Worker participation in decision-making, worker sorting, and firm performance

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Abstract: Worker participation in decision-making is often associated with high-wage and high-productivity firm strategies. Using linked-employer-employee data for Germany and worker effects from a two-way-fixed-effects model measuring observed and unobserved worker quality, we confirm that establishments with formal worker participation via works councils indeed employ higher-quality workers. Importantly, works council establishments are more productive, pay higher wages, and are more profitable even after adjusting for differences in observed and unobserved worker quality.

Keywords: works councils, worker sorting, worker quality, between-firm wage inequality, productivity, profits

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1 Introduction

Mandated worker participation in firm decision-making is present in many European countries for decades. The questions whether employee participation boosts productivity and drives up wages has been discussed intensively and are nowadays increasingly relevant against the background of the productivity slowdown and falling labor shares in national income. The German model of plant-level participation via works councils has attracted particular interest because of the strong legal rights councils enjoy there. Standard economic theory perceived works councils to be a labor market friction (Jensen and Meckling 1979) and, thus, adverse economic effects have been expected initially. However, several of German works councils' legal rights (discussed later in more detail) have the potential to increase firm productivity directly, e.g. via generating collective voice, reducing information asymmetries between workers and management, and fostering trust and longer-term relations between them. Mounting empirical research indeed demonstrates that council firms have less employee fluctuation (Addison *et al.* 2001, Hirsch *et al.* 2010, Adam 2019), are able to pay higher wages (Addison *et al.* 2001, Hirsch and Mueller 2020), and enjoy a productivity premium (Mueller 2012, Mueller and Stegmaier 2017). Against the background of these economically desirable effects, the continued decline in works council coverage (Oberfichtner and Schnabel 2019)[1] raises concerns about productivity growth perspectives and workers share in firm surplus.

Hitherto unrelated to the worker participation literature, assortative matching of high-wage workers to high-wage establishments has been documented in a number of studies.[2] As works council establishments can clearly be described as high-productivity high-wage establishments, a core question is whether councils directly increase these

[1] An important question is why council incidence declines despite these positive effects. Freeman and Lazear (1995) argue that employers fight against productivity increasing councils as long as the latter deteriorate profits. Mueller and Stegmaier (2018) provide an explanation of employers resistance against works councils even in the light of positive profitability effects of councils as documented e.g. in Mueller (2011).

[2] This includes e.g. Andrews *et al.* (2012) for Germany, Bonhomme *et al.* (2019) using Swedish data, and Lopes (2018) for Brazil. Studies applying two-way-fixed effects models of wages as pioneered in Abowd *et al.* (1999, henceforth AKM) often show very small or even negative assortative matching, e.g. AKM for France and the US. However, the AKM procedure is prone to underestimate positive assortative matching due to 'limited mobility bias' (see Andrews *et al.* 2008). Card *et al.* (2013) document positive assortative matching for Germany even when using the AKM method.

outcomes or whether council establishments employ workers of higher quality who will increase productivity (see Bender *et al.* 2018) and earn higher wages by definition. The worker co-determination literature usually argued along the lines of the first scenario (e.g. Mueller 2012, Jirjahn and Smith 2018) and less so regarding a potential self-selection of high-quality workers into works council firms. However, for most workers, going to a high-paying firm offering stable employment perspectives is attractive and, hence, assortative matching of high-quality workers into high-paying works council plants seems plausible.

Should assortative matching be the driver of positive outcomes of works council firms, high-wage high-performance firms with works councils would coexist with low-wage low-performance firms without councils. This would not only imply estimating spurious productivity and wage gains from co-determination. It would also suggest that the legal mandate for councils contributes both to between-firm wage inequality (Card *et al.* 2013, Hirsch and Mueller 2020) and productivity dispersion across firms (Syverson 2011). We will not discuss whether council firms attract excellent workers or whether high-quality workers are more likely to opt for a council. We instead ask whether the positive link between council existence and productivity and wages, respectively, vanishes after taking into account properly measured establishment differences in unobserved worker quality. If employee sorting by and large explains the council effects on productivity and wages, the literature's assessment of the economic effects of works councils needs to be revised.

