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# The Productivity Effect of Non-Union Representation

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## Abstract

Declining union density in many industrialized countries directs attention to alternative ways of labor relations and worker representation as, e.g., works councils. German works councils belong to the most powerful worker representations in developed countries but little is known of their causal effect on productivity. A large linked employer-employee panel is used to examine this issue. Comparing firms with and without a works council I find that firms with a works council are on average 6.5 percent more productive. I present evidence that this estimate is the lower bound to the causal productivity effect of works councils.

**Keywords:** worker participation, works council, productivity

**JEL Classification:** D24; J53

## 1 Introduction

The present system of labor relations in the United States is part of the “New Deal”, initiated between 1933 and 1936 by President F.D. Roosevelt as a reaction to the Great Depression. While strengthening workers’ rights when engaging in collective bargaining, the National Labor Relations Act of 1935 (and its amendment, the Taft-Hartley act of 1947) prohibits the formation of any form of employer-employee committee that has the power to decide on working conditions and labor-management relations.<sup>1</sup> As a

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<sup>1</sup> See section 8(a)(2) of the National Labor Relations Act.

result, the present system of industrial relations contains union bargaining but no mandatory or voluntary form of workplace representation. Low union density<sup>2</sup> recently raised doubts about whether this system still does a good job and increased interest in alternative ways of employee representation at the workplace. In the mid-nineties economists<sup>3</sup> and politicians<sup>4</sup> analyzed the industrial relations system of European countries to learn which institutions may help to improve the competitive position of the United States. The debate passed without strengthening employees' participation rights in the National Labor Relations Act – possibly due to the uncertainty about the economic consequences of formalized participation.

The most prominent example of non-union workers' participation in European countries is employee representation via works councils. Rogers and Streeck (1995) define works councils as “institutionalized bodies for representative communication between a single employer and the employees of a single plant or enterprise”. Works councils are designed to give workers a collective voice and to increase workplace democracy. But they do more: many studies show that they positively contribute to a society's regulatory performance by enforcing commitment to legal standards regarding, e.g., environmental protection (Askildsen et al. (2006)), gender equality (Heywood and Jirjahn (2009)), and health and safety (Weil (1999)).

Given the positive social effects of works councils as mentioned above, a society is better off with works councils if councils increase productivity. Even if works councils are permitted by law and even if employers and workers knew that a works council would increase productivity, expected distributional conflicts at the firm level can obstruct their foundation (Freeman and Lazear (1995)). Hence, if a society desires to have strong works councils, it has to make them mandatory.

The hypothesis of increased firm productivity through works councils mainly rests on the assumption that they improve communication between management and workers. Works councils can be an important source of information for managers helping them to improve the quality of their decisions. Also, councils may be able to motivate both parties to make longer-term commitments (Freeman and Lazear (1995)) and, hence, increase the probability

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<sup>2</sup> The share of union members among private sector workers decreased from 24.2 percent in 1983 to 7.6 percent in 2008, see Hirsch and Macpherson (2009).

<sup>3</sup> Rogers and Streeck (1995) published an influential book on works councils. This book is one outcome of the comprehensive NBER project “Working and Earning under Different Rules: What the United States Can Learn from Labor Market Institutions in Other Developed Countries” by Richard B. Freeman.

<sup>4</sup> See e.g. the Commission on the Future of Worker-Management Relations (“Dunlop Commission”) initiated by the U.S. Department of Labor, final report (1994).

of workers' concessions in economically difficult times and of higher investments in firm-specific human capital. Smith (1991) argues that employee participation may reduce opportunistic behavior of managers. However, a works council may also worsen performance. Depending on the specific design of the council's rights, managers may have to consult it or have to come to an agreement with it in situations where fast decision-making is necessary. If councils have co-determination rights, they can block decisions. Therefore, from a theoretical point of view, the productivity effect of works councils is unclear.

Because mandated works councils do not exist in the United States, the productivity effect of councils can only be estimated for other countries. Nevertheless, if the effect is positive there – maybe United States can learn from that. German works councils belong to the most powerful ones in Europe (see Streeck and Vitols (1995 p. 270) or Streeck (1995) for a comparison of European works councils) and most empirical studies found a non-negative productivity effect (see Addison et al. (2004) for a survey). But, since existing data do not include direct information on capital stock, inference regarding the productivity effect of works councils is conditional on the assumption that capital stock does not matter. Previous results contain a wide variety in the estimated council effect, including obviously implausible “productivity effects” of up to 30 percent.

This contribution studies whether works councils increase or decrease the productivity of German establishments. In order to estimate the productivity effect, in a first step, value added is regressed on capital and labor inputs with a GMM-SYS estimator to address endogeneity issues. In a second step, the residuals of step 1 are regressed on firm characteristics. At this second stage, an Oaxaca-Blinder-decomposition of the output differential of firms with and without a council is used to estimate the productivity effect. Finally, an endogenous switching regression model is applied to check for unobserved mechanisms that, simultaneously, may explain productivity and self-selection into the observed works council status.

