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Abstract: This article examines the relationship between works councils and the closure of manufacturing establishments in Germany. The relationship varies according to circumstances and type of establishment. For the subsample of single-establishment firms, the estimates show that works council presence interacts with the coverage by a collective bargaining agreement. The presence of a works council is associated with a higher probability of closure within the uncovered industrial relations regime but not within the covered regime. For establishments being parts of multi-establishment firms, works council presence is associated with a lower probability of closure. This specifically holds true if establishments face adverse economic conditions.

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1. Introduction

Job destruction due to establishment closures has been a matter of great concern in recent years. International evidence confirms that a significant amount of job destruction is attributable to the exit of establishments (Blanchard and Portugal 2001, Davis et al. 1996). A popular view holds that distortions caused by non-market institutions are important factors behind poor labor market performance. Against this background, several studies have examined the relationship between unionization and establishment closures. While studies for the United States show little or no union effect (DiNardo and Lee 2002, Dunn and Macpherson 1994, Freeman and Kleiner 1999), examinations for Australia (Brown and Heywood 2006) and Canada (Fang and Heywood 2006) find a positive association between unions and plant closures. Studies for Britain provide mixed results (Addison et al. 2003, Bryson 2004, Machin 1995, Stewart 1995).

This paper examines the relationship between works councils and the closure of manufacturing establishments in Germany. Industrial relations in Germany are characterized by a dual structure of employee representation. While collective agreements are usually negotiated between unions and employers' associations on the industrial level, works councils provide a highly developed mechanism for establishment-level participation. The German case study represents more than just another data point as works councils have legally defined functions that are distinct from those of unions. They are an institution designed to foster communication between employees and management and to build trustful and cooperative industrial relations within the establishment. Works councils play an important role in corporate governance and industrial relations in many West European countries. Compared to councils in other European countries, German works councils have acquired relatively extensive powers (Thelen and Turner 1997). Nonunion worker representation has also received considerable attention outside Europe. In Korea, mandated works councils deal with productivity concerns, employee training, and health and safety issues (Kleiner and Lee

1997). In the US, the interest has been spurred by a sharp decline in union density and the growth of a substantial 'representation gap' in the workforce (Freeman and Rogers 1999). Much of the political discussion has centered on the idea of mandating German-style works councils. In Canada, nonunion worker representation has a long tradition. Mandatory health and safety committees have been introduced in several provinces (Bernard 1995). Moreover, committees must be set up in case of plant shutdowns and substantial layoffs. Canada's mandatory committees have characteristics similar to works councils (Adams 1985).

The intended purpose of works councils is to create joint establishment surplus rather than to redistribute it. Hence, works councils may contribute to an improved quality of industrial relations. As indicated by cross-country studies (Blanchard and Philippon 2006, Feldmann 2006), improved quality of employer-employee relations in turn can result in positive labor market outcomes. However, from a theoretical point of view, councils may use their codetermination rights for rent seeking activities and informal negotiations with management. Hence, like unions, councils may theoretically have both a voice and a monopoly role, resulting in an ambiguous effect on establishment survival.

Which role of works councils dominates may vary according to circumstances and type of establishment. We formulate hypotheses on these circumstances and test the hypotheses using rich data on a sample of manufacturing establishments in Germany. We argue that works council presence interacts with collective bargaining coverage, ownership type and the economic situation of the establishment. The empirical results confirm that moderating factors play a crucial role. Using the full sample, the estimates show no significant link between works councils and closures. However, the combined sample hides a far richer pattern. For the subsample of single-establishment firms, we find an interaction of works councils with collective bargaining coverage. The presence of a works council is associated with a higher probability of establishment closure within the uncovered industrial relations regime but not within the covered regime. For establishments belonging to multi-

establishment firms, the estimates show that the presence of a council is associated with a lower probability of closure. This specifically holds true if establishments face adverse economic conditions (proxied by short-time work and import penetration).

While there is an increasing number of empirical examinations on German works councils, little attention has been paid to the link between councils and closures. Two exceptions are the studies by Addison et al. (2004) and Addison and Teixeira (2006). Based on the IAB Establishment Panel, the first study finds that councils are positively associated with the closure of establishments. The link appears to be stronger in establishments not covered by a collective agreement. However, using the same data, the second study shows no significant relationship between council presence and establishment closure. Given the mixed results, more evidence is certainly warranted. This paper contributes to the literature not only by using an alternative data set.[1] The main contribution is a detailed analysis of the moderating factors influencing the relationship between works councils and establishment closures. Moreover, the paper also contributes to the broader literature on the effects of works councils. This literature has not yet considered the crucial interactions of works councils with the type of ownership and the economic situation of the establishment.

The rest of the paper is organized as follows. The institutional framework is described in Section 2. In Section 3, the theoretical background is discussed. Section 4 describes the data, variables and estimation method. Section 5 presents the results. Section 6 concludes.

2. Institutional Framework

German industrial relations are characterized by a dual structure of employee representation with both works councils and unions (Hubler and Jirjahn 2003). Collective agreements are usually negotiated between unions and employers' associations on a broad industrial level. They regulate wage rates and general aspects of the employment contract. The coverage by a collective agreement does not depend on the decision of the establishment's workforce.

Typically, establishments are covered if they are members of an employers' association.[2] The agreement can be extended to non-member establishments by the Federal Ministry of Labor. Covered establishments pay the negotiated wage rate to both union and non-union members.

Works councils provide a highly developed mechanism for establishment-level codetermination that is formally independent of the process of collective bargaining.[3] Their rights are defined in the Works Constitution Act (WCA), which was introduced in 1952 and amended in 1972, 1989, and 2001. The law states that councils shall be elected by the workforce of establishments with five or more employees. Multi-establishment firms additionally have a central council *(Gesamtbetriebsrat)*, composed of delegates of the establishment-level works councils. However, the creation of a works council depends on the initiative of the workforce. Hence, councils are not present in all eligible establishments.

