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**Wage Distributions by Bargaining Regime: Linked  
Employer-Employee Data Evidence from Germany**

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## **Abstract**

Using linked employer-employee data from the German Structure of Earnings Survey 2001, this paper provides a comprehensive picture of the wage structure in three wage-setting regimes prevalent in the German system of industrial relations. We analyze wage distributions for various labor market subgroups by means of kernel density estimation, variance decompositions, and individual and firm-level wage regressions. Unions' impact through collective and firm-level bargaining mainly works towards a higher wage level and reduced overall and residual wage dispersion. Yet observed effects are considerably heterogeneous across different labor market groups. There is no clear evidence for wage floors formed by collectively bargained low wage brackets which would operate as minimum wages for different groups of workers.

**Keywords:** Collective wage bargaining, wage structure, kernel density estimation, variance decomposition, wage equations, German Structure of Earnings Survey

**JEL Classifications:** J31, J51, J52.

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# 1 Introduction

Trade unions bargain for higher wages, equal pay, fair working conditions, or employment protection (Freeman and Medoff 1984). Classical models such as monopoly unions, right-to-manage models, or efficient bargaining predict a monotonic positive relationship between union power and the level of bargained wages; see the surveys of Farber (1986), Oswald (1985), and Naylor (2003). Some more recent studies emphasize effects on higher moments of the wage distribution. In line with an insurance motive for union representation of risk-averse workers (Agell and Lommerud 1992, Burda 1995), union impact compresses the wage distribution relative to the distribution of productivities. By enforcing “equal pay for equal work” unions further seek to limit favoritism and discrimination by superiors and colleagues, and to encourage solidarity among the work force (Freeman 1982). Union-bargained wages may serve as wage floors, thereby narrowing the distribution of wages from below.

Collective agreements reflecting unions’ bargaining objectives then have two effects on the structure of wages. First, differences between covered and non-covered segments would increase as the result of the unions’ strive for higher wages. Second, wage compression induced through a collective contract would reduce within-segment inequality. The question which effect would prevail has been discussed for some time in the Anglo-Saxon context; see the survey of Card, Lemieux, and Riddell (2003).

However, the Anglo-Saxon concept of union gaps or membership premia is inappropriate for Germany because collective agreements constituting discriminatory wage policies with disadvantages for non-members are forbidden by constitutional law (negative freedom of association, *negative Koalitionsfreiheit, Grundgesetz Art. 9*). The scope of collective agreements goes beyond the organized parties. Wages set at the firm level as well as individually bargained wages are adapted towards collective bargaining agreements, be it in order to reduce transaction costs or not to create incentives for employees to join a union. Collective bargaining coverage thus is considerably higher than union density. The decision whether to apply a collective contract or not is basically left to the firms. In the interpretation of Dustmann and Schönberg (2004), firms use collective agreements as a commitment device.

Employees are paid either according to individual contracts between the employee and the firm or according to a collective agreement. The collective agreement can be negotiated between a union and an employers’ association, a union and a firm, or a works council and a firm. Arrangements between firm and works council are only allowed to govern wages or salaries if the firm is not subject to a collective contract or if the collective

contract explicitly allows for this type of arrangement.<sup>1</sup> Firm-level agreements involving a union are allowed to set wages even if a collective agreement exists, as long as the firm-level agreement is more specific than the collective agreement. No more than one collective wage agreement must apply at the same time, but not all employees working in a firm applying a collective agreement are automatically covered. Collective contracts may also contain an opening clause explicitly allowing deviations from the terms of the contract under particular circumstances (Heinbach 2006).

Collective bargaining coverage, as measured by the share of employment contracts following collective agreements, was relatively stable in West Germany until the mid 1990's but has been declining since. By the year 2003, 70% (45%) of West German employees (firms) were covered by a collective agreement (Schnabel 2005). With respective shares of 47% and 26%, coverage in East Germany was markedly lower.<sup>2</sup> The “erosion” towards more decentralized wage setting is examined by a group of studies using firm-level data, and is reconfirmed by survey evidence from works councils.<sup>3</sup>

Evidence on the effects of bargaining coverage on the German wage structure is still sparse. In this paper we use newly available linked employer-employee data for Germany, the German Structure of Earnings Survey (GSES, *Gehalts- und Lohnstrukturerhebung*) 2001, in order to provide a first comprehensive picture of wage structures in the different bargaining regimes for various labor market subgroups. Broadening the scope of previous results at the Federal-State level, we compare individual, firm-level, and collective bargaining among male full-time employees, female full-time, and female part-time employees, and we distinguish between blue-collar and white-collar workers and between establishments in East and West Germany.

The thrust of our findings confirms a priori expectations. Union impact through collective bargaining results in a higher wage level as well as reduced overall and residual wage dispersion. Yet there is no clear evidence for disproportionate wage compression from below or a wage floor formed by collectively bargained low wage brackets. Moreover, we detect considerable heterogeneity of union impacts across different labor market groups as well as subtle differences between individual and firm-level evidence.

The course of the paper is organized as follows. Section 2 briefly reviews related studies in the literature. Section 3 introduces the GSES 2001 data. Framework and results of our empirical investigation are discussed in section 4. Section 5 concludes.

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<sup>1</sup>See Addison, Teixeira, and Zwick (2006) for a discussion of the effects of German works councils.

<sup>2</sup>In contrast, aggregate gross union density—i. e., the ratio of the number of union members and the number of employees in the German labor market—was only 27% in the year 2004 (Fitzenberger, Kohn, and Wang 2006).

<sup>3</sup>Kohaut and Bellmann (1997), Bellmann, Kohaut, and Schnabel (1999), Kohaut and Schnabel (2003b, 2003a), Bispinck and Schulten (2003), Bosch (2004).

## 2 Related Literature

Empirical studies of the impact of the different bargaining regimes in Germany have become feasible with recent years' growing availability of linked employer-employee data. Based on linked data of the IAB employment statistics and the IAB establishment panel, Dustmann and Schönberg (2004) find that under collective coverage, employee turnover is higher, wage cuts occur more often, and (conditional) wages have a lower variance. Gürtzgen (2006), also using linked IAB data, reports positive wage premia for industry-level contracts in West Germany and for firm-level contracts in East Germany.

A couple of studies analyze subsamples of the German Structure of Earnings Survey (GSES, *Gehalts- und Lohnstrukturerhebung*). Using different cross sections (1990, 1995, 2001) of the manufacturing subsample for the state of Lower-Saxony, Gerlach and Stephan (2002, 2006a, 2006c) report kernel density estimates of log wage distributions for labor market regimes with and without collective and firm-level wage agreements, and estimate firm-level wage regressions. Average hourly wages paid in accordance with a collective or a firm-level agreement are higher than the average of individually negotiated wages. Yet unconditional as well as conditional wage dispersion is highest among individual contracts. Differences between regimes increased between the years 1990 and 2001. Similar results are obtained by Bechtel, Mödinger, and Strotmann (2004) based on the GSES subsample for the state of Baden-Württemberg. Multi-level regression models in Stephan and Gerlach (2003, 2005) reveal that differences in individual wages are consistent with a higher base wage in case of collective coverage. Returns to human capital—skill, experience, and tenure—as well as residual wage dispersion are lower under collective coverage. Gerlach and Stephan (2006b) note that collective agreements compress within-firm compensation schemes across occupations.

Heinbach (2006) merges the GSES subsample for Baden-Württemberg with information on the existence of opening clauses in collective agreements. When distinguishing between collective agreements with and those without opening clauses in firm-level regressions, he finds that mean wages for blue-collar workers in manufacturing are lower under opening clauses, but no significant wage differences exist for white-collar workers. Moreover, no significant differences exist regarding wage dispersion as measured by the standard deviation of wages.

In a companion paper (Fitzenberger, Kohn, and Lembcke 2007) we augment the GSES 2001 by estimates of union membership taken from Fitzenberger, Kohn, and Wang (2006) in order to simultaneously study the impacts of both collective bargaining regimes and union bargaining power as measured by net union density at an aggregate level.<sup>4</sup>

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<sup>4</sup>Net union density in homogenously defined labor market segments is estimated by average union

Collective bargaining as well as net union density significantly influence wages. Individual coverage and union density lower wages, while the firm-level share of covered employees raises wages. This result corroborates the notion that bargaining coverage and union density have distinct effects on the German wage structure (cf. Fitzenberger and Kohn 2005).

A collective agreement does not constrain a firm’s right to pay premia above the wage set in the collective contract. So actual wages may differ substantially from the contractual wage. This aspect is examined by the wage-drift literature and studies related to nominal, notional, or real wage rigidity; see, e. g., Bauer, Bonin, and Sunde (2003) and Pfeiffer (2003). Cardoso and Portugal (2005) analyze the gap between contractual and actual wages for employees covered by different types of collective agreements in Portugal.<sup>5</sup> They find that the positive effect of union strength—as measured by the share of covered employees—on the level of contractual wages is partly offset by a smaller wage cushion. So higher contractual wages in sectors with a high share of covered employees may not lead to higher actual wages by the same degree.

### 3 Data

Our study is based on the German Structure of Earnings Survey (GSES, *Gehalts- und Lohnstrukturerhebung*) 2001, a cross-sectional linked employer-employee data set containing about 850,000 employees in some 22,000 firms. Missing essentially the public sector, the GSES 2001 covers the major part of industry and private services. There are several advantages to using the GSES 2001. It is one of the largest mandatory surveys available for Germany. The sample not only includes workers in regular employment, but also employees in vocational training, marginal employment, or partial retirement schemes. In contrast to earlier GSES waves and to the IAB linked employer-employee data set (LIAB), wages are neither truncated nor censored so that lower and upper parts of the wage distribution can be analyzed precisely. Moreover, and most importantly for our study, collective bargaining coverage is recorded for each of the individuals, and not only at the firm level as, e. g., in the LIAB. GSES data are gathered from firms’ official reporting obligations. Therefore, they are more reliable than information from individual-level surveys or data not covered by duties of disclosure (Jacobebbinghaus 2002).

The GSES 2001 has only recently been made available for research. So far, analyses with GSES data have been restricted to administrative use or to regional subsamples

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membership propensities.

<sup>5</sup>Cardoso and Portugal (2005) refer to this gap as “wage cushion” (p. 877) in order to distinguish it from the notion of wage drift, which traditionally focusses on the change of the gap.

(cf. Fitzenberger and Reize (2002, 2003) and the studies cited in section 2). See Hafner (2005) and Statistisches Bundesamt (2000, 2004) for descriptions of the data set. Details on the on-site-use version employed in this study and our selection of data are provided in the appendix.

We consider male full-time, female full-time, and female part-time employees and distinguish between blue-collar and white-collar workers and between East and West Germany. Our analysis focusses on the distribution of log hourly wages in three regimes of bargaining coverage:

- CC: collective contract negotiated between an employers' association and a union.
- FC: firm-level contract negotiated between a firm and a union or a works council.
- IC: individual contracts negotiated between employer and employee.

Table 1 displays the shares of employees in the respective labor market groups covered by the different bargaining regimes. The numbers are broadly in line with those reported by other studies using different data sets, but—ranging between 28 and 61%—collective coverage rates differ considerably between different types of employees.<sup>6</sup> Coverage is generally lower in East Germany than in the West.<sup>7</sup> In comparison to females, male workers exhibit higher coverage rates among blue-collar, but lower rates among white-collar workers. Coverage among white-collar workers is usually higher than among blue-collar workers, with the notable exception of male full-time workers in West Germany. For this traditional core group we observe the highest coverage rate of 61%. Firm-level agreements are not applied as often as collective agreements, but again the share of covered employees varies between 4% and 13% across types of employees.

## 4 Wage Distributions by Bargaining Regime

### 4.1 Unconditional Distributions

Table 2 reports means and standard deviations of log hourly wages by bargaining regimes for the different labor market groups. The overall picture meets a priori expectations. However, there are noteworthy differences between groups regarding both wage levels and wage dispersion.

Average wages are in most cases highest under firm-level contracts, closely followed by collective contracts, and both FC and CC leaving individually negotiated wages behind.

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<sup>6</sup>Kohaut and Schnabel (2003a) and Schnabel (2005) report differences by industries and establishment size, respectively. However, none of these studies differentiates by labor market subgroups.

<sup>7</sup>Only for the group of female part-time employees, the East-West difference is basically negligible.

Yet there is the notable exception of male full-time white-collar workers in West Germany, for whom the average of wages set in individual contracts is highest. So even though we have excluded white-collar workers in the highest professional status category (*leitende Angestellte*), employees payed above the agreed scale rate (*außertarifliche Angestellte*) have a pronounced effect on the wage level. As expected, higher wages are paid in West Germany as compared to the East, for men as compared to women, and for full-time employees as compared to part-timers.

Overall wage dispersion is generally highest among individual contracts, but again we find diverse patterns. Considering white-collars, dispersion is higher among firm-level agreements than among collective contracts in West Germany, but the ranking is reversed in the East. In total though, differences between East and West Germany are small. Dispersion among blue-collar workers is generally lower than among white-collars. East German blue-collar workers even face lowest overall dispersion when being paid according to individual contracts.

Mean and standard deviation are only insufficient measures of the distributions if there are categorization effects leading to multiple peaks or if the different bargaining regimes have asymmetric impacts, such as predicted by a minimum-wage argument for collective wages. We therefore estimate the densities  $f_r(y_r)$  of log wages  $y_r \equiv \ln(w_r)$  in regimes  $r$  by means of nonparametric kernel density estimation:

$$\hat{f}_h(y) = \frac{1}{Nh} \sum_{i=1}^N K\left(\frac{y - y_i}{h}\right), \quad (1)$$

where  $i = 1, \dots, N$  denotes individuals and the index  $r$  is omitted for notational simplicity. We employ an Epanechnikov kernel  $K(\cdot)$  and choose the bandwidth  $h$  according to Silverman's (1986) rule of thumb.

By and large, our findings in figure 1 match those in the related literature, with densities of individual wages being located to the left of the densities of collective and firm-level agreements, and IC densities showing higher variances and more mass at the tails. For most groups, the shape of the FC density is more similar to that of CC than to the shape of the IC density. Evidence regarding the skewness of the distributions is mixed, though. We find no clear support for the hypothesis that lower wage brackets in collective and firm-level agreements form strong wage floors and compress the distribution from below. Moreover, there are important differences between labor market groups. For example, there are notable categorization effects among part-time workers with collective or firm-level contracts, as well as among full-time blue-collar women in East Germany. For these groups, the distributions show very pronounced or even multiple peaks, indicating that employees are selected into certain wage brackets which are similar across firms and



occupations.<sup>8</sup> We also find that the high average of IC wages among the large group of male white-collar workers in West Germany is supported by a less clear-cut mode and relatively high mass in the upper half of the distribution, even though there is also a long left tail.

In order to approach the nature of wage dispersion underlying the observed distributions, we decompose the variance of log hourly wages for each regime into within and between-firm effects:

$$\sum_{j=1}^J \sum_{i=1}^{N_j} (y_{ij} - \bar{y})^2 = \sum_{j=1}^J \sum_{i=1}^{N_j} (y_{ij} - \bar{y}_j)^2 + \sum_{j=1}^J N_j (\bar{y}_j - \bar{y})^2, \quad (2)$$

where  $y_{ij}$  denotes the log hourly wage of individual  $i$  in firm  $j$ ,  $\bar{y}_j$  the mean log hourly wage in firm  $j$ ,  $\bar{y}$  the overall mean log hourly wage, and  $N_j$  the number of employees in firm  $j$ .

The height of the bars in figure 2 recalls the level of overall dispersion discussed above. With respect to the shares of within and between-dispersion, there are generally little differences between the bargaining regimes, but considerable ones across groups. Whereas variation within and between firms both contribute equally to the dispersion among white-collar workers, blue-collar workers—and in particular those in East Germany—exhibit a disproportionately large share of between-firm effects. While highlighting again the existence of heterogeneity across groups, these findings also show the necessity to control for differences between firms as well as differences between individuals within the same firm when judging pay differentials between bargaining regimes.

## 4.2 Individual-Level Wage Regressions

In order to control for different selections of workers and firms into bargaining regimes in terms of observable characteristics, we estimate flexible individual-level wage regressions using sets of covariates fully interacted with regime indicators. As to the focus of our analysis, this approach has two advantages. First, it allows not only the base level of wages to vary between regimes, but also the effects of all covariates. Second, we can subsequently analyze the distributions of the residuals in order to shed light on differences in residual wage dispersion between the regimes.

We exploit the nature of the linked employer-employee data set and include covariates  $X_{ij}$  at the individual level, such as human capital variables (educational attainment,

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<sup>8</sup>Alternatively, the number of observations for these groups (coming down to about 500 for part-time blue-collar women in the East) might already be too small for nonparametric estimation, such that the results would reflect a statistical artefact. However, the pronounced patterns rather suggest the existence of categorization effects.

age, tenure) and workplace-related characteristics (indicators for shift-work or work on Sundays, etc.), as well as firm-level covariates  $Z_j$ , such as size and industry of the firm or average characteristics of the firm’s workforce:

$$\begin{aligned}
y_{ij} = & \alpha_0 + CC_{ij}\alpha_1 + FC_{ij}\alpha_2 + \tilde{X}_{ij}\beta_0 + CC_{ij}\tilde{X}_{ij}\beta_1 + FC_{ij}\tilde{X}_{ij}\beta_2 \\
& + \tilde{Z}_j\gamma_0 + CC_{ij}\tilde{Z}_j\gamma_1 + FC_{ij}\tilde{Z}_j\gamma_2 + \epsilon_{ij}.
\end{aligned} \tag{3}$$

As the covariates  $\tilde{X}_{ij} = X_{ij} - \bar{X}$  and  $\tilde{Z}_j = Z_j - \bar{Z}$  are included in terms of deviations from sample means, the coefficients  $\alpha_1$  and  $\alpha_2$  can be interpreted as average partial effects of collective and firm-level contracts. Estimates of these are summarized in table 4.<sup>9</sup> *Ceteris paribus*, workers covered by either a collective or a firm-level agreement earn significantly higher wages in almost all labor market groups.<sup>10</sup> Unions (or works councils) are thus more successful in bargaining for higher wages as compared to individual workers themselves.<sup>11</sup> Yet again there is a considerable degree of heterogeneity across labor market groups. Not only do the positive APEs vary in a range between 1% and 43%, but the APE of CC among male white-collar employees working full-time in West Germany is even negative by the order of 2%. Employees of this prominent group in fact receive a premium if they do not subject themselves to collective contracts. So the larger share of employees paid above the agreed scale rate (*außertarifliche Angestellte*) has a pronounced effect on the wage level net of all observable individual and firm-level controls.<sup>12</sup>

Evidence on the ranking of CC and FC premia is mainly inconclusive, but in most cases the two are close to each other. With the exception of the group of female part-time workers in East Germany—for whom the estimation is generally least precise—APEs are also similar between blue-collar and white-collar workers. However, the effects are considerably larger in East Germany than in West Germany, and for women as compared to men. Whereas the latter result reflects the fact that institutionalized wage setting reduces pay differentials in general, and gender wage gaps in particular, the former result is in line with the view that a larger number of firms in East Germany who have opted out of collective contracts in recent years, have done explicitly so in order to set lower wages.

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<sup>9</sup>We also experimented with variants of equation (3) including only individual-level covariates  $X_{ij}$ . In contrast to the presented model using the rich set of covariates, these variants could be estimated with firm-fixed effects. As it turned out, estimates do usually not differ with respect to the ranking of wages by regime. Definitions of all employed variables are provided in table 3. Complete regression results are available from the authors upon request.

<sup>10</sup>Only a couple of FC effects with a small absolute value do not turn out significant.

<sup>11</sup>Gürtzgen (2005a, 2005b) discusses rent-sharing as a plausible explanation for related findings.

<sup>12</sup>Note again that we have excluded white-collar workers in the highest professional status category (*leitende Angestellte*); cf. section 4.1. Note further that—even though being positive—the APEs of CC and FC among male blue-collar workers in West Germany are also comparably small.

### 4.3 Residual Wage Dispersion

The residuals from individual-level wage regressions provide insights into unions' impact on residual wage dispersion, i. e., on variation remaining after individual and firm characteristics have been controlled for. In figure 3 we compare residual variances between regimes and across groups and provide decompositions into within and between-firm effects.<sup>13</sup> As expected, residual wage dispersion is considerably lower than overall dispersion and the share of between-firm variation net of observable influences is considerably smaller. There is a clear ranking between regimes, with individual contracts showing the highest residual dispersion. In contrast to the case of overall dispersion, this finding now holds for all groups, as the regressions capture the categorization effects detected above. Unions' impact on reducing wage dispersion shows in both collective and firm-level bargaining.

In general, the level of residual dispersion is lower among blue-collar workers as compared to white-collar workers, and fairly similar in East and West Germany. Yet the difference between IC dispersion on the one hand and CC and FC dispersion on the other is more pronounced in the East. Unions therefore have a larger impact in East Germany.

### 4.4 Firm-Level Wage Regressions

Finally, we compare the regimes with respect to firm-average wage levels and to wage dispersion within firms in a firm-level regression framework. We regress the average of log wages  $\bar{y}_j$  and the standard deviation of log wages  $\sigma_j$ , respectively, on a set of firm-level control variables.<sup>14</sup> This approach offers the advantage that it explicitly considers both the wage level and wage dispersion within firms.

We specify

$$\bar{y}_j = \alpha_0 + \text{SHARE\_CC}_j \alpha_1 + \text{SHARE\_FC}_j \alpha_2 + Z_j \kappa + \varepsilon_j \quad (4)$$

and

$$\sigma_j = \delta_0 + \text{SHARE\_CC}_j \delta_1 + \text{SHARE\_FC}_j \delta_2 + Z_j \lambda + \nu_j, \quad (5)$$

where  $\text{SHARE\_CC}_j$  and  $\text{SHARE\_FC}_j$  denote the share of workers in firm  $j$  covered by collective and firm-level agreements, respectively.

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<sup>13</sup>We use the residuals from individual wage regressions estimated separately for the three regimes. Note that the asymptotic distribution of residuals does not reveal any skewness or kurtosis effects by construction. Residual kernel density estimates reported in figure 4 corroborate this notion.

<sup>14</sup>We include shares for variables which are discrete at the individual level, and mean values for continuous ones.

The results in table 5 reveal significant mark-ups for both collective and firm-level bargaining coverage. Differences between collective and firm-level agreements are of minor importance, but again there is notable heterogeneity across groups. For example, a change from zero to full CC (FC) coverage would increase wages by 2% (3%) for male blue-collar workers in West Germany, but by 24% (22%) for part-time working white-collar women in the East. The effects are considerably larger in East Germany than in West Germany, for women as compared to men, and for white-collar workers compared to blue-collar workers.

The impacts measured at the firm level thus coincide with the impacts estimated at the individual level for most labor market groups. However, the firm-level regressions are not sufficient for detecting—in particular—the subtle differences for the group of male white-collar workers in West Germany because they do not capture selection effects to the same degree. As not only firms take the decision whether to apply collective contracts at all, but also individuals within firms select themselves based on their personal characteristics, it is in fact important to consider the individual level (cf. Fitzenberger, Kohn, and Lembcke 2007).

Regarding firm-level wage dispersion, both collective and firm-level coverage show negative signs, even though only the effects for male blue-collar workers turn out significant. Being in line with the patterns revealed above, these results meet a priori expectations.

## 5 Concluding Remarks

This paper studies the wage structure in three wage-setting regimes prevalent in the German system of industrial relations. Using newly available linked employer-employee data from the German Structure of Earnings Survey (GSES) 2001, we look at various groups in the labor market in order to analyze unions' impact through collective and firm-level bargaining on the structure of wages.

By and large, our findings meet a priori expectations. The impact of wage bargaining mainly works towards a higher wage level and reduced overall, firm-level, and residual wage dispersion. Yet there is no clear evidence for disproportionate wage compression from below or wage floors formed by collectively bargained low wage brackets which would operate as minimum wages for different groups of workers. Moreover, we detect considerable heterogeneity in the impacts across different labor market groups as well as subtle differences between individual and firm-level evidence. As a robust result, the effects of wage bargaining are stronger in East Germany as compared to the West, and for women as compared to men. On average, male white-collar workers in West Germany earn highest wages when not covered by a collective contract.

There is a number of interesting issues for future research arising from our analysis. First of all, differences regarding the returns to human capital and other individual and firm-level characteristics should be analyzed in order to answer the question who gains most from collective bargaining. Second, the choice of a bargaining regime is clearly endogenous. Selection of individuals driven by observable characteristics would contribute to explaining the revealed differences between individual and firm-level evidence. However, it is not possible to control for selection based on unobservable individual or match-specific effects, and therefore the results should be taken as descriptive rather than causal. As finding valid instruments for collective coverage generally proves intricate, using a matching technique as in Card and de la Rica (2006) would be a promising approach. Third, as the GSES wave 1995 is scheduled to be made available for research, future studies might take account of variations over time. Fourth, applying quantile regressions as in Fitzenberger, Kohn, and Lembcke (2007) or Bechtel (2006) would promise additional insights. Fifth, and finally, unions' impacts on the structure of wages and on employment should be analyzed simultaneously.

Table 1: Wage-Setting Regimes: Coverage Shares and Sample Sizes

White-Collar						
regime	Male Full-T. West	Male Full-T. East	Female Full-T. West	Female Full-T. East	Female Part-T. West	Female Part-T. East
CC	0.505	0.363	0.557	0.437	0.518	0.506
FC	0.062	0.092	0.056	0.084	0.041	0.065
IC	0.433	0.545	0.387	0.479	0.441	0.429
N	148.909	21.515	80.361	20.364	41.704	7.175
Blue-Collar						
regime	Male Full-T. West	Male Full-T. East	Female Full-T. West	Female Full-T. East	Female Part-T. West	Female Part-T. East
CC	0.605	0.324	0.524	0.282	0.409	0.386
FC	0.081	0.066	0.103	0.130	0.074	0.073
IC	0.314	0.610	0.373	0.588	0.517	0.541
N	214.988	54.342	34.385	13.057	35.827	6.990

Shares of employees covered by different regimes, accounting for sampling weights. Numbers of observations by labor market groups. Data source: GSES 2001.

Table 2: Wage Level and Dispersion by Wage-Setting Regimes

White-Collar												
regime	Male Full-T. West		Male Full-T. East		Female Full-T. West		Female Full-T. East		Female Part-T. West		Female Part-T. East	
	mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.
CC	3.001	0.296	2.808	0.297	2.722	0.289	2.567	0.300	2.601	0.347	2.365	0.326
FC	2.990	0.341	2.764	0.270	2.756	0.298	2.656	0.261	2.704	0.365	2.463	0.374
IC	3.045	0.391	2.675	0.398	2.660	0.383	2.284	0.361	2.363	0.496	1.992	0.388
total	3.019	0.345	2.734	0.355	2.700	0.332	2.453	0.359	2.505	0.438	2.209	0.409
Blue-Collar												
regime	Male Full-T. West		Male Full-T. East		Female Full-T. West		Female Full-T. East		Female Part-T. West		Female Part-T. East	
	mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.
CC	2.686	0.222	2.443	0.241	2.451	0.238	2.250	0.268	2.229	0.273	1.987	0.349
FC	2.704	0.247	2.407	0.278	2.497	0.225	2.392	0.316	2.539	0.268	2.420	0.337
IC	2.505	0.264	2.187	0.239	2.253	0.247	1.951	0.248	2.063	0.295	1.766	0.314
total	2.632	0.253	2.298	0.273	2.385	0.260	2.104	0.321	2.178	0.319	1.925	0.393

Log gross hourly wages (Euro) and corresponding standard deviations. Data source: GSES 2001.

Table 3: Definition of Variables

Label	Description
Individual Level	
AGE	Age in years/10.
AGESQ	AGE squared.
TENURE	Tenure in years/10.
TENURESQ	TENURE squared.
LOW_EDUC	Low level of education: no training beyond a school degree (or no school degree at all).
MED_EDUC	Intermediate level of education: vocational training.
HIGH_EDUC	High level of education: university or technical college degree.
NA_EDUC	Missing information on the level of education.
BC_STAT1	Blue-collar worker, professional status category 1: vocationally trained or comparably experienced worker with special skills and highly involved tasks.
BC_STAT2	Blue-collar worker, professional status category 2: vocationally trained or comparably experienced worker.
BC_STAT3	Blue-collar worker, professional status category 3: worker trained on-the-job.
BC_STAT4	Blue-collar worker, professional status category 4: laborer.
WC_STAT2	White-collar worker, professional status category 2: executive employee with limited procuration.
WC_STAT3	White-collar worker, professional status category 3: employee with special skills or experience who works on his own responsibility on highly involved or complex tasks.
WC_STAT4	White-collar worker, professional status category 4: vocationally trained or comparably experienced employee who works autonomously on involved tasks.
WC_STAT5	White-collar worker, professional status category 5: vocationally trained or comparably experienced employee working autonomously.
WC_STAT6	White-collar worker, professional status category 6: employee working on simple tasks.
NIGHT	Individual worked night shifts.
SUNDAY	Individual worked on Sundays or on holidays.
SHIFT	Individual worked shift.
OVERTIME	Individual worked overtime.
Firm Level	
S_FEM	Share of female employees.
S_AGE1	Share of employees of age 20 or younger.
S_AGE2	Share of employees of age 21–25.
S_AGE3	Share of employees of age 26–30.
S_AGE4	Share of employees of age 31–35.
S_AGE5	Share of employees of age 36–40.
S_AGE6	Share of employees of age 41–45.
S_AGE7	Share of employees of age 46–50.
S_AGE8	Share of employees of age 51–55.
S_AGE9	Share of employees of age 56–60.
S_AGE10	Share of employees of age 61 or older.
S_TENURE1	Share of employees with less than 1 year of tenure.
S_TENURE2	Share of employees with 1–2 years of tenure.
S_TENURE3	Share of employees with 3–5 years of tenure.
S_TENURE4	Share of employees with 6–10 years of tenure.
S_TENURE5	Share of employees with 11–15 years of tenure.

*Continued on next page...*



... table 3 continued

Label	Description
S_TENURE6	Share of employees with 16–20 years of tenure.
S_TENURE7	Share of employees with 21–25 years of tenure.
S_TENURE8	Share of employees with 26–30 years of tenure.
S_TENURE9	Share of employees with 31 or more years of tenure.
S_LOW_EDUC	Share of employees with LOW_EDUC.
S_MED_EDUC	Share of employees with MED_EDUC.
S_HIGH_EDUC	Share of employees with HIGH_EDUC.
S_NA_EDUC	Share of employees with NA_EDUC.
HOURSWORKED	Average hours worked in the firm.
S_IRREG	Share of employees for whom any of NIGHT, SUNDAY, or SHIFT applies.
S_OVERTIME	Share of employees working overtime.
S_BC	Share of blue-collar workers.
S_NOT_FT	Share of employees who do not work full-time.
FIRMSIZE1	Firm has between 10 and 49 employees.
FIRMSIZE2	Firm has between 50 and 249 employees.
FIRMSIZE3	Firm has between 250 and 499 employees.
FIRMSIZE4	Firm has between 500 and 999 employees.
FIRMSIZE5	Firm has between 1000 and 1999 employees.
FIRMSIZE6	Firm has 2000 or more employees.
SECTOR1	Mining and quarrying (NACE: 10–14)
SECTOR2	Manufacture of food products, beverages and tobacco (NACE: 15–16)
SECTOR3	Manufacture of textiles and textile products; leather and leather products (NACE: 17–19)
SECTOR4	Manufacture of wood and wood products; pulp, paper and paper products (NACE: 20–21)
SECTOR5	Publishing, printing and reproduction of recorded media (NACE: 22)
SECTOR6	Manufacture of coke, refined petroleum products and nuclear fuel; chemicals and chemical products (NACE: 23–24)
SECTOR7	Manufacture of rubber and plastic products (NACE: 25)
SECTOR8	Manufacture of other non-metallic mineral products (NACE: 26)
SECTOR9	Manufacture of basic metals; fabricated metal products, except from machinery and equipment (NACE: 27–28)
SECTOR10	Manufacture of machinery and equipment n.e.c. (NACE: 29)
SECTOR11	Manufacture of electrical machinery and apparatus n.e.c. (NACE: 31)
SECTOR12	Manufacture of electrical and optical equipment; radio, television, and communication equipment and apparatus (NACE: 30 + 32)
SECTOR13	Manufacture of medical, precision and optical instruments, watches and clocks (NACE: 33)
SECTOR14	Manufacture of transport equipment (NACE: 34–35)
SECTOR15	Manufacture n.e.c. (NACE: 36–37)
SECTOR16	Electricity, gas and water supply (NACE: 40–41)
SECTOR17	Construction (NACE: 45)
SECTOR18	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel (NACE: 50)
SECTOR19	Wholesale trade and commission trade except of motor vehicles and motorcycles (NACE: 51)
SECTOR20	Retail trade, except from motor vehicles and motorcycles; repair of personal and household goods (NACE: 52)
SECTOR21	Hotels and restaurants (NACE: 55)
SECTOR22	Land transport; transport via pipelines; air transport (NACE: 60 + 62)
SECTOR23	Water transport (NACE: 61)

Continued on next page...

... table 3 continued

Label	Description
SECTOR24	Supporting and auxiliary transport activities; activities of travel agencies (NACE: 63)
SECTOR25	Post and telecommunications (NACE: 64)
SECTOR26	Financial intermediation, except from insurance and pension funding; activities auxiliary to financial intermediation, except from insurance and pension funding (NACE: 65 + 67.1)
SECTOR27	Insurance and pension funding, except compulsory social security; activities auxiliary to insurance and pension funding (NACE: 66 + 67.2)
SECTOR28	Real estate activities; renting of machinery and equipment without operator and of personal and household goods (NACE: 70–71)
SECTOR29	Computer and related activities (NACE: 72)
SECTOR30	Research and development; other business activities (NACE: 73–74)
PUBLIC1	Firm is privately owned.
PUBLIC2	Firm is partly public-owned (<50%).
PUBLIC3	Firm is mainly public-owned (>50%).
REGION1	Firm is located in Schleswig-Holstein or Hamburg.
REGION2	Firm is located in Lower Saxony or Bremen.
REGION3	Firm is located in North Rhine-Westphalia.
REGION4	Firm is located in Hesse.
REGION5	Firm is located in Rhineland-Palatinate or Saarland.
REGION6	Firm is located in Baden-Württemberg.
REGION7	Firm is located in Bavaria.
REGION9	Firm is located in Brandenburg or Mecklenburg-West Pomerania.
REGION10	Firm is located in Saxony.
REGION11	Firm is located in Saxony-Anhalt.
REGION12	Firm is located in Thuringia.

Data source: GSES 2001.

Table 4: Individual-Level Wage Regressions

White-Collar												
regime	Male Full-T. West		Male Full-T. East		Female Full-T. West		Female Full-T. East		Female Part-T. West		Female Part-T. East	
	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.
CC	-0.020**	(0.005)	0.073**	(0.011)	0.050**	(0.005)	0.137**	(0.012)	0.135**	(0.011)	0.277**	(0.020)
FC	-0.011	(0.009)	0.011	(0.015)	0.071**	(0.009)	0.134**	(0.016)	0.167**	(0.016)	0.425**	(0.034)
Blue-Collar												
regime	Male Full-T. West		Male Full-T. East		Female Full-T. West		Female Full-T. East		Female Part-T. West		Female Part-T. East	
	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.
CC	0.010*	(0.005)	0.095**	(0.011)	0.112**	(0.009)	0.145**	(0.019)	0.117**	(0.012)	0.149**	(0.032)
FC	0.008	(0.010)	0.014	(0.015)	0.098**	(0.013)	0.162**	(0.020)	0.089**	(0.026)	0.022	(0.057)

Log gross hourly wages. Average partial effects of collective and firm-level contracts estimated by OLS regressions including full sets of individual- and firm-level covariates, interacted with regime indicators, and accounting for sampling weights. (Firm-level) clustered standard errors in parentheses. \* / \*\* indicate significance at 5% / 1% level. Data source: GSES 2001.

Table 5: Firm-Level Regressions

<b>Mean Log Hourly Wage</b>												
	Male Full-T. West		Male Full-T. East		Female Full-T. West		Female Full-T. East		Female Part-T. West		Female Part-T. East	
White-Collar	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.
CC	0.066**	(0.005)	0.198**	(0.011)	0.099**	(0.005)	0.216**	(0.011)	0.113**	(0.008)	0.241**	(0.021)
FC	0.061**	(0.007)	0.154**	(0.018)	0.102**	(0.008)	0.187**	(0.018)	0.115**	(0.015)	0.217**	(0.041)
Blue-Collar												
CC	0.021**	(0.004)	0.100**	(0.009)	0.079**	(0.007)	0.152**	(0.013)	0.092**	(0.008)	0.191**	(0.022)
FC	0.037**	(0.007)	0.080**	(0.016)	0.078**	(0.012)	0.113**	(0.024)	0.108**	(0.015)	0.159**	(0.035)
<b>Std. Dev. Log Hourly Wage</b>												
	Male Full-T. West		Male Full-T. East		Female Full-T. West		Female Full-T. East		Female Part-T. West		Female Part-T. East	
White-Collar	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.
CC	-0.004	(0.003)	0.001	(0.007)	-0.003	(0.004)	-0.010	(0.008)	-0.005	(0.008)	-0.006	(0.022)
FC	-0.008	(0.005)	0.001	(0.011)	-0.020**	(0.006)	-0.019	(0.011)	-0.014	(0.012)	-0.040	(0.030)
Blue-Collar												
CC	-0.014**	(0.002)	-0.011**	(0.003)	-0.010*	(0.004)	-0.009	(0.006)	-0.005	(0.006)	-0.013	(0.015)
FC	-0.006	(0.003)	-0.009	(0.005)	-0.004	(0.007)	-0.008	(0.009)	0.024	(0.012)	0.000	(0.027)

Partial effects of collective and firm-level contracts, estimated by OLS regressions including full sets of firm-level covariates, accounting for sampling weights.

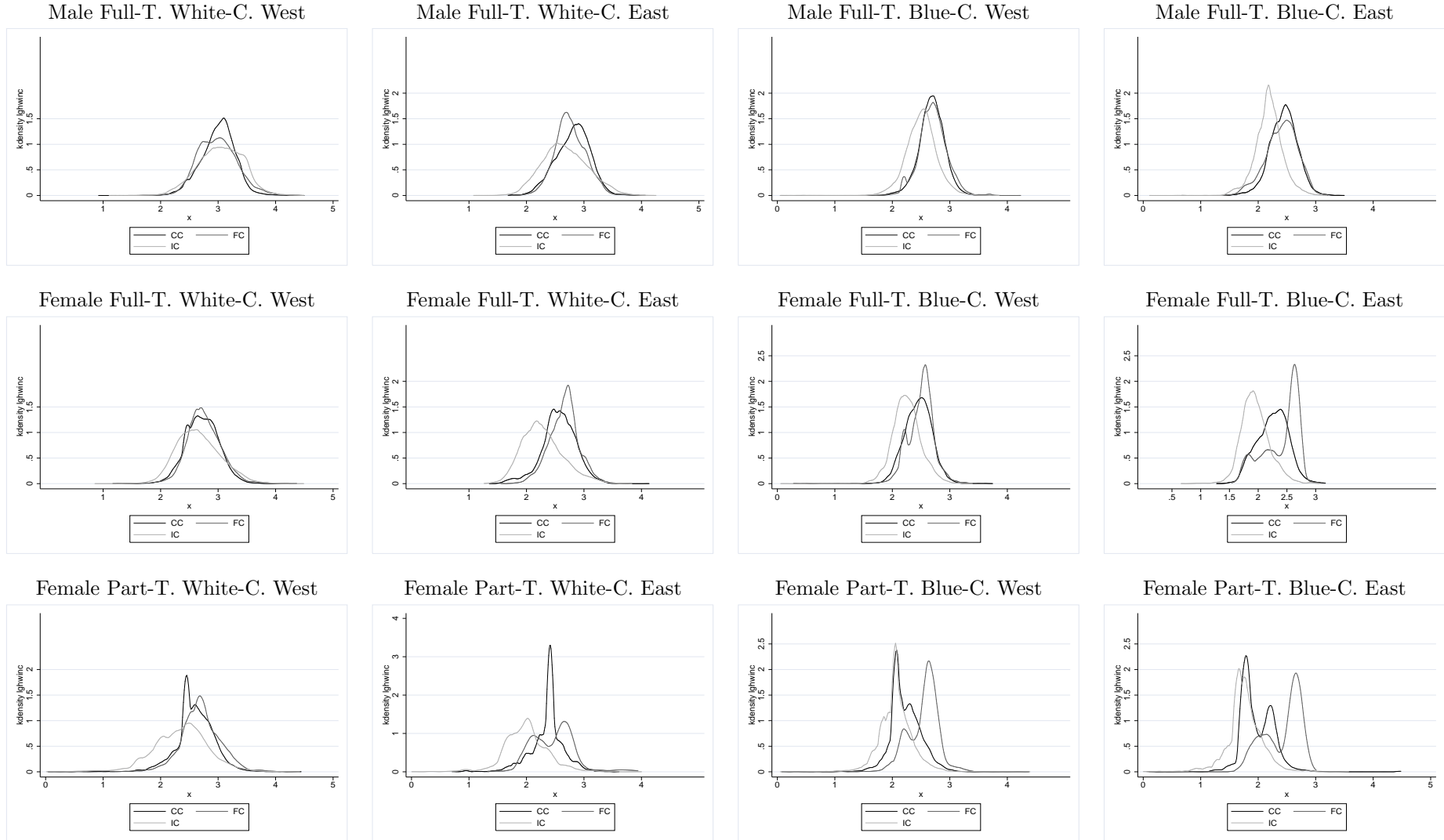
Robust standard errors in parentheses. \* / \*\* indicate significance at 5% / 1% level. Data source: GSES 2001.

Table 6: Sectors Sampled with the GSES 2001

NACE	Sector	European Regulation	German Law	Data
C-F	Industry	yes	yes	yes
G	Wholesale and Retail Trade	yes	yes	yes
H	Hotels and Restaurants	yes	no	yes
I	Transport, Storage and Communication	yes	no	yes
J	Financial Intermediation	yes	yes	yes
K	Real Estate, Renting and Business Activities	yes	no	yes
M	Education	opt	no	no
N	Health and Social Work	opt	no	no
O	Other Community, Social, and Personal Service Activities	opt	no	no

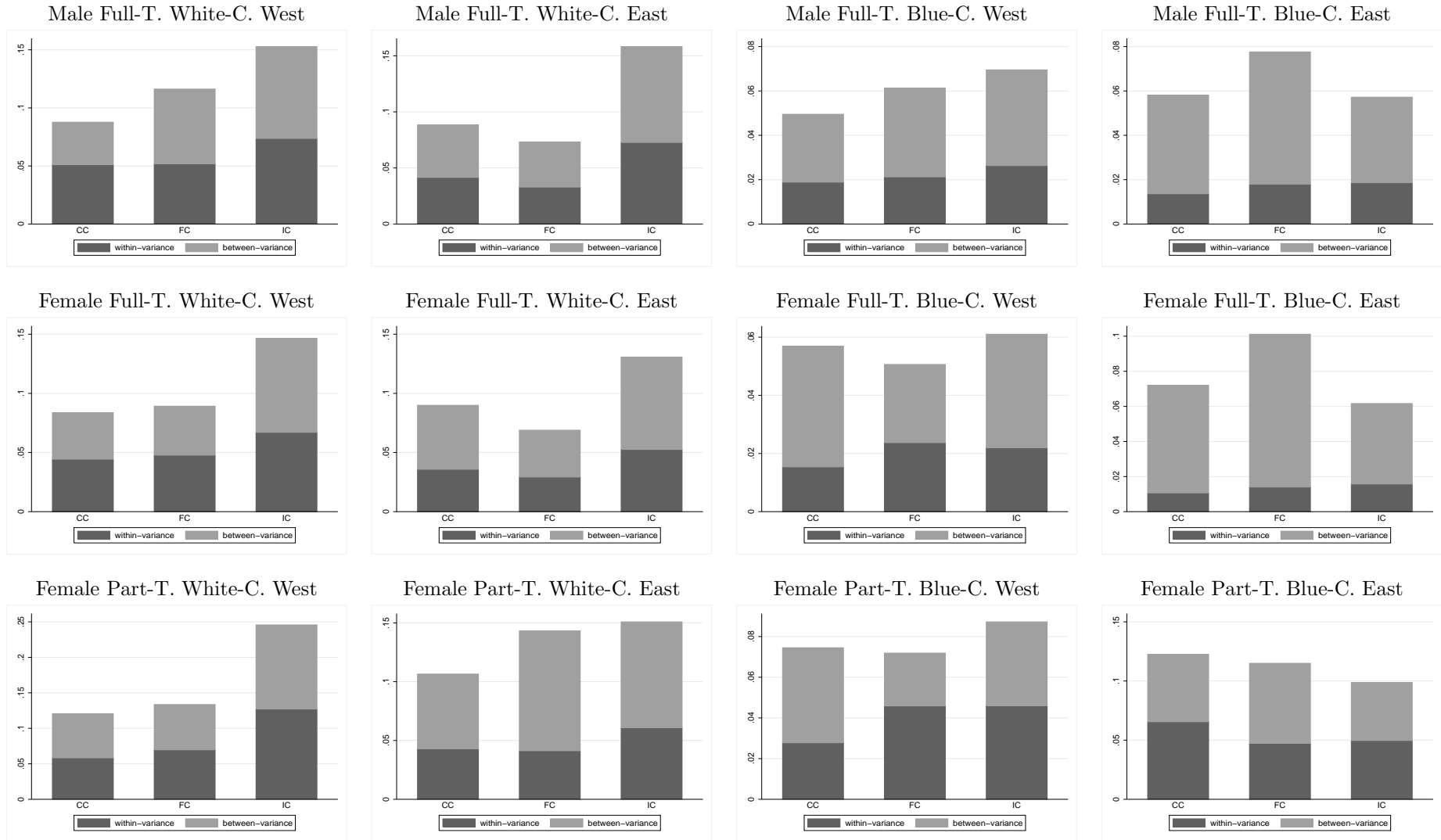
yes: required sector; no: sector to be left out; opt: inclusion of sector optional.  
Sectors not mentioned are excluded under both regulations.

Figure 1: Unconditional Wage Distributions



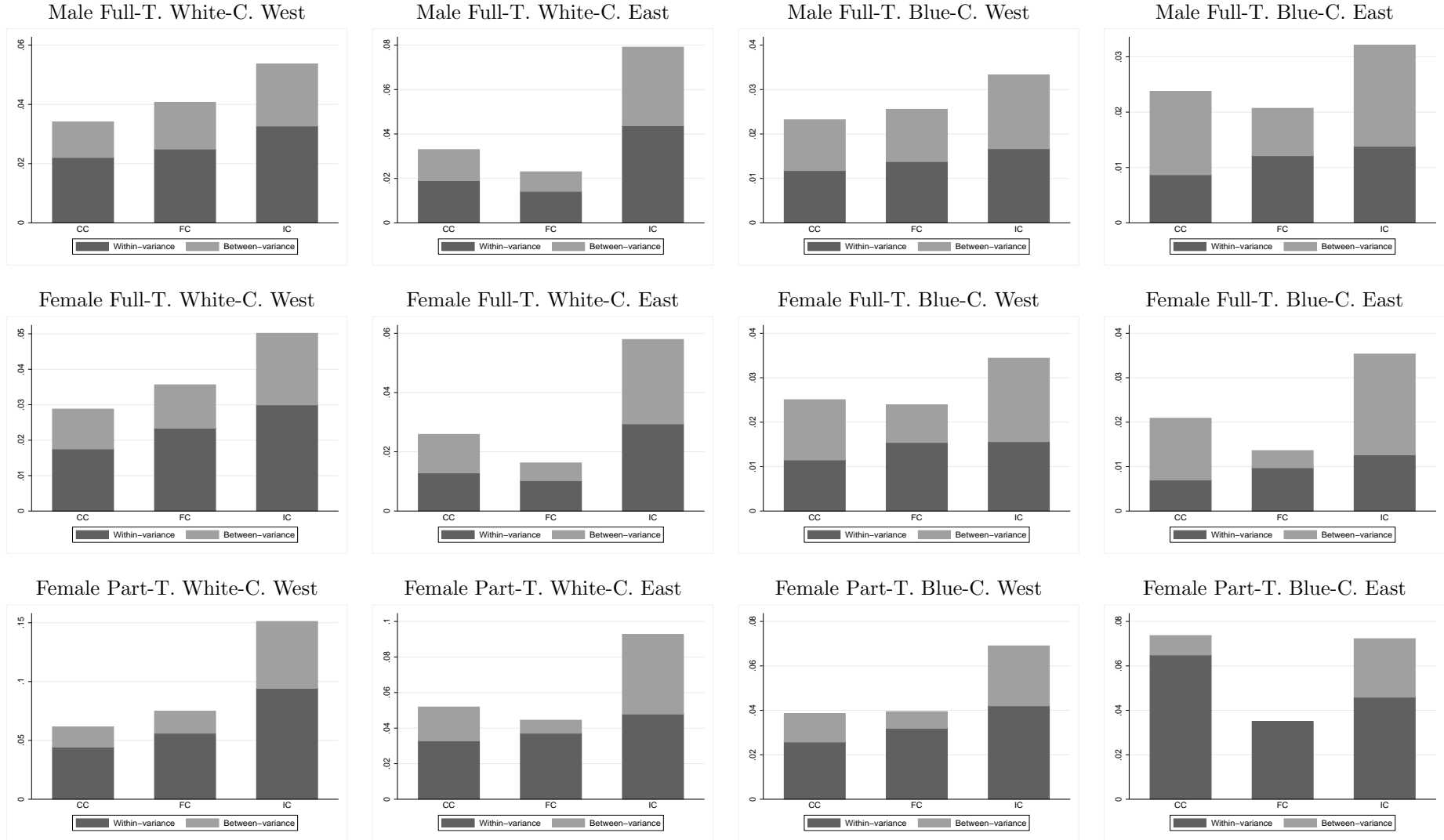
Kernel density estimates: log gross hourly wages. Data source: GSES 2001.