I find a positive impact of councils on firm productivity of 6.5 percent. However, I do not claim this figure to be the causal effect of council existence on productivity. Rather I present empirical evidence and additional theoretical arguments that this figure is the lower bound to the causal productivity effect. The conclusion is that works councils, embedded in an appropriate system of industrial relations, have no negative impact on productivity.

## 2 German Works Councils

In Germany, the Works Constitution Act (*Betriebsverfassungsgesetz*) is the legal base for works councils. Workers have the right to establish a council in firms with at least five employees. Hence, works councils are mandatory but not automatic. The employer bears the expenses for the election and other costs the council causes. Works council members are elected for four years and enjoy strong employment protection. For firms with more than 200 employees, at least one councillor acts as a full-time councillor. The larger the firm, the higher is the number of works councillors and the stronger are their rights.

In general, council rights are weaker with regard to financial and economic affairs and stronger in personnel matters and social concerns. Explicitly, the Works Constitution Act (WCA) gives councils co-determination rights in the field of workers' health and safety and of social and personnel matters such as, e.g., the introduction of new payment methods, the regulation of overtime, recruitment guidelines, transfers, and dismissals. Furthermore, they have information and consultation rights in financial matters, personnel planning, and with respect to changes in the work environment and the adoption of new technologies.

The WCA not only determines the rights of councils, it also obliges councillors to cooperate with the management. Councils and management should act in "a spirit of mutual trust", "in cooperation with union and employer organizations" and "to the benefit of the employees and of the establishment" (WCA, Section 2). It is also determined that councils have no wage bargaining power and no right to call a strike and that the work of the union is not restricted by the WCA. Hence, the German system of industrial relations consists of two parts. While unions have the exclusive right of industry-wide collective bargaining, works councils are designed to be the collective voice w.r.t. work place conditions for *all* workers in a specific plant or establishment, regardless of whether they are union members or not or whether their establishment is covered by collective bargaining. Although works councils and unions are formally independent, most works councillors are union members or have close ties to a union. Unions devote expertise and financial resources to councils, while works councillors often actively recruit new union members (Streeck (1995) p. 335).

### 3 Literature

#### 3.1 How can works councils affect productivity?

Councils act as the collective voice and as the ear of the workers and are able to reduce information asymmetries between labor and management. Management may, e.g., misinform workers about the true economic state of the firm to extract higher effort. Anticipating such strategies, workers may distrust management information, even if it is truthful. Councils with legal **information rights** are able to act as workers' ear by verifying such information and thus may be able to solve or at least reduce the communication problem (see e.g. Rogers and Streeck (1995)).

As their collective voice, councils communicate workers' preferences to the management. **Consultation rights** commit the employer to listen to this voice and to consult the council prior to intended changes. Additionally, formal consultation provides a forum for both sides to find new solutions to problems and this may help managers to improve the quality of their decisions. If a council has **co-determination rights** on a particular matter, its agreement is necessary for a decision.

Giving workers a voice and letting them articulate dissatisfaction will reduce costly quits (see Hirschman (1970)). Several studies found a decrease in personnel turnover in case of works council presence (see e.g. Frick (1996) or Addison et al. (2001)) supporting a reduced exit propensity.

Section 80 of the WCA calls upon councils to enforce the legal rights of workers at the firm level. The strong **employment protection** legislation,<sup>5</sup> co-determination rights, and the council's support to workers (e.g. legal advice) have the potential to considerably hinder displacements.<sup>6</sup> As a result, workers and management may make longer-term commitments which would, e.g., decrease the hold-up problem of investing in firm-specific human capital.

Of course, all those positive effects can be costly. If councillors do not work in a "spirit of mutual trust" and "to the benefit of the firm" as demanded by the WCA, they are able to deteriorate firms' performance. But even if councils are cooperative, some of their characteristics are inherently productivity decreasing. Informing a council takes time, and, worse, consultation takes time *before* a decision can be made and this can result in the

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<sup>5</sup> According to the overall employment protection index of the OECD (see OECD (2004) chart 2.1), 18 out of 28 countries have less strict regularities than Germany.

<sup>6</sup> A methodological implication of increased employment protection through works councils is that workers could tend to erect a works council in times of bad firm performance to save their jobs. This kind of self selection will lead to a downward bias in the estimated effect of council existence on firm productivity.

loss of profitable opportunities. Co-determination can lead to a suboptimal allocation of a firm's resources and, of course, having a secure working place also may create incentives for moral hazard. In sum, whether the benefits of councils outweigh the costs is an empirical question.

