0.128	(0.334)
Age	39.61	(7.99)	40.59	(7.99)	38.95	(8.47)	39.58	(8.66)
Tenure	10.05	(9.15)	10.59	(9.16)	8.55	(8.35)	8.91	(8.22)
Firm level								
10 - 99 employees	0.348	(0.476)	0.339	(0.473)	0.352	(0.478)	0.347	(0.476)
100 - 199 employees	0.130	(0.336)	0.135	(0.341)	0.140	(0.347)	0.145	(0.352)
200 - 999 employees	0.265	(0.441)	0.266	(0.442)	0.281	(0.449)	0.296	(0.456)
1000 - 1999 employees	0.069	(0.254)	0.079	(0.270)	0.073	(0.260)	0.081	(0.272)
More than 2000 employees (Reference)	0.188	(0.391)	0.181	(0.385)	0.155	(0.362)	0.132	(0.339)
Share of male employees	0.759	(0.185)	0.756	(0.185)	0.525	(0.234)	0.518	(0.235)
Schleswig-Holstein, HH	0.055	(0.228)	0.058	(0.234)	0.069	(0.253)	0.071	(0.257)
Lower Saxony, Bremen	0.115	(0.319)	0.114	(0.317)	0.098	(0.297)	0.105	(0.306)
NRW (Reference)	0.295	(0.456)	0.276	(0.447)	0.279	(0.449)	0.263	(0.440)
Hesse	0.091	(0.288)	0.098	(0.297)	0.105	(0.306)	0.117	(0.322)
RLP, Saarland	0.069	(0.253)	0.064	(0.245)	0.062	(0.241)	0.056	(0.229)
Baden-Württemberg	0.188	(0.390)	0.189	(0.391)	0.195	(0.397)	0.186	(0.389)
Bavaria	0.187	(0.390)	0.201	(0.401)	0.192	(0.394)	0.202	(0.401)
Mining, quarrying	0.012	(0.109)	0.009	(0.095)	0.002	(0.045)	0.001	(0.036)
Manufact: Food	0.033	(0.178)	0.029	(0.169)	0.059	(0.236)	0.056	(0.231)
Manufact: Textiles	0.009	(0.095)	0.007	(0.084)	0.027	(0.162)	0.019	(0.137)
Manufact: Wood	0.024	(0.152)	0.019	(0.135)	0.013	(0.112)	0.011	(0.106)
Publishing, printing	0.021	(0.142)	0.016	(0.124)	0.032	(0.177)	0.024	(0.153)
Manufact: Coke, chemicals	0.042	(0.200)	0.034	(0.181)	0.038	(0.191)	0.034	(0.181)
Manufact: Rubber, plastic	0.032	(0.177)	0.028	(0.164)	0.027	(0.163)	0.023	(0.148)
Manufact: Non-metallic	0.021	(0.144)	0.016	(0.124)	0.010	(0.099)	0.010	(0.098)
Manufact: Metals (Reference)	0.087	(0.282)	0.076	(0.264)	0.042	(0.200)	0.034	(0.182)
Manufact: Machinery	0.096	(0.294)	0.103	(0.304)	0.047	(0.212)	0.050	(0.217)
Manufact: Electr. machinery	0.033	(0.178)	0.031	(0.174)	0.036	(0.186)	0.030	(0.171)
Manufact: Electr. equipment	0.019	(0.136)	0.013	(0.111)	0.022	(0.146)	0.014	(0.118)
Manufact: Instruments	0.019	(0.137)	0.019	(0.137)	0.025	(0.157)	0.023	(0.149)
Manufact: Transport	0.086	(0.280)	0.104	(0.305)	0.031	(0.173)	0.033	(0.179)
Manufact: n.e.c.	0.019	(0.138)	0.015	(0.122)	0.016	(0.126)	0.013	(0.113)
Electricity, gas, water	0.013	(0.114)	0.016	(0.124)	0.007	(0.081)	0.007	(0.085)
Construction	0.090	(0.287)	0.068	(0.251)	0.019	(0.140)	0.013	(0.114)
Auto sales, repair	0.030	(0.170)	0.032	(0.176)	0.015	(0.123)	0.017	(0.129)
Wholesale trade	0.077	(0.267)	0.079	(0.269)	0.085	(0.279)	0.093	(0.290)
Retail trade	0.039	(0.194)	0.036	(0.187)	0.119	(0.324)	0.123	(0.329)
Hotels, restaurants	0.011	(0.103)	0.011	(0.106)	0.031	(0.173)	0.033	(0.180)
Transport	0.016	(0.127)	0.027	(0.161)	0.008	(0.090)	0.013	(0.113)
Auxiliary transport	0.025	(0.155)	0.033	(0.178)	0.025	(0.157)	0.032	(0.177)
Post, telecommunications	0.009	(0.093)	0.008	(0.089)	0.009	(0.094)	0.008	(0.090)
Finance, insurance	0.053	(0.225)	0.043	(0.203)	0.121	(0.326)	0.097	(0.296)
Real estate	0.007	(0.083)	0.029	(0.169)	0.012	(0.108)	0.027	(0.162)
Data processing	0.018	(0.132)	0.005	(0.074)	0.017	(0.128)	0.010	(0.101)
Research, other services	0.059	(0.236)	0.095	(0.294)	0.103	(0.304)	0.151	(0.358)
No. of observations	311,054		517,969		101,992		184,247	