To analyze whether sorting explains the productivity and wage effects of works councils, we attempt to improve on prior research by utilizing a summary measure of observable and unobservable general human capital components of workers. Specifically, we use AKM worker fixed effects from a wage decomposition computed as in Card *et al.* (2013). Higher worker effects are rewarded higher across all employers, which justifies labeling individuals with high AKM worker effects as high-quality workers. Importantly, AKM person effects capture all human capital components that are invariant in the time span under consideration and therefore include observable human capital variables like education or initial age but also unobservable concepts like 'ability' or 'motivation'.[3] Our

[3] A detailed discussion of AKM effects will be provided in section 3.2.

first contribution will be to present descriptive evidence on existence and magnitude of worker sorting by works council existence.

Previous studies on productivity and wage effects of works councils typically only roughly control for worker quality, e.g. by controlling for the share of skilled workers in the workforce (Mueller 2012, Jirjahn and Mueller 2014). As these controls e.g. do not capture unobserved worker quality differences, previous studies may suffer from an omitted variable bias of a priori unknown magnitude and our ability to fix this is a potentially important contribution to this literature. Besides testing whether positive effects of works councils on establishment performance and wages is driven by sorting, we also look at profit effects to see whether the net effect of councils on productivity and wages benefits employers. In doing so, we examine to what extent the surplus generated by councils is shared with workers and we therefore present evidence on how worker involvement in decision-making shapes the labor share at the plant level. Finally, we will also ask the question of whether there is complementarity in labor productivity between worker-participation and workforce quality to assess whether such sorting may improve allocative efficiency.

We will find that council firms indeed employ workers of higher quality even if other plant characteristics are taken into account, that the share of high-quality workers strongly increases firms' labor productivity, and that the council effect declines just by one fifth if AKM person effects are controlled for. This is good news for the validity of previous studies as it implies that ignoring labor sorting biased their estimates of labor productivity effects of councils only moderately upwards. We also find that council establishments pay higher wages even after taking worker quality into account. We show that council firms' higher labor productivity is roughly equally shared by firms and workers, reinforcing positive profitability effects as reported in Mueller (2011). Last but not least we do not find evidence for the notion that high-quality workers' productivity premium is higher in council firms and, hence, cannot confirm the existence of complementarity between worker participation and worker quality.

2 Institutional setting, theory and some literature

2.1 Regulatory framework and worker sorting

The German system of industrial relations rests on two pillars, i.e. plant-level codetermination via works councils and sectoral collective wage bargaining between unions and employer associations.[4] The works constitution act (Betriebsverfassungsgesetz) requires works councils to act in the interest of workers and the firm and in a spirit of mutual trust. The works constitution act further codifies the rules for council elections and the rights elected councils have. Workers of plants with at least five permanent employees have the right to establish a council but there is no automatism to do so. In fact, as of 2015 only 42 percent of workers in West Germany - that will be the focus of our analysis - worked in the 9 percent of plants that have a works council (Ellguth and Kohaut 2016).[5]

The works constitution act grants councils several information and consultation rights and additionally defines topics where councils can block decisions (veto rights) or have the right to codetermine matters. Information rights, for instance, include the right to get access to information on the firm's economic and financial situation. These rights put councils in the position to verify management provided information and, thus, potentially lead to a more credible top down communication. By reducing information asymmetries between workers and the firm, information rights may, for instance, prevent inefficient firm closure (Freeman and Lazear 1995). Works councils have to be informed and consulted if the employer plans major changes in the work environment or the production process. On the one hand, this need for consultation may reduce employers incentives to adapt new technologies, but on the hand, if managed appropriately, the consultation process

[4] For excellent theoretical discussions on non-union worker representation and the German experience we refer to Addison (2009) and Jirjahn and Smith (2018).

[5] Why only a small and declining share of eligible firms has a council (Oberfichtner and Schnabel 2019) is not fully understood. Employers are prohibited to interfere with works council elections and even have to bear the costs for running the election. Once elected, councilors enjoy very strong employment protection. Because of this, and because time spent on work as a works councilor counts as regular working time, the nonexistence of councils in many eligible plants points to additional costs potential councilors face. These costs may, for instance, include the costs of positioning oneself as a works councilor while many employers have reservations against codetermination (Mueller and Stegmaier 2018) as well as the costs of actively organizing a joint position of workers, representing their interests, and being responsible for the negotiation outcomes.

addresses potential fears of workers and results in a well informed workforce committed to the desired change.[6] The standard 'collective voice' argument can also be made for workplace representation via works councils. Collective voice (Freeman 1976) as opposed to exit voice (Hirschman 1970) emphasizes that worker representation at the workplace gives dissatisfied workers a chance to anonymously express their dissatisfaction without having to fear punishment by the employer. This and the council's capability to actually resolve the sources of dissatisfaction may prevent these workers from quitting their jobs (or from reducing effort without quitting formally) and it provides employers with more information about worker preferences than 'exit voice' would do.

Works councils have their strongest rights in social matters. If a council formally disagrees with an individual dismissal this dismissal turns void until a labor court finally decides the matter. As a consequence, firing costs increase for employers and this may well have implications for productivity and sorting. Increased firing costs may, at the one hand, deteriorate productivity by reducing incentives to work hard (Addison *et al.* 2001, p. 671) but, on the other hand, let both sides take a longer-term view on the employment relationship, which incentivizes individual workers to care about the economic viability of their firm. From the employer perspective, a profit-maximizing reaction to increased firing costs can be to invest in screening activities when hiring new workers. If an improved screening technology increases the firm's capability to select high-productivity workers, the share of such workers will be higher in council firms. If, additionally, workers have a preference for stable and high-paying jobs and for firms where workers have a say in work-related matters, high-productivity workers will have a higher probability to apply for jobs at council firms, reinforcing assortative matching.

Both the firing cost argument and the collective voice argument imply reduced worker fluctuation in codetermined plants. Using plant-level data, Frick (1996) finds that works council existence is related to fewer quits and, among others, Addison *et al.* (2001), Frick and Möller (2003), Pfeifer (2011), and Grund *et al.* (2016) confirm that fluctuation is

[6] The link between council existence and innovative activity has been analyzed in Schnabel and Wagner (1994), Addison and Wagner (1997), and Addison *et al.* (2001). Neither of these studies found any statistically significant relationship. Interestingly, Jirjahn and Kraft (2011) find a positive link with incremental product innovations but not with drastic innovations.

reduced. Whether these are indeed direct collective voice effects or whether they are rather monopoly effects is analyzed by Hirsch *et al.* (2010) and Adam (2019). Utilizing employer-employee data, Hirsch *et al.* (2010) find voice effects only for a subgroup of low tenure workers. Adam (2019) resorts on plant-level data and exploits a change in the legal framework to estimate a difference-in-difference setting and finds strong voice effects being the source for reduced fluctuation. To sum up, the literature almost uniformly finds reduced employee fluctuation and some role for collective voice in explaining it.

Last but not least, one of the main arguments for high-wage workers to go to works council firms is that the latter pay wage premia to all of their workers. This is documented in Hirsch and Mueller (2020) who, using the same data set as we use, show that councils are associated with higher firm wage premia even conditional on firms' quasi rents. They estimate the additional wage premia to be about five percent.

Collective wage bargaining between unions and employer associations forms the second cornerstone of industrial relations in Germany. In 2015, 59 (31) percent of workers (plants) were covered by collective agreements in West Germany (Ellguth and Kohaut 2016). The works constitution act clarifies the relationship between works councils and unions by stipulating that councils are not allowed to interfere with union wage setting and are not allowed to call strikes. Although formally independent from each other, works councils and unions have close ties, with unions e.g. providing works councilors with resources and councils recruiting new union members at the shop floor (Behrens 2009). Freeman and Lazear (1995) argue that the existence of sector level wage bargaining should increase the productivity effect of councils because councils are then less engaged in distributional conflicts and care more about increasing the overall pie to be shared between workers and the firm.

2.2 Works councils and firm and worker outcomes

2.2.1 Productivity

The empirical economic literature on the productivity effect of works councils already started in the late 1980ies. While early studies had to rely on very small samples and

estimated negative council effects (FitzRoy and Kraft 1987), later studies where able to utilize large scale plant-level data. As a workhorse model, these studies estimated (mostly Cobb-Douglas) production functions in which the coefficient of a council dummy indicates the ceteris paribus productivity advantage/disadvantage of works council existence. Council effects from standard OLS estimations range from about 18 percent in Mueller (2015) to 25 percent in Addison *et al.* (2006) and even 30 percent in Frick and Möller (2003). Though these studies usually control for the fraction of skilled craftsman in the workforce (and sometimes also for the share of university graduates) they were not able to control for additional human capital components like worker experience or unobserved ability.

Mueller (2012), Mueller (2015), and Mueller and Stegmaier (2017) analyze various dimensions of the council's productivity effect and control for the fractions of skilled workers, apprentices, and part-time workers in the workforce and for the capital stock. While Mueller (2012) combines a GMM-SYS production function estimation with an endogenous switching regression and finds a productivity effect of about 7 percent, Mueller (2015) employs recentered influence function techniques (Firpo *et al.* 2009) and reports that the council effect is higher in unproductive firms. In an event-study setting, Mueller and Stegmaier (2017) show a long run increase in productivity after council introduction. Furthermore, Freeman and Lazear's (1995) hypothesis for a moderating effect of sector level wage bargaining on the productivity effect of councils has received strong support in empirical work (e.g. Hübler and Jirjahn 2003, Jirjahn and Mueller 2014, Brändle 2017).

To sum up, literature on the productivity effects of works councils finds univocally non-negative and in most cases substantial positive effects. With few exceptions, this literature is not dealing econometrically with endogeneity issues. In particular, no study has been able to control for employee sorting based on unobserved worker quality differences.

2.2.2 Wages

Literature on works councils and wages documents mainly a positive relationship. Using collective voice, works councils can be assumed to strengthen the bargaining power of

workers. Through their extensive rights to intervene in management decisions, works councils have additional possibilities to increase the workers' bargaining power. Using a sample of manufacturing firms from Lower Saxony, Addison *et al.* (2001) find 15% higher wages in works council establishments. Later studies using the LIAB support the positive relationship between works councils and wages (Gürtzgen 2009). At the individual level, Addison *et al.* (2010) show that workers in establishments with a works council benefit from works council premiums, a result that has been reinforced by Hirsch and Mueller (2020). As high-wage workers earn higher wages by definition, we expect that the estimated relationship between works councils and wages is reduced, when we control for AKM person effects at the establishment level. Dobbelaere *et al.* (2020) directly show that works councils are able to improve the bargaining position of workers, which in turn leads to higher wages.

2.2.3 Profits

The effect on profits depends on the relative size of the positive council effects on productivity and on wages, respectively, where the former increases profits and the latter mutes it. The model of Freeman and Lazear (1995) refers directly to firm surplus and suggests an inverted U-shaped relation between profits and the degree of worker rights. Empirical literature on the effects of works councils on profits is sparse. Early literature uses subjective management assessments of profits and finds a negative relationship between works councils and profits supporting the view that wage increases do more than fully eat up productivity gains (Addison and Wagner 1997, Addison *et al.* 2001). Using an objective measure of profits, Mueller (2011) finds a positive relationship between profits and works councils. In line with Freeman and Lazear (1995), Mueller (2011) finds that the profit effect is higher when a collective wage agreements is present. Again, these studies do not fully control for (un)observed worker quality. Whether previous studies over or underestimate the profit effects depends on whether any bias is stronger in the productivity or the wage estimates, respectively.

3 Empirical Strategy

3.1 Data

The data used is the Linked-Employer-Employee-Data (LIAB) of the Institute for Employment Research (IAB). It links plant-level survey information from the IAB Establishment Panel to social security records of all workers employed at the survey establishments (Heining *et al.* 2014). The IAB Establishment Panel covers yearly information for the years 1993 to 2017. It is a representative survey of German establishments with at least one employee subject to socially security contributions (Ellguth *et al.* 2014). Since 2001, it covers between 15,000 and 16,000 establishments each year. The data contains information on revenue, employment, capital stock,[7] intermediate inputs, and information on industrial relations and other firm characteristics. We merge to the LIAB the AKM person fixed effects estimated by Card *et al.* (2013), which are available upon request from the IAB.

As AKM effects are only available up to the year 2009 and for West German plants, only, and because we would need to impute works councils status for some early years, we use only information on West German establishments between 1998 and 2009. We omit establishments, which are publicly owned or belong to the financial services, insurance, or real estate industry as for those industries either sales (financial sector) or capital stock (real estate sector) are not well defined. In our analysis we also omit establishments that have less than five permanent employees or no information on the industrial relations regime. To deal with outliers in the survey data, we truncate the 1st and the 99th percentiles of value added per worker and capital stock per worker, respectively, within 1-digit industries and four year periods.

[7] The capital stock is not directly observed in the establishment panel and is computed using information on investments with the use of the modified perpetual inventory approach by Mueller (2008, 2010, 2017).

3.2 Two way fixed effects model

To capture unobserved worker quality we rely on the AKM model estimated by Card *et al.* (2013) and generate a measure of unobserved worker quality at the establishment level. Concretely, worker fixed effects come from the following wage equation:

$$log(wage_{it}) = \alpha_i + \Psi_{J(i,t)} + x'_{it}\beta_k + \epsilon_{it} \tag{1}$$

where the logarithm of the wage of individual i is the sum of a time invariant person-effect (α_i), a time invariant establishment-effect ($\Psi_{J(i,t)}$) for the establishment worker i is employed at time t plus time varying person characteristics[8] affecting workers' wages equally at all firms ($x'_{it}\beta_k$), and a residual pay component ϵ_{it}, which is by assumption independent of the right-hand-side variables.[9]

For our analysis, the worker effect is key. It captures time invariant person characteristic that are rewarded equally among employers. This e.g. captures observable characteristics as education and initial age as well as inherently unobservable wage and productivity components as e.g. problem solving skills, motivation, and ability. Including worker and firm effects in the same model ensures that what is deemed to be a person-specific effect is not obscured by firm-wide pay policies. This is the main advantage of using an AKM setting compared to just using worker fixed effects from a simple one-way fixed-effects model of wages, where estimates of worker effects mix up both worker and firm characteristics.

We use the person effects and aggregate it at the establishment level to obtain a measure of worker quality at the establishment level. In doing so, we first demean the person effect for each year by gender cell in the entire sample, i.e. not by establishment. This is because the Card *et al.* (2013) estimation procedure induces jumps in the level of person effects between (but not within) the multiple year time intervals used by Card *et al.* (2013) and because the level difference between men and women has no quantitative

[8] The time varying person characteristics ($x'_{it}\beta_k$) include an unrestricted set of year dummies and quadratic and cubic terms in age, which are fully interacted with educational attainment

[9] Card *et al.* (2013) discuss exogeneity assumptions in detail and provide suggestive evidence for them being fulfilled.

meaning. In a second step, we generate year-specific means of the demeaned person effects at the establishment level.[10] This yields measures for plant level worker quality that can be readily compared between plants and within plants over time. By construction, average quality of workers within a certain establishment and a certain multiple year time period is fixed unless worker composition changes.

4 Results

We perform OLS estimations of the model

$$y_{jt} = \beta_0 + \beta_1 woco_{jt} + \beta_2 \overline{a}_{jt} + \beta_3 kn_{jt} + \beta_4 l_{jt} + controls_{jt} + u_{jt}, \tag{2}$$

where y_{jt} is either the log of value added per worker, the log of the wage bill per worker, or the log of quasi rent as our profit measure. More specifically, in defining the profit measure we follow Mueller (2011) and use a per worker measure of value added minus wage costs, the latter including employers' social security contributions. As we control for (the log of) capital per worker kn_{jt}, ceteris paribus differences in the quasi rent per worker reflect differences in the rent going to employers.[11]

In equation 2, $woco_{jt}$ is a dummy indicating the presence of a works council, $\overline{a}_{jt}$ is the standardized mean of worker quality at the establishment level as described in the previous section, l_{jt} is a set of dummies flexibly capturing the number of workers, and $controls_{jt}$ include a collective wage bargaining dummy, the percentages of qualified workers, part-time workers, apprentices and women among all employees at the establishment, plus dummies for export, single-plant status, and the technical standard of the equipment. We further include controls for 2-digit industries, regions and years.

[10] Part-time employees, trainees, minijob workers, employees younger than 20 and older than 60 years of age are excluded from this aggregated measure of worker quality at the establishment level Card *et al.* (2013).

[11] Strictly speaking we additionally need to assume that, conditional on covariates, employers pay similar interest rates for capital. With integrated capital markets we believe this to be a sensible assumption.

4.1 Descriptive evidence

Descriptive results are presented in Table 1, which confirms standard results in terms of showing that council firms have higher labor productivity, pay higher wages, earn higher quasi rents, employ more workers, have a higher capital intensity, and are more likely to be covered by a collective wage agreement. The striking new result is that works council firms employ workers whose AKM person effects are more than one third of a standard deviation higher compared to non-council firms. Together with the results on productivity and wages, the descriptive analysis therefore points to strong assortative matching of high-wage workers to high-wage and high-productivity firms and it shows that having a council or not makes a big difference in these firm and worker characteristics.

What is in particular interesting for our paper is that the standard variable previous studies on German works councils used to capture workforce quality, which is the percentage of skilled workers, is rather similar in the two council regimes. The percentage of skilled jobs is about 66 versus 63 percent in council versus non-council establishments.[12] This difference is equivalent to less than one eight of a standard deviation in the percentage of skilled workers. An explanation for seeing the huge gap in worker quality and at the same time only small differences in the percentage of skilled jobs might be that the latter measures rather modest minimum skills (e.g. those typically possessed by a trained blue collar worker).

In Table A.1 we present regression results for worker sorting. Results show that also conditional on the controls listed above, works council plants have substantially higher AKM person effects. Not controlling for the fraction of skilled jobs (column 1) yields a works council coefficient of 0.2, which implies that worker quality in council firms is ceteris paribus one fifth of a standard deviation higher. Controlling for the fraction of skilled jobs (column 2), reduces the coefficient to 0.15. These results clearly show that controlling just for the percentage of skilled workers will not properly capture differences in worker quality across the two firm types.

[12] Very similar results are presented in Mueller and Stegmaier (2017).

4.2 Productivity estimates

Table (2) presents our labor productivity regressions. Coefficients for covariates all make sense, i.e. establishments that export, belong to multi-branch firms, use more capital per worker or more up-to-date equipment, or employ less apprentices or part-time workers do ceteris paribus have higher labor productivity. Also the modestly negative relationship between collective wage agreements and productivity has been documented before (e.g. Jirjahn and Mueller 2014).

At the center of this analysis, however, is the effect of council existence and how it is shaped by worker quality. Not controlling for worker quality (column 1) shows that council firms are ceteris paribus 15 percent more productive. Adding the percentage of skilled workers in column (2) gives a positive impact of skill on productivity and a reduction of the council coefficient from 0.15 to 0.13. With this result, we are in the same range of magnitude as other more recent studies (see e.g. Jirjahn and Mueller 2014, Mueller 2015). Adding AKM person effects to the analysis (column 3) yields a strong positive impact of AKM effects on productivity and a further reduction of the council effect from 0.13 to 0.11. This leads to two interesting conclusions: first, the council effect is reduced by about 15 percent but there is still a substantial productivity effect left and, second, AKM person effects are strongly related to productivity even if the percentage of skilled jobs is controlled for.

Column (5) shows that interacting worker quality and council status yields an insignificant and small coefficient for the interaction term and is not changing any results. This is interesting as it leads to the conclusion that while council firms do employ better workers as documented in Tables (1) and (A.1), they are *not* making better use of them. Hence there is no complementarity in productivity. Column (6) finally documents that the interaction term between works council presence and collective agreements, which is positive in almost all studies on German works councils and also in our column (4), is not shaped by controlling for AKM effects.

4.3 Wages estimates

Table (3) shows our wage estimates, follows the same structure as the productivity table, and is based on the same sample. The coefficients of the control variables mostly have the same sign as in the productivity regressions, underlining the close link between productivity and wages. The exception is the collective agreement dummy, which is now zero. Without controlling for skill requirements and worker quality, works councils are ceteris paribus associated with 13 percent higher wages (column 1), which drops to 11 percent when the percentage of skilled workers is added (column 2). Further adding AKM person effects reduces the council wage premium further to about 9 percent (column 3). These estimates are smaller than e.g. