Appendix

Trade unions, bargaining coverage and low pay: a multilevel test of institutional effects on low-pay risk in Germany

Contents

A1. Variable creation and description

A1.1. Dependent variable

Figure A1.1.1: Histogram wages (salary from main job)
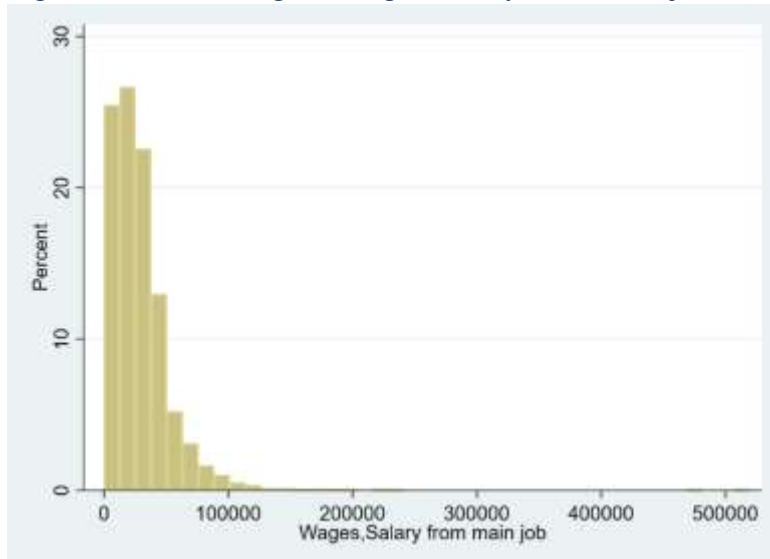
Figure A1.1.2: Histogram weekly actual working time
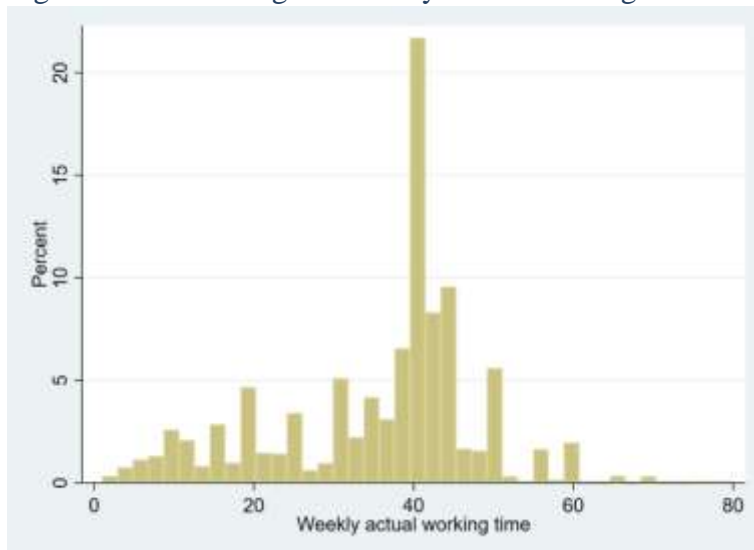
Table A1.1.1: Tabulation low pay dummy

Hourly pay	Frequency	Percentage
No	9,999	75.26
Yes	3,287	24.74

Figure A1.1.3: Histogram vacation bonus
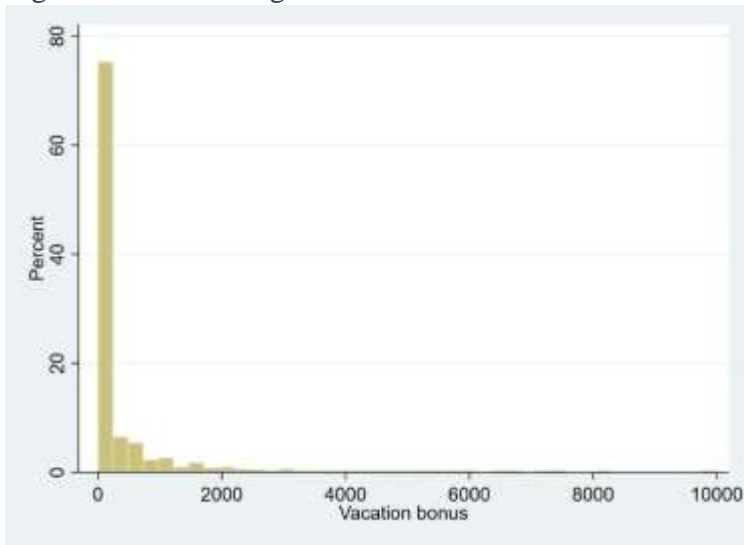
Figure A1.1.4: Histogram Christmas bonus
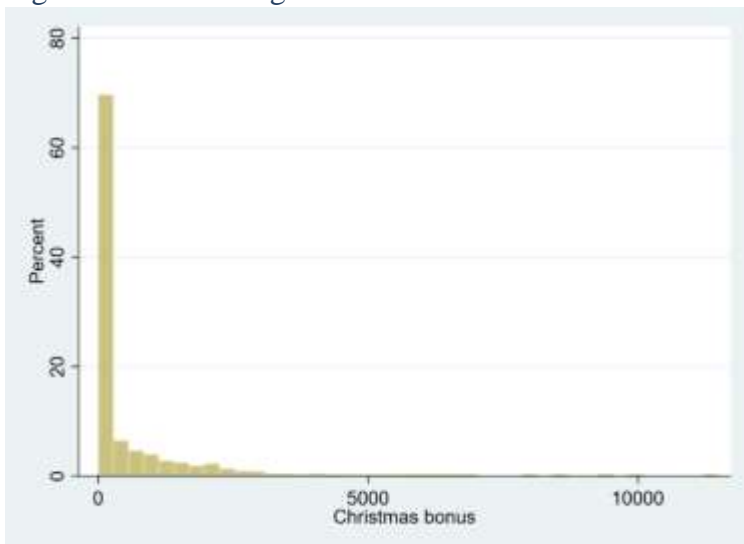
Figure A1.1.5: Histogram other bonus
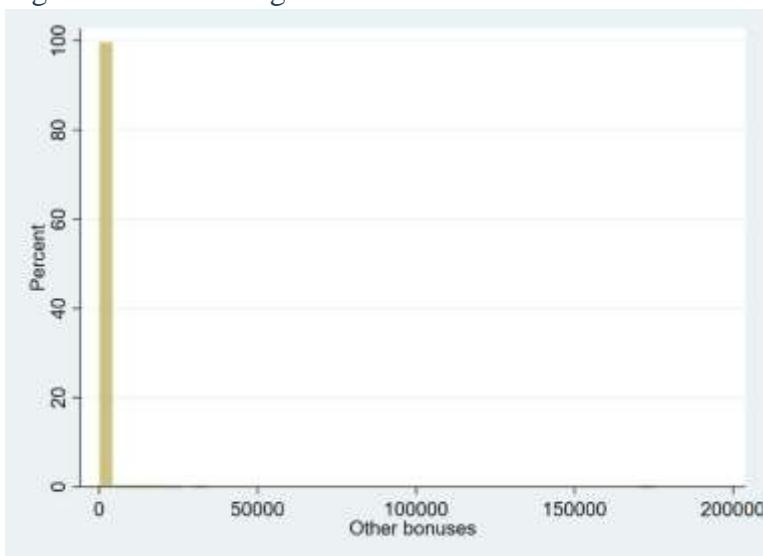
Table A1.1.2: Tabulation low pay dummy including bonus

Hourly low pay (with bonus)	Frequency	Percentage
No	10,073	75.82
Yes	2,313	24.18

A1.2. Independent variables

Figure A1.2.1. Individual union membership (0 – No; 1 – Yes)
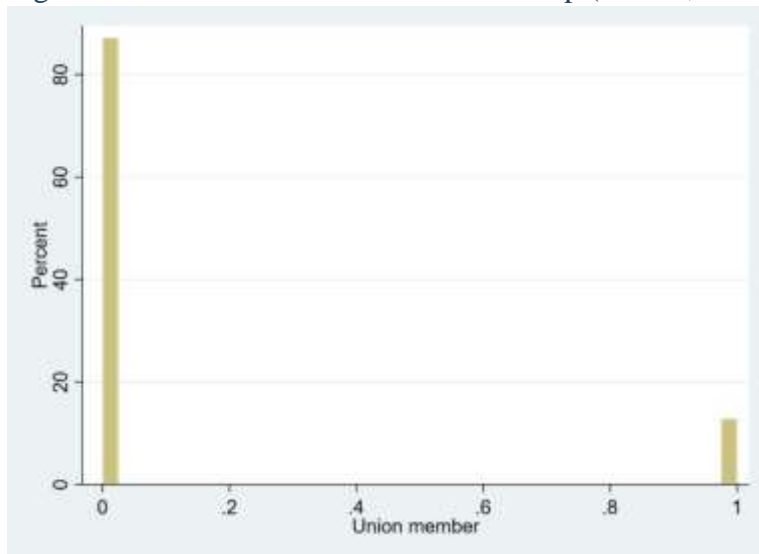
Figure A1.2.2. Individual covered by sectoral agreement (0 – No; 1 – Yes)
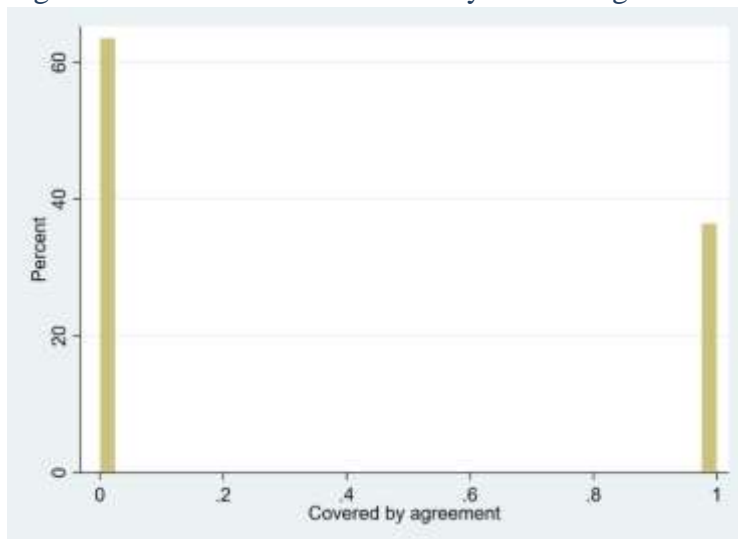
Figure A1.2.3. Individual covered by sectoral or company agreement (0 – No; 1 – Yes)
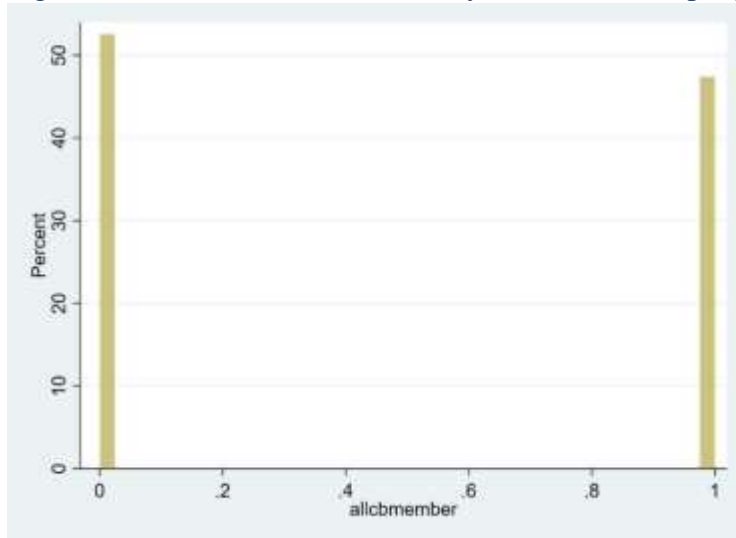
Figure A1.2.4. Sectoral level union density
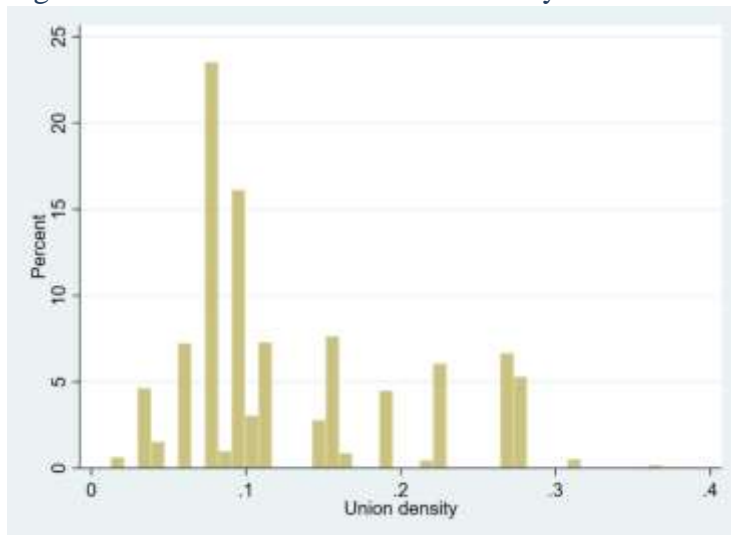
Figure A1.2.5. Sectoral level bargaining coverage of sectoral agreements
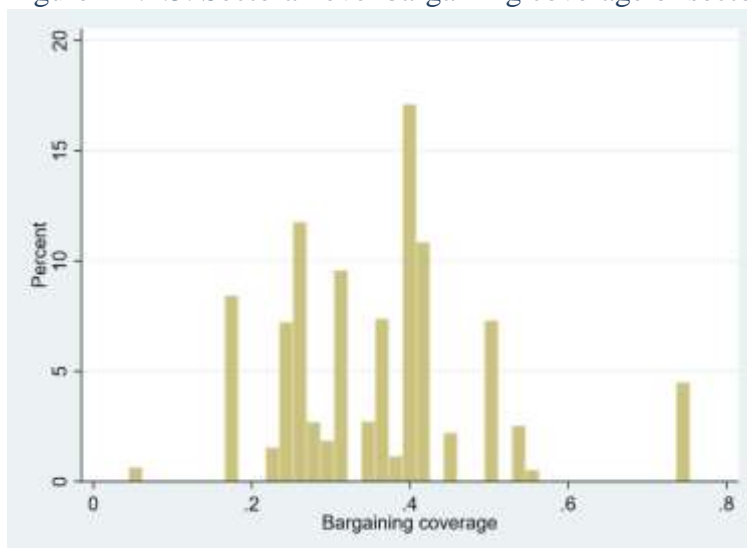
Figure A1.2.6. Sectoral level bargaining coverage of sectoral and company agreements
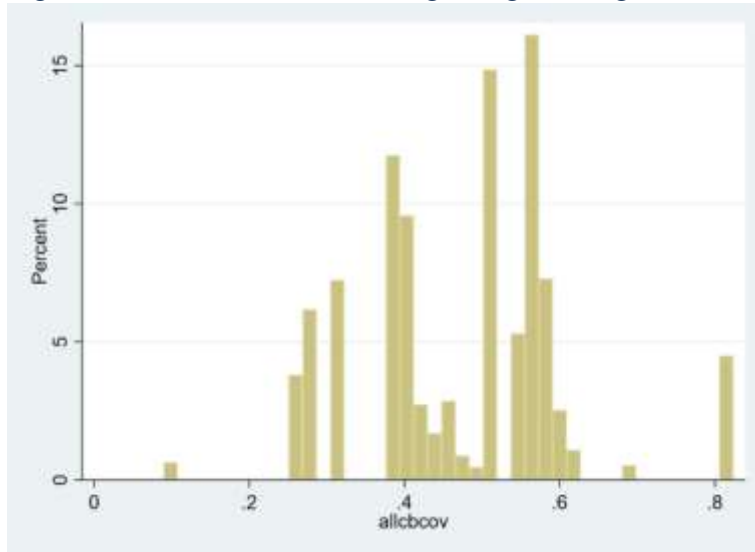
Table A1.2.1. Tabulation of union membership and sector