*All statistics are weighted by the inverse sampling probability.*

Table A.2: Probit results males, 2001 and 2006, West

Variable	2001				2006			
	Coeff.	(s.e.)	Marg. Eff.	(s.e.)	Coeff.	(s.e.)	Marg. Eff.	(s.e.)
Individual level								
Low education	-0.029	(0.010)	-0.007	(0.002)	0.025	(0.008)	0.008	(0.003)
High education	0.007	(0.011)	0.002	(0.003)	-0.041	(0.008)	-0.013	(0.003)
Education n/a	-0.337	(0.013)	-0.084	(0.003)	-0.520	(0.010)	-0.162	(0.003)
Age	-0.002	(0.000)	-0.000	(0.000)	-0.003	(0.000)	-0.001	(0.000)
Tenure	0.027	(0.001)	0.007	(0.000)	0.021	(0.000)	0.006	(0.000)
Firm level								
10 - 99 employees	-1.810	(0.014)	-0.447	(0.003)	-1.112	(0.010)	-0.347	(0.003)
100 - 199 employees	-1.191	(0.015)	-0.295	(0.004)	-0.627	(0.010)	-0.196	(0.003)
200 - 999 employees	-0.708	(0.014)	-0.175	(0.003)	-0.326	(0.010)	-0.102	(0.003)
1000 - 1999 employees	-0.309	(0.018)	-0.076	(0.004)	0.125	(0.012)	0.039	(0.004)
Share of male employees	0.562	(0.023)	0.139	(0.006)	0.707	(0.020)	0.221	(0.006)
Schleswig-Holstein, HH	-0.407	(0.014)	-0.101	(0.003)	0.010	(0.011)	0.031	(0.003)
Lower Saxony, Bremen	0.081	(0.012)	0.020	(0.003)	0.258	(0.010)	0.081	(0.003)
Hesse	-0.316	(0.013)	-0.078	(0.003)	-0.111	(0.010)	-0.035	(0.003)
RLP, Saarland	-0.171	(0.013)	-0.042	(0.003)	0.196	(0.011)	0.061	(0.004)
Baden-Württemberg	-0.299	(0.011)	-0.074	(0.003)	-0.087	(0.009)	-0.027	(0.003)
Bavaria	-0.162	(0.011)	-0.040	(0.003)	0.069	(0.009)	0.022	(0.003)
Mining, quarrying	0.797	(0.030)	0.197	(0.008)	0.233	(0.035)	0.073	(0.011)
Manufact: Food	0.053	(0.022)	0.013	(0.005)	-0.120	(0.016)	-0.038	(0.005)
Manufact: Textiles	0.406	(0.035)	0.101	(0.009)	0.241	(0.024)	0.075	(0.007)
Manufact: Wood	0.036	(0.018)	0.009	(0.004)	0.061	(0.019)	0.019	(0.006)
Publishing, printing	0.359	(0.021)	0.089	(0.005)	0.323	(0.017)	0.101	(0.005)