### 3.2 Empirical Results

To assess the productivity effects of German works councils, mainly two large-scale data sets have been used so far,<sup>7</sup> the IAB Establishment Panel<sup>8</sup> (e.g. Addison et al. (2006), Frick and Moeller (2003), Schank et al. (2002), Wolf and Zwick (2002)) and the Hannover Panel<sup>9</sup> (e.g. Addison et al. (2001), Huebler and Jirjahn (2003), Jirjahn (2003)).

Generally, the estimated productivity effect of councils is non-negative, ranging from insignificant effects close to zero (Addison et al. (2006); Schank et al. (2002)) to large effects (i.e. around 15 percent in Addison et al. (2001) and Wolf and Zwick (2002); up to 30 percent in Frick and Moeller (2003) and Addison et al. (2006)). All studies with large productivity estimates applied OLS, while those which estimated a zero effect used the fixed effects estimator. The difference can be explained with unobserved heterogeneity that leads to upwards biased OLS estimates.

However, this does not mean that the insignificant estimates close to zero are necessarily correct. A fixed effects estimator only uses within-firm variations to identify partial effects. Few firms establish or close a council (see e.g. Addison et al. (2006)) and this may explain the insignificance of the effect. Also, changes in the council regime may have no immediate effects on productivity.

Existing studies on councils' productivity effect only crudely control for capital stock.<sup>10</sup> Further problems with respect to the sample selection of previous studies are described below. Addressing these problems, I test whether works councils deteriorate firm productivity. My empirical strategy allows for causal inference.

## 4 Data

This analysis is based on the Linked Employer-Employee Panel of the Institute for Employment Research (IAB). In the data set, administrative in-

<sup>7</sup> See Addison et al. (2004) for an overview over the results from small-scale data sets.

<sup>8</sup> See <http://www.iab.de/de/erhebungen/iab-betriebspanel.aspx>.

<sup>9</sup> Observations from 1994–1997, meanwhile part of the IAB Establishment Panel.

<sup>10</sup> See Mueller (2008) for a discussion of capital stock approximation.

formation on employees is matched with survey information on firms. The survey unit is the establishment or local production unit, rather than the legal and commercial entity of the company.

## 4.1 Sample Selection

I restrict the analysis to the manufacturing sector. Since works council rights increase if a firm has more than 20 employees, I drop all firms that have less than 21 employees in at least one of the periods under consideration. The probability of works council existence increases with firm size: while only about half of the firms with 21 to 100 employees have a council, this share is about 99 percent in the group of manufacturing firms with more than 300 employees. An objection against former studies which neglect the correlation between firm size and council probability is that the measured productivity effect is biased due to unobserved effects that are correlated with firm size. To avoid this potential weakness, my analysis is confined to firms with, at the maximum, 300 workers. A dummy for firms with less than 101 workers is also included in regression.

Since the reform of the WCA in 2001 implies substantial changes in the council rights, I only consider the period from 2001 to 2005 and end up with 2,879 firm-year observations on 1,086 different firms.

## 4.2 Variables

Because different firms will produce output using different shares of intermediate inputs, value added is a better approximation for economic performance than total sales and is used as the dependent variable in the production function. Value added is regressed on works council presence, the number of employees and the value of the capital stock.<sup>11</sup> The other control variables are the percentages of part-time workers, apprentices and skilled workers<sup>12</sup> in total employment, whether the firm is covered by collective bargaining, the number of persons participating in employer-supported training programs, industry affiliation, location in East or West Germany, a dummy indicating whether the firm has between 21 and 100 employees, the state of technology, the indication whether the firm exports and whether it belongs to a group

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<sup>11</sup> The data does not contain direct information on the capital stock. I use an approach by Mueller (2008) to compute the capital stock from investment data.

<sup>12</sup> Skilled workers are craftsmen who have at least two years of formal professional education, or other employees who perform qualified tasks, i.e. also university graduates are included in that group.



of affiliated companies.<sup>13</sup>

The theoretical considerations in the previous section indicate that losses of firm-specific human capital due to personnel fluctuation may be important for productivity and related to council existence. The regressor “number of employees” controls for changes in the total amount of labor used in production. However, it does not control for fluctuations that leave the level of total employment unaffected. To deal with this, the churning rate is taken as an additional measure of fluctuation (see Burgess et al. (2000)).<sup>14</sup> The churning rate is a measure for separations that lead to replacement hirings and thus indicates fluctuations that do not affect total employment.

## 5 Empirical Model

### 5.1 The Production Function

I base my analysis on a Cobb-Douglas production function that contains value added ( $Y$ ), labor ( $L$ ), capital ( $K$ ), works council presence, and the other above mentioned control variables.