Sector identifier	Non-union member	Union member
1 AgricFor&Fisheries	1.698	0.560
2 EnergyWater	1.092	1.307
3 Mining	0.110	0.436
4 Chemicals	1.864	4.543
5 Synthetics	0.863	1.120
6 EarthClayStone	0.395	0.747
7 IronSteel	3.773	9.210
8 Mech	3.663	4.605
9 Electr	2.561	3.298
10 WoodPaperPrint	1.652	1.929
11 Textile	0.551	0.436
12 Food	2.892	1.556
13 Construction	5.609	3.360
14 Constr Rel	4.416	11.51
15 Wholesale	12.38	7.405
16 Other Trans.	5.462	10.64
17 Finance	2.580	1.929
18 Insurance	1.019	0.685
19 Restaurants	5.260	1.307
20 Services	7.812	3.485
21 Trash Removal	0.725	0.0622
22 EducSport	7.326	6.534
23 Health	16.63	11.89
24 Other services	3.993	2.178
25 Volunt Church	1.092	1.369
26 Priv Household	0.431	1.307
27 PA	4.149	6.596

Table A1.2.2. Tabulation of union membership and gender

Union member	Male	Female
No	83.53	90.48
Yes	16.47	9.520

Table A1.2.3. Tabulation of union membership and firm size

Union member	Firm size under 100	Between 100 and 200	Above 200
No	94.35	88.33	79.92
Yes	5.65	11.67	20.08

Table A1.2.4. Tabulation of union membership and age

Union member	Under 25	25-34	35-44	45-54	55-64
No	94.91	91.42	89.85	84.44	79.49
Yes	5.087	8.585	10.15	15.56	20.51

Table A1.2.5. Tabulation of individual bargaining coverage

Individual agreement:	Frequency	Percentage
No agreement	6,029	52.57
Only firm agreement	1,259	10.98
Only sector agreement	4,180	36.45

Table A1.2.6. Tabulation of individual bargaining coverage and age

Age below	Type of agreement right	No agreement	Company agreement	Sector agreement	Total
Under 25	Frequency	333	61	139	533
Under 25	Percentage	62.48	11.44	26.08	
25-34	Frequency	1,148	237	733	2,118
25-34	Percentage	54.20	11.19	34.61	
35-44	Frequency	1,794	357	1,202	3,353
35-44	Percentage	53.50	10.65	35.85	
45-54	Frequency	1,822	411	1,341	3,574
45-54	Percentage	50.98	11.50	37.52	
55-64	Frequency	904	184	751	1,839
55-64	Percentage	49.16	10.01	40.84	

Table A1.2.7. Tabulation of individual bargaining coverage and union membership

Union member	Type of agreement right	No agreement	Company agreement	Sector agreement	Total
No	Frequency	5,411	1,000	3,225	9,636
No	Percentage	56.15	10.38	33.47	
Yes	Frequency	419	230	869	1,518
Yes	Percentage	27.60	15.15	57.25	

Note: this table shows row percentages, e.g. 5,411 divided by 9,636 is 56.15%, 1,000 out of 9,636 represents 10.38%, and so on. For cell percentages, please see table 1 in the manuscript.

Table A1.2.8. Tabulation of individual bargaining coverage and gender

Gender	Type of agreement right	No agreement	Company agreement	Sector agreement	Total
Male	Frequency	2,974	620	1,979	5,573
Male	Percentage	53.36	11.13	35.51	
Female	Frequency	3,055	639	2,201	5,895
Female	Percentage	51.82	10.84	37.34	

Table A1.2.9. Tabulation of individual bargaining coverage and firm size

Firm size employees	Type of agreement	No agreement	Firm level agreement	Sector agreement	Total
Under 100	Frequency	3,380	386	1,110	4876
Under 100	Percentage	69.32	7.916	22.76	
100-200	Frequency	523	137	384	1,044
100-200	Percentage	50.10	13.12	36.78	
Above 200	Frequency	2,080	725	2,651	5,456
Above 200	Percentage	38.12	13.29	48.59	

Table A1.2.10. Tabulation of individual bargaining coverage and sector

Sector number	Type of agreement	No agreement	Firm level agreement	Sector agreement	Total
1	Frequency	123	9	40	172
1	Percentage	71.51	5.233	23.26	
2	Frequency	51	27	57	135
2	Percentage	37.78	20	42.22	
3	Frequency	11	3	6	20
3	Percentage	55	15	30	
4	Frequency	135	14	122	271
4	Percentage	49.82	5.166	45.02	
5	Frequency	49	11	34	94
5	Percentage	52.13	11.70	36.17	
6	Frequency	27	7	19	53
6	Percentage	50.94	13.21	35.85	
7	Frequency	252	48	220	520
7	Percentage	48.46	9.231	42.31	
8	Frequency	275	36	144	455
8	Percentage	60.44	7.912	31.65	
9	Frequency	188	20	113	321
9	Percentage	58.57	6.231	35.20	
10	Frequency	112	29	61	202
10	Percentage	55.45	14.36	30.20	
11	Frequency	35	5	18	58
11	Percentage	60.34	8.621	31.03	
12	Frequency	153	54	79	286
12	Percentage	53.50	18.88	27.62	
13	Frequency	353	53	185	591
13	Percentage	59.73	8.968	31.30	
14	Frequency	279	84	256	619
14	Percentage	45.07	13.57	41.36	
15	Frequency	789	152	335	1,276

Sector number	Type of agreement	No agreement	Firm level agreement	Sector agreement	Total
15	Percentage	61.83	11.91	26.25	
16	Frequency	333	99	242	674
16	Percentage	49.41	14.69	35.91	
17	Frequency	127	19	171	317
17	Percentage	40.06	5.994	53.94	
18	Frequency	57	12	47	116
18	Percentage	49.14	10.34	40.52	
19	Frequency	354	44	87	485
19	Percentage	72.99	9.072	17.94	
20	Frequency	584	63	201	848
20	Percentage	68.87	7.429	23.70	
21	Frequency	61	3	3	67
21	Percentage	91.04	4.478	4.478	
22	Frequency	345	80	418	843
22	Percentage	40.93	9.490	49.58	
23	Frequency	828	290	745	1,863
23	Percentage	44.44	15.57	39.99	
24	Frequency	324	34	78	436
24	Percentage	74.31	7.798	17.89	
25	Frequency	68	16	53	137
25	Percentage	49.64	11.68	38.69	
26	Frequency	20	9	36	65
26	Percentage	30.77	13.85	55.38	
27	Frequency	96	38	410	544
27	Percentage	17.65	6.985	75.37	

A1.3. Descriptive statistics

Table A1.3.1: Variable descriptions and summary statistics

Variable name	Description	Values	N	mean	sd	min	max
Dependent variable							
Hourly low pay dummy	Hourly pay is calculated as following: hourly_pay=ijob1/(pgtatzeit*52). Being ijob1 the annual salary from main job, pgtatzeit the weekly working hours and 52 the average number of weeks in a year. If hourly pay is lower than 8.5€, which is 67% of the median hourly wage, it can be categorized as low pay	1= respondent is on a low-pay contract 0= respondent is not on a low-pay contract	12,871	0.24326	0.4290675	0	1
Individual level independent variables							
Union member	Union membership	1= union member 0= not in the union	12,500	0.129	0.335	0	1
Covered by firm agreement	Being covered by company agreements in each sector	1= being covered 0= not covered	11,468	.1097837	.3126336	0	1
Covered by sector agreement	Being covered by sectoral agreements in each sector	1= being covered 0= not covered	11,468	0.364	0.481	0	1
Covered by sector or firm agreement	Being covered by sectoral or company agreements in each sector	1= being covered 0= not covered	11,468	.4742762	.4993596	0	1

Sectoral level independent variables							
Sectoral bargaining coverage	Individual coverage by the sectoral agreement	1= covered by sectoral agreement 0= not covered by sectoral agreement	12,871	0.361	0.128	0.0448	0.754
Sectoral union density	% employees who are union members in each sector		12,871	0.129	0.0723	0.0125	0.368
Individual level controls							
Age category	Age of respondent by group	1=15-24 2=25-34 3=35-44 4=45-54 5=55-64	12,812	3.332	1.117	1	5
Occupation		1=Managers 2=Professionals 3=Technicians and Associate Professionals 4=Clerical Support workers 5=Services and Sales Workers					

		6=Skilled Agricultural, Forestry and Fishery Workers					
		7=Craft and Related Trades Workers					
		8=Plant and Machine Operators and Assemblers					
		9=Elementary Occupations					
Female dummy	Gender	1=female 0=male	12,871	0.521	0.500	0	1
Firm size	Firm size (number of employees)	1 = below 100 employees 2 = between 100 and 200 employees 3= above 200 employees	12,727	2.025	0.952	1	3
Job change dummy	How easy it is to find a new position at the same conditions	1= difficult/almost impossible 0 = easy	12,724	0.651	0.477	0	1
Job tenure	Tenure within the firm (years)		12,807	9.42	9.63	0	49.3
Nationality category	Nationality	1 =German 2 =old EU member	12,871	1.367	0.887	1	4

		States					
		3 =new EU member States					
		4 =others					
Sector	Sectoral dummies	1 Agriculture, Forestry and Fisheries	12,871	16.70531	6.406917	1	27
		2 Energy and Water					
		3 Mining					
		4 Chemicals					
		5 Synthetics					
		6 Earth, Clay and Stone					
		7 Iron and Steel					
		8 Mechanics					
		9 Electronics					
		10 Wood, Paper and Print					
		11 Textile					
		12 Food					
		13 Construction					
		14Construction-related services					
		15 Wholesale					

		16 Transportation					
		17 Finance					
		18 Insurance					
		19 Restaurants					
		20 Services					
		21 Trash Removal					
		22 Education and Sport					
		23 Health					
		24 Other services					
		25 Charities and Church					
		26 Private Household					
		27 Public Administration					
Education category	ISCED qualification	1= primary education	12,618	2.286	0.487	1	3
		2= secondary education (including VET)					
		3= tertiary education					
Part time work	Part time work	1=part time worker	12,871	.2504856	.4333095	0	1
		0=not part time worker					
Sectoral level controls							

Sectoral average female	% of female employees in each sector		12,871	0 .521	0.223	0.1567	0 .8293
Sectoral average job change	% of respondents who find it difficult to find a new position at the same conditions in each sector		12,871	.6507468	.0887763	.5253658	.95
Sectoral average hourly pay	Average pay in each sector		12,871	14.70457	3.754216	7.411175	25.33596
Sectoral average education	Average education in each sector		12,871	1.76071	.3226848	1.254438	2.432934
Geographic level control							
Eastern Germany dummy	Eastern Federal State of residence	1= Federal States which used to belong to the German Democratic Republic 0= Federal States which used to belong to the Federal Republic of Germany	12,871	0.2077	0.4057	0	1
States	Federal State of residence	1=Schleswig-Holstein 2=Hamburg 3=Lower Saxony 4=Bremen 5=North-Rhine-Westfalia	12,871	7.758838	3.746176	1	16

		6=Hessen					
		7=Rheinland-Pfalz					
		8=Baden-Wuerttemberg					
		9=Bavaria					
		10=Saarland					
		11=Berlin					
		12=Brandenburg					
		13=Mecklenburg-Vorpommern					
		14=Saxony					
		15=Saxony-Anhalt					
		16=Thuringia					

Table A1.3.2: Correlation table (correlation above 0.4 in bold)

	Education	Job tenure	Female dummy	Job change	Age	Firm size
Education	1					
Job tenure	-0.00073869	1				
Female dummy	-0.05661372	-0.0797486	1			
Job change	-0.05038926	0.22260745	-0.02364915	1		
Age	0.0454432	0.47990817	0.01057659	0.26517914	1	
Firm size	0.12534484	0.20597231	-0.09241009	0.06893411	0.045714	1
Nationality	-0.04891288	-0.21034389	-0.05177594	-0.06951351	-0.16936446	-0.05886641
Job change (sector)	0.03793465	0.20552938	-0.23759931	0.18613349	0.08005454	0.18305587
Female dummy (sector)	0.02092316	-0.09383147	0.44676825	-0.099133	-0.00770024	-0.05162505
Covered by sectoral agreement	-0.00388716	0.15775111	0.01896485	0.0524314	0.05767203	0.25521554
Sectoral bargaining coverage	0.13066653	0.19445494	0.02636296	0.0849539	0.10132848	0.23712922
Union membership	-0.01670525	0.25143143	-0.10376608	0.10461807	0.1314024	0.20471882
Union density	0.06339256	0.17494566	-0.26471272	0.11395121	0.06851006	0.25168727

	Nationality	Job change (sector)	Female dummy (sector)	Covered by sectoral agreement	Sectoral bargaining coverage	Union membership
Nationality	1					
Job change (sector)	-0.08485476	1				
Female dummy (sector)	-0.01951096	-0.53181778	1			
Covered by sectoral agreement	-0.03082797	0.12460544	0.01798222	1		
Sectoral bargaining coverage	-0.14718177	0.45740198	0.05900817	0.26867883	1	
Union membership	-0.08977075	0.13270764	-0.12836388	0.16915536	0.11069348	1
Union density	-0.07495383	0.61205329	-0.59250564	0.13424307	0.50895741	0.21657626

Table A1.3.3: Collinearity Diagnostic

Variable	VIF	SQRT VIF	Tolerance	R-Squared
Individual covered by sectoral agreement	1.15	1.07	0.8663	0.1337
Sectoral agreement bargaining coverage	2.4	1.55	0.417	0.583
Union member	1.15	1.07	0.8689	0.1311
Sectoral union density	2.96	1.72	0.3382	0.6618
Education dummy 1	16.54	4.07	0.0605	0.9395
Education dummy 2	16.61	4.08	0.0602	0.9398
Job tenure	1.51	1.23	0.6633	0.3367
Female dummy	1.28	1.13	0.7819	0.2181
Job change	1.13	1.06	0.8851	0.1149
Age category dummy 1	4.8	2.19	0.2083	0.7917
Age category dummy 1	6.3	2.51	0.1587	0.8413
Age category dummy 3	6.72	2.59	0.1489	0.8511
Age category dummy 4	4.85	2.2	0.206	0.794
Firm size dummy 1	1.13	1.06	0.8855	0.1145
Firm size dummy 2	1.35	1.16	0.7415	0.2585
National category dummy 1	1.02	1.01	0.9765	0.0235
National category dummy 2	1.05	1.03	0.9481	0.0519
National category dummy 3	1.07	1.03	0.9381	0.0619
Sectoral average job change	2.2	1.48	0.4545	0.5455
Sectoral average female	2.97	1.72	0.3365	0.6635
Mean VIF	3.91			

Note: "As a rule of thumb, a variable whose VIF values are greater than 10 may merit further investigation. Tolerance, defined as 1/VIF, is used by many researchers to check on the degree of collinearity. A tolerance value lower than 0.1 is comparable to a VIF of 10". See https://stats.idre.ucla.edu/stata/webbooks/reg/chapter2/stata-webbooksregressionwith-statachapter-2-regression-diagnostics/

A1.4. Sector specific logistic regressions

Figure A1.4.1: Effect of being covered by agreement and union membership on low pay probability in series of sector specific logistic regressions
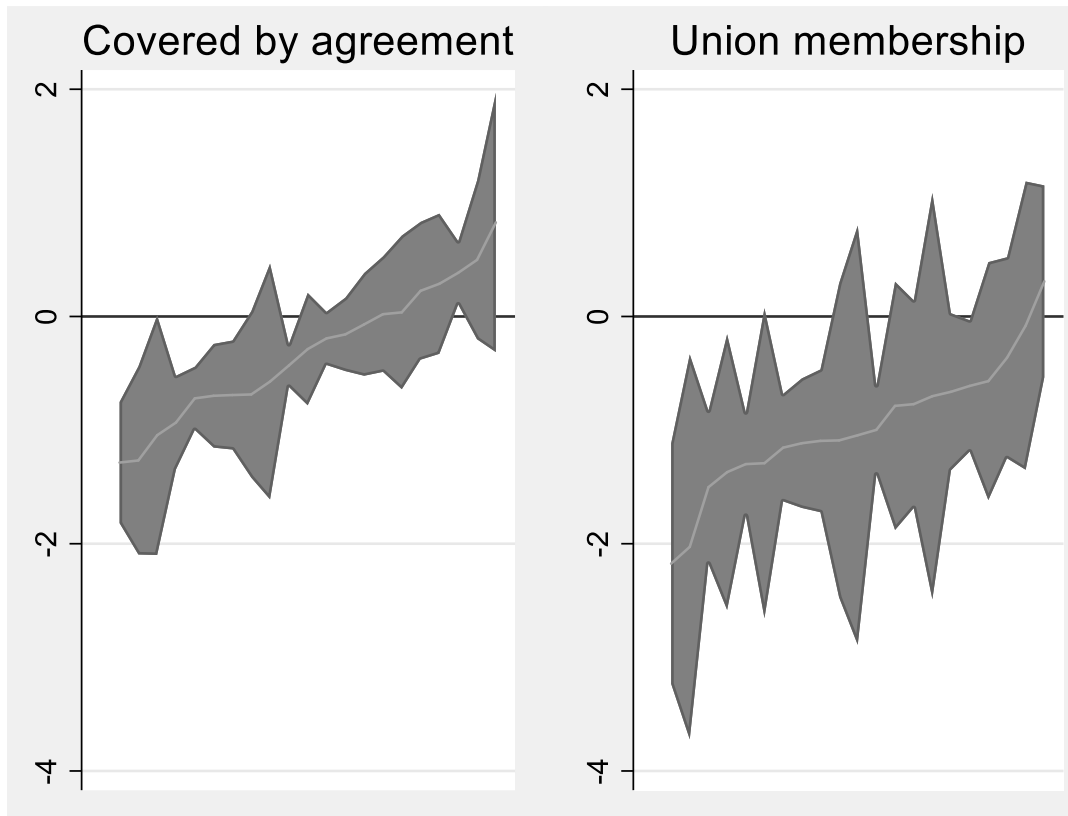
A2. Regression results – direct effects

A2.1. Figures showing results from multilevel logistic regressions

Figure A2.1.1: Multilevel logistic regression
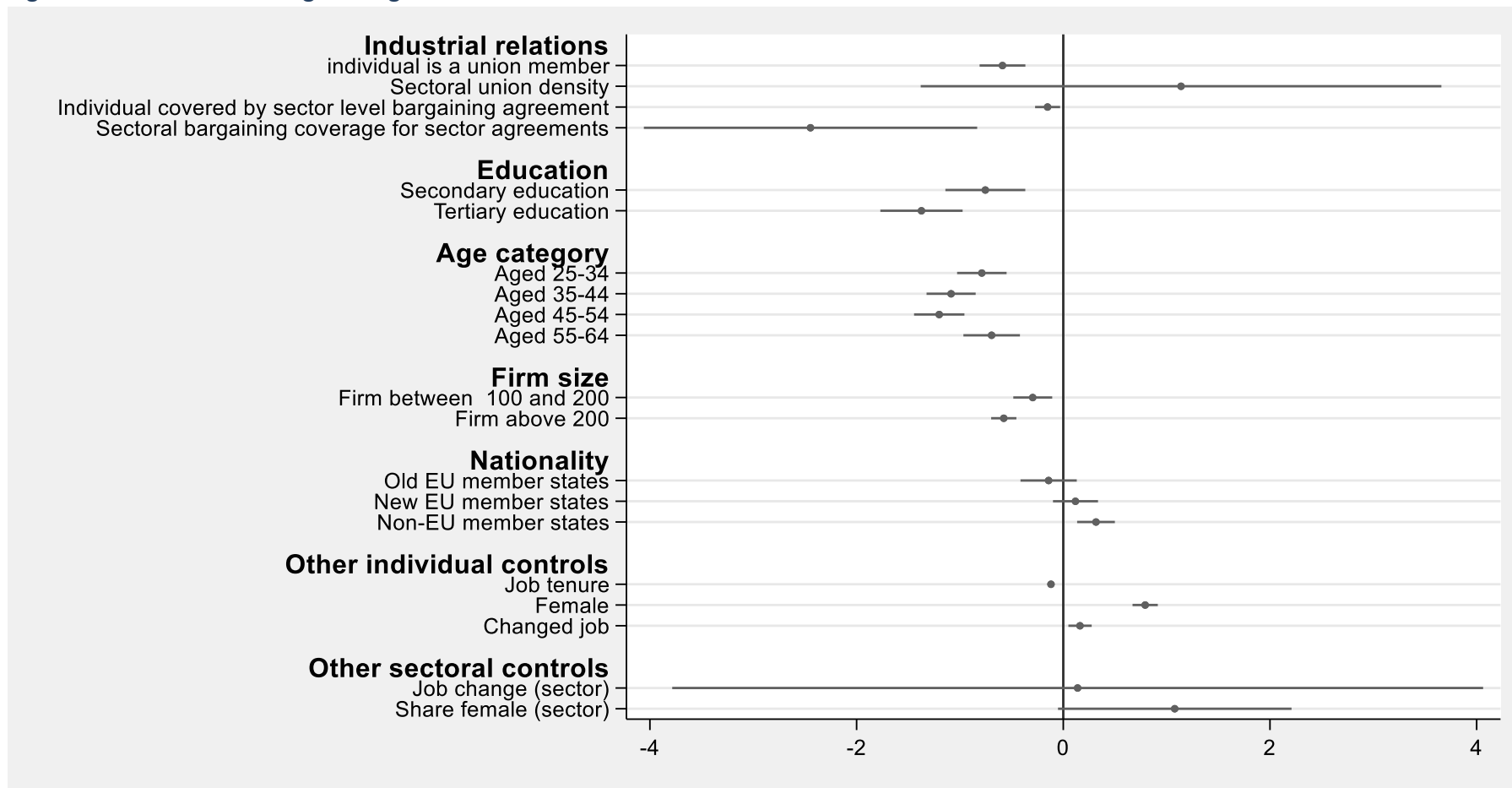
Figure A2.1.2: Multilevel logistic regressions with part time work control
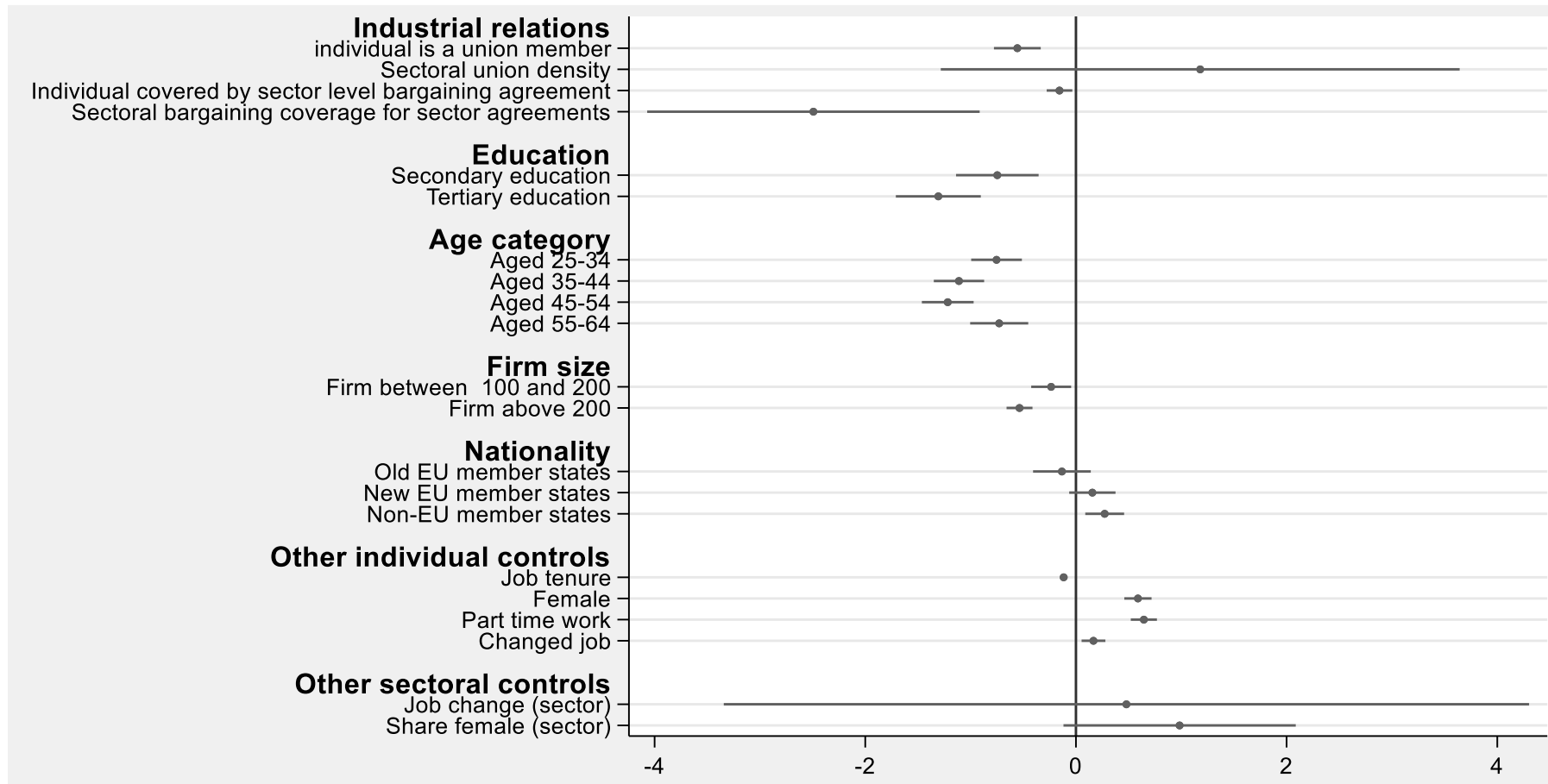
A2.2. Alternatives to multilevel logistic regressions

Figure A2.2.1: Comparing normal standard errors with and without robust clustered SE in multilevel mixed-effects models
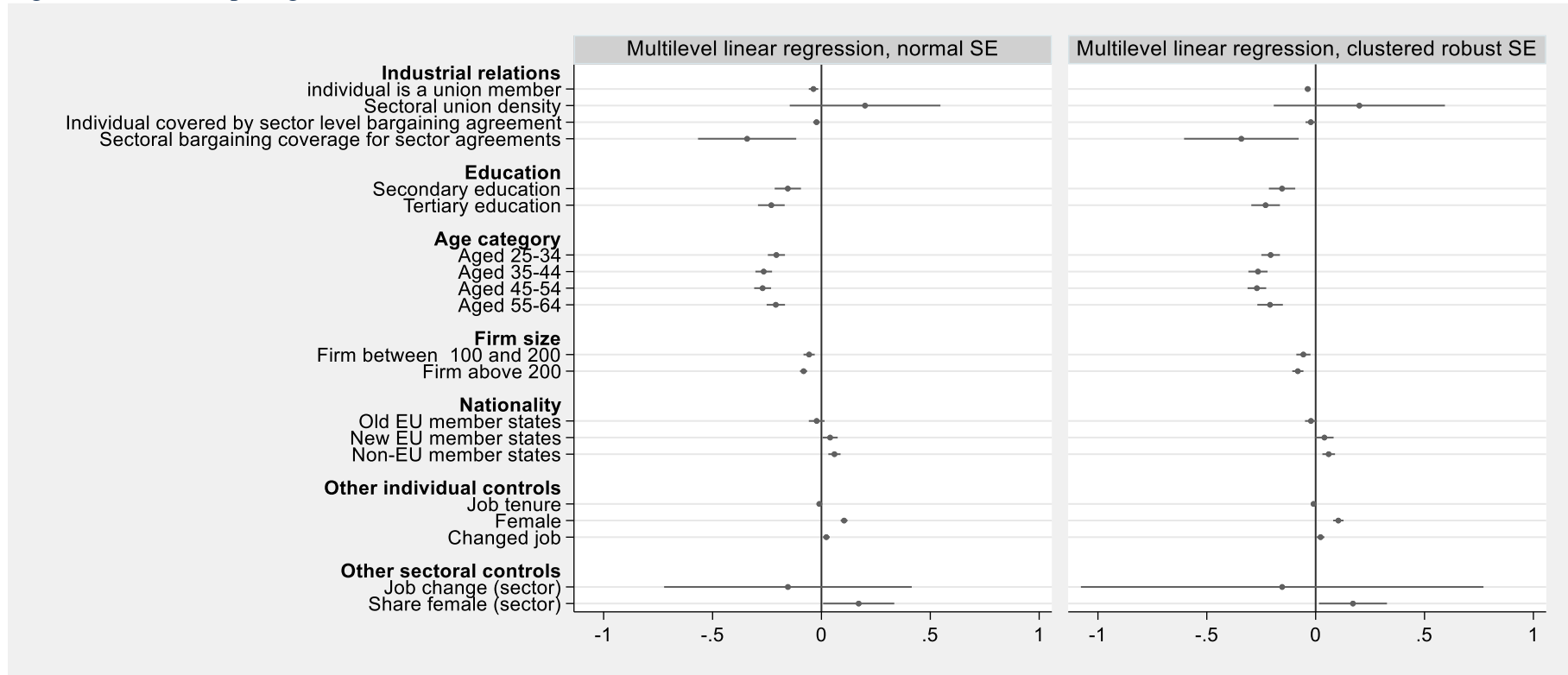
Figure A2.2.2: Logistic regression with sector fixed effects
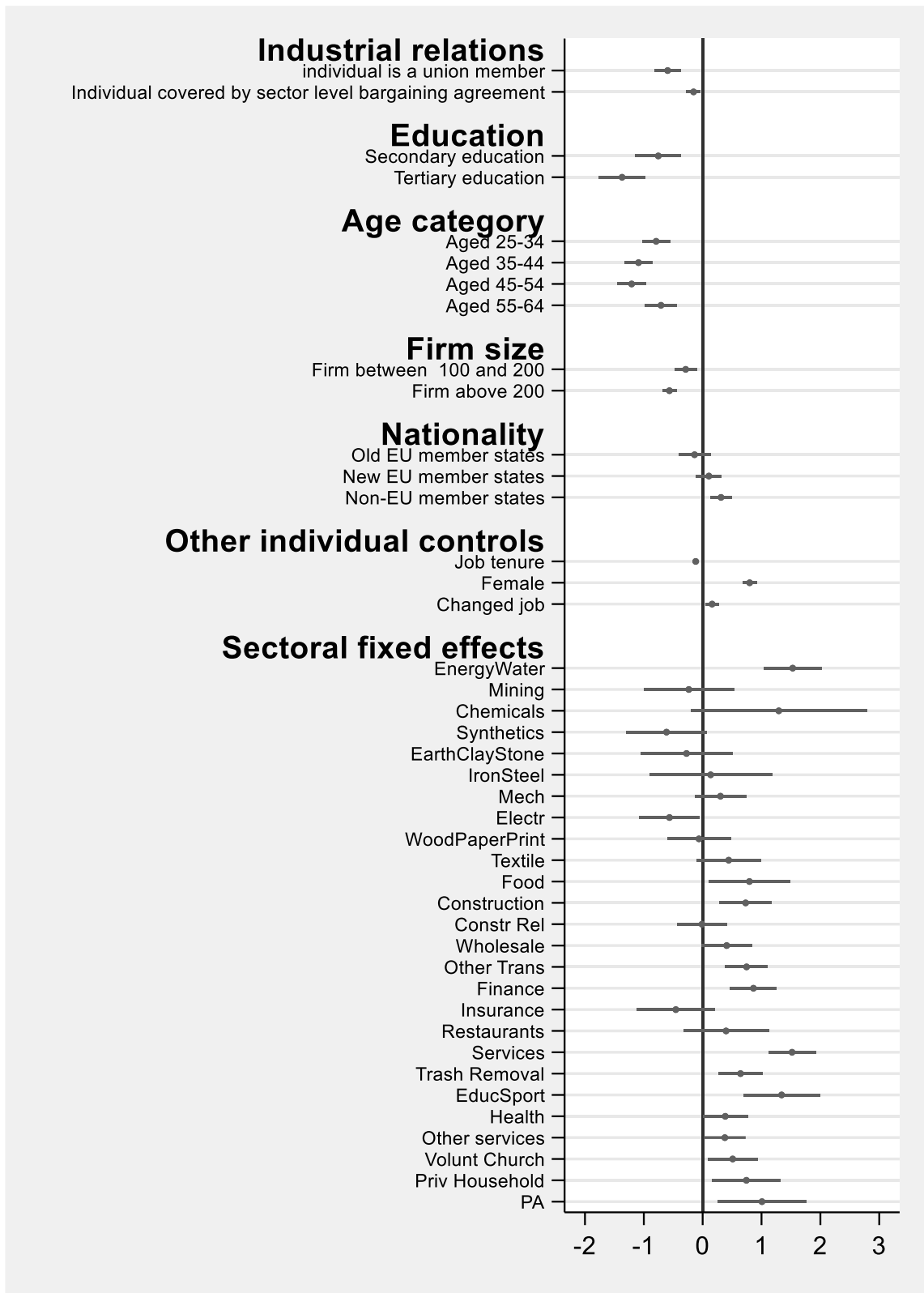
A2.3. Controlling for East Germany as dummy and for States

Table A2.3.1: Tabulation of States

State of Residence		Freq.	Percent	Cum.
[1] Schleswig-Holstein	1	395	3.07	3.07
[2] Hamburg	2	213	1.65	4.72
[3] Lower Saxony	3	1,212	9.42	14.14
[4] Bremen	4	82	0.64	14.78
[5] North-Rhine-Westfalia	5	2,564	19.92	34.70
[6] Hessen	6	967	7.51	42.21
[7] Rheinland-Pfalz	7	640	4.97	47.18
[8] Baden-Wuerttemberg	8	1,699	13.20	60.38
[9] Bavaria	9	2,308	17.93	78.32
[10] Saarland	10	117	0.91	79.22
[11] Berlin	11	426	3.31	82.53
[12] Brandenburg	12	413	3.21	85.74
[13] Mecklenburg-Vorpommern	13	236	1.83	87.58
[14] Saxony	14	728	5.66	93.23
[15] Saxony-Anhalt	15	395	3.07	96.30
[16] Thuringia	16	476	3.70	100.00
Total		12,871	100.00	

Table A2.3.2: Tabulation of Eastern Germany

. tab East_dummy

East_dummy	Freq.	Percent	Cum.
0	10,197	79.22	79.22
1	2,674	20.78	100.00
Total	12,871	100.00	

Figure A2.3.1: Multilevel logistic regression when controlling for States
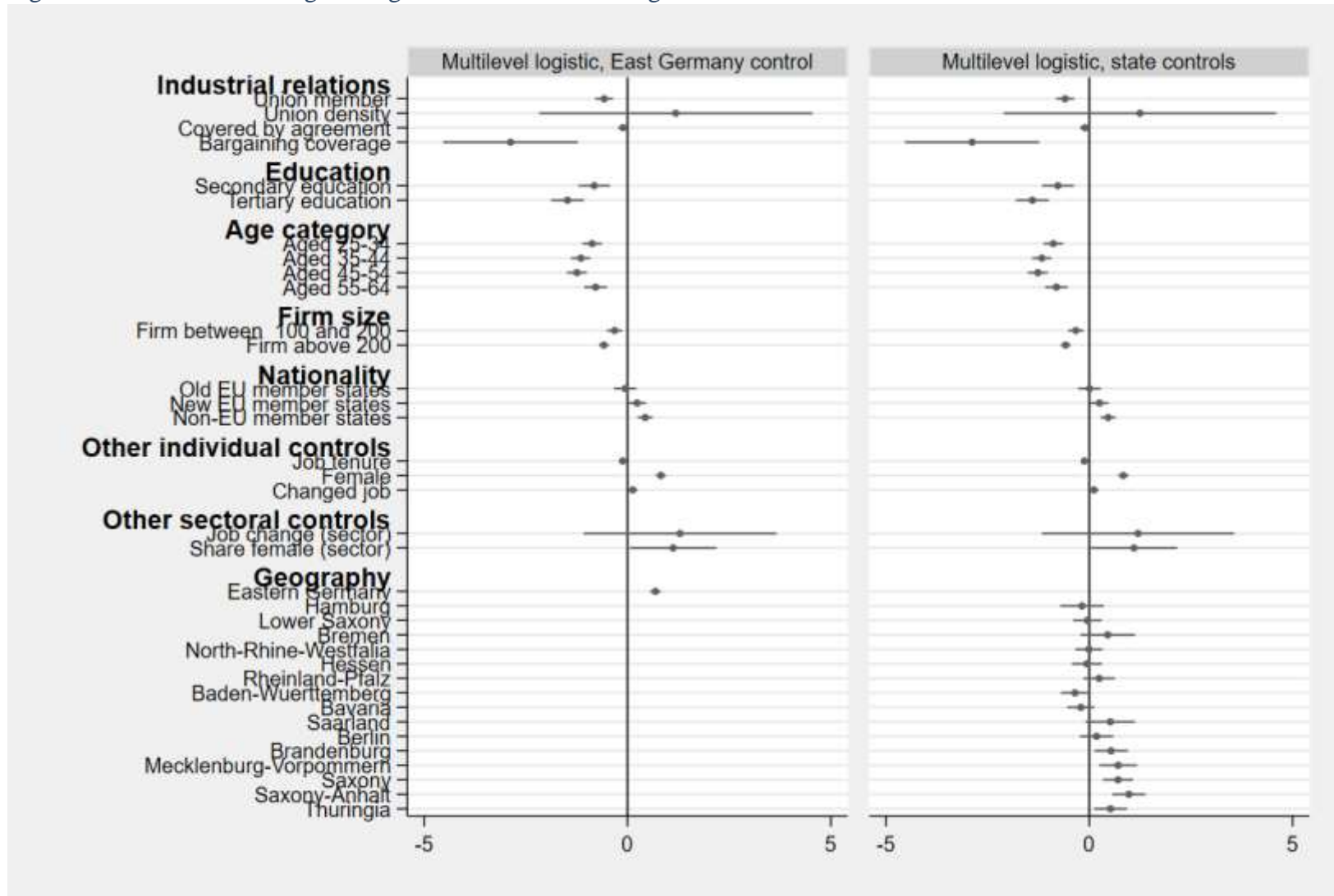
A2.4. Controlling for productivity

Figure A2.4.1: Histogram average hourly pay
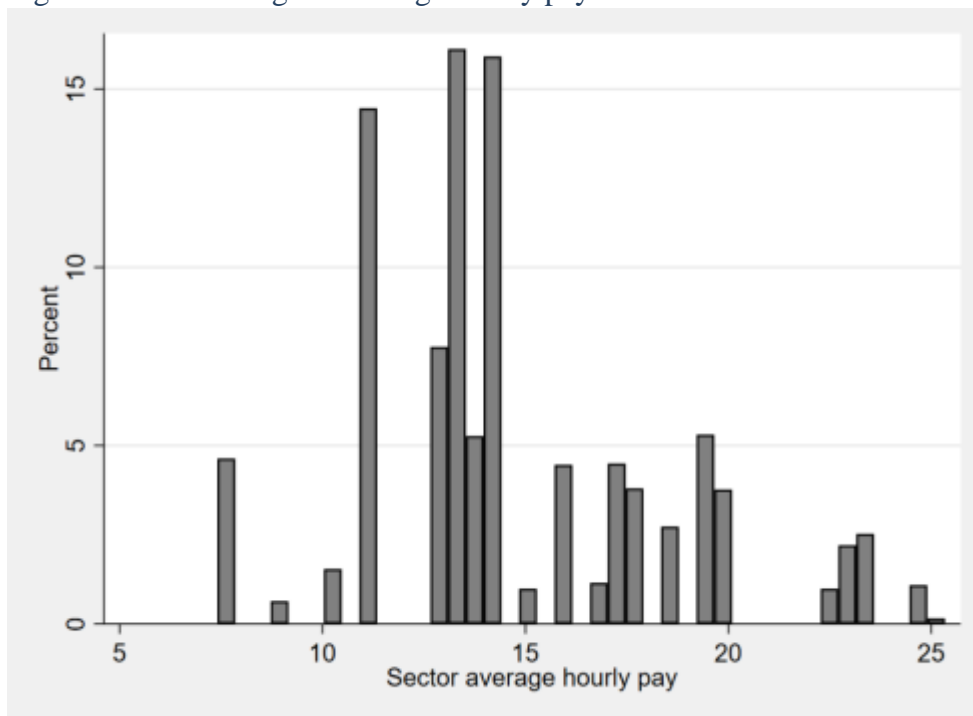
Table A2.4.1: Tabulation of education

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. tab pgisced11
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ISCED-2011-Klassifikation	Freq.	Percent	Cum.
[-1] keine Angabe	209	1.62	1.62
[0] in school	44	0.34	1.97
[1] Primary education	206	1.60	3.57
[2] Lower secondary education	1,118	8.69	12.25
[3] Upper secondary education	6,068	47.14	59.40
[4] Post-secondary non-tertiary educati	1,415	10.99	70.39
[5] Short-cycle tertiary education	217	1.69	72.08
[6] Bachelors or equivalent level	2,595	20.16	92.24
[7] Masters or equivalent level	843	6.55	98.79
[8] Doctoral or equivalent level	156	1.21	100.00
Total	12,871	100.00	

Figure A2.4.2: Histogram sectoral average education
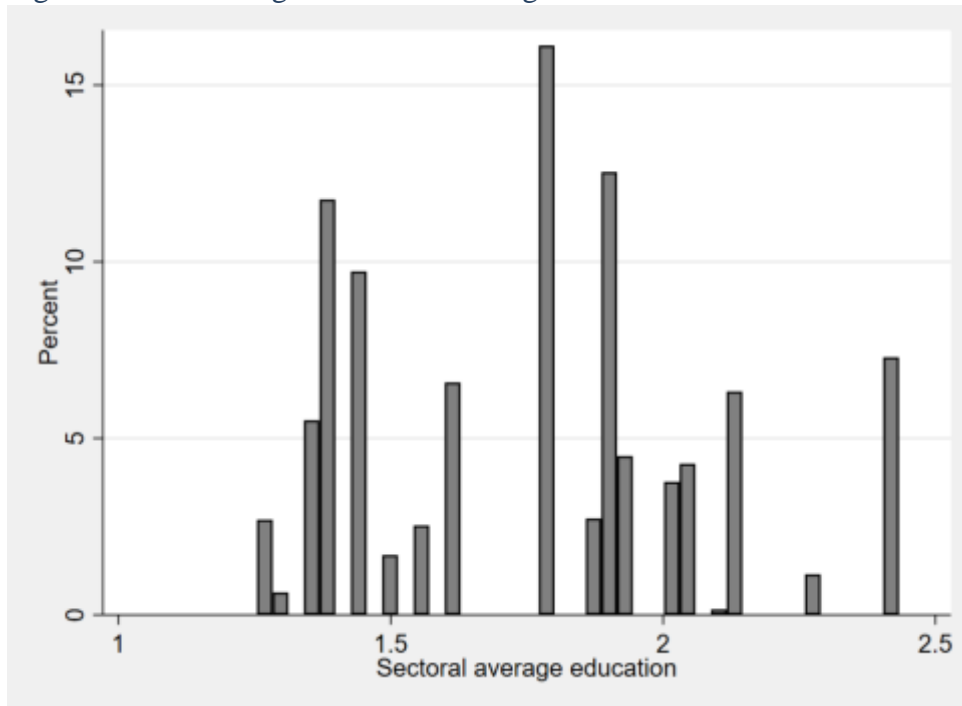
Figure A2.4.2: Scatterplot of average hourly pay and education
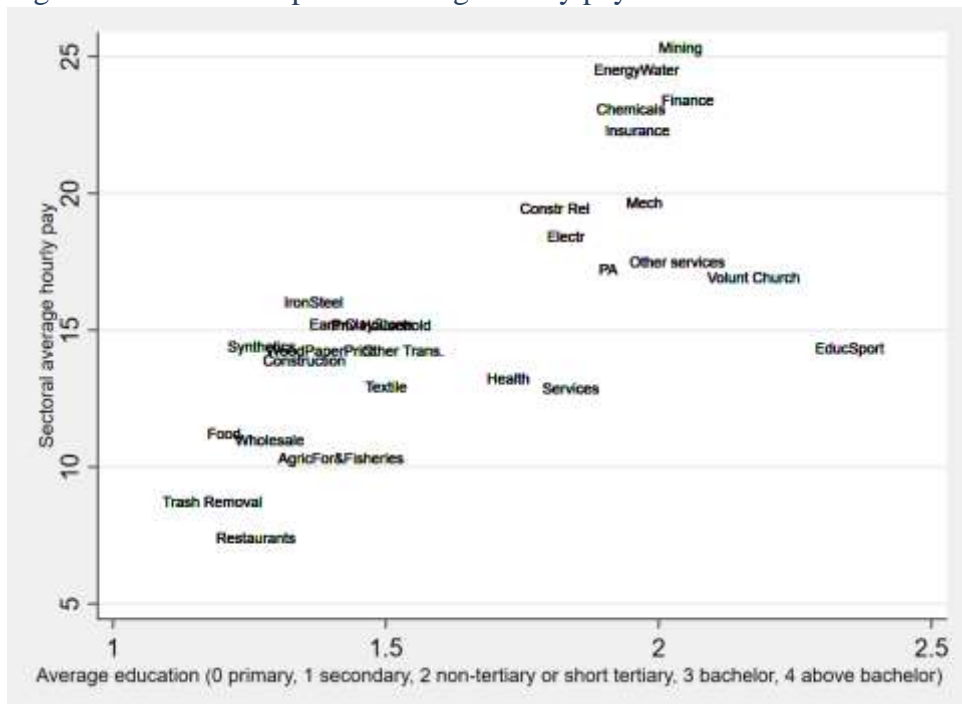
Table A2.4.2: Correlation sectoral average hourly wage and sectoral education

```
              | hourl~my av_ho~ay
--------------+------------------
 hourlylowp~y |  1.0000
              |
 av_hourly_~y | -0.2574   1.0000
              |  0.0000
```

Figure A2.4.3: Multilevel logistic regression controlling for sectoral average hourly pay and sectoral average education
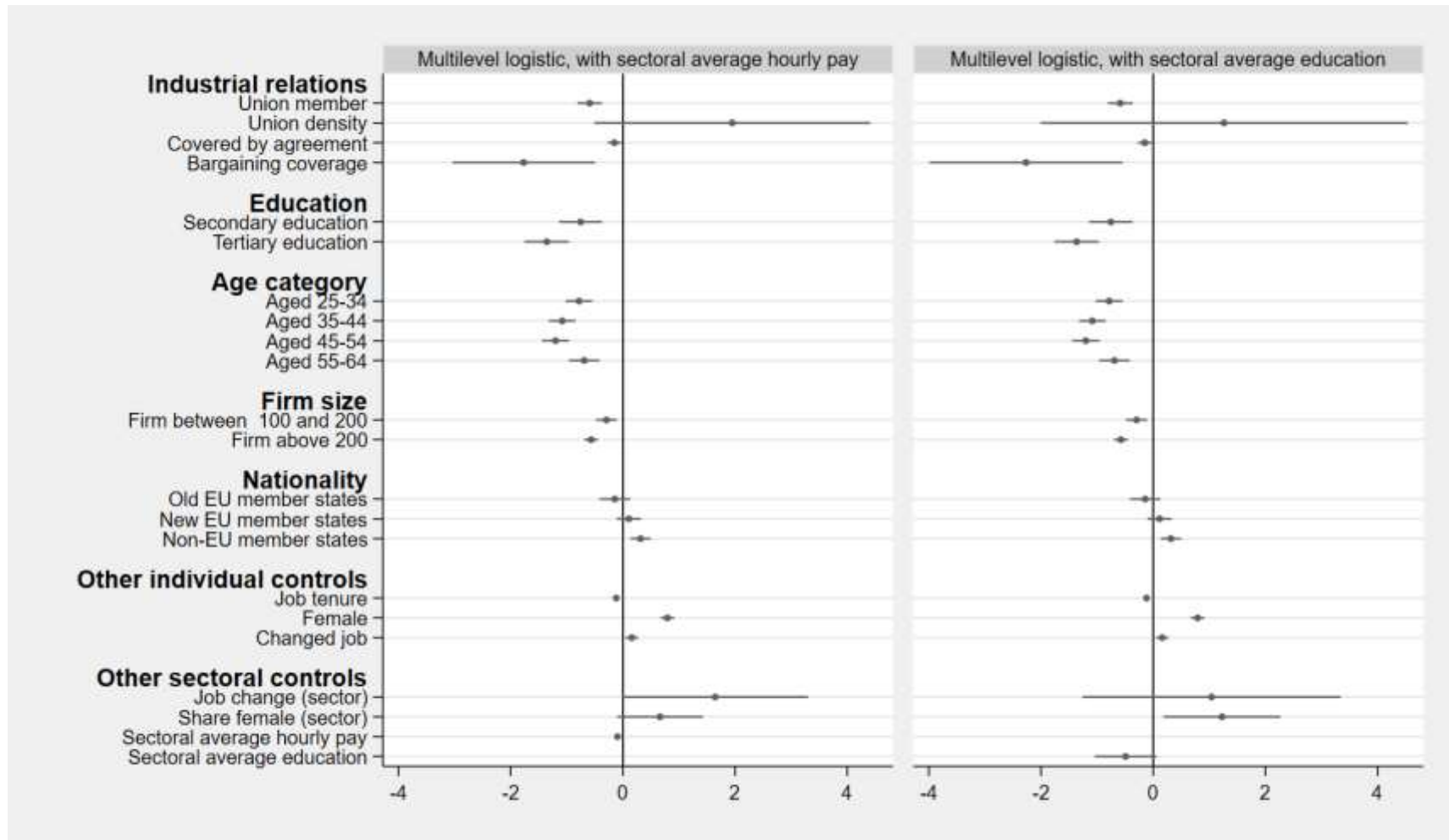
A2.5. Different operationalisation of bargaining coverage and union membership

Figure A2.5.1: Multilevel logistic regression controlling for different measures of bargaining agreement
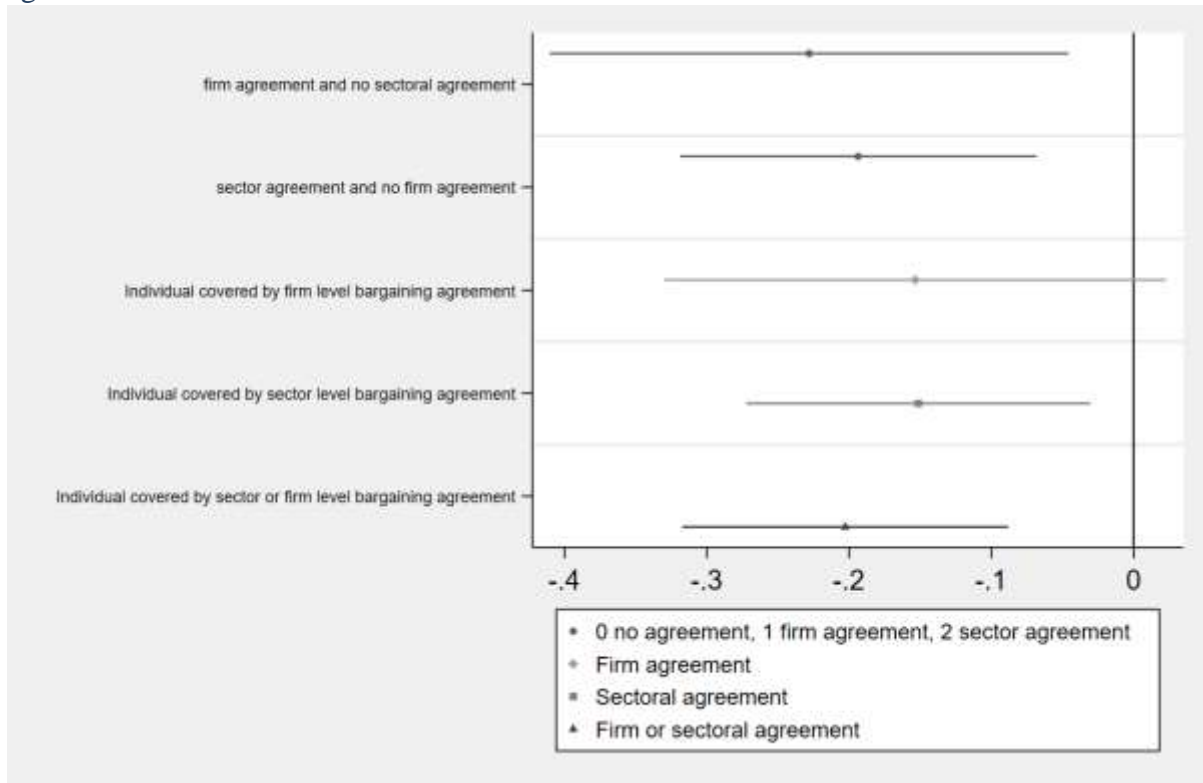
Note: the graph shows the effect of different measures of bargaining agreement using multilevel random intercept logistic regressions of hourly low pay dummy controlling for the same variables as in baseline model. The first two rows plot the effect of having a firm agreement versus a sector agreement where a categorical variable is included which is coded 0 no agreement, 1 just firm agreement and 2 just sector agreement. The third row shows the effect of being covered by a firm level agreement, the fourth row by a sectoral level agreement and the fifth row by either a firm or a sectoral agreement.

Figure A2.5.2: Multilevel logistic regression changing two variables "individual union membership and individual wage bargaining coverage" into three variables
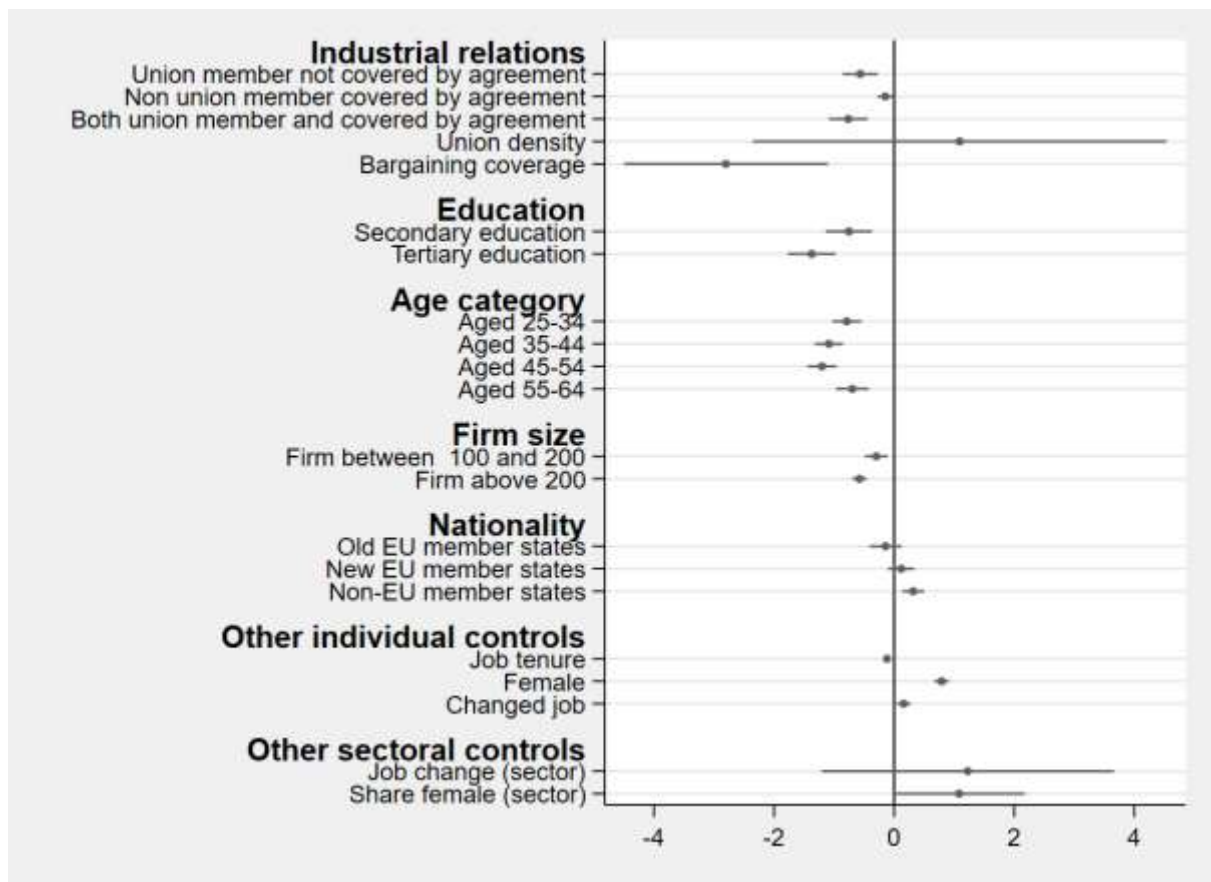
A2.6. Excluding public sector workers

Figure A2.6.1 Multilevel logistic regression - Results when excluding public sector
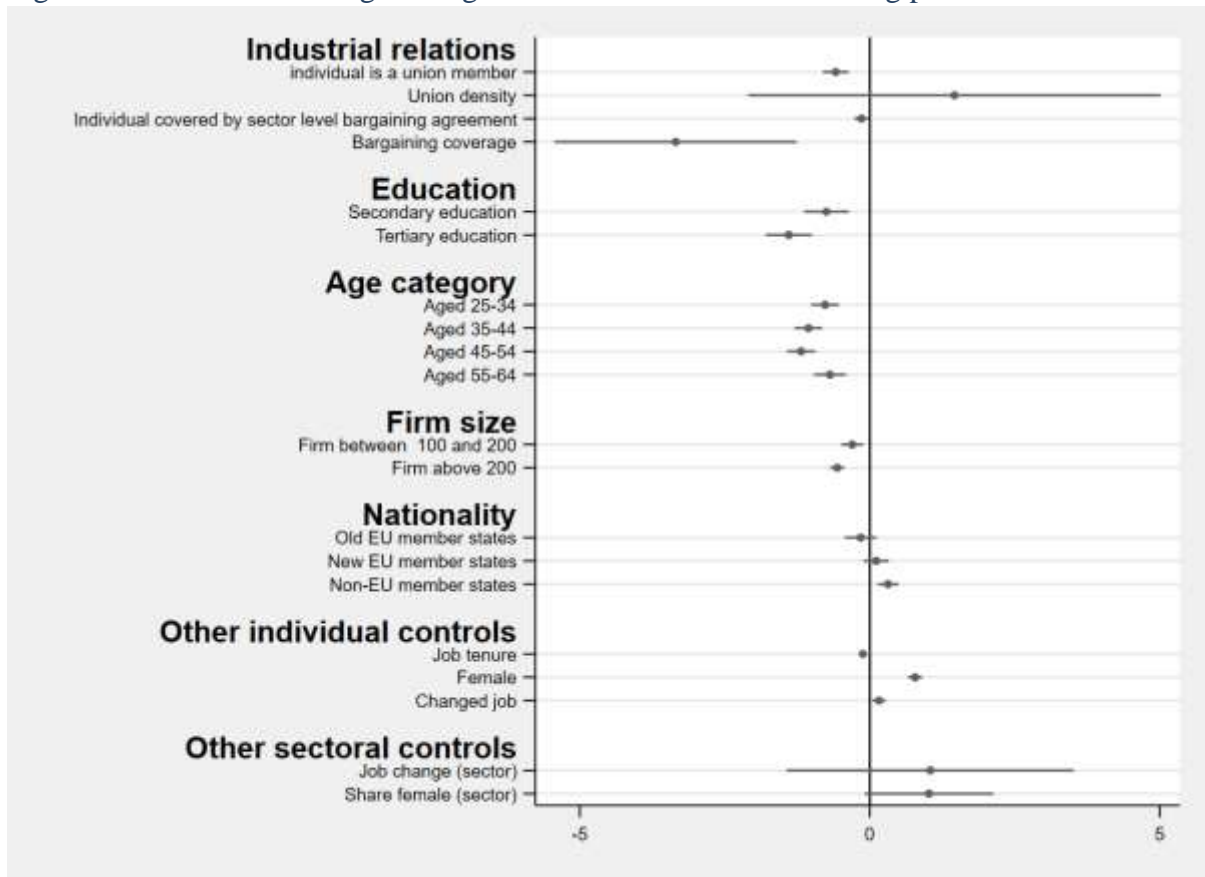
A2.7. Controlling for occupations

Figure A2.7.1. Histogram
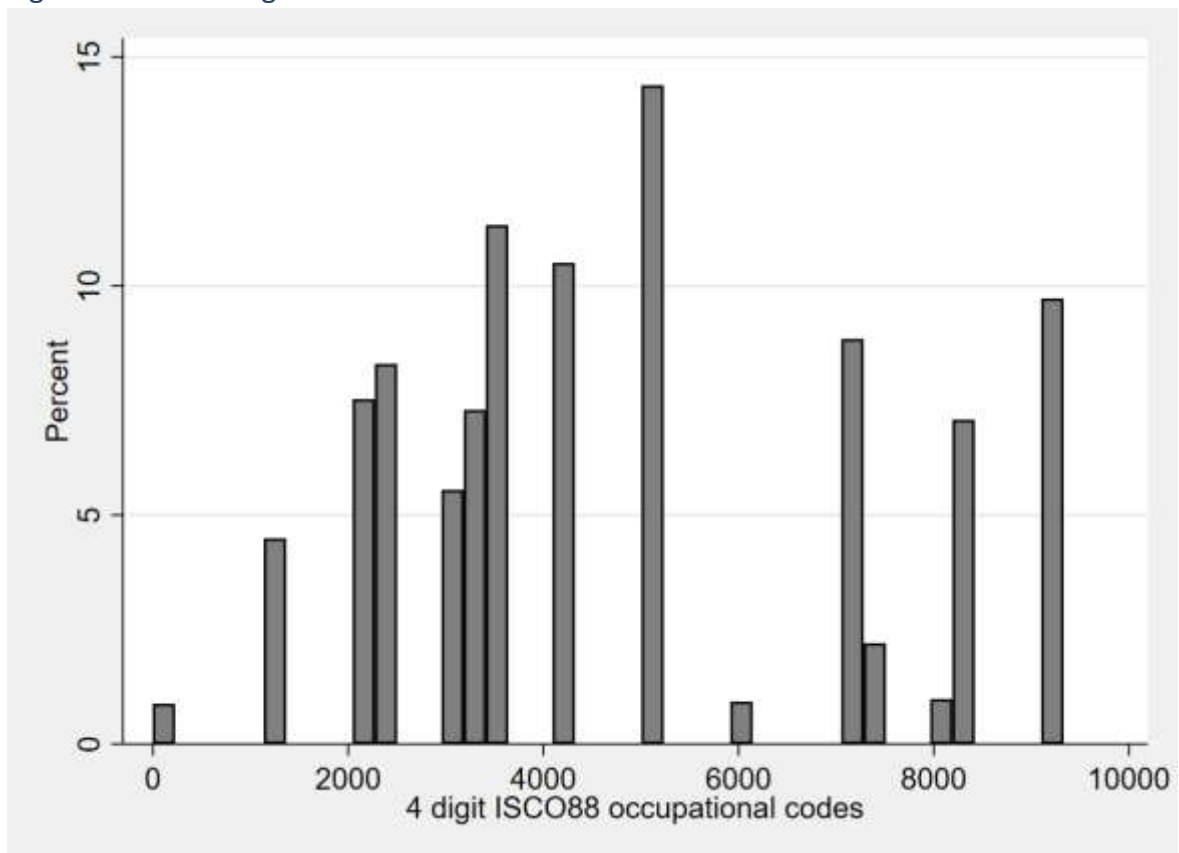
Figure A2.7.2. Results from multilevel logistic regression
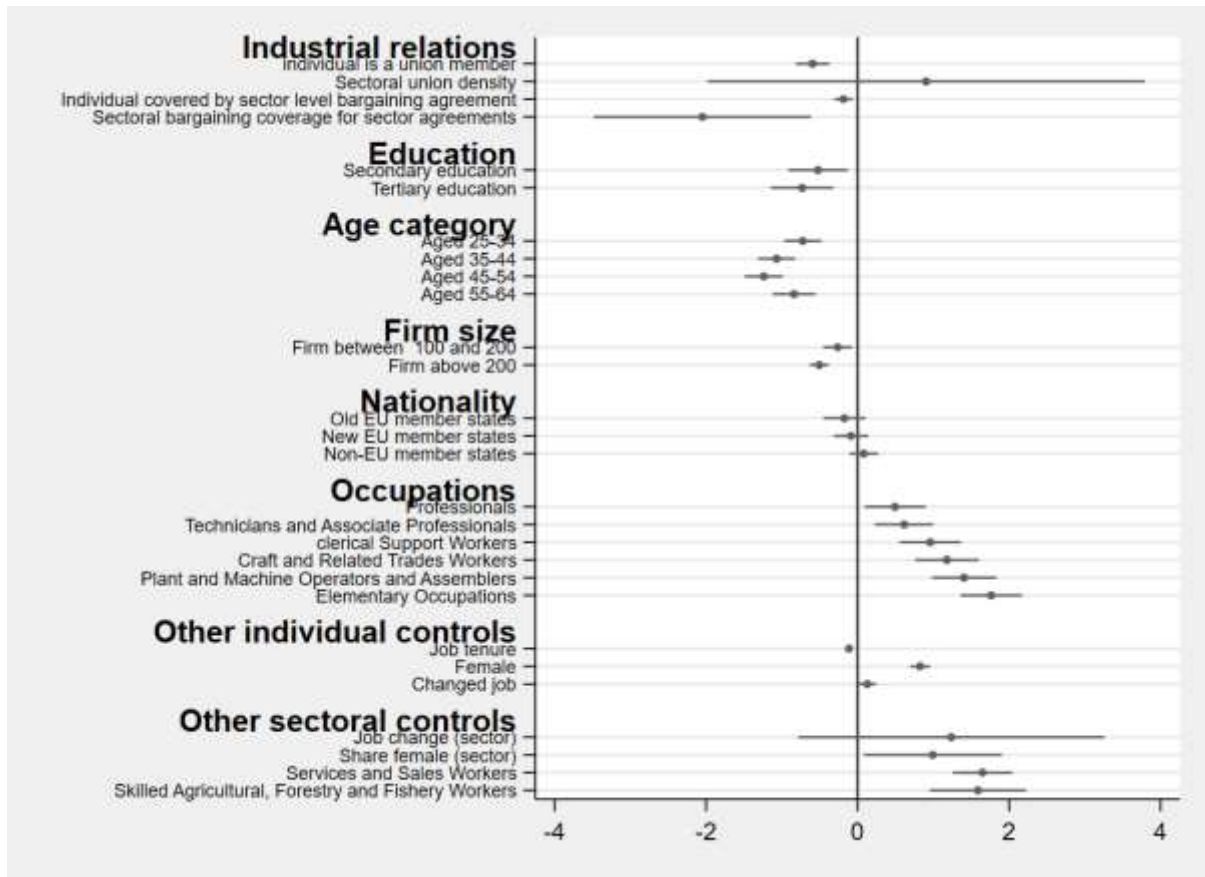
A2.8. Results from multilevel logistic regressions in table format

Table A2.8.1. Reporting results from section A2 in table format

Model	1	2	3	4
Dependent variable	Hourly low pay dummy	Hourly low pay dummy	Hourly low pay dummy	Hourly low pay dummy
Estimation method	Multilevel logistic regression, random intercept	Mixed effects regression, random intercept	Mixed effects regression, random intercept, robust standard errors clustered by sector	OLS regression, with sector fixed effects
INDUSTRIAL RELATIONS - INDIVIDUAL LEVEL				
Union membership	-0.588***	-0.0363***	-0.0363***	-0.0369***
	(0.113)	(0.0110)	(0.00658)	(0.00658)
Covered by a sectoral agreement	-0.151**	-0.0222***	-0.0222*	-0.0225*
	(0.0617)	(0.00790)	(0.0125)	(0.0125)
INDUSTRIAL RELATIONS - SECTORAL LEVEL				
Sectoral level bargaining coverage of sectoral agreements	-2.800***	-0.420***	-0.420***	
	(0.866)	(0.120)	(0.0813)	
Sectoral union density	1.091	0.124	0.124	
	(1.757)	(0.241)	(0.258)	
OTHER INDIVIDUAL LEVEL CONTROLS				
Education (ref: below secondary)				
Secondary education	-0.754***	-0.154***	-0.154***	-0.154***
	(0.197)	(0.0308)	(0.0308)	(0.0309)
Tertiary education	-1.372***	-0.230***	-0.230***	-0.229***
	(0.203)	(0.0313)	(0.0335)	(0.0336)
Age (ref: under 25 years)				
Aged 25-34	-0.787***	-0.207***	-0.207***	-0.206***
	(0.122)	(0.0200)	(0.0217)	(0.0219)
Aged 35-44	-1.086***	-0.265***	-0.265***	-0.264***
	(0.121)	(0.0195)	(0.0224)	(0.0227)
Aged 45-54	-1.201***	-0.270***	-0.270***	-0.269***
	(0.124)	(0.0198)	(0.0218)	(0.0220)
Aged 55-64	-0.694***	-0.209***	-0.209***	-0.210***
	(0.140)	(0.0215)	(0.0298)	(0.0300)

Firm size (ref: under 100)				
Firm between 100 and 200	-0.295***	-0.0564***	-0.0564***	-0.0551***
	(0.0960)	(0.0131)	(0.0165)	(0.0163)
Firm above 200	-0.577***	-0.0820***	-0.0820***	-0.0802***
	(0.0622)	(0.00840)	(0.0131)	(0.0131)
Nationality (ref: German)				
Old EU member states	-0.142	-0.0215	-0.0215	-0.0211
	(0.139)	(0.0185)	(0.0138)	(0.0141)
New EU member states	0.118	0.0402**	0.0402*	0.0379*
	(0.111)	(0.0176)	(0.0213)	(0.0217)
Non-EU member states	0.318***	0.0600***	0.0600***	0.0590***
	(0.0930)	(0.0143)	(0.0149)	(0.0144)
Job tenure	-0.119***	-0.00958***	-0.00958***	-0.00955***
	(0.00532)	(0.000452)	(0.000928)	(0.000933)
Female dummy variable	0.792***	0.104***	0.104***	0.104***
	(0.0624)	(0.00803)	(0.0121)	(0.0121)
Job change	0.161***	0.0223***	0.0223**	0.0222**
	(0.0574)	(0.00792)	(0.00892)	(0.00894)
SECTOR LEVEL CONTROLS				
Job change (sectoral average)	1.227	0.167	0.167	
	(1.241)	(0.176)	(0.179)	
Female (sectoral average)	1.082*	0.177**	0.177**	
	(0.557)	(0.0796)	(0.0712)	
State Fixed Effects	No	No	No	No
Sector Fixed Effects	No	No	No	Yes
Constant	0.582	0.651***	0.651***	0.878***
	(0.872)	(0.124)	(0.105)	(0.0394)
Var(constant)	0.1540586	0.0033663	0.0033663	
ICC	0.0447334	0.0243179	0.0243179	
Observations	10,741	10,741	10,741	10,741
Number of groups	27	27	27	27

*Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.*

Model	5	6	7
Dependent variable	Hourly low pay dummy (with bonus)	Hourly low pay dummy (with bonus)	Hourly low pay dummy
Estimation method	Multilevel logistic regression	Multilevel logistic regression, robust standard errors clustered by sector	Multilevel logistic regression, controlling for part time work
INDUSTRIAL RELATIONS - INDIVIDUAL LEVEL			
Union membership	-0.601***	-0.601***	-0.556***
	(0.115)	(0.0829)	(0.113)
Covered by a sectoral agreement	-0.162***	-0.162*	-0.156**
	(0.0624)	(0.0978)	(0.0620)
INDUSTRIAL RELATIONS - SECTORAL LEVEL			
Sectoral level bargaining coverage of sectoral agreements	-2.688***	-2.688***	-2.733***
	(0.868)	(0.522)	(0.853)
Sectoral union density	1.078	1.078	1.094
	(1.760)	(2.173)	(1.727)
OTHER INDIVIDUAL LEVEL CONTROLS			
Education (ref: below secondary)			
Secondary education	-0.754***	-0.754***	-0.746***
	(0.197)	(0.207)	(0.200)
Tertiary education	-1.354***	-1.354***	-1.306***
	(0.203)	(0.182)	(0.206)
Age (ref: under 25 years)			
Aged 25-34	-0.826***	-0.826***	-0.753***
	(0.122)	(0.0934)	(0.123)
Aged 35-44	-1.104***	-1.104***	-1.110***
	(0.121)	(0.100)	(0.122)
Aged 45-54	-1.243***	-1.243***	-1.217***
	(0.125)	(0.0976)	(0.125)
Aged 55-64	-0.712***	-0.712***	-0.729***
	(0.140)	(0.185)	(0.141)
Firm size (ref: under 100)			
Firm between 100 and 200	-0.298***	-0.298***	-0.235**
	(0.0968)	(0.108)	(0.0968)
Firm above 200	-0.603***	-0.603***	-0.536***
	(0.0629)	(0.0893)	(0.0628)
Nationality (ref: German)			
Old EU member states	-0.132	-0.132	-0.133
	(0.140)	(0.102)	(0.140)
New EU member states	0.155	0.155	0.156
	(0.111)	(0.125)	(0.112)
Non-EU member states	0.333***	0.333***	0.274***
	(0.0933)	(0.0685)	(0.0941)
Job tenure	-0.122***	-0.122***	-0.116***
	(0.00547)	(0.00655)	(0.00534)
Female dummy variable	0.760***	0.760***	0.589***
	(0.0629)	(0.0938)	(0.0661)
Job change	0.163***	0.163***	0.165***
	(0.0578)	(0.0575)	(0.0578)
Part-time worker			0.644***
			(0.0634)
SECTOR LEVEL CONTROLS			

Job change (sectoral average)	1.052	1.052	1.252
	(1.243)	(1.103)	(1.219)
Female (sectoral average)	1.022*	1.022**	0.924*
	(0.557)	(0.496)	(0.548)
State Fixed Effects	No	No	No
Sector Fixed Effects	No	No	No
Constant	0.707	0.707	0.497
	(0.873)	(0.673)	(0.858)
Var(constant)	0.1526551	0.1526551	0.1441225
ICC	0.044344	0.044344	0.0419694
Observations	10,741	10,741	10,741
Number of groups	27	27	27

*Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.*

Model	8	9	10	11
Dependent variable	Hourly low pay dummy	Hourly low pay dummy	Hourly low pay dummy	Hourly low pay dummy
Estimation method	Multilevel logistic regression; Eastern Germany dummy	Multilevel logistic regression; state fixed effects	Multilevel logistic regression, control for hourly pay (sectoral average)	Multilevel logistic regression, control for education (sectoral average)

INDUSTRIAL RELATIONS - INDIVIDUAL LEVEL

	8	9	10	11
Union membership	-0.572***	-0.594***	-0.591***	-0.588***
	(0.113)	(0.114)	(0.113)	(0.113)
Covered by a sectoral agreement	-0.111*	-0.106*	-0.152**	-0.151**
	(0.0622)	(0.0625)	(0.0616)	(0.0617)

INDUSTRIAL RELATIONS - SECTORAL LEVEL

	8	9	10	11
Sectoral level bargaining coverage of sectoral agreements	-2.873***	-2.879***	-1.769***	-2.268***
	(0.846)	(0.843)	(0.649)	(0.878)
Sectoral union density	1.188	1.245	1.952	1.263
	(1.714)	(1.709)	(1.256)	(1.670)

OTHER INDIVIDUAL LEVEL CONTROLS

Education (ref: below secondary)

	8	9	10	11
Secondary education	-0.817***	-0.770***	-0.755***	-0.755***
	(0.199)	(0.200)	(0.197)	(0.197)
Tertiary education	-1.475***	-1.398***	-1.358***	-1.365***
	(0.205)	(0.206)	(0.202)	(0.203)

Age (ref: under 25 years)

	8	9	10	11
Aged 25-34	-0.869***	-0.882***	-0.782***	-0.786***
	(0.123)	(0.124)	(0.122)	(0.122)
Aged 35-44	-1.146***	-1.165***	-1.082***	-1.085***
	(0.122)	(0.123)	(0.121)	(0.121)
Aged 45-54	-1.243***	-1.263***	-1.200***	-1.200***
	(0.125)	(0.126)	(0.124)	(0.124)
Aged 55-64	-0.785***	-0.805***	-0.691***	-0.692***
	(0.141)	(0.142)	(0.139)	(0.140)

Firm size (ref: under 100)

	8	9	10	11
Firm between 100 and 200	-0.319***	-0.328***	-0.293***	-0.296***
	(0.0967)	(0.0972)	(0.0959)	(0.0960)
Firm above 200	-0.580***	-0.580***	-0.566***	-0.576***
	(0.0627)	(0.0630)	(0.0621)	(0.0622)

Nationality (ref: German)

Old EU member states	-0.0527	0.00790	-0.144	-0.144
	(0.140)	(0.142)	(0.139)	(0.139)
New EU member states	0.235**	0.249**	0.107	0.114
	(0.113)	(0.113)	(0.111)	(0.111)
Non-EU member states	0.435***	0.463***	0.315***	0.315***
	(0.0944)	(0.0948)	(0.0929)	(0.0930)
Job tenure	-0.120***	-0.121***	-0.119***	-0.119***
	(0.00535)	(0.00538)	(0.00532)	(0.00532)
Female dummy variable	0.821***	0.837***	0.794***	0.793***
	(0.0629)	(0.0633)	(0.0623)	(0.0624)
Job change	0.131**	0.114*	0.159***	0.160***
	(0.0579)	(0.0582)	(0.0573)	(0.0574)
SECTOR LEVEL CONTROLS				
Job change (sectoral average)	1.292	1.199	1.644*	1.042
	(1.209)	(1.206)	(0.847)	(1.175)
Female (sectoral average)	1.123**	1.100**	0.664*	1.226**
	(0.543)	(0.541)	(0.391)	(0.533)
Hourly pay (sectoral average)			-0.0956***	
			(0.0190)	
Education (sectoral average)				-0.491*
				(0.282)
Eastern Germany dummy variable	0.688***			
	(0.0647)			
State Fixed Effects	No	Yes	No	No
Sector Fixed Effects	No	No	No	No
Constant	0.487	0.607	1.473**	1.293
	(0.851)	(0.863)	(0.644)	(0.922)
Var(constant)	0.1447447	0.142555	0.0613594	0.1535993
ICC	0.042143	0.0415319	0.0183095	0.044606
Observations	10,741	10,741	10,741	10,741
Number of groups	27	27	27	27

*Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.*

Model	12	13	14	15
Dependent variable	Hourly low pay dummy	Hourly low pay dummy	Hourly low pay dummy	Hourly low pay dummy
Estimation method	Multilevel logistic regression, distinguishing firm and sector bargaining coverage	Multilevel logistic regression, replacing sector with firm bargaining agreement	Multilevel logistic regression, firm and sector level agreement both coded as 1, no agreement 0	Multilevel logistic regression, distinguishing being just a member from being a member and covered, or just covered
INDUSTRIAL RELATIONS - INDIVIDUAL LEVEL				
Union membership	-0.576***	-0.604***	-0.575***	
	(0.113)	(0.113)	(0.113)	
Covered by a firm level agreement		-0.154*		
		(0.0900)		
Covered by a firm and/or sectoral level agreement			-0.203***	
			(0.0585)	
Sectoral and firm level bargaining agreement (ref: no agreement)				
Firm agreement and no sectoral agreement	-0.228**			
	(0.0930)			
Sector agreement and no firm agreement	-0.194***			
Just union member dichotomous variable				-0.565***
				(0.151)
Just covered by a sectoral agreement dichotomous variable				-0.148**
				(0.0640)
Dichotomous variable for both union member and covered by sectoral agreement				-0.763***
				(0.164)
INDUSTRIAL RELATIONS - SECTORAL LEVEL				
Sectoral level bargaining coverage of sectoral agreements	-2.782***	-2.935***	-2.772***	-2.801***
	(0.872)	(0.864)	(0.871)	(0.866)
Sectoral union density	1.109	1.154	1.103	1.089
	(1.768)	(1.754)	(1.767)	(1.757)
OTHER INDIVIDUAL LEVEL CONTROLS				
Education (ref: below secondary)				
Secondary education	-0.760***	-0.768***	-0.759***	-0.754***
	(0.197)	(0.197)	(0.197)	(0.197)
Tertiary education	-1.386***	-1.385***	-1.384***	-1.372***
	(0.203)	(0.203)	(0.203)	(0.203)
Age (ref: under 25 years)				

Aged 25-34	-0.786***	-0.790***	-0.786***	-0.788***
	(0.122)	(0.122)	(0.122)	(0.122)
Aged 35-44	-1.085***	-1.090***	-1.085***	-1.086***
	(0.121)	(0.121)	(0.121)	(0.121)
Aged 45-54	-1.197***	-1.199***	-1.198***	-1.201***
	(0.125)	(0.124)	(0.125)	(0.124)
Aged 55-64	-0.694***	-0.698***	-0.694***	-0.695***
	(0.140)	(0.140)	(0.140)	(0.140)
Firm size (ref: under 100)				
Firm between 100 and 200	-0.278***	-0.302***	-0.278***	-0.296***
	(0.0963)	(0.0960)	(0.0963)	(0.0960)
Firm above 200	-0.554***	-0.598***	-0.554***	-0.577***
	(0.0629)	(0.0612)	(0.0629)	(0.0622)
Nationality (ref: German)				
Old EU member states	-0.142	-0.147	-0.142	-0.142
	(0.139)	(0.139)	(0.139)	(0.139)
New EU member states	0.129	0.109	0.129	0.118
	(0.111)	(0.111)	(0.111)	(0.111)
Non-EU member states	0.324***	0.316***	0.323***	0.317***
	(0.0931)	(0.0930)	(0.0931)	(0.0930)
Job tenure	-0.119***	-0.120***	-0.119***	-0.119***
	(0.00533)	(0.00532)	(0.00532)	(0.00533)
Female dummy variable	0.791***	0.788***	0.791***	0.792***
	(0.0624)	(0.0624)	(0.0624)	(0.0624)
Job change	0.162***	0.164***	0.162***	0.161***
	(0.0574)	(0.0574)	(0.0574)	(0.0574)
SECTOR LEVEL CONTROLS				
Job change (sectoral average)	1.235	1.239	1.234	1.226
	(1.249)	(1.240)	(1.249)	(1.241)
Female (sectoral average)	1.095*	1.094**	1.094*	1.081*
	(0.561)	(0.557)	(0.561)	(0.557)
State Fixed Effects	No	No	No	No
Sector Fixed Effects	No	No	No	No
Constant	0.589	0.605	0.587	0.583
	(0.877)	(0.871)	(0.877)	(0.872)
Var(constant)	0.1564538	0.1538324	0.1540586	0.1563389

ICC	0.0453973	0.0446707	0.0447334	0.0453655
Observations	10,741	10,741	10,741	10,741
Number of groups	27	27	27	27

*Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.*

Table A2.8.2. Stepwise insertion of variables in multilevel logistic regressions

Model	1	2	3	4	5	6	7	8	9	10	11
Covered by sectoral agreement	-0.431***				-0.361***	-0.354***	-0.252***	-0.261***	-0.269***	-0.148**	-0.154**
Union member		-1.170***			-1.163***	-1.156***	-0.724***	-0.695***	-0.697***	-0.605***	-0.593***
Sectoral bargaining coverage			-4.195***			-3.114***	-2.462**	-2.830***	-2.832***	-2.440***	-2.373***
Sectoral union density				-5.720***		-2.171	-1.833	-0.653	-0.704	-0.343	-0.313
Job tenure							-0.132***	-0.132***	-0.133***	-0.129***	-0.127***
Female								0.788***	0.794***	0.746***	0.761***
Job change									0.111**	0.126**	0.124**
Firm size (ref: under 100)											
Firm size between 100 and 200										-0.307***	-0.310***
Firm size above 200										-0.597***	-0.597***
Nationality (ref: German)											
Old EU member state											-0.259*
New EU member state											0.0756
Non-EU country											0.343***
Occupation dummies	No	No	No	No	No	No	No	No	No	No	No
Constant	-1.372***	-1.274***	0.0863	-0.590**	-1.247***	0.180	0.774**	0.343	0.283	0.308	0.243
Observations	11,468	12,500	12,871	12,871	11,154	11,154	11,100	11,100	11,038	10,965	10,965
Number of groups	27	27	27	27	27	27	27	27	27	27	27

*Note: *** p<0.01, ** p<0.05, * p<0.1.*

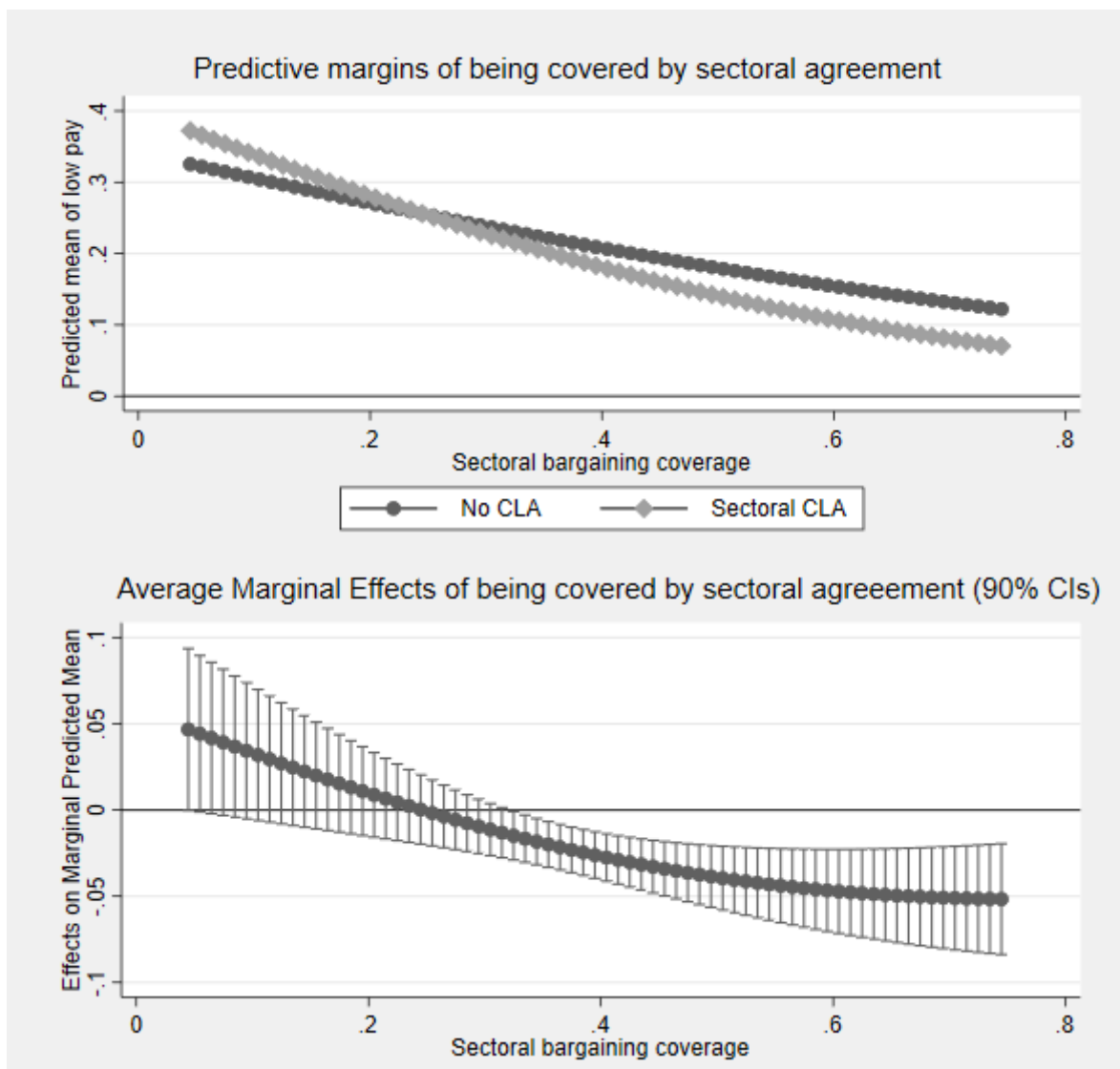| Model	12	13	14	15	16	17
Covered by sectoral agreement	-0.146**	-0.152**	-0.156**	-0.187***	-0.187***	-0.187***
Union member	-0.585***	-0.589***	-0.557***	-0.568***	-0.566***	-0.569***
Sectoral bargaining coverage	-2.336***	-2.055**	-2.053**	-1.337*	-1.488**	-1.769**
Sectoral union density	-0.359	-0.335	-0.0396	-0.220	-0.647	1.318
Job tenure	-0.118***	-0.119***	-0.116***	-0.111***	-0.111***	-0.111***
Female	0.811***	0.804***	0.599***	0.685***	0.685***	0.674***
Job change	0.187***	0.161***	0.166***	0.136**	0.134**	0.138**
Firm size (ref: under 100)						
Firm size between 100 and 200	-0.290***	-0.295***	-0.234**	-0.212**	-0.212**	-0.214**
Firm size above 200	-0.617***	-0.573***	-0.533***	-0.469***	-0.470***	-0.472***
Nationality (ref: German)						
Old EU member state	-0.202	-0.143	-0.134	-0.171	-0.170	-0.170
New EU member state	0.110	0.114	0.152	-0.0473	-0.0467	-0.0447
Non-EU country	0.363***	0.318***	0.274***	0.0596	0.0610	0.0586
Age group (ref: under 25)						
Aged 25-34	-1.125***	-0.788***	-0.754***	-0.700***	-0.699***	-0.700***
Aged 35-44	-1.391***	-1.085***	-1.110***	-1.084***	-1.084***	-1.085***
Aged 45-54	-1.491***	-1.199***	-1.216***	-1.246***	-1.246***	-1.248***
Aged 55-64	-1.009***	-0.692***	-0.727***	-0.851***	-0.850***	-0.854***
Education (ref: primary)						
Secondary education		-0.753***	-0.745***	-0.530***	-0.531***	-0.529***
Tertiary education		-1.369***	-1.303***	-0.719***	-0.721***	-0.719***
Part time work			0.646***	0.514***	0.514***	0.511***
Occupation dummies	No	No	No	Yes	Yes	Yes
Sectoral average job change					0.884	
Sectoral average female						0.778*
Constant	1.334***	1.855***	1.696***	0.172	-0.325	-0.241
Observations	10,919	10,741	10,741	10,665	10,665	10,665
Number of groups	27	27	27	27	27	27

*Note: *** p<0.01, ** p<0.05, * p<0.1.*

A3. Regression results – indirect effects

Figure A3.1: Results from multilevel logistic regression, with interaction between union membership and union density
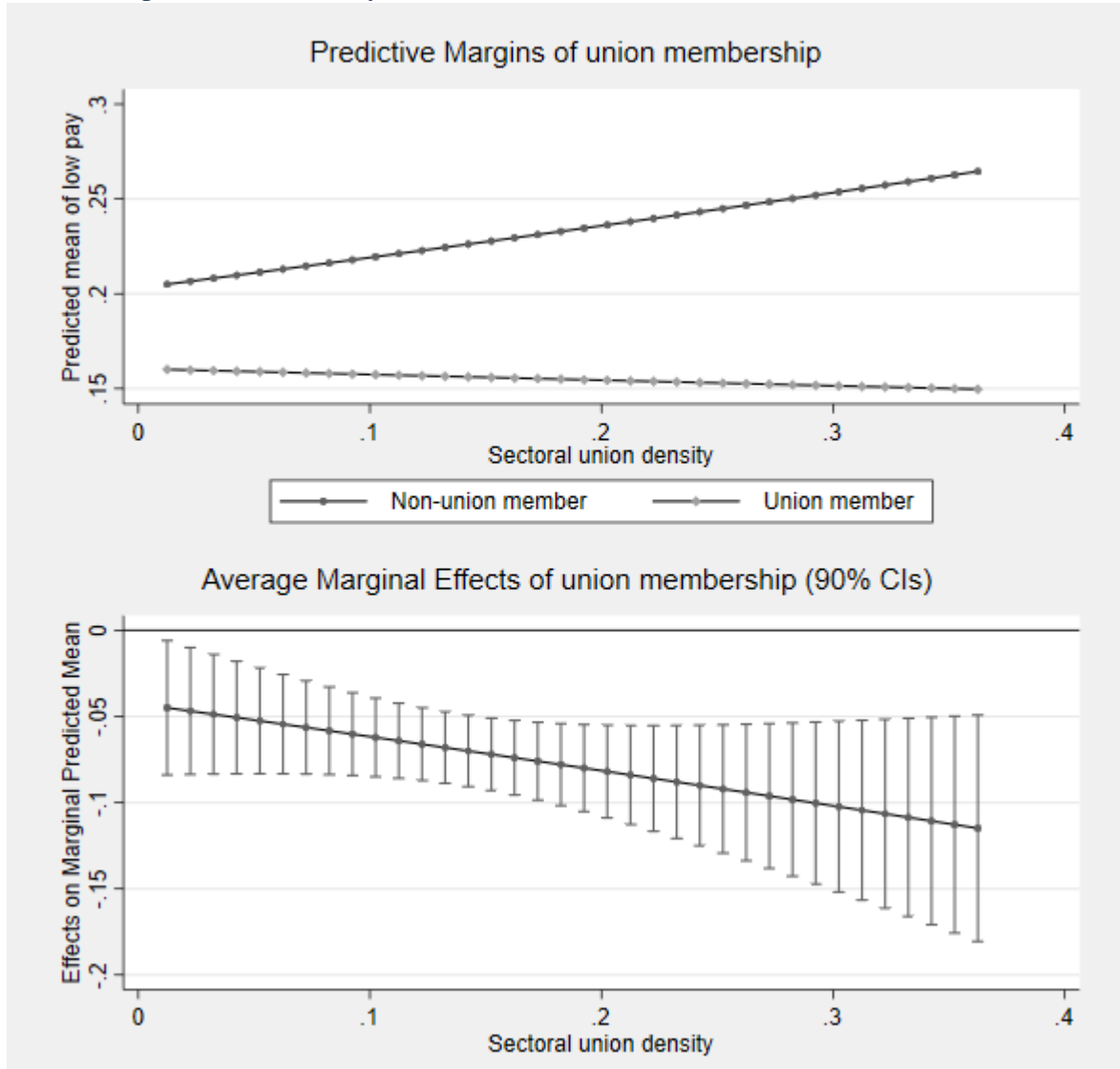
Note: the results were estimated using the same variables and model as in column 1 in section A2.9 but also include an interaction between individual union membership and sectoral union density.

Figure A3.2: Results from multilevel logistic regression, with interaction between sectoral bargaining agreement and sectoral bargaining coverage

Note: the results were estimated using the same variables and model as in column 1 in section A2.9 but also include an interaction between sectoral bargaining agreement and sectoral bargaining coverage.