Manufact: Coke, chemicals	0.446	(0.022)	0.110	(0.005)	0.836	(0.017)	0.261	(0.005)
Manufact: Rubber, plastic	-0.109	(0.018)	-0.027	(0.005)	-0.162	(0.019)	-0.051	(0.006)
Manufact: Non-metallic	0.623	(0.020)	0.154	(0.005)	0.095	(0.020)	0.030	(0.006)
Manufact: Machinery	-0.000	(0.016)	-0.000	(0.004)	0.304	(0.015)	0.095	(0.005)
Manufact: Electr. machinery	0.053	(0.021)	0.013	(0.005)	0.171	(0.017)	0.053	(0.005)
Manufact: Electr. equipment	-0.038	(0.021)	-0.009	(0.005)	-0.205	(0.019)	-0.064	(0.006)
Manufact: Instruments	-0.219	(0.022)	-0.054	(0.006)	0.083	(0.017)	0.026	(0.005)
Manufact: Transport	0.302	(0.019)	0.075	(0.005)	0.421	(0.015)	0.131	(0.005)
Manufact: n.e.c.	0.029	(0.023)	0.007	(0.006)	-0.034	(0.021)	-0.010	(0.006)
Electricity, gas, water	0.740	(0.038)	0.183	(0.009)	0.935	(0.025)	0.292	(0.008)
Construction	0.515	(0.016)	0.128	(0.004)	0.447	(0.016)	0.140	(0.005)
Auto sales, repair	0.352	(0.022)	0.087	(0.005)	0.177	(0.021)	0.055	(0.007)
Wholesale trade	-0.182	(0.017)	-0.045	(0.004)	-0.128	(0.017)	-0.040	(0.005)
Retail trade	0.286	(0.023)	0.071	(0.006)	0.085	(0.024)	0.027	(0.007)
Hotels, restaurants	0.454	(0.034)	0.113	(0.009)	0.625	(0.030)	0.195	(0.009)
Transport	-0.183	(0.024)	-0.045	(0.006)	-0.026	(0.016)	-0.008	(0.005)
Auxiliary transport	-0.002	(0.019)	-0.001	(0.005)	-0.249	(0.017)	-0.078	(0.005)
Post, telecommunications	1.170	(0.093)	0.290	(0.023)	-0.049	(0.018)	-0.015	(0.006)
Finance, insurance	0.863	(0.047)	0.214	(0.011)	0.937	(0.019)	0.293	(0.006)
Real estate	-0.974	(0.021)	-0.241	(0.005)	-0.442	(0.016)	-0.138	(0.005)
Data processing	0.341	(0.041)	0.084	(0.010)	0.352	(0.030)	0.110	(0.009)
Research, other services	-0.758	(0.018)	-0.188	(0.004)	0.169	(0.015)	0.053	(0.005)
Constant	0.731	(0.004)			0.143	(0.003)		
No. of observations	311,054				517,969			

*The table displays average marginal effects. The regression model does not contain any interaction terms. The standard errors for the marginal effects are obtained from the delta method. All statistics are weighted by the inverse sampling probability.*

Table A.3: Probit results females, 2001 and 2006, West

Variable	2001				2006			
	Coeff.	(s.e.)	Marg. Eff.	(s.e.)	Coeff.	(s.e.)	Marg. Eff.	(s.e.)
Individual level								
Low education	0.036	(0.016)	0.010	(0.004)	0.089	(0.014)	0.028	(0.005)
High education	-0.096	(0.022)	-0.026	(0.006)	-0.019	(0.017)	-0.006	(0.005)
Education n/a	-0.291	(0.022)	-0.078	(0.006)	-0.374	(0.016)	-0.120	(0.005)
Age	-0.001	(0.001)	-0.000	(0.000)	-0.004	(0.001)	-0.001	(0.000)
Tenure	0.026	(0.001)	0.007	(0.000)	0.022	(0.001)	0.007	(0.000)
Firm level								
10 - 99 employees	-1.639	(0.025)	-0.441	(0.007)	-0.901	(0.021)	-0.289	(0.006)
100 - 199 employees	-1.128	(0.026)	-0.304	(0.007)	-0.430	(0.020)	-0.138	(0.006)
200 - 999 employees	-0.678	(0.024)	-0.182	(0.006)	-0.211	(0.019)	-0.068	(0.006)
1000 - 1999 employees	-0.172	(0.032)	-0.046	(0.008)	0.201	(0.022)	0.064	(0.007)
Share of male employees	0.378	(0.033)	0.102	(0.009)	0.758	(0.027)	0.243	(0.009)
Schleswig-Holstein, HH	-0.319	(0.025)	-0.086	(0.007)	0.131	(0.018)	0.042	(0.006)
Lower Saxony, Bremen	0.127	(0.022)	0.034	(0.006)	0.190	(0.018)	0.061	(0.006)
Hesse	-0.396	(0.024)	-0.107	(0.006)	-0.104	(0.020)	-0.033	(0.006)
RLP, Saarland	-0.015	(0.024)	-0.004	(0.006)	0.341	(0.020)	0.109	(0.006)
Baden-Württemberg	-0.301	(0.019)	-0.081	(0.005)	0.020	(0.015)	0.006	(0.005)
Bavaria	-0.137	(0.020)	-0.037	(0.005)	0.059	(0.015)	0.019	(0.005)
Mining, quarrying	0.851	(0.095)	0.229	(0.026)	0.027	(0.093)	0.009	(0.030)
Manufact: Food	-0.055	(0.037)	-0.015	(0.010)	-0.210	(0.035)	-0.067	(0.011)
Manufact: Textiles	0.360	(0.040)	0.097	(0.011)	-0.048	(0.037)	-0.015	(0.012)
Manufact: Wood	0.076	(0.040)	0.021	(0.011)	-0.079	(0.048)	-0.025	(0.015)
Publishing, printing	0.235	(0.036)	0.063	(0.010)	0.299	(0.035)	0.096	(0.011)