The static Cobb-Douglas specification is:

$$\ln(Y_{it}) = \alpha \ln(L_{it}) + \beta \ln(K_{it}) + \delta' Z_{it} + \nu_i + m_t + \eta_{it} \quad (1)$$

with

$$\eta_{it} = \rho \eta_{i,t-1} + \epsilon_{it}$$

where  $\nu_i$  is a firm-specific fixed effect,  $m_t$  captures time effects that are common to all firms,  $\eta_{it}$  is an idiosyncratic and possibly autoregressive productivity shock,  $\epsilon_{it}$  is a white noise error term,  $\alpha$  and  $\beta$  are the output elasticities w.r.t. labor and capital, and  $\delta'$  is a vector of coefficients on  $Z_{it}$ , the vector of control variables. Note that some of the control variables are time-invariant or at least nearly time-invariant.

A dynamic representation of equation 1 is

$$\begin{aligned} \ln(Y_{it}) = & \alpha \ln(L_{it}) - \rho \alpha \ln(L_{i,t-1}) + \beta \ln(K_{it}) - \rho \beta \ln(K_{i,t-1}) + \\ & \rho \ln(Y_{i,t-1}) + \delta \ln(Z_{it}) - \rho \delta \ln(Z_{i,t-1}) + \\ & (1 - \rho)(\nu_i) + (m_t - \rho m_{t-1}) + \epsilon_{it} \end{aligned} \quad (2)$$

<sup>13</sup> Summary statistics of the firm-specific means are presented in table 2 on page 16.

<sup>14</sup> The churning rate is the difference between the total work flow rate (WF) minus the absolute value of the net change rate (NET) in employment. WF is the share of hired (WIF) plus the share of displaced workers in total employment (WOF), and  $NET = WIF - WOF$ .

where the possibly autoregressive nature of productivity shocks is explicitly modeled and therewith removed from the error term. The static specification in equation 1 is a special case of equation 2. Both equations coincide if  $\rho$  is zero. In order to consider the more general case, I estimate the dynamic specification.

## 5.2 Endogeneity and Time-Invariance

When estimating a production function, one generally faces the problems of simultaneity and unobserved heterogeneity. Additionally, when estimating works council effects, one has to be aware of the time invariance of the council status.

From an econometrician's perspective, the simultaneity problem is a correlation of the time-varying part of the error term with one or more explanatory variables (typically with labor and capital). Similarly, unobserved heterogeneity can be viewed as a correlation of the time-invariant part of the error term with one or more explanatory variables. One way around both problems is to use lagged differences of the endogenous regressors to instrument their levels. Unfortunately, lagged differences are often only weakly correlated with the original regressor. To overcome this problem, Arellano and Bover (1995) proposed to additionally estimate the model in first differences and instrument with lagged levels. In that case, problems arise if the researcher is interested in estimating the coefficients of nearly time-invariant regressors (e.g. works council existence) or, even worse, totally time-invariant regressors because any differences of time-invariant regressors are zero and, therefore, no variation remains to identify their coefficients.

However, the situation of endogeneity and time-invariance is manageable using a two-staged approach, as, e.g., applied in Black and Lynch (2001). In a first step, value added is regressed on the variable inputs while – as described above – internal instruments are used to deal with the potential endogeneity of the regressors. The residuals of that first step regression are averaged within firms and used as dependent variable in a second step. In that second step, the averaged residuals are regressed on the remaining time-invariant regressors. As a result, coefficients of time-invariant regressors can be estimated while one has controlled for the endogeneity of the variable inputs. However, if the time-invariant regressors are themselves endogenous, their coefficients may be still biased.

In my study, the regressors in  $Z_{it}$  are time-invariant or nearly time-invariant. I construct the within-firm averages of the nearly time-invariant regressors and use these averages together with the time-invariant regressors as explanatory variables in the second step. Next, both steps are explained

in more detail.

### 5.2.1 First-Step Estimation

Natural candidate instruments for the variable input factors labor and capital are lagged differences of the regressors because they are correlated with the regressor but are assumed to be exogenous. The more lags are used, the more efficient is the estimate but the smaller is the sample size. Because I have only a short panel of five years, classical IV-style instruments are inadequate. A way around this problem is to use GMM style instruments as proposed by Holtz-Eakin et al. (1988).

With these instruments, equation 2 can be estimated consistently with the system GMM (GMM-SYS) estimator proposed by Arellano and Bover (1995) and which was first applied to a production function estimation by Blundell and Bond (2000). To improve efficiency, the GMM-SYS estimator estimates a system of a first-differenced and a level equation. It uses lagged levels of the endogenous variables as instruments in the first differenced equation. Additionally, lagged differences are used to instrument the regressors in the level equation.

### 5.2.2 Second Step Estimation

The dependent variable for the second step is the fixed effect of each firm. To obtain it, I first generate the predicted values for value added and subtract it from the observed values<sup>15</sup>

$$\ln(Y_{it}) - [\widehat{\ln(Y_{it})}] = (1 - \rho)(\delta'Z_i + \nu_i) + error_{it}. \quad (3)$$

I then average that value over the period 2001–2005 for each establishment to get an estimate of the firm-specific time-invariant component of the first step residual, i.e.  $(1 - \rho)(\delta'Z_i + \nu_i)$ . If *error* is a zero mean error term, averaging over time will eliminate or at least substantially reduce its contribution to the residual.

The second step estimation equation is

$$R_i = \delta'Z_i + \nu_i + \widetilde{error}_i \quad (4)$$

with

$$R_i = \frac{\frac{1}{T} \sum_t \ln(Y)_{it} - [\widehat{\ln(Y)_{it}}]}{1 - \rho}.$$

<sup>15</sup> Note, because  $Z$  contains now only time-invariant regressors, it varies only between firms and the equation simplifies.

### Oaxaca-Blinder Decomposition

An interesting alternative to estimating equation 4 directly with OLS is the Oaxaca-Blinder decomposition, introduced by Oaxaca (1973) and Blinder (1973): the output differential between two groups can be decomposed into explained and unexplained components. The output differential between firms with a council (C) and firms without (N) can be partitioned in either of the two following ways:

$$R_C - R_N = \delta_C(Z_C - Z_N) + Z_N(\delta_C - \delta_N) + (error_C - error_N) \quad (5)$$

or

$$R_C - R_N = \delta_N(Z_C - Z_N) + Z_C(\delta_C - \delta_N) + (error_C - error_N) \quad (6)$$

where, for clarity, the firm subscript has been dropped.  $R_C - R_N$  is the mean output differential,  $Z_C$  and  $Z_N$  are vectors of mean values of the independent variables (including an intercept) and  $\delta_C$  and  $\delta_N$  are estimated coefficient vectors. Equation 5 says that the output differential can be decomposed into a part due to differences in endowments evaluated at the council firms' coefficients and a part due to differences in coefficients evaluated at the means of the group without councils. The first part of the equation 5 can be interpreted as the difference in output the council group would achieve if it had the other group's endowments, i.e. the explained part of the output gap. The second part represents the difference in output the group without councils would experience if it had the same productivity as the council group, i.e. the unexplained part or, if assuming random assignment of councils to firms, the average treatment effect on the non-treated.

In the second term of equation 6 the productivity differences are evaluated at the council group's means. Assuming random assignment of councils to firms, this term is the average treatment effect on the treated, indicating the difference in output the council group would experience if it had no council. This is the effect I estimate below.

Following an idea of Winsborough and Dickenson (1971), the treatment effect on the treated can be estimated using a threefold decomposition of the output differential:

$$\begin{aligned} R_N - R_C &= \delta_C(Z_N - Z_C) \\ &\quad + Z_C(\delta_N - \delta_C) \\ &\quad + (\delta_N - \delta_C)(Z_N - Z_C). \end{aligned} \quad (7)$$

While the unexplained part in the second line is the desired treatment effect on the actually treated firms,<sup>16</sup> the third term indicates whether, e.g., the council firms accumulate more of such endowments for which they have a productivity advantage (compared to the other group) or not.

### Self-Selection into Works Council Regimes

Workers have the right to establish or close a works council. Hence, they select their firm into one of two possible regimes, i.e. into having a council or not. If the self-selection mechanism is systematically related to the firms' productivity, OLS estimates of the council effect and the Oaxaca-Blinder decomposition are biased. However, for at least some self-selection patterns the direction of the OLS bias is clear.

Consider the case where there are unobserved factors that increase the incentives of workers to establish or maintain a works council and, at the same time, are negatively correlated with productivity. In that case, random assignment of councils to firms would increase the output differential. Applying the Oaxaca-Blinder decomposition to an output differential that is too small leads to underestimation of the council effect. In the following it is briefly shown how to adjust the output differential.

The self-selection into a works council regime can be described by an endogenous switching regression model.<sup>17</sup> If the utility of having a council is higher than its costs, workers will choose to maintain a works council. Even though the utility cannot be observed by the researcher, the workers' choices are observed. The endogenous switching regression model can be estimated using the Heckman two-step estimator (see Heckman (1979)). The latent utility of having a council is

$$W_i^* = \gamma'Z_i + \tau'I_i + u_i \quad (8)$$

with  $Z_i$  as the vector of second step regressors from equation 4,  $I_i$  as a vector of external instruments,  $\gamma'$  and  $\tau'$  as coefficient vectors and  $u_i$  as a random error. The observed choices are

$$\begin{aligned} W &= 1 & \text{if } W^* > 0 \\ W &= 0 & \text{if } W^* \leq 0 \end{aligned}$$

<sup>16</sup> Note, this decomposition leads to a negative output differential. Hence, the second term is negative if the council firms have a productivity advantage. This could be interpreted as the output reduction that they would experience if they close the council.