Councils negotiate over a bundle of interrelated company policies. On some issues, they have the right to information and consultation, in others a veto power over management initiatives, in still others the right to coequal participation in the design and implementation of policy. Their rights are strongest in social and personnel matters such as the introduction of new payment methods, the allocation of working hours, the introduction of technical devices designed to monitor employee performance, and up and down grading. They have less strong consultation rights in matters such as changes in equipment and working methods that affect job requirements, decisions relating to manpower planning, and planned structural alterations to the plant. The participation rights in financial and economic matters cover information provision. Their rights are also directly related to the closure of the establishment. Councils can bargain over social compensation plans. They have the right to demand compensation for the dislocation caused by plant closings and major changes in organization.

Works councils are institutionalized bodies of worker representation that have functions that are distinct from those of unions. They do not have the right to strike. If council and management fail to reach an agreement, they may appeal to an internal arbitration board.

Moreover, the WCA does not allow wage negotiations; the aim is to restrict distributional conflicts. Rather works councils are designed to increase joint establishment surplus. Council representatives are required by law to cooperate with management "in a spirit of mutual trust . . . for the good of the employees and of the establishment."

3. Background Discussion

3.1 Voice and Monopoly Roles of Works Councils

From a theoretical point of view, the relationship between works councils and establishment survival is ambiguous. Councils may have a positive effect on survival due to their collective voice role. Many working conditions are workplace public goods. The individual voice mechanism is not effective in case of workplace public goods because there are free rider problems, as with any other public good. A collective voice institution can potentially aggregate workers' preferences and overcome those free-rider problems. This voice institution can communicate the preferences to management, helping to optimize the provision of workplace public goods and to establish an effective personnel management (Freeman 1976, Freeman and Medoff 1979). This, in turn, increases worker morale and productivity and, hence, may contribute to a higher probability of establishment survival.

However, the strong codetermination rights of works councils go far beyond the rights of a simple voice institution. These codetermination rights are one mechanism to prevent employers from engaging in opportunistic behavior (Freeman and Lazear 1995, Kaufman and Levine 2000, Smith 1991). Employees will withhold effort and cooperation when an employer cannot credible commit to take into account their interests. For example, workers fearing job loss due to organizational or technological change may try to sabotage a management-initiated restructuring of production. Moreover, if information about potentially performance-enhancing innovations is in the hand of the employees, they may not wish to reveal it for the fear that the employer might use the information to their disadvantage.

Providing works councils with codetermination rights is one way to protect the interests of the workforce and to realize mutual gains for the employees and the owners of the establishment. The councils' role in building trustful employer-employee relations is also strengthened by the legal requirement to cooperate with management. As stressed in the previous section, the WCA aims at restricting the scope for redistribution. Altogether, the unique institutional design of works councils suggests that they have the potential to increase establishment performance. Recent studies confirm that works councils indeed can increase productivity and reduce personnel turnover (Addison et al. 2001, Frick and Moller 2003, Smith 2006).

This line of reasoning implies that councils may have a positive impact on establishment survival. However, though works councils have functions distinct from those of unions, they may engage in rent-seeking activities. A council may use its codetermination rights on social or personnel matters to obtain employer concessions on issues where it has no legal powers. Even though wage negotiations between council and management are not authorized by law, the works council may have an influence on wages. If employer and works council fail to reach an agreement in informal wage negotiations, the council can threaten to be uncooperative in areas where its consent is necessary. Empirical studies confirm that the presence of a works council is associated with a higher average wage level per employee (Addison et al. 2001), more generous fringe benefits (Bellmann and Frick 1999) and reduced intra-firm wage dispersion between skilled and unskilled workers (Hubler and Meyer 2001).[4]

If works councils primarily raise labor costs, the presence of a council will be associated with reduced profitability. This in turn may result in a higher probability of establishment closure. One may object that even if works councils are engaged in rent-seeking activities, they will not imperil their own survival by threatening that of the establishment. As Freeman and Kleiner (1999: p. 512) put it in their analysis of unions: "The rational union will not raise wages to the point where the firm is sufficiently unprofitable to go out of business." Yet, from a theoretical point of view, the optimal strategy of rent extraction depends on the

workers' discount rates (Fang and Heywood 2006). If workers heavily discount future employment with the establishment, a council might negotiate away all possibility for future rents. Such rent-seeking behavior would result in a hold-up problem. Owners would have a reduced incentive to invest in new capital if the council expropriates a large portion of the rents arising from those investments. The result would be the closure of the establishment.

Empirical studies suggest that councils neither inhibit investments nor innovations (Addison et al. 2001, Dilger 2002, Hubler 2003). Quite the contrary, recent evidence shows that they are positively associated with specific types of innovations. While works councils are not associated with general process innovations, there is a positive relationship between works councils and investments in environmentally friendly production processes (Askildsen et al. 2006). Furthermore, there is no link between councils and drastic product innovations but a positive relationship between councils and incremental product innovations (Jirjahn and Kraft 2009).[5] These findings may cast some doubt on the view that workers heavily discount future employment with the establishment.

In summary, both theoretical considerations and empirical investigations suggest that works councils have both a voice and a monopoly role. It is an open question which effect dominates. Hence, works councils may be positively or negatively associated with the closure of establishments. In what follows, we hypothesize that moderating factors play an important role in the relationship between works councils and closures.

3.2 Type of Ownership

Addison et al. (2003) show for Britain that the relationship between unionization and closures depends on the type of ownership. They find a positive association that is driven by plants belonging to multi-establishment firms. No such relationship obtains in single-establishment firms. These results conform to theoretical expectations. The costs of establishment closure to the workers are likely to be lower in multi-establishment entities. Workers may have transfer

rights (by seniority) to other units of the firm. Moreover, the ongoing firm is more likely to fulfill its contractual and legal requirements such as severance pay. Hence, the union's incentive to engage in rent-seeking activities is likely to be higher in plants that are parts of multi-establishment firms. In contrast, the closure of a single independent establishment implies that workers will certainly lose their jobs. This reduces the incentive for rent-seeking activities, resulting in an increased willingness on the part of the union to make concessions. This line of reasoning can be applied to German works councils. If works councils primarily play the role of a rent-seeking institution, this role should be stronger in establishments that are parts of multi-establishment firms. We should find a positive association between councils and closures in multi-establishment entities and a less strong or even insignificant association in the case of single-establishment firms.

However, if councils primarily play the role of a voice institution, there should be a negative association between works councils and closures. This negative relationship should particularly hold true in multi-establishment entities. In those firms, decision-making is more complex and less transparent to the workforce of the local establishment. Employee interests are not only affected by decisions of local managers but also by decisions made at other locations of the firm. This suggests a specific voice role of works councils in establishments that are parts of a multi-establishment firm. A council can help workers to get access to firm-wide information and to influence decisions at the firm level. This may be particularly the case if the council of the local establishment is supported by a central works council operating at the firm level. Altogether, works councils are more likely to play an important role in building trust and ensuring workers' cooperation if the establishment is part of a multi-establishment firm. In single-establishment firms, councils may play a less strong role in building trustful employer-employee relations. As decisions are solely made by local managers, decision processes are more transparent to the workforce. Alternatively, it can be argued that councils in single-establishment firms play a less powerful voice role as they

cannot participate in a network of works councils where they receive additional support.[6]

3.3 Economic Situation of the Establishment

Theoretical reasoning suggests that the economic situation of the establishment should also play a moderating role in the relationship between worker representation and establishment closures. Booth (1995: p. 53) and Bryson (2004) argue that rent-seeking unions may have no or little effect on employer survival if the extra surplus accruing to employees through higher wages does not come through normal profits but through excess profits. Imperfect product market competition is one source of excess profits. It allows establishments to be price makers rather than price takers. In this case, establishments can pass higher labor costs on to their consumers without losing market shares. Applying this line of reasoning to German works councils, councils as a rent-seeking institution should have little effect on closures if establishments operate in product markets with high sales potentials and little competition. Rent-seeking works councils should have a stronger positive effect on closures only if establishments face high competition and shrinking sales opportunities. This effect may be reinforced by an endgame phenomenon. Espinoza and Rhee (1989) argue that workers in shrinking industries prefer to maximize their short-term gains by negotiating for higher wages. These workers may have a short time horizon as they face a high probability of losing their jobs.[7] In such circumstances, rent-seeking activities of works councils might aggravate distributional conflicts. This, in turn, might accelerate the process of establishment closures.

If works councils are primarily a voice institution, the economic situation of the establishment is also likely to play a moderating role. Yet, the role differs sharply from that described for the rent-seeking case (Jirjahn 2009). We hypothesize that works councils as a voice institution particularly contribute to establishment survival if establishments face adverse economic conditions. A poor economic situation can result in inefficient closures (Hashimoto and Yu 1980). If the employer does not take into account the workers' quasi-

rents, she may close the establishment even when total surplus from continuing the employment relationships is positive. To avoid inefficient plant closures, employer and workforce may want to bargain over employee concessions (e.g. higher effort). However, information asymmetries can cause workers to refuse concessions even when the concessions may be unavoidable to overcome the crisis. If workers do not share the same economic information possessed by management, they may fear that the employer overstates the crisis to demand greater concessions. In this situation, codetermination can help to rebuild trust (Furubotn and Wiggins 1984). The information rights of the council help to verify the employer's claims.[8] This, in turn, increases workers' willingness to make 'legitimate' concessions. Hence, the council contributes to overcoming the crisis by negotiating for performance-enhancing changes that otherwise would not have been possible.[9] Our previous discussion suggests that information asymmetries are greater in establishments that belong to multi-establishment firms. This implies that councils may play a specific role in rebuilding trust and overcoming poor financial performance for this type of ownership. Hence, councils should be particularly associated with a lower probability of closure if the establishment under pressure is part of a multi-establishment firm.

3.4 Collective Bargaining Coverage

Although establishment-level codetermination and industry-wide collective bargaining are formally independent there are important linkages. Building from Freeman and Lazear (1995), Hubler and Jirjahn (2003) argue that the voice and the monopoly roles of works councils depend on collective bargaining coverage. There are several reasons why rent-seeking activities of councils are more restricted in covered establishments. First, establishment-level bargaining undermines the unions' power and contributes to dispersed earnings across establishments. Second, because of the centralized bargaining system, unions are more interested in the industry-wide employment levels than are the parties within the individual

establishment (Svejnar 1982). Therefore, a union will provide a council with expertise to strengthen the council's position against an opportunistic employer but it will try to restrict rent-seeking activities. Hence, performance-enhancing work practices are more likely to be negotiated by management and council when distributional conflicts are moderated by unions and employers' associations outside the establishment. Hubler and Jirjahn's (2003) empirical results conform to their bargaining model. They find a positive link between councils and productivity for covered establishment but not for uncovered establishments.[10] Conversely, the link between councils and wages is less strong in covered establishments than in uncovered establishments. Moreover, the results by Addison et al. (2004) indicate that the link between councils and closures is moderated by collective bargaining. They find a positive association between councils and closures, which is weaker in covered establishments.

In what follows we will examine whether the interaction of councils with collective bargaining coverage depends on the type of ownership. The moderating role of collective bargaining coverage may be less important for establishments that are parts of multi-establishment firms. In these establishments, councils already have a strong voice role due to the need to monitor complex decision-processes. The voice role may be even further strengthened by the network of councils within the firm that provides local works councils with support against employer opportunism. Moreover, local works councils may be disciplined within the network to limit rent-seeking activities if those activities harm other units of the firm. Hence, unions may play a less strong role in restricting rent-seeking behavior of works councils and in providing them with support against opportunistic managers if the establishment belongs to a multi-establishment firm.

4. Data, Variables and Estimation Method

4.1 Data Set

The empirical investigation is based on the Hanover Panel, a four-wave panel (1994-1997)

with data from manufacturing establishments in the federal state of Lower Saxony (Gerlach et al. 2003). Investigating the determinants of the closure of establishments in the manufacturing sector is interesting for several reasons. First, a relatively high percentage of economic activity in comparative perspective is still concentrated in manufacturing in Germany (Vitols 2005). The importance of traditional branches, such as the automobile industry, appears to even have increased within manufacturing as a whole. Second, the dual system of employee representation with establishment-level codetermination and industry-level collective bargaining is common in the manufacturing sector. This sector has also been traditionally the wage leader. Negotiations in the manufacturing sector often serve as a point of reference for negotiations in other sectors. Third, the effects of worker representation may differ between industries (Doucouliagos and Laroche 2003). Focusing on manufacturing establishments helps to avoid a bias due to heterogeneity across industries.

The population of the survey consists of all manufacturing establishments with five or more employees. This is important as the WCA applies to establishments with at least five employees. The sample is stratified according to firm size and industry, with an oversampling of larger establishments. The sample was designed in such a way that a sufficient number of cell entries remained after four waves despite sample attrition. The survey was financed by the Volkswagen Foundation. Interviews were conducted by Infratest Sozialforschung, a leading German survey and opinion research institute. The data were collected on the basis of a questionnaire in personal interviews with the owner, top manager or head of the personnel department. The questionnaire covered various aspects of establishment structure, establishment behavior and establishment performance with an emphasis on issues relating to personnel. A nucleus of themes was addressed annually. Different additional topics were sampled in consecutive waves.

In the first wave of interviews (1994) 51 percent of the establishments in the sample agreed to participate. In spite of this non-response rate the difference between the planned and

realized stratification is so small that the data are representative of the manufacturing establishments in Lower Saxony in 1994 and in the subsequent waves. The net sample of the first wave was used as the basis for the following waves. Hence, establishments that answered in the first wave were contacted further whereas establishments that declined to answer in that wave were not taken into account again.

4.2 Dependent Variable

Information on establishment outcomes in the years following 1994 comes from survey interviewers' contacts with the establishments as part of the second, third and fourth wave. The outcome codes provide the information enabling us to identify establishment closure. We construct a dummy variable that is equal to one if the establishment has been closed during autumn 1994 and autumn 1997. Only unambiguous closures are considered. Establishments that had not been traced are excluded from the analysis. The dependent variable equals zero if the establishment has not been closed during those years. The group of surviving employers includes both establishments that participated in the fourth wave of the survey and establishments that refused to participate in the fourth wave. Variable definitions and descriptive statistics are shown in Table 1.[11] 7.4 percent of establishments closed over the three-year period. This implies an average annual rate of 2.5 percent. The rate is comparable with the closure rates shown in other studies.

4.3 Explanatory Variables of Primary Interest

The data provide a rich set of explanatory variables.[12] The information available in the first wave of the panel is used to explain establishment closures between 1994 and 1997. The explanatory variable of primary interest is a dichotomous variable for the presence of a works council. Our theoretical considerations suggest that ownership type, the broader industrial relations system and the economic situation may play moderating roles in the relationship between councils and closures. Ownership type and the broader industrial relations systems

are captured by dummy variables for single-establishment firms and collective bargaining coverage. Product market competition is controlled for by including variables for sectoral concentration (sales of six largest firms as share of total) and sectoral import penetration. Official German statistics are matched to 31 industrial sectors in manufacturing identified by the survey. Three broader-defined industry dummies are included to account for variation in the nature of what is being produced. Moreover, a dummy variable for short-time work is included to capture the economic situation of the establishment. Short-time work is associated with falling demand for the establishment's products. While temporary layoffs are virtually unknown in Germany, the German unemployment insurance system does provide for short-time benefits (Abraham and Houseman 1994, Mosley and Kruppe 1996). With the approval of the Employment Service, establishments can reduce employees' hours of work and those employees receive prorated unemployment insurance benefits. Initially introduced as an instrument to stabilize employment in establishments facing temporary economic adversities, short-time work has been increasingly used as a measure to cope with structural change.

4.4 Other Determinants of Closure

The survey provides several indicators of the managerial environment. Profit sharing for executive managers may help eliminate agency problems by aligning the interest of managers and owners (Ross 1973). If profit sharing induces more effort from managers, it should lower the probability of establishment closure. Similarly, the presence of active owners may be associated with reduced agency problems. Moreover, we take into account that managers may be more willing to close the establishment if adversarial employer-employee relations – with or without works councils – reduce their job satisfaction. A variable for a negative or positive management attitude toward employee involvement in decision making indicates the presence or absence of such adversarial relationships.

The legal form of the establishment may also play a role. German law distinguishes

between two types of legal forms involving the conduct of business for profit, namely non-corporate and corporate establishments (Harhoff et al. 1998). While non-corporate establishments have no legal capacity separate from their owners, corporate establishments have this status. Most importantly, owners of non-corporate establishments are fully liable with their entire personal assets whereas owners of corporate establishments are only liable up to their individual shares. Stiglitz and Weiss (1981) argue that owners are more willing to support risky projects if they are protected by limited liability. Hence, limited liability should be positively associated with the probability of establishment closure. The legal form is captured by a dummy equal to one if the establishment is a non-public limited liability company (*GmbH*) or a public limited company (*AG*).

Several variables capture the structure of the workforce. The share of blue-collar workers and the share of women should be positively associated with the closure probability as they reflect a relatively low cost of closing the establishment. In Germany, the amount of severance payment depends on the worker's previous wage and tenure. Women have a substantially lower average tenure than men (Harhoff 1998). Blue-collar workers are typically viewed as low-qualified employees receiving relatively low earnings (Berman et al. 1998). Hence, the total amount of severance payments will be smaller if the employer closes an establishment with high shares of women and blue-collar workers. Variables for the share of temporary workers and part-time workers are also included. These variables may also reflect low costs of establishment closure. On the other hand, they may indicate increased employment flexibility and, hence, may be associated with a lower probability of failure.

Findings by Doms et al. (1995) indicate that the vintage of production technology has an influence on survivability. A modern production technology increases the establishment's competitiveness and, hence, reduces the probability of closure. Moreover, a dummy for the use of shift work is included. Shift work reflects the capability to adjust production to fluctuations in demand (Jirjahn 2008). Hence, it can be viewed as an additional indicator of

competitiveness. Establishment size is also controlled for. Jovanovic's (1982) model of learning and market selection suggests that the failure rate is a decreasing function of establishment size. The key assumption is that establishments differ in their efficiency, but efficiency levels are not observable. Actual production costs depend on both efficiency and stochastic factors. Managers choose the output level based on their expectations about the establishment's efficiency. If establishments survive, they update their beliefs and increase production. Hence, size predicts efficiency and a high chance of future survival.

Finally, the age of the establishment is controlled for. The limk between age and failure has received considerable attention. However, the results appear to be mixed. Some studies find that young establishments are more likely to close (Baldwin and Gorecki 1991, Mata and Portugal 1994). This may reflect the liability of newness. Inexperienced managers of younger establishments may make more mistakes. However, other studies find a nonlinear relationship. Bartelsmann et al. (2005) provide some evidence of a 'honeymoon' effect whereby the establishment's initial stock of assets affords it some insurance against failure in the early life. Bruderl and Schussler (1990) find an inverted U-shaped risk pattern implying a higher probability of closure for middle-aged establishments. Thornbill and Amit (2003) show that younger establishments are more likely to fail because of inadequacies in managerial knowledge. Older establishments are more likely to fail because of the inability to adjust to environmental change.

4.5 Methodology

As the dependent variable is dichotomous, we will fit the determinants of closure to a cumulative normal function using ML probit estimation. While this is a standard routine described in most introductory text books, the interpretation of interaction effects in the probit model remains a controversial issue. As moderating factors play a central role in this study, we provide a brief discussion. For the sake of simplicity, a specification with only one

interaction variable is considered. Let Y_i denote the decision whether or not to close establishment i. The decision is defined by

$$Y_i = \begin{cases} 1, \text{if } Y_i^* > 0, \\ 0, \text{otherwise} \end{cases} \tag{1}$$

with the latent model $Y_i^* = \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_{12} X_{1i} X_{2i} + \boldsymbol{\beta' Z}_i + u_i$ where X_{1i} and X_{2i} are the variables that may interact. $\boldsymbol{Z}_i$ is the vector of additional explanatory variables and u_i the error term. The conditional mean of the dependent variable is $\Pr(Y_i = 1) = \Phi(\beta_1 X_{1i} + \beta_2 X_{2i} + \beta_{12} X_{1i} X_{2i} + \boldsymbol{\beta' Z}_i)$ where $\Phi(.)$ is the standard cumulative distribution. A natural interpretation is that the coefficient β_{12} reflects the interaction of X_{1i} and X_{2i}. However, Ai and Norton (2003) have recently suggested that the interaction effect is represented by the cross derivative of the expected value of the observed variable Y_i

$$\frac{\partial \Phi(.)}{\partial X_{1i} \partial X_{2i}} = \beta_{12} \phi(.) + (\beta_1 + \beta_{12} X_{2i})(\beta_2 + \beta_{12} X_{1i}) \phi'(.), \tag{2}$$

where $\phi(.)$ is the density function. A similar interpretation has been critized a decade ago by Frant (1991) as it can potentially result in artificial and atheoretical predictions. The functional form of the probit model implies that all explanatory variables have nonlinear effects on $\Pr(Y_i = 1)$. Hence, equation 2 can produce interaction effects by assumption rather than by conclusion. For example, the cross derivative may be nonzero even if $\beta_{12} = 0$. To avoid spurious interpretations, Nagler (1991) has suggested to interpret interaction effects with respect to the cross derivative of the underlying latent variable

$$\frac{\partial Y_i^*}{\partial X_{1i} \partial X_{2i}} = \beta_{12}. \tag{3}$$

As this study aims at testing theoretical predictions, the main focus will be on the sign and the statistical significance of the estimated coefficients. However, from a policy viewpoint, it is also interesting to get an impression of the magnitude of the influences. Therefore, we will

additionally discuss how our key variables influence average changes in the closure probability. Let X_2 be a dummy variable that moderates the effect of X_1 and consider a change in X_1 from x_1 to $x_1 + \delta$. If $X_2 = 0$, the average change in the closure probability is

$$\overline{\Delta\mathrm{Pr}}\,|_{X_2=0} = \frac{1}{N_0} \sum_{i=1}^{N_0} \left\{ \Phi[\beta_1(x_1 + \delta) + \boldsymbol{\beta'Z}_i] - \Phi[\beta_1 x_1 + \boldsymbol{\beta'Z}_i] \right\}. \tag{4}$$

If $X_2 = 1$, we obtain for the average change in the probability of closure

$$\overline{\Delta\mathrm{Pr}}\,|_{X_2=1} = \frac{1}{N_1} \sum_{i=1}^{N_1} \left\{ \Phi[(\beta_1 + \beta_{12})(x_1 + \delta) + \beta_2 + \boldsymbol{\beta'Z}_i] - \Phi[(\beta_1 + \beta_{12})x_1 + \beta_2 + \boldsymbol{\beta'Z}_i] \right\}. \tag{5}$$

By comparing 4 and 5, we get an impression how X_2 moderates the quantitative effect of X_1.

5. Empirical Analysis

5.1 Initial Regression Results

Table 2 presents the initial regression results for the full sample of establishments.[13] Several of the control variables take statistically significant coefficients of the expected sign. A modern production technology, managerial profit sharing, establishment size and the share of part-time workers are negative covariates of closure. Limited liability of the owners and the shares of female and temporary workers are positively associated with establishment closure. The economic situation also plays a role. Import penetration is a positive and sectoral concentration a negative determinant. These findings suggest that product market competition increases the probability of closure. Moreover, short-time work is positively associated with establishment closure. The coverage by a collective bargaining agreement has no statistically significant influence. This is consistent with Addison et al. (2004) and Addison and Teixeira (2006). Their estimates show also no significant relationship between collective bargaining coverage and closures. Turning to our variable of primary interest, the presence of a works council does not emerge as a statistically significant determinant. This finding supports the results by Addison and Teixeira (2006) and contradicts the study by Addison et al. (2004).

However, the relationship between works councils and closures may remain obscured until the role of moderating factors has been considered.

5.2 The Role of Moderating Factors

Our theoretical discussion suggests that the relationship between councils and closures may differ between single independent establishments and establishments that are parts of multi-establishment firms. Moreover, our discussion suggests that the interaction of works councils with collective bargaining coverage and economic factors may differ between both types of establishments. Hence, while our estimates show no direct effect of ownership type on closures, the type of ownership may have an indirect effect by moderating the link between councils and closures. Therefore, the determinants of closure are estimated separately by type of ownership. Table 3 shows the estimates for single-establishment firms. Table 4 presents the estimates for establishments that are parts of multi-establishment firms. Each table contains the results of three regressions. Regression 1 does not take into account additional interaction variables. Regression 2 includes a variable for the interaction of works councils and collective bargaining. Regression 3 includes the interactions of works councils with economic factors.

We start with a comparison of the results on the control variables. Neither in the single-establishment sector nor in the multi-establishment sector there is evidence that collective bargaining coverage exerts a direct influence on closure. Product market competition plays a similar role in both types of establishments. Import penetration is a positive and sectoral concentration a negative covariate of closure. However, short-time work is positively associated with the closure probability only in the multi-establishment sector. While the share of women and the share of part-time workers play similar roles in both types of establishments, the share of temporary workers is a positive covariate of closure in the single-establishment sector and a negative covariate in the multi-plant sector. Size is a negative determinant of closure in the single-establishment sector whereas the vintage of

production technology and shift work are negative covariates of closure in the multi-establishment sector. Limited liability of the owners is positively associated with the closure probability of establishments that are parts of multi-establishment firms. Managerial profit sharing is a negative covariate of the closure of single independent establishments. A positive management attitude toward employee involvement is negatively associated with closures in the multi-establishment sector.

Returning to our main theme, the role of works councils differs sharply between the two types of ownership. Regression 1 of Table 3 shows no significant association between councils and the closure of single independent establishments. Furthermore, regression 3 provides no evidence that councils interact with the economic situation of single independent establishments. However, regression 2 reveals that councils interact with collective bargaining coverage. The interaction takes a negative coefficient that is highly significant. Moreover, the positive coefficient on council incidence is now statistically significant. The pattern of results indicates a positive relationship between councils and closures for uncovered establishments. On average, the presence of a council is associated with a 10 percentage point higher closure probability if the establishment is not covered. In contrast, there is no significant relationship between councils and closures for covered establishments. The coefficient on the interaction of councils and collective bargaining is of similar magnitude (but of opposite sign) as that for the basic works council variable. As a consequence, the null hypothesis that councils have no influence on the closure of covered single-establishment firms cannot be rejected by a chi-square test (χ^2 = .46). In sum, collective bargaining moderates the relationship between councils and the closure of single-establishment firms. The voice role of councils appears to be rather weak if single independent establishments are not covered. Coverage strengthens the voice role of councils in these establishments so that there is no longer a positive influence on closure. Rent-seeking activities may be more restricted in covered establishments. Moreover, unions may strengthen the councils' position against opportunistic employers.

Regression 1 of Table 4 shows a negative link between works councils and closures in the multi-establishment sector. On average, the incidence of a council is associated with a 7 percentage point lower probability of closure. The finding fits the notion that works councils play a specific voice role for this type of ownership. In multi-plant firms, decision making is complex and less transparent to the workforce of the local establishment. A council helps employees to get access to firm-wide information and to influence decisions at the firm level. Regression 2 provides no evidence that collective bargaining coverage plays a moderating role in the negative relationship between councils and closures. This result also conforms to theoretical expectations. In multi-establishment firms, collective bargaining coverage may be less important in restricting rent-seeking activities if local councils are already disciplined within the firm-wide network of works councils. Moreover, unions may be less important in providing local councils with support against opportunistic managers if the firm-wide network of works councils already provides support against employer opportunism.

Finally, regression 3 of Table 4 reveals that the voice role of works councils in the multi-plant sector specifically holds true if establishments face adverse economic conditions. While council incidence is no longer a significant direct covariate of establishment closure, the interactions of works councils with import penetration and short-time work take significantly negative coefficients. The interaction effects are quantitatively important. On average, short-time work is associated with a 47 percentage point higher closure probability if no council is present. In contrast, if a works council is present, a chi-square test cannot reject the null hypothesis that short-time work is not associated with closure ($\chi^2 = 1.63$). On average, an increase in import penetration from 20 percent to 30 percent implies a 7 percentage point higher closure probability when there is no works council. In contrast, for establishments with works councils, the same increase in import penetration is on average only associated with a 3 percentage point higher probability of closure. Altogether, the presence of a council reduces the negative influence of adverse economic conditions on

survival to a substantial degree. This finding accords with the hypothesis that councils specifically help to negotiate for employee concessions and performance-enhancing changes if an establishment is under pressure. Information asymmetries are likely to be greater in establishments that are parts of multi-establishment entities. Hence, especially in these establishments, councils can contribute to overcoming a crisis by reducing information asymmetries and rebuilding trust.

6. Concluding Remarks

German works councils have attracted considerable attention as an alternative form of worker participation to promote industrial democracy and to improve both the quality of working life and economic performance. They are an institution designed to build trustful and cooperative employer-employee relations. However, from a theoretical point of view, works councils may not only have a voice but also a monopoly role. Our results support the notion that the functioning of works councils crucially depends on circumstances and type of establishment.

The estimates show that works councils indeed can play their intended role if establishments are parts of multi-establishment firms. For this type of establishment, the presence of a works council is associated with a higher probability of establishment survival. This specifically holds true if establishments face adverse economic conditions (proxied by import penetration and short-time work). The findings conform to theoretical expectations. In multi-establishment entities, decision making is less transparent to the workforce of the local establishment. Specifically, in a crisis, workers may fear employer opportunism. In this situation, a council helps rebuilding trust and sustaining employer-employee cooperation. The position of the local council may be strengthened by a firm-wide network of works councils.

Works councils appear to play a rather weak voice role in the single-establishment sector. Here the presence of a council is associated with a reduced probability of survival if the establishment is not covered by a collective bargaining agreement. However, there is no

significant relationship between councils and establishment survival if single-establishment firms are covered by a collective agreement. These results support the notion that collective bargaining and non-union employee representation are complementary. Unions may strengthen the voice role of works councils by providing them with support against employer opportunism. At the same time centralized collective bargaining may reduce distributional conflicts at the establishment level. This aspect is often ignored in the discussion about potential inflexibilities of centralized collective bargaining. Critics of the collective bargaining system in Germany have suggested that councils should get more competencies in wage negotiations. Our results suggest that this might be counter-productive as it strengthens the monopoly role of works councils and weakens their voice role.

We end with proposals for future research. First, while there is an increasing number of studies on the effects of works councils, a comprehensive analysis on the role of moderating factors is missing. This study is a first step in this direction. It would be interesting to investigate if similar interaction effects also hold for wages, productivity or investments. Second, our results indicate that the effects of union and nonunion worker representation can differ. Studies for other countries had their focus only on unions. It would be interesting to extend the international analyses to nonunion worker representation.

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Table 1: Variable Definitions and Descriptive Statistics (*N* = 831)

		Mean, Std.Dev.
Establishment Closure	Dummy equals 1 if the establishment closed between 1994 and 1997.	.0734, .2610
Works Council	Dummy equals 1 if a works council is in the establishment.	.5692, .4955
Collective Agreement	Dummy equals 1 if the establishment is covered by a collective bargaining agreement.	.6510, .4769
Single Independent Establishment	Dummy equals 1 if the establishment has no subsidiaries and is not itself a subsidiary. The variable equals 0 if the establishment is part of a multi-establishment firm.	.5897, .4922
Short-Time Work	Dummy equals 1 if blue-collar workers work short time.	.1865, .3898
Ln Import	Log of sales of foreign firms as a percentage share of total sales in the industry.	3.141, .5870
Ln Sales Concentration	Log of sales of the six largest companies in each industrial sector as a percentage share of total sales in the sector. Official German statistics are matched to 32 industrial sectors identified by the survey.	2.597, .6791
Managerial Profit Sharing	Dummy equals 1 if executive managers have a profit sharing plan.	.4128, .4926
Active Owner	Dummy equals 1 if active owners are present in the establishment.	.6414, .4799
Management Attitude	Ordered variable for management attitude toward employee involvement in decision making (1 = very negative, …, 4 = very positive).	3.001, .7628
Ln Size	Log of total employees in the establishment.	4.177, 1.298
Age90	Dummy equals 1 if the establishment was created at the beginning of the 1990s.	.0349, .1836
Age80	Dummy equals 1 if the establishment was created in the 1980s.	.0987, .2984
Age70	Dummy equals 1 if the establishment was created in the 1970s.	.0878, .2832
Age60	Dummy equals 1 if the establishment was created in the 1960s.	.1179, .3227
Limited Liability	Dummy equals 1 if the establishment is a non-public limited liability company (*Gesellschaft mit beschränkter Haftung*) or a public limited company (*Aktiengesellschaft*).	.5391, .4988
Technology	Ordered variable for the vintage of technology used (1 = very old, …, 4 = state of the art technology).	2.994, .9203
Shift Work	Dummy equals 1 if the establishment uses shift work.	.4140, .4928
Blue-Collar Workers	Blue-collar workers as a proportion of total employees.	.6291, .1854
Female Workers	Women as a proportion of total employees.	.2895, .2393
Part-Time Workers	Part-time workers as a proportion of total employees.	.0781, .1213
Temporary Workers	Temporary workers as a proportion of total employees.	.0273, .0850
Industry Dummies	3 broad defined industry dummies.	

Table 2: Determinants of Establishment Closure; All Establishments

Constant	-.5670 (.81)
Works Council	.0904 (.46)
Collective Agreement	.1140 (.67)
Single Independent Establishment	.0154 (.15)
Ln Import	.3909 (2.67)***
Short-Time Work	.3291 (2.32)**
Ln Sales Concentration	-.5669 (5.41)***
Managerial Profit Sharing	-.3743 (2.15)**
Active Owner	-.2052 (1.08)
Management Attitude	-.0287 (.42)
Ln Size	-.2974 (3.73)***
Age90	.3278 (1.36)
Age80	-.1124 (.40)
Age70	.0533 (.25)
Age60	.0747 (.37)
Limited Liability	.3315 (1.96)**
Technology	-.1642 (1.70)*
Shift Work	-.1091 (.58)
Blue-Collar Workers	.7293 (1.63)
Female Workers	1.076 (3.02)***
Part-Time Workers	-1.995 (3.18)***
Temporary Workers	2.753 (4.50)***
Industry Dummies	Included
McFadden R^2	.1753
Number of Observations	831

Coefficients are estimated by ML probit. T-statistics are in parentheses. Standard errors are adjusted for intra-industry correlation based on the Huber-White sandwich variance estimator. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level.

Table 3: Determinants of Establishment Closure; Only Single Independent Establishments

	(1)	(2)	(3)
Constant	-.8007 (.84)	-1.030 (1.05)	-.9361 (.87)
Works Council	.3823 (1.36)	.7570 (2.08)**	.7288 (.72)
Collective Agreement	.1516 (.53)	.4044 (1.56)	.1340 (.50)
Short-Time Work	-.1252 (.44)	-.1059 (.38)	-.2691 (.57)
Ln Import	.4284 (2.03)**	.4475 (2.07)**	.4142 (1.83)*
Ln Sales Concentration	-.5550 (3.84)***	-.5652 (3.61)***	-.4730 (2.58)**
Managerial Profit Sharing	-.4264 (1.85)*	-.4216 (1.80)*	-.4122 (1.74)*
Active Owner	-.1365 (.71)	-.1281 (.68)	-.1426 (.75)
Management Attitude	.0446 (.48)	.0528 (.55)	.0388 (.41)
Ln Size	-.3939 (2.67)***	-.4122 (2.71)***	-.4014 (2.60)***
Age90	.3686 (.90)	.4134 (1.03)	.3430 (.85)
Age80	-.1453 (.42)	-.1647 (.47)	-.1415 (.41)
Age70	.3201 (1.19)	.2972 (1.10)	.3284 (1.21)
Age60	.1243 (.42)	.1321 (.45)	.1483 (.49)
Limited Liability	.1748 (.82)	.1819 (.83)	.1729 (.79)
Technology	-.1725 (1.30)	-.1812 (1.36)	-.1653 (1.22)
Shift Work	.1562 (.56)	.1624 (.57)	.1714 (.62)
Blue-Collar Workers	.8886 (1.33)	.9894 (1.49)	.9199 (1.35)
Female Workers	.8646 (1.66)*	.9834 (1.98)**	.8523 (1.64)
Part-Time Workers	-2.210 (2.52)**	-2.192 (2.57)**	-2.202 (2.49)**
Temporary Workers	3.538 (4.61)***	3.532 (4.79)***	3.544 (4.63)***
Works Council X Collective Agreement	-----	-.5919 (2.72)***	-----
Works Council X Short-Time Work	-----	-----	.2499 (.61)
Works Council X Ln Import	-----	-----	.0364 (.13)
Works Council X Sales Concentration	-----	-----	-.2051 (.79)
Industry Dummies	Included	Included	Included
McFadden R^2	.1641	.1717	.1666
Number of Observations	490	490	490

Coefficients are estimated by ML probit. T-statistics are in parentheses. Standard errors are adjusted for intra-industry correlation based on the Huber-White sandwich variance estimator. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level.