Manufact: Coke, chemicals	0.113	(0.039)	0.030	(0.010)	0.523	(0.036)	0.168	(0.012)
Manufact: Rubber, plastic	-0.193	(0.038)	-0.052	(0.010)	-0.274	(0.042)	-0.088	(0.013)
Manufact: Non-metallic	0.387	(0.046)	0.104	(0.012)	-0.145	(0.048)	-0.046	(0.016)
Manufact: Machinery	0.062	(0.040)	0.017	(0.011)	0.002	(0.039)	0.001	(0.012)
Manufact: Electr. machinery	-0.044	(0.040)	-0.012	(0.011)	-0.028	(0.038)	-0.009	(0.012)
Manufact: Electr. equipment	-0.145	(0.038)	-0.039	(0.010)	-0.460	(0.039)	-0.147	(0.013)
Manufact: Instruments	-0.231	(0.039)	-0.062	(0.011)	-0.130	(0.036)	-0.042	(0.012)
Manufact: Transport	0.461	(0.050)	0.124	(0.013)	0.217	(0.041)	0.070	(0.013)
Manufact: n.e.c.	-0.126	(0.043)	-0.034	(0.012)	-0.321	(0.046)	-0.103	(0.015)
Electricity, gas, water	0.399	(0.082)	0.107	(0.022)	0.979	(0.059)	0.314	(0.019)
Construction	0.339	(0.046)	0.091	(0.012)	0.241	(0.052)	0.077	(0.017)
Auto sales, repair	0.336	(0.050)	0.090	(0.014)	-0.051	(0.051)	-0.016	(0.016)
Wholesale trade	-0.175	(0.034)	-0.047	(0.009)	-0.389	(0.036)	-0.125	(0.012)
Retail trade	0.626	(0.037)	0.168	(0.010)	0.044	(0.038)	0.014	(0.012)
Hotels, restaurants	0.437	(0.043)	0.118	(0.011)	0.561	(0.042)	0.180	(0.013)
Transport	-0.104	(0.052)	-0.028	(0.014)	0.010	(0.038)	0.003	(0.012)
Auxiliary transport	0.064	(0.037)	0.017	(0.011)	-0.223	(0.037)	-0.072	(0.012)
Post, telecommunications	0.922	(0.171)	0.248	(0.046)	-0.274	(0.039)	-0.088	(0.012)
Finance, insurance	0.975	(0.058)	0.262	(0.015)	0.824	(0.035)	0.264	(0.011)
Real estate	-0.832	(0.039)	-0.224	(0.010)	-0.616	(0.037)	-0.197	(0.012)
Data processing	0.028	(0.054)	0.007	(0.015)	0.043	(0.046)	0.014	(0.015)
Research, other services	-0.580	(0.033)	-0.156	(0.009)	-0.130	(0.034)	-0.042	(0.011)
Constant	0.536	(0.007)			-0.052	(0.005)		
No. of observations	101,992				184,247			

The table displays average marginal effects. The regression model does not contain any interaction terms. The standard errors for the marginal effects are obtained from the delta method. All statistics are weighted by the inverse sampling probability.

Table A.4: Descriptive statistics, East

Label	Males				Females			
	2001		2006		2001		2006	
	Mean	Stdd.	Mean	Stdd.	Mean	Stdd.	Mean	Stdd.
Individual level								
Low education	0.050	(0.217)	0.046	(0.211)	0.065	(0.247)	0.054	(0.226)
Medium education (Reference)	0.733	(0.443)	0.717	(0.450)	0.721	(0.449)	0.695	(0.460)
High education	0.107	(0.309)	0.107	(0.309)	0.090	(0.286)	0.104	(0.305)
Education n/a	0.110	(0.313)	0.130	(0.336)	0.124	(0.330)	0.147	(0.354)
Age	40.041	(7.923)	41.068	(8.337)	40.569	(7.888)	41.657	(8.246)
Tenure	7.464	(8.166)	8.121	(8.346)	7.539	(7.556)	8.750	(8.015)
Firm level								
10 - 99 employees	0.554	(0.497)	0.485	(0.500)	0.480	(0.500)	0.428	(0.495)
100 - 199 employees	0.141	(0.348)	0.161	(0.367)	0.149	(0.356)	0.154	(0.361)
200 - 999 employees	0.195	(0.397)	0.205	(0.404)	0.237	(0.425)	0.244	(0.429)
1000 - 1999 employees	0.039	(0.194)	0.039	(0.192)	0.047	(0.211)	0.051	(0.220)
More than 2000 employees (Reference)	0.071	(0.257)	0.110	(0.313)	0.088	(0.284)	0.124	(0.329)
Share of male employees	0.771	(0.201)	0.756	(0.203)	0.463	(0.260)	0.470	(0.251)
Berlin	0.184	(0.387)	0.177	(0.382)	0.212	(0.409)	0.210	(0.407)
Brandenburg, Meck-Pom (Reference)	0.226	(0.418)	0.226	(0.418)	0.211	(0.408)	0.222	(0.416)
Saxony	0.288	(0.453)	0.302	(0.459)	0.276	(0.447)	0.294	(0.456)
Saxony-Anhalt	0.147	(0.354)	0.143	(0.350)	0.135	(0.341)	0.120	(0.324)
Thuringia	0.155	(0.362)	0.152	(0.359)	0.166	(0.372)	0.154	(0.361)
Mining, quarrying	0.009	(0.096)	0.007	(0.086)	0.004	(0.065)	0.004	(0.067)
Manufact: Food	0.033	(0.180)	0.032	(0.177)	0.109	(0.311)	0.083	(0.276)
Manufact: Textiles	0.007	(0.084)	0.005	(0.070)	0.028	(0.165)	0.017	(0.131)
Manufact: Wood	0.019	(0.136)	0.022	(0.145)	0.015	(0.121)	0.012	(0.107)
Publishing, printing	0.013	(0.115)	0.013	(0.114)	0.026	(0.160)	0.022	(0.146)
Manufact: Coke, chemicals	0.022	(0.146)	0.023	(0.148)	0.028	(0.165)	0.028	(0.166)
Manufact: Rubber, plastic	0.023	(0.151)	0.024	(0.152)	0.020	(0.139)	0.023	(0.148)
Manufact: Non-metallic	0.028	(0.166)	0.022	(0.148)	0.016	(0.127)	0.012	(0.108)
Manufact: Metals (Reference)	0.084	(0.277)	0.081	(0.273)	0.035	(0.184)	0.032	(0.177)
Manufact: Machinery	0.063	(0.242)	0.058	(0.234)	0.024	(0.152)	0.021	(0.143)
Manufact: Electr. machinery	0.022	(0.146)	0.024	(0.153)	0.028	(0.166)	0.024	(0.152)
Manufact: Electr. equipment	0.018	(0.135)	0.020	(0.140)	0.017	(0.129)	0.019	(0.135)
Manufact: Instruments	0.014	(0.116)	0.015	(0.120)	0.023	(0.151)	0.027	(0.162)
Manufact: Transport	0.045	(0.206)	0.052	(0.221)	0.018	(0.132)	0.021	(0.144)
Manufact: n.e.c.	0.016	(0.126)	0.014	(0.117)	0.015	(0.123)	0.013	(0.112)
Electricity, gas, water	0.016	(0.125)	0.021	(0.143)	0.012	(0.109)	0.017	(0.128)
Construction	0.233	(0.423)	0.142	(0.349)	0.044	(0.205)	0.024	(0.154)
Auto sales, repair	0.044	(0.205)	0.038	(0.191)	0.023	(0.149)	0.018	(0.134)
Wholesale trade	0.056	(0.231)	0.060	(0.238)	0.066	(0.248)	0.056	(0.229)
Retail trade	0.035	(0.185)	0.035	(0.184)	0.127	(0.333)	0.106	(0.308)
Hotels, restaurants	0.014	(0.116)	0.015	(0.123)	0.040	(0.196)	0.056	(0.230)
Transport	0.028	(0.165)	0.057	(0.232)	0.011	(0.105)	0.029	(0.168)
Auxiliary transport	0.025	(0.155)	0.035	(0.184)	0.016	(0.125)	0.022	(0.146)
Post, telecommunications	0.009	(0.096)	0.011	(0.106)	0.014	(0.120)	0.015	(0.123)
Finance, insurance	0.018	(0.134)	0.020	(0.139)	0.077	(0.266)	0.078	(0.268)
Real estate	0.020	(0.139)	0.035	(0.183)	0.033	(0.179)	0.040	(0.195)
Data processing	0.007	(0.085)	0.006	(0.079)	0.014	(0.118)	0.015	(0.123)
Research, other services	0.078	(0.268)	0.113	(0.317)	0.116	(0.320)	0.168	(0.374)
No. of observations	27,975		140,374		26,840		72,658	

*All statistics are weighted by the inverse sampling probability.*

Table A.5: Probit results males, 2001 and 2006, East

Variable	2001				2006			
	Coeff.	(s.e.)	Marg. Eff.	(s.e.)	Coeff.	(s.e.)	Marg. Eff.	(s.e.)
Individual level								
Low education	0.278	(0.31)	0.079	(0.009)	0.183	(0.024)	0.052	(0.007)
High education	0.103	(0.021)	0.029	(0.006)	-0.114	(0.017)	-0.032	(0.005)
Education n/a	-0.122	(0.023)	-0.034	(0.000)	-0.190	(0.021)	-0.054	(0.006)
Age	-0.001	(0.001)	-0.000	(0.000)	-0.003	(0.001)	-0.001	(0.000)
Tenure	0.035	(0.001)	0.010	(0.000)	0.040	(0.001)	0.011	(0.000)
Firm level								
10 - 99 employees	-1.905	(0.039)	-0.539	(0.011)	-1.201	(0.021)	-0.339	(0.006)
100 - 199 employees	-1.283	(0.041)	-0.363	(0.011)	-0.710	(0.021)	-0.200	(0.006)
200 - 999 employees	-0.754	(0.040)	-0.213	(0.011)	-0.260	(0.020)	-0.073	(0.006)
1000 - 1999 employees	-0.257	(0.048)	-0.073	(0.014)	0.182	(0.029)	0.051	(0.008)
Share of male employees	-0.368	(0.043)	-0.104	(0.012)	0.497	(0.036)	0.140	(0.010)
Berlin	0.439	(0.019)	0.124	(0.005)	-0.272	(0.017)	-0.077	(0.005)
Saxony	-0.033	(0.020)	-0.009	(0.006)	0.064	(0.016)	0.018	(0.005)
Saxony-Anhalt	-0.018	(0.021)	-0.005	(0.006)	0.033	(0.018)	0.009	(0.005)
Thuringia	-0.084	(0.021)	-0.024	(0.006)	-0.047	(0.016)	-0.013	(0.005)
Mining, quarrying	1.134	(0.048)	0.321	(0.013)	1.045	(0.059)	0.295	(0.016)
Manufact: Food	0.159	(0.040)	0.045	(0.011)	0.403	(0.030)	0.114	(0.008)
Manufact: Textiles	0.215	(0.057)	0.061	(0.016)	0.046	(0.068)	0.013	(0.019)
Manufact: Wood	0.111	(0.035)	0.031	(0.010)	0.279	(0.032)	0.079	(0.009)
Publishing, printing	0.274	(0.041)	0.078	(0.012)	0.272	(0.034)	0.077	(0.010)
Manufact: Coke, chemicals	0.870	(0.042)	0.246	(0.012)	0.997	(0.033)	0.281	(0.009)
Manufact: Rubber, plastic	0.101	(0.036)	0.029	(0.010)	-0.090	(0.034)	-0.025	(0.010)
Manufact: Non-metallic	0.893	(0.034)	0.253	(0.009)	0.675	(0.033)	0.190	(0.009)
Manufact: Machinery	0.241	(0.031)	0.068	(0.009)	-0.075	(0.029)	-0.021	(0.008)
Manufact: Electr. machinery	0.375	(0.038)	0.106	(0.011)	0.471	(0.031)	0.133	(0.009)
Manufact: Electr. equipment	0.067	(0.039)	0.019	(0.011)	-0.395	(0.037)	-0.111	(0.010)
Manufact: Instruments	0.080	(0.041)	0.023	(0.012)	0.434	(0.036)	0.122	(0.010)
Manufact: Transport	0.815	(0.032)	0.231	(0.009)	0.684	(0.026)	0.193	(0.007)
Manufact: n.e.c.	0.241	(0.040)	0.068	(0.011)	-0.230	(0.045)	-0.065	(0.013)
Electricity, gas, water	0.342	(0.052)	0.097	(0.015)	1.762	(0.041)	0.497	(0.011)
Construction	0.398	(0.027)	0.113	(0.008)	0.603	(0.027)	0.170	(0.007)
Auto sales, repair	0.290	(0.035)	0.082	(0.010)	-0.499	(0.041)	-0.141	(0.012)
Wholesale trade	0.461	(0.034)	0.131	(0.009)	0.445	(0.042)	0.125	(0.012)
Retail trade	0.403	(0.045)	0.114	(0.013)	0.545	(0.044)	0.154	(0.012)
Hotels, restaurants	0.399	(0.048)	0.113	(0.014)	0.777	(0.047)	0.219	(0.013)
Transport	0.080	(0.038)	0.023	(0.011)	0.266	(0.027)	0.075	(0.008)
Auxiliary transport	0.253	(0.036)	0.072	(0.010)	-0.214	(0.030)	-0.060	(0.008)
Post, telecommunications	1.279	(0.068)	0.362	(0.019)	0.697	(0.035)	0.197	(0.010)
Finance, insurance	1.238	(0.067)	0.350	(0.0019)	1.310	(0.040)	0.370	(0.011)
Real estate	-0.508	(0.045)	-0.144	(0.013)	0.753	(0.034)	0.213	(0.009)
Data processing	0.330	(0.082)	0.093	(0.023)	1.060	(0.067)	0.299	(0.019)
Research, other services	-0.466	(0.036)	-0.132	(0.010)	0.829	(0.028)	0.234	(0.008)
Constant	0.046	(0.006)			-0.503	(0.006)		
No. of observations	84,186				140,374			

*The table displays average marginal effects. The regression model does not contain any interaction terms. The standard errors for the marginal effects are obtained from the delta method. All statistics are weighted by the inverse sampling probability.*

Table A.6: Probit results females, 2001 and 2006, East

Variable	2001				2006			
	Coeff.	(s.e.)	Marg. Eff.	(s.e.)	Coeff.	(s.e.)	Marg. Eff.	(s.e.)
Individual level								
Low education	0.238	(0.041)	0.067	(0.011)	0.191	(0.029)	0.053	(0.008)
High education	0.108	(0.032)	0.030	(0.009)	0.032	(0.024)	0.009	(0.007)
Education n/a	-0.054	(0.031)	-0.015	(0.009)	-0.020	(0.027)	-0.006	(0.008)
Age	0.001	(0.001)	0.000	(0.000)	0.001	(0.001)	0.000	(0.000)
Tenure	0.034	(0.001)	0.010	(0.000)	0.037	(0.001)	0.010	(0.000)
Firm level								
10 - 99 employees	-1.523	(0.049)	-0.429	(0.013)	-1.142	(0.029)	-0.319	(0.007)
100 - 199 employees	-0.834	(0.051)	-0.235	(0.014)	-0.623	(0.028)	-0.174	(0.008)
200 - 999 employees	-0.332	(0.050)	-0.094	(0.014)	-0.194	(0.026)	-0.054	(0.007)
1000 - 1999 employees	0.091	(0.063)	0.026	(0.018)	0.172	(0.036)	0.048	(0.010)
Share of male employees	-0.167	(0.047)	-0.047	(0.013)	0.407	(0.042)	0.114	(0.012)
Berlin	0.208	(0.028)	0.059	(0.008)	-0.349	(0.024)	-0.098	(0.007)
Saxony	-0.201	(0.028)	-0.057	(0.008)	-0.048	(0.023)	-0.013	(0.006)
Saxony-Anhalt	-0.010	(0.032)	-0.003	(0.008)	0.069	(0.025)	0.019	(0.007)
Thuringia	-0.313	(0.029)	-0.088	(0.008)	-0.125	(0.023)	-0.035	(0.007)
Mining, quarrying	1.043	(0.096)	0.294	(0.027)	1.344	(0.115)	0.376	(0.032)
Manufact: Food	0.192	(0.054)	0.054	(0.015)	0.356	(0.053)	0.099	(0.015)
Manufact: Textiles	0.090	(0.063)	0.025	(0.018)	-0.220	(0.077)	-0.062	(0.021)
Manufact: Wood	0.153	(0.062)	0.043	(0.017)	0.475	(0.067)	0.133	(0.019)
Publishing, printing	0.358	(0.058)	0.101	(0.016)	0.397	(0.056)	0.111	(0.016)
Manufact: Coke, chemicals	0.779	(0.064)	0.219	(0.018)	1.004	(0.057)	0.281	(0.016)
Manufact: Rubber, plastic	0.007	(0.066)	0.002	(0.018)	0.043	(0.065)	0.012	(0.018)
Manufact: Non-metallic	0.915	(0.067)	0.258	(0.019)	0.631	(0.070)	0.176	(0.019)
Manufact: Machinery	0.239	(0.074)	0.067	(0.021)	0.146	(0.067)	0.041	(0.019)
Manufact: Electr. machinery	0.305	(0.061)	0.086	(0.017)	0.548	(0.059)	0.153	(0.017)
Manufact: Electr. equipment	0.207	(0.065)	0.058	(0.018)	-0.201	(0.064)	-0.056	(0.018)
Manufact: Instruments	-0.134	(0.063)	-0.038	(0.018)	0.261	(0.058)	0.073	(0.016)
Manufact: Transport	0.795	(0.070)	0.224	(0.020)	0.731	(0.059)	0.205	(0.017)
Manufact: n.e.c.	0.113	(0.068)	0.032	(0.019)	-0.409	(0.089)	-0.114	(0.025)
Electricity, gas, water	0.458	(0.090)	0.129	(0.025)	2.061	(0.073)	0.577	(0.020)
Construction	0.405	(0.067)	0.114	(0.019)	0.747	(0.073)	0.209	(0.020)
Auto sales, repair	0.237	(0.070)	0.067	(0.020)	-0.434	(0.082)	-0.121	(0.023)
Wholesale trade	0.605	(0.059)	0.170	(0.017)	0.466	(0.069)	0.130	(0.019)
Retail trade	0.768	(0.057)	0.216	(0.016)	0.617	(0.059)	0.173	(0.016)
Hotels, restaurants	0.675	(0.060)	0.190	(0.017)	0.975	(0.059)	0.273	(0.016)
Transport	0.249	(0.083)	0.070	(0.023)	0.598	(0.060)	0.167	(0.017)
Auxiliary transport	0.571	(0.063)	0.161	(0.018)	0.233	(0.057)	0.065	(0.016)
Post, telecommunications	1.345	(0.079)	0.379	(0.022)	0.751	(0.059)	0.210	(0.017)
Finance, insurance	1.677	(0.071)	0.472	(0.020)	1.442	(0.056)	0.404	(0.016)
Real estate	-0.022	(0.067)	-0.006	(0.019)	0.407	(0.059)	0.114	(0.017)
Data processing	0.369	(0.094)	0.104	(0.027)	1.180	(0.077)	0.330	(0.021)
Research, other services	0.029	(0.059)	0.008	(0.017)	0.581	(0.054)	0.163	(0.015)
Constant	0.177	(0.009)			-0.533	(0.008)		
No. of observations	41,762				72,658			

*The table displays average marginal effects. The regression model does not contain any interaction terms. The standard errors for the marginal effects are obtained from the delta method. All statistics are weighted by the inverse sampling probability.*