

Collective Bargaining and Innovation in Germany: A Case of Cooperative Industrial Relations?

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I. Introduction

A European-North American dichotomy?

Scope: investigation of product/process innovation (and even failure to innovate) in Germany, 2007-2012.

Focus: the role of different institutional arrangements, with changes in collective bargaining status providing identification.

Context: a rather mixed theoretical backdrop and empirical literature that justifies further consideration of the German case.

Conclusion: collective bargaining is not to be construed as inhibiting innovation and may indeed prove beneficial when accompanied by workplace codetermination.

II. Theoretical Considerations

Unions and the tax on labor.

Unions and the tax on capital (Grout, 1984) and the link to innovation through asset specificity (Cavenaugh, 1989).

Hold-up and repeated games (van der Ploeg, 1987).

The strategic aspect of innovative activity (Menezes-Filho and van Reenen, 2003).

More positive aspects: collective voice, governance/efficient contracting to include hold-up on the other side of the market (Freeman and Medoff, 1984; Malcolmson, 1983).

... *theoretical considerations (continued)*

An application of *reverse* hold-up and the role of specific types of collective bargaining (Haucap and Wey 2004).

The notion of innovating employees and recognition of other institutional characteristics (Acharya, Baghai, and Subramian [ACB] (2012).

The *Betriebsrat* (Freemann and Medoff, 1984; Hübler and Jirjahn, 2003).

III. The Empirical Literature

Cross-country surveys (Menezes-Filho and van Reenen, 2003).

U.S studies using DiD and RDD (ACB, 2012; Bradley, Kim, and Tian, 2013).

More recent German studies on works councils and innovation (Canter, Gerstlberger, and Roy, 2014; Dilger, 2002; Scholl, Breitling, Janetzke, and Shajek, 3013; Kriegsmann and Kley, 22012; Jirjahn, 2012).

The interaction between works councils and collective bargaining proper.

A digression on pacts (Addison, Teixeira, Evers, and Bellmann, 2016).

IV. The Dataset

IAB-Betriebspanel: 2008-2013 surveys (with data covering the period 2007-2012).

Why 2008 as the starting period?

Use of 5 innovation dummies covering product (radical, imitation, incremental, and composite measure) and process innovation

Wide range of controls in addition to collective bargaining status and workplace representation: establishment workforce structure, age, size, state of technology, ownership, share of exports in sales, expected sales development, competitive pressure, profit situation, presence of an R&D department, expansion investments as share of total investment; whether the establishment resulted from a spin-off or had experienced the integration of other establishments; and industry dummies.

... dataset continued

We did not use information on orientation or opting out/pacts, but did exploit a question contained in the 2009, 2011, and 2013 waves of inquiring of the reasons for failing to innovate.

Restrictions: sample limited to plants with at least 5 employees in the private sector, excluding agriculture, extractive industries, and public utilities.

V. Some Introductory Facts

Since we are looking at plants that are observed on either single or multiple occasions, we need to determine that they are not too distinctive from their innovation profiles.

We find that pure cross section units tend to reveal a higher incidence of innovation than panel units across all types of innovation.

Other findings are that the incidence of product innovation is higher and more ongoing than process innovation; that incremental innovation is the most common and persistent type of innovation, and radical product innovation the least; and that a sizable subset of German establishments do not innovate.

Table 1 gives the unconditional probability of innovation in the pooled data as well as the probabilities conditional on works council and collective bargaining status.

Table 2 gives the tetrachoric correlation coefficients for these institutional and innovation measures.

... introductory facts (continued)

Table 1 shows that works councils and collective bargaining are associated with a higher incidence of innovation of all types, if not to the same degree. The data also suggest that firm agreements are also somewhat more favorable to innovation than sectoral agreements. This pattern largely obtains when we disaggregate by broad sector (manufacturing and services) and also by establishment size.

Table 2 shows that there is a strong positive correlation between works councils and innovation although the association between innovation and collective bargaining is weaker. Again, firm agreements seemingly have the edge, especially in the case of incremental innovations.

TABLE 1
SAMPLE INNOVATION INCIDENCE, 2007-2012 (in percent)

	Type of innovation					
	Incremental	Imitation	Radical	Product	Process	Any type
(a) Private sector						
P(.)	49.1	28.7	11.8	55.7	24.7	58.1
P(. cb_status=scb)	48.5	28.3	11.3	54.8	25.0	57.0
P(. cb_status=fcb)	57.5	30.5	13.1	62.5	31.0	65.0
P(. cb_status=no cb)	46.9	27.0	11.0	53.5	21.6	55.9
P(. woco=0)	41.1	24.8	9.0	47.9	17.8	50.2
P(. woco=1)	64.3	34.2	16.3	69.6	36.4	72.0

TABLE 2
TETRACHORIC CORRELATION BETWEEN INNOVATION AND SELECTED INSTITUTIONAL VARIABLES, 2007-2012

	Type of innovation											
	Incremental		Imitation		Radical		Product		Process		Any type	
Sectoral agreement	0.025	** *	0.024	** *	0.009		0.020	**	0.069	** *	0.018	**
N	34,432		34,437		34,435		34,427		34,407		34,421	
Firm-level agreement	0.140	** *	0.056	** *	0.055	** *	0.122	** *	0.155	** *	0.125	** *
N	22,595		22,595		22,588		22,591		22,576		22,588	
No collective agreement	-0.048	** *	-0.031	** *	-0.018	*	-0.040	** *	-0.088	** *	-0.039	** *
N	37,248		37,249		37,248		37,243		37,222		37,239	
Works council	0.347	** *	0.166	** *	0.218	** *	0.331	** *	0.340	** *	0.338	** *
N	37,348		37,350		37,349		37,343		37,322		37,339	

Notes: The reported coefficients provide the correlations between pairs of binary variables and are obtained using a biprobit model with no regressors. *, **, and *** denote statistical significance at the 0.1, 0.05, and 0.01 levels, respectively.

VI. Cet. Par. Analysis

A. Regression results using pooled data

We first provide results in Table 3 for a linear probability model for our dichotomous innovation variables. Of the key institutional variables we now drop firm-level agreements for consistency with our subsequent analysis and because such agreements represent just 7.5% of the total sample.

We thus have a total of 4 possible combinations: no sectoral agreement-no works council (reference category), no sectoral agreement-works council, sectoral agreement-no works council, and sectoral agreement-works council.

We have an extensive set of establishment-level variables, as well as time, size, and industry dummies, although Table 3 just gives the results for the institutional arguments.

What do we find? Well, the coefficient estimates for the institutional dummies are not statistically significant in one-half of the cases. Note the poor showing in respect of imitation and radical innovations.

But there is the suggestion that sectoral agreements without (with) a works council are seemingly unlikely (likely) to be associated with a higher probability of innovation.

Some additional remarks.

TABLE 3
 LINEAR PROBABILITY MODELS OF THE DETERMINANTS OF INNOVATION IN GERMANY, 2007-2012

	Incremental		Imitation		Radical		Product		Process		Any type	
No collective agreement-no works council (reference)												
No sectoral agreement-works council	-0.006		-0.007		-0.025 **		-0.002		0.002		0.003	
	(0.016)		(0.016)		(0.011)		(0.016)		(0.015)		(0.015)	
Sectoral agreement-no works council	-0.038 ***		-0.013		-0.006		-0.038 ***		-0.027 ***		-0.04 ***	
	(0.010)		(0.009)		(0.005)		(0.010)		(0.007)		(0.01)	
Sectoral agreement-works council	0.038 ***		-0.002		-0.003		0.032 **		0.025 **		0.026 *	
	(0.014)		(0.013)		(0.010)		(0.014)		(0.012)		(0.013)	
Constant	0.335 ***		0.171 ***		0.051 ***		0.377 ***		0.174 ***		0.396 ***	
	(0.029)		(0.028)		(0.019)		(0.029)		(0.025)		(0.029)	
R ²	0.21		0.08		0.10		0.19		0.16		0.19	
Number of establishments	9,093		9,095		9,094		9,095		9,090		9,094	
Number of observations	26,476		26,485		26,482		26,477		26,468		26,478	

Notes: Clustered (by establishment) standard errors in parentheses. *, **, and *** denote statistical significance at the 0.1, 0.05, and 0.01 levels, respectively.

Interdependence and Exogeneity Considerations

Two obvious concerns are the potential interdependence of sectoral agreements and works council presence and the assumed exogeneity of the two variables in the innovation equation.

Our approaches to this issue are both informal and formal.

In the former context, we looked to three pieces of ‘descriptive’ evidence on interdependence:

(i) We examined the (eight) reasons for not implementing planned innovation changes contained in the 2009, 2011 and 2013 surveys to determine whether there were systematic differences between plants with and without sectoral agreements and plants with and without works councils. The null hypothesis that the incidence of the problems serving to frustrate innovation are the same in establishments with and without sectoral agreements (works councils) were rejected in just 2 (5) out of 24 cases, suggesting that establishment characteristics omitted in Table 3 are not correlated in some obvious way with a particular institutional configuration.

(ii) We also examined the relative frequency of transitions into and out of collective agreements/works councils. The former transitions, at approximately 6%, were three times greater than of the latter.

(iii) Finally, are these institutional transitions linked? To examine this question we considered the works council transitions of sectoral agreement joiners and leavers. Very roughly speaking, over a period of six years, 10 out of 100 sectoral agreement joiners changed their works council status, and similarly for sectoral agreement leavers.

... interdependence and exogeneity considerations (continued)

Our formal interdependence and exogeneity tests are, respectively, a recursive, simultaneous equations model and a single-equation linear probability model with two selection arguments obtained from a bivariate probit with two choice equations in the manner of Hübler and Jirjahn (2003).

The recursive model

As can be seen from Table 4, it appears that works councils are more likely when sectoral agreements are present (second equation), that works council presence per se is favorable to innovation, if not that of a collective agreement again taken in isolation (third equation, Alternative 1), while only the combination of the two institutions points to greater innovative activity (third equation, Alternative 2). Moreover, the null that the correlation across unobservables in the three equations of the system is statistically different from zero cannot be rejected, ruling out the possibility that the role of institutions is the result of unobserved establishment characteristics.

The linear probability model with selection

Table 5 indicates that the selectivity term for sectoral agreement presence is significantly different from zero in 3 out of 6 cases, though only in 1 case and then marginally for works council presence. But key finding is that the impact on the sign and significance of the three interaction terms is muted (cf. Table 3).

TABLE 4
SUMMARY RESULTS OF THE RECURSIVE MULTIVARIATE PROBIT MODEL

	Sectoral agreement (first equation)		Works council (second equation)		Innovation (Any type) (third equation)			
					Alternative 1: without an interaction term		Alternative 2: with an interaction term	
Sectoral agreement	-----		0.58 ***		-0.05		-0.12 **	
			(0.07)		(0.53)		(0.055)	
Works council	-----		-----		0.09 **		-0.03	
					(0.047)		(0.05)	
Interaction term: sectoral agreement-works council	-----		-----		-----		0.22 ***	
							(0.04)	
ρ_{21}	0.04		0.04		0.04		0.04	
	(0.04)		(0.04)		(0.04)		(0.04)	
ρ_{31}	-0.05		-0.05		-0.05		-0.02	
	(0.03)		(0.03)		(0.03)		(0.03)	
ρ_{32}	-0.02		-0.02		-0.02		-0.01	
	(0.03)		(0.03)		(0.03)		(0.02)	
Log likelihood	-32,191.44		-32,191.44		-32,191.44		-32,178.36	
N	21,777		21,777		21,777		21,777	

Notes: The null hypothesis of $\rho_{21} = \rho_{31} = \rho_{32} = 0$ is not rejected at conventional levels as the chi-square statistic of the corresponding likelihood ratio test is 1.74 (p-value=0.63) and to 1.24 (p-value=0.75) in Alternative 1 and Alternative 2, respectively. $\rho_{jk}, j, k = 1, 2, 3, j \neq k$, denotes the correlation between the residuals of the j^{th} and k^{th} equations in the system. The fourth column presents just the coefficients of the third equation of the recursive system in which a sectoral agreement-works council interaction term is added to the right-hand-side of the innovation equation.

TABLE 5

BEAR PROBABILITY MODELS OF THE DETERMINANTS OF INNOVATION IN GERMANY WITH SELECTIVITY TERMS, ALL ESTABLISHMENTS WITH AT LEAST FIVE EMPLOYEES IN THE PRIVATE SECTOR, 2007-2012

	Incremental		Imitation		Radical		Product		Process		Any type	
no collective agreement-no works council (reference)												
no sectoral agreement-works council	0.019		-0.008		-0.034 **		0.019		0.008		0.018	
	(0.024)		(0.023)		(0.016)		(0.023)		(0.022)		(0.022)	
sectoral agreement-no works council	-0.047 ***		-0.007		-0.002		-0.037 **		-0.026 **		-0.038 **	
	(0.015)		(0.013)		(0.008)		(0.015)		(0.011)		(0.015)	
sectoral agreement-works council	0.061 ***		-0.011		-0.005		0.047 **		0.039 **		0.042 **	
	(0.020)		(0.019)		(0.014)		(0.020)		(0.018)		(0.019)	
works council selectivity term	-0.030 *		0.022		-0.001		-0.027		0.014		-0.027	
	(0.017)		(0.015)		(0.011)		(0.017)		(0.015)		(0.017)	
sectoral agreement selectivity term	0.102 ***		0.016		0.008		0.096 ***		0.007		0.105 ***	
	(0.030)		(0.031)		(0.022)		(0.029)		(0.028)		(0.029)	
	0.22		0.09		0.10		0.20		0.16		0.21	
number of establishments	4,867		4,867		4,866		4,866		4,866		4,866	
number of observations	11,527		11,528		11,527		11,526		11,526		11,529	

Notes: Clustered (by establishment) standard errors in parentheses. The two selectivity terms for the presence of works council and sectoral agreement being derived from a biprobit that uses a non-common set of regressors in the corresponding choice equations. The null of no interdependence between the two equations in the biprobit is rejected comfortably at the 0.01 level. *, **, and *** denote statistical significance at the 0.1, 0.05, and 0.01 levels, respectively.

TABLE 6
THE SELECTION OF SUBSAMPLES

	Subsample [Given by the sectoral bargaining and innovation status in t_0 (i.e. 2007-2008)]	Sectoral bargaining status in t_1 [i.e. 2009-2010]	Outcome Innovation in t_1 [i.e. 2009-2010]	Interpretation A positive coefficient on the scb variable means that:
Case 1	Establishments that are both non-innovators and not covered by a sectoral agreement; that is, Innov=0 in both 2007 and 2008 scb=0 in both 2007 and 2008	1/0 dummy (1 if scb=1 in both 2009 and 2010); 0 if scb=0 in both 2009 and 2010)	1/0 dummy (1 if Innov=1 in either 2009 or 2010, or in both; 0 otherwise)	Joining a sectoral agreement increases the probability of innovation for plant without any innovation at all in t_0
Case 2	Establishments that are both non-innovators and covered by a sectoral agreement; that is, Innov=0 in both 2007 and 2008 scb=1 in both 2007 and 2008	1/0 dummy (1 if scb=0 in both 2009 and 2010); 0 if scb=1 in both 2009 and 2010)	1/0 dummy (1 if Innov=1 in either 2009 or 2010, or in both years; 0 otherwise)	Leaving sectoral agreement increases the probability of innovation for plant without any innovation at all in t_0
Case 3	Establishments that are both innovators and not covered by a sectoral agreement; that is, Innov=1 in either 2007 and 2008 (or in both) scb=0 in both 2007 and 2008	1/0 dummy (1 if scb=1 in both 2009 and 2010); 0 if scb=0 in both 2009 and 2010)	1/0 dummy (1 if Innov=1 in either 2009 or 2010, or in both years; 0 otherwise)	Joining a sectoral agreement increases the probability of innovation for plant with some innovation in t_0

TABLE 6
THE SELECTION OF SUBSAMPLES (cont.)

	Subsample [Given by the sectoral bargaining and innovation status in t_0 (i.e. 2007-2008)]	Sectoral bargaining status in t_1 [i.e. 2009-2010]	Outcome Innovation in t_1 [i.e. 2009-2010]	Interpretation A positive coefficient on the scb variable means that:
Case 4	Establishments that are both innovators and covered by a sectoral agreement, that is, Innov=1 in either 2007 and 2008 (or in both years) scb=1 in both 2007 and 2008	1/0 dummy (1 if scb=0 in both 2009 and 2010); 0 if scb=1 in both 2009 and 2010)	1/0 dummy (1 if Innov=1 in either 2009 or 2010, or in both years; 0 otherwise)	Leaving sectoral agreement increases the probability of innovation for plant with some innovation in t_0

Note: This table illustrates the case in which the selected observation window is given by $t_0=2007-2008$ and $t_1= 2009-2010$.

B. Difference-in-Differences

We next more fully exploit the panel structure of the data.

We require a pre-treatments and a treatment period, respectively t_0 and t_1 . For example, $t_0 = 2007-2008$ and $t_1 = 2009-2012$. In this case we require six years of consecutive observation

We require appropriate comparison groups: sectoral agreement leavers vs. collective agreement stayers and joiners versus never members.

In a less demanding exercise, we shall require establishments to be observed only over four rather than six consecutive years; specifically, $t_0 = 2$ years and $t_1 = 2$ years, and hence deploy three moving windows. So we are comparing, say, plants that are not covered by a collective agreement in t_0 and comparing the incidence of innovative activity among those that joined an agreement in t_1 with that of those who stayed uncovered.

Finally, we have to further redefine the samples by their innovation or non-innovation status in t_0 and t_1 .

We thus have four different scenarios shown in Table 6 (for $t_0 = 2007-2008$ and $t_1 = 2009-2010$, ignoring works council status for expositional convenience).

Findings

Table 7 gives the results for joining and leaving a collective agreement in t_1 . It can be seen that in the subsample of establishments without works councils in t_0 joining a collective agreement is associated with reduced innovative activity among the sample of innovating establishments, while leaving collective bargaining may also be favorable to innovation among non-innovators in circumstances where a works council was present in the earlier period. The wider message, however, is that collective bargaining seemingly does not impair innovation to any material degree in specifications that also control for the endogeneity of sectoral agreements (and works councils).

This broader message is reiterated in Table 8 which purges (the small number of) works council switchers from the sample. The finding among non-innovators of a positive effect of leaving a collective agreement mirrors the finding in Table 7. For its part, among earlier innovators leaving a collective agreement versus staying covered seemingly has no direct effect although works council presence in such circumstances is associated with a marginally significant decline in innovation.

In the final application considered here, we attempted to examine any possible longer-term impact by requiring six consecutive years of observation with $t_0 = 2007-2008$ and $t_1 = 2009-2013$. As can be seen from Table 9, among early innovators abandoning collective bargaining reduces innovative activity, albeit significantly so only where a works council is present.

TABLE 7
 THE DIFFERENCE-IN-DIFFERENCES EFFECT OF JOINING/LEAVING SECTORAL COLLECTIVE BARGAINING AGREEMENTS ON THE PROBABILITY OF ANY TYPE OF INNOVATION IN GERMANY, POOLED CASE

(a) Non-innovators sample

	Without works council (in t_0)				With works council (in t_0)			
	Joining scb vs. Staying uncovered		Leaving scb vs. Staying covered		Joining scb vs. Staying uncovered		Leaving scb vs. Staying covered	
	Scb coefficient		-0.02	-0.02	-0.08	-0.08	0.09***	0.09**
Works council selectivity term		-----	56.80*	-----	-0.27	-----	-0.33	
Sectoral agreement selectivity term		-----	-1.73	-----	0.4	-----	1.80***	
R²		0.57	0.61	0.14	0.14	0.05	0.05	
N		82	82	520	520	3,914	3,914	

(b) Innovators sample

	Without works council (in t_0)				With works council (in t_0)			
	Joining scb vs. Staying uncovered		Leaving scb vs. Staying covered		Joining scb vs. Staying uncovered		Leaving scb vs. Staying covered	
	scb coefficient	-0.43**	-0.43*	0.09	0.10	-0.002	-0.002	0.004
Works council selectivity term	-----	3.55	-----	34.69	-----	-0.73	-----	1.63
Sectoral agreement selectivity term	-----	2.12	-----	0.81	-----	0.03	-----	0.19
R²	0.72	0.73	0.32	0.33	0.10	0.10	0.08	0.08
N	58	58	154	154	1,146	1,146	9,498	9,498

Notes: In each panel, the reported coefficients are obtained by running a linear probability model. Both the dependent variable – any type of innovation – and the sectoral collective bargaining agreement variable are dated in t_1 . The control variables are in first differences. No estimates could be obtained for the joining scb vs. staying uncovered case in panel (a). The selectivity terms are derived from a bivariate probit model that models now the works council and sectoral agreement switching decisions. The null of no interdependence across the two equations in the bivariate probit is always rejected at the 0.01 level. *, **, *** denote statistical significance at the 0.1, 0.05, and 0.01 levels, respectively.

TABLE 8

THE DIFFERENCE-IN-DIFFERENCES EFFECT OF JOINING/LEAVING SECTORAL COLLECTIVE BARGAINING AGREEMENTS ON THE PROBABILITY OF ANY TYPE OF INNOVATION IN GERMANY, POOLED CASE WITH NO WORKS COUNCIL SWITCHERS

	Non-innovator				Innovator			
	Joining scb vs. Staying uncovered	Leaving scb vs. Staying covered		Joining scb vs. Staying uncovered	Leaving scb vs. Staying covered			
Scb coefficient	-0.09	0.09***	0.09***	-0.002	-0.005	0.001	0.001	
Works council selectivity term	-----	-----	-0.56	-----	-1.32	-----	2.40	
Sectoral agreement selectivity term	-----	-----	1.11	-----	0.15	-----	-0.40	
Works council (in t_0)	0.10	0.07	0.07	0.04	0.04	-0.06*	-0.06*	
R²	0.14	0.05	0.05	0.09	0.10	0.09	0.09	
N	518	3,905	3,905	1,162	1,162	9,403	9,403	

Notes: No estimates could be obtained for the joining scb vs. staying uncovered/non-innovator case in the second column. The selectivity terms are derived from a biprobit that models, respectively, works council presence and sectoral agreement transitions. The null of no interdependence across the two equations in the biprobit is always rejected at the 0.01 level. *, **, and *** denote statistical significance at the 0.1, 0.05, and 0.01 levels, respectively.

TABLE 9
MEDIUM-TO LONG-RUN EFFECTS OF JOINING/LEAVING SECTORAL COLLECTIVE BARGAINING
AGREEMENTS ON THE PROBABILITY OF ANY TYPE OF INNOVATION IN GERMANY, 2007-2012

(a) Non-innovators sample

	Without works council		With works council	
	Joining scb vs. Staying uncovered	Leaving scb vs. Staying covered	Joining scb vs. Staying uncovered	Leaving scb vs. Staying covered
Scb coefficient	0.16	0.17		
R ²	0.14	0.19		
N	310	188		

(b) Innovators sample

	Without works council		With works council	
	Joining scb vs. Staying uncovered	Leaving scb vs. Staying covered	Joining scb vs. Staying uncovered	Leaving scb vs. Staying covered
Scb coefficient	0.14	-0.04	0.16	-0.38***
R ²	0.09	0.21	0.24	0.23
N	644	229	107	301

Notes: The pre-treatment period t_0 comprises the 2007-2008 interval; $t_1=2009-2012$ is the treatment period. No estimates could be obtained for the last two columns in panel (a). See the text for a full description of the experiment.

VII. Conclusions

The largely Anglo-Saxon focus of the (investment and) innovation literature, taken in conjunction with recent theoretical developments, suggest that there is an pressing need to examine other-country experience, not least the German case.

The pooled data estimates provided here is broadly favorable to joint presence of both institutions. This is no less true of process than product innovation, even if there is no suggestion of any positive effect on radical (product) innovation.

Our DiD estimates yielded mixed results. Thus, there was the finding among non-innovators that leaving a collective agreement could actually benefit innovative activity. By the same token, it was also reported for innovators that leaving (joining) a collective agreement can be injurious to innovation in the presence (absence) of a works council. If there was little overall indication that the role of collective bargaining was to inhibit innovation, there was some suggestion then that the role of the dual system was mutually supportive.

Nevertheless, it has to be borne in mind we have largely focused on one composite facet of innovative activity. Research using other datasets and other indicators (such as continuous input and output measures) is patently required.