<sup>17</sup> Also called "Roy Model", see, e.g., Maddala (1983).

with  $W$  as a dummy indicating the presence of a works council. The output equations can be estimated consistently with

$$R_{Ci} = \alpha_C + \delta'_C Z_i + \sigma_C \left( \frac{\phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)}{\Phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)} \right) + \epsilon_{Ci} \quad \text{if } W = 1 \quad (9)$$

$$R_{Ni} = \alpha_N + \delta'_N Z_i + \sigma_N \left( -\frac{\phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)}{1 - \Phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)} \right) + \epsilon_{Ni} \quad \text{if } W = 0 \quad (10)$$

where  $\hat{\gamma}' Z_i + \hat{\tau}' I_i$  is the predicted probability of having a works council from equation 8,  $\phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)$  is the density function evaluated at  $\hat{\gamma}' Z_i + \hat{\tau}' I_i$  and  $\Phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)$  is the cumulative distribution function at this point.<sup>18</sup> Hence, the expressions after  $\sigma_C$  and  $\sigma_N$  are the inverse Mills' ratios, accounting for the non-random selection of works council regimes.

After having estimated equations 9 and 10, the output differential ( $R_N - R_C$ ) can be adjusted by subtracting  $\hat{\sigma}_C \left( \frac{\phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)}{\Phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)} \right)$  and  $\hat{\sigma}_N \left( -\frac{\phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)}{1 - \Phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)} \right)$  from both sides of the respective equation. Hence, the selectivity-corrected dependent variables are  $R_{Ci}^* = R_{Ci} - \hat{\sigma}_C \left( \frac{\phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)}{\Phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)} \right)$  and  $R_{Ni}^* = R_{Ni} - \hat{\sigma}_N \left( -\frac{\phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)}{1 - \Phi(\hat{\gamma}' Z_i + \hat{\tau}' I_i)} \right)$ . Imitating random assignment of works councils, the corrected output differential ( $R_N^* - R_C^*$ ) is decomposed using equation 7.<sup>19</sup>

Although the endogenous switching regression model is identified through nonlinearities, additional instruments will improve identification. Appropriate instruments have to be uncorrelated with the errors in equations 8, 9, and 10 but should explain as much variation in  $W$  as possible.

Acknowledging that valid instruments are hard to find, I choose the industry share of firms having a works council as a technical instrument. Additionally, I construct two instruments from the data's employee dimension that reflect worker heterogeneity within firms. The first heterogeneity measure is the within firm standard deviation in workers age. The other is the Herfindahl Index of four groups of employees: blue vs. white collar workers by gender. As a homogenous work force is assumed to agree more easily on electing and running a works council,<sup>20</sup> I expect the heterogeneity measures to be negatively correlated with council existence. The industry share is by construction positively correlated with council existence. Empirical evidence is presented in the next section.

<sup>18</sup> For consistency of the endogenous switching regression model one has to assume that  $u_i$ ,  $\epsilon_{Ci}$  and  $\epsilon_{Ni}$  follow a trivariate normal distribution.

<sup>19</sup> See Neuman and Oaxaca (2004) for a methodological analysis of decompositions with selectivity corrected equations.

<sup>20</sup> See Freeman and Medoff (1984) and Demsetz (1993) for a discussion of worker heterogeneity and union representation elections.

Tab. 1: Production function estimation of manufacturing firms for the years 2001–2005 using the GMM-SYS estimator

Variable	Coefficient	(Std.Error)
L1.log(value added)	0.290***	(0.065)
log(number of employees)	0.754**	(0.350)
L1.log(number of employees)	-0.228	(0.377)
log(capital stock)	0.487***	(0.163)
L1.log(capital stock)	-0.304**	(0.134)
Intercept	5.700***	(1.267)
Observations		2879
Firms		1086

*Note:* Robust standard errors. \*\*,\*\*\* denote significance at the 0.05 and 0.01 level, respectively, and L1 is the one-period lag operator. Year dummies are included.

Assuming valid instruments, the productivity effect from estimating equation 7 with the adjusted dependent variables is the average treatment effect of council existence, while estimating equation 7 with the unadjusted variables gives the treatment effect on those who actually choose to have a council. However, using non-experimental data, one can rarely be sure that an instrument is uncorrelated with the error terms in the outcome equations. To check robustness of the estimated selectivity pattern, I will apply a number of specifications of the endogenous switching model using a variety of different instruments to equation 8. Of course, each specification will produce its own selectivity-corrected output differential and, therefore, its own estimate for the average treatment effect. Instead of interpreting one of the resulting point estimates as the average treatment effect, I will only check whether they are higher or lower than the estimate from the unadjusted decomposition. If they are higher, I interpret the estimate from the unadjusted decomposition as the lower bound to the unknown average treatment effect.

## 6 Results

### 6.1 First-Step Results

The results in table 1 show short-run output elasticities of 0.75 w.r.t. labor and 0.49 w.r.t. capital.<sup>21</sup> The long-run elasticities are 0.75 for labor and 0.26

<sup>21</sup> I used twice and more lagged levels of the output variable, threefold lagged levels of the input variables and simple lagged levels of time dummies as instruments in the first

for capital, and all estimated parameters except the one for the lagged labor input are highly significant.

After having controlled for capital and labor, the (unadjusted) output differential  $R_C - R_N$  amounts to 19.4 percent, indicating that firms with a works council produce *ceteris paribus* on average 19.4 percent more value added. This is not interpretable as a productivity effect of works councils because other firm characteristics have not been controlled for so far.

## 6.2 Second-Step Results

The second-step estimations are used to obtain the productivity effect. Table 2 shows descriptive statistics of the second step variables.

### Oaxaca-Blinder Decomposition

The decomposition results are presented in table 3.<sup>22</sup> Two third of the output differential can be explained by different endowments and interaction effects. The unexplained part amounts to 6.5 percent and reflects a higher productivity of works council firms; i.e. after having controlled for all available information (but not for self-selection), council firms create on average 6.5 percent more value added.<sup>23</sup>

The central result is the positive 6.5 percent productivity effect of works councils on the actually treated firms.<sup>24</sup> In the following it is discussed why this is the lower bound to the average treatment effect.

### Underestimation of the Council Effect

There are econometric and economic arguments for considering the estimated

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differenced equation. For the levels equation, once lagged first differences of the output variable and twice lagged first differences of the input regressors are used as instruments. To improve efficiency, instruments are drawn from all past waves of the IAB Establishment Panel starting in 1993. The total amount of instruments is 96 and the Sargan test of overidentifying restrictions suggests no misspecification of the model ( $Prob > \chi^2 = 0.20$ ). The Arellano-Bond test for autocorrelation in the first-differenced errors does not reject the hypothesis of no autocorrelation ( $Prob > z = 0.21$ ).

<sup>22</sup> The decomposition is conducted using the “Oaxaca” command in Stata. For the computation of the standard errors see Jann (2009).

<sup>23</sup> Being aware of the criticism of Jones (1983), I will not interpret the contribution of each regressor to the unexplained part.

<sup>24</sup> As a robustness check, I dropped one or more second step regressors arbitrarily and repeated the decomposition. The resulting productivity effects are of similar magnitude and never below 6.5 percent.



Tab. 2: Summary statistics of 2nd-step variables

Variable	Works Council		No Works Council	
	Mean	Std.Dev.	Mean	Std.Dev.
average residual from first-step GMM-SYS estimation	0.07	0.60	-0.13	0.61
Churning rate (percent)	2.66	2.29	4.29	7.09
Covered by collective bargaining (yes = 1)	0.72	0.39	0.30	0.38
East Germany (yes = 1)	0.39	0.49	0.57	0.50
State of technology (index: 1 = state of the art; 5 = obsolescent)	2.27	0.65	2.13	0.58
Percentage of part-time workers	5.60	7.17	9.14	11.40
Percentage of temporary workers	3.44	6.58	2.29	4.62
Percentage of apprentices	4.25	3.62	6.22	5.90
Percentage of skilled workers	76.96	22.72	77.53	23.79
Exporter (yes = 1)	0.75	0.38	0.55	0.45
Does not belong to a group of affiliated firms (yes = 1)	0.69	0.41	0.84	0.31
Percentage of workers participating in training programs	18.73	18.15	14.82	16.27
Observations	560		488	

*Note:* The means are averages over the years 2001 to 2005. The average residual is measured in logs. Compared to the 1086 observations in the first step I lose 38 observations due to missing values in the second step variables.

productivity effect on the treated of 6.5 percent as a lower bound to the true effect. The economic argument stems from the well-known phenomenon of decreasing productivity during cyclical downturns due to labor hoarding. Labor hoarding means that firms do not fully adjust their labor input to decreasing production. The consequence is a lower capacity utilization and therefore a lower productivity. The period under examination in this study (2001–2005) is characterized by a cyclical downturn of the German economy with an average annual growth rate of real GDP in the manufacturing sector of 1.5 percent, while in 2000 and 2006 growth rates were around 7 percent.<sup>25</sup> Assuming that stronger employment protection in works council firms increases labor hoarding, the productivity effect of councils is higher in cyclical upturns and is therefore underestimated in this study.

<sup>25</sup> German Federal Statistical Office (2008)

Tab. 3: Oaxaca-Blinder decomposition

Variable	Coefficient	(Std.Err.)
Unadjusted Differential		
Prediction with council	0.066***	(0.026)
Prediction without council	-0.127***	(0.028)
Output Differential	0.194***	(0.038)
Decomposition		
Endowments	0.142***	(0.046)
Coefficients	0.065	(0.062)
Interaction	-0.013	(0.068)

*Notes:* \*\*\* denotes significance at the 0.01 level. Positive numbers for the decomposition results indicate advantages for the council group. Decomposition evaluated at the council firms' endowments.

From a econometric point of view, self-selection into the works council regime is found to be the main reason why my results are only lower bounds to the true average treatment effect. The results with selectivity correction presented in table 4 show that random assignment of works councils to firms increases the output differential and the estimated productivity effect. These results are estimated with different combinations of the following instruments in the selection equation 8 (the first figure in parentheses is the pairwise correlation coefficient with council existence and the second figure is the associated p-value for a test of the hypothesis that this correlation coefficient is equal to zero):

1. SHARE: = industry share of works council firms (0.160; 0.000)
2. AGE: = within-firm standard deviation of employees' age (-0.194; 0.0000)
3. HERF: = Herfindahl Index of the within-firm shares of four groups of employees<sup>26</sup>(-0.094; 0.000).

As discussed in more detail in the previous section, the first instrument is a standard technical instrument and the two other instruments reflect worker heterogeneity within firms. The reported signs for the correlation coefficients with council existence coincide with a priori expectations: firms with a high degree of heterogeneity in workers age or in the blue vs. white collar and gender dimensions are significantly less likely to have a council.

<sup>26</sup> Sum over the squared shares of blue collar males, blue collar females, white collar males and white collar females in total employment.

Table 4 shows the adjusted output differentials from endogenous switching regression models and the corresponding decomposition results for different combinations of instruments. While there is some variation in the productivity effect, the general direction is obvious. The adjusted output gap as well as the productivity effect are clearly higher than the estimates from the unadjusted case (for the latter see table 3). This change in the results occurs because both  $\sigma_i$  are estimated to be negative.<sup>27</sup> With negative  $\sigma_i$ , it can directly be seen from equations 9 and 10 that the average firm in the council group would perform poorer than the average firm in the whole sample would do, provided that both have a council or both have no council.<sup>28</sup> This is an important additional insight and can be explained by the councils' offer of employment protection – workers of poorly performing firms may choose to maintain a council to protect their rents (for a discussion see Jirjahn (2009)).<sup>29</sup>

Nevertheless, keeping in mind the difficulties in finding appropriate instruments, there is good reason to be very careful in interpreting the figures presented in table 4. All I claim here is that the true productivity effect is higher than the not selectivity-corrected productivity estimate of 6.5 percent and I do not claim to what extent this may be the case.

Tab. 4: Selection Adjustment

Instrument	SHARE		AGE		HERF		ALL	
Adjusted output gap	0.31	(0.00)	0.52	(0.00)	0.52	(0.00)	0.40	(0.00)
Productivity effect	0.26	(0.00)	0.65	(0.00)	0.68	(0.00)	0.42	(0.00)

*Notes:* p-values in parentheses. For the estimates reported in the last column all three instruments are jointly used in the selection equation.

<sup>27</sup> Jirjahn (2009) finds the same selection pattern.

<sup>28</sup> In contrast to the interpretation of the classical Roy Model it is impossible to conclude from both  $\sigma_i$  being negative that both types of firms are better off with the council regime they are in. This is because in the Roy Model the agents behave optimal with respect to their outcomes (earnings) while workers in my model do not necessarily care about productivity when deciding about works council existence.

<sup>29</sup> As another check for robustness, the endogenous switching regression model is estimated via full information maximum likelihood. Regardless of the combination of instruments, the correlations of the error terms of the output equations with the error of the selection equation are negative and hence, both  $\sigma_i$  in equations 9 and 10 are negative.

## 7 Summary

Most economists expect non-union participation of employees in firm-level decision-making to have desirable social effects, such as workplace democracy or the enforcement of legal standards in working conditions and environmental protection. However, there is no unambiguous empirical evidence about the economic efficiency of such participation. I examine German works councils as a prominent example of non-union participation to assess their influence on firm productivity.

Data on roughly 1,050 small to medium-sized manufacturing firms is taken from the 2001–2005 waves of the Linked Employer-Employee Panel of the Institute for Employment Research (IAB). A GMM-SYS estimator addresses the endogeneity of capital and labor in the production function. After controlling for capital and labor, I decompose the remaining output differential between firms with a council and firms without a council into explained and unexplained parts and estimate a positive productivity effect of council existence of 6.5 percent. However, this is the effect for firms whose workers actually *choose* to maintain a works council. An endogenous switching regression model controls for self-selection into the council regime and mimics random assignment of councils to firms. Its results and further economic and empirical arguments indicate that the estimated effect of 6.5 percent is the lower bound to the average treatment effect.

This study shows that it is possible to design a system of industrial relations where works councils improve the productivity of firms. Theoretical studies (Freeman and Lazear (1995)) and empirical studies (Huebler and Jirjahn (2003)) showed that the productivity effect of works councils increases if distributional conflicts are worked out on a higher level than the firm level. Hence, industries in the United States that have centralized wage bargaining for a group of firms or an industry (like e.g. the automobile industry) could benefit from mandatory works councils – given that unions concentrate on bargaining and works councils focus on working conditions.

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