Figure 2: Unconditional Variance Decompositions



Variance decomposition: log gross hourly wages. Data source: GSES 2001.

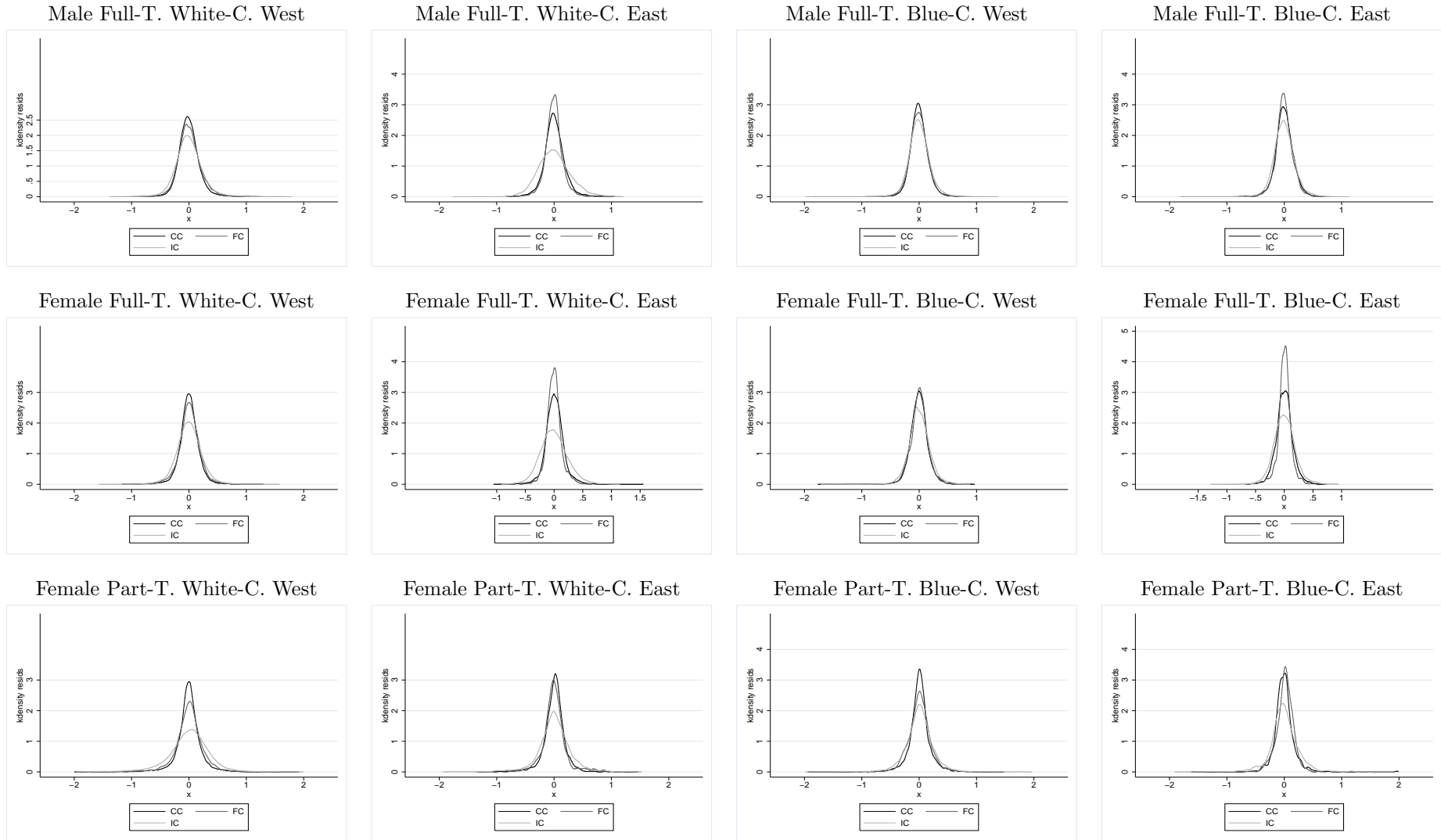
Figure 3: Residual Variance Decompositions



Variance decomposition: residuals from individual-level wage regressions. Data source: GSES 2001.



Figure 4: Residual Wage Distributions



Kernel density estimates: Residuals from individual-level wage regressions. Data source: GSES 2001.

## A German Structure of Earnings Survey 2001

The German Structure of Earnings Survey (GSES, *Gehalts- und Lohnstrukturerhebung*) 2001 is a linked employer-employee data set administered by the German Statistical Office subject to European law (European Council Regulation (EC) No 530/1999, amended by EC 1916/2000) as well as to German law (Law on Wage Statistics, *LohnStatG*). It is a sample of all firms in manufacturing and private service sectors with at least ten employees; see table 6 for a synopsis of sectors sampled. Sampling takes place at the firm or establishment level.<sup>15</sup> At a first stage, firms are randomly drawn at the Federal State level, where the sampling probability varies between 5.3% for the largest state (North Rhine-Westphalia) and 19.4% for the smallest (Bremen). Following a procedure for comparable precision, the resulting standard deviation of gross wages in the smallest Federal State is about twice the standard deviation in the largest State; see Krug, Nourney, and Schmidt (2001) and Statistisches Bundesamt (2004). At the second stage, employees are randomly chosen from the firms sampled at the first stage. The share of employees sampled depends upon the firm size and ranges between 6.25% for the largest firms and 100% for firms with less than 20 employees. The data set provides sampling weights.

The GSES 2001 is available for on-site use at Research Centers of the Federal States' Statistical Offices (FDZ) since the year 2005. This study uses an anonymized use-file which includes all firms and employees from the original data except for one firm in Berlin (the only firm in Berlin falling into NACE section C). Regional information is condensed to 12 "states", and some industries have been aggregated at the two-digit level. Overall, the use-file consists of 22,040 sites with 846,156 sampled employees.

We focus on employees aged 16–65 years. Employees in vocational training, interns, and employees subject to partial retirement schemes are left out because compensation for these groups does not follow the regular compensation schedule, but special regulations or even special collective bargaining agreements do apply. We also exclude white-collar workers in the highest professional status category (category 1) who can reasonably be expected to pursue management objectives and whose wages are hardly in the focus of collective wage setting. Individuals who worked less than 90% of their contractual working hours in October 2001 and individuals paid subject to a collective contract with a missing identification number for the agreement are dropped. Part-time and full-time employees are distinguished based on the employer's assessment recorded in the GSES. For blue-collar workers, actual working time and not contractual working time is relevant for monthly payments. We exclude individuals with an actual working time of more than 390 hours in October 2001. We analyze gross hourly wages including premia. This

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<sup>15</sup>Throughout this paper, we use the terms firm, establishment, and company site synonymously.

measure is more appropriate than wages without premia if premia are paid on a regular basis. A lower bound of one euro is imposed for hourly wages.

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