Table 4: Determinants of Establishment Closure; Only Establishments Being Parts of a Multi-Establishment Firms

	(1)	(2)	(3)
Constant	.9259　(1.00)	1.068　(1.07)	-.0110　(.01)
Works Council	-.7425　(2.37)**	-.8994　(1.66)*	.9629　(.76)
Collective Agreement	-.0076　(.02)	-.1109　(.35)	.2175　(.48)
Short-Time Work	1.003　(2.89)***	1.003　(2.88)***	2.206　(3.64)***
Ln Import	.4486　(1.99)**	.4214　(1.84)*	.8165　(2.50)**
Ln Sales Concentration	-.8183　(3.99)***	-.8011　(3.68)***	-.9024　(3.14)***
Managerial Profit Sharing	-.0270　(.12)	-.0249　(.11)	-.0242　(.12)
Active Owner	-.3764　(.94)	-.3810　(.96)	-.3517　(.85)
Management Attitude	-.3638　(2.30)**	-.3642　(2.29)**	-.4644　(3.07)***
Ln Size	-.0740　(.60)	-.0794　(.63)	-.0682　(.44)
Age90	-.1227　(.25)	-.1315　(.27)	-.0774　(.14)
Age80	-.5739　(1.13)	-.5743　(1.13)	-.5552　(1.09)
Age70	-1.109　(1.62)	-1.095　(1.54)	-1.057　(1.47)
Age60	.0452　(.14)	.0522　(.16)	.1170　(.36)
Limited Liability	.6773　(3.13)***	.6698　(3.16)***	.6607　(3.13)***
Technology	-.3033　(2.18)**	-.3078　(2.16)**	-.3723　(2.16)**
Shift Work	-.7815　(2.61)***	-.7859　(2.63)***	-.6724　(1.77)*
Blue-Collar Workers	.6560　(.87)	.6832　(.93)	.4017　(.42)
Female Workers	2.073　(4.87)***	2.059　(4.64)***	2.683　(7.63)***
Part-Time Workers	-5.480　(3.18)***	-5.396　(3.04)***	-6.416　(3.05)***
Temporary Workers	-5.426　(1.92)*	-5.372　(1.96)*	-5.975　(1.88)*
Works Council X Collective Agreement	-----	.2435　(.35)	-----
Works Council X Short-Time Work	-----	-----	-1.601　(1.83)*
Works Council X Ln Import	-----	-----	-.4408　(2.32)**
Works Council X Sales Concentration	-----	-----	-.0046　(.01)
Industry Dummies	Included	Included	Included
McFadden R^2	.3862	.3868	.4214
Number of Observations	341	341	341

Coefficients are estimated by ML probit. T-statistics are in parentheses. Standard errors are adjusted for intra-industry correlation based on the Huber-White sandwich variance estimator. * Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level.

Endnotes

[1] Hamermesh (2000: p. 376) emphasizes that "the credibility of a new finding that is based on carefully analyzing two data sets is far more than twice that of a result based only on one."

[2] Although centralized collective bargaining in Germany is coming under increasing threat, the share of establishments covered by firm-specific agreements is very small.

[3] Note that employee involvement through works councils is entirely separate from the system of supervisory board codetermination (FitzRoy and Kraft 2005, Renaud 2007).

[4] However, a recent study by Kraft and Lang (2008) finds no significant relationship between works councils and wages.

[5] These findings fit with evidence provided by Smith (1994). Using data on a sample of Italian cooperatives, he shows that employee involvement particularly fosters improved product quality and incremental innovations.

[6] Relatedly, Bryson (2004) and Fernie and Metcalf (1995) show for Britain that only strong unions are able to take an effective voice role.

[7] However, the international evidence on a potential endgame phenomenon is very mixed. Estimates for the US indicate that unions and employers in industries with high failure rates are less cooperative (Kahn 1993). Bryson (2004) finds for Britain that unionization and competition do not interact with respect to plant closures. Carneiro and Portugal (2006) show for Portugal that a higher probability of plant closing is associated with lower wages. Instead of negotiating for higher wages, workers appear to be willing to make wage concessions when they face a high probability of job loss due to closure.

[8] Relatedly it can be argued that works councils can rebuild trust by preventing the employer from reneging on implicit promises made to the employees. Both theoretical analyses (Francois and Roberts 2003, Ramey and Watson 1997) and empirical examinations (Bertrand 2004, Idson and Valetta 1996, Valetta 1999) suggest that employers are more likely to renege on implicit contracts with their employees when they face financial distress. Hence, a breach of trust and cooperation is more likely in a poor economic situation. A works council can facilitate communication and coordination among employees. To the extent coordinated actions of the workforce result in a more severe punishment of employer opportunism, the employer's incentive to default is reduced (Hogan 2001).

[9] This line of reasoning fits Agell's (2002) hypothesis that worker representation may be crucial for competitiveness.

[10] See Wagner (2008) for a related result.

[11] Descriptive statistics and the multivariate analysis are not weighted. The sampling weights available in the data set only correct for stratification by establishment size. Thus, using the weights in multivariate regressions will probably result in biased estimates. A more appropriate method is to control for the two stratification characteristics firm size and industry in the regressions (Winship and Radbill 1994). To relate descriptive statistics to regression results, they are also not weighted.

[12] The data set is unique in that it affords the opportunity to include an unusually rich set of explanatory variables. The inclusion of a broad set of establishment controls is crucial as it mitigates the potential problem of inconsistency due to omitted variables (Jirjahn 2009).

[13] To take into account that random disturbances of establishment closures may be correlated within the 31 industries identified by the survey, standard errors are adjusted by using the Huber-White sandwich estimator. Ignoring clustering in the regression may produce biased standard errors (Moulton 1990) as the variables for product market concentration and import penetration are based on aggregated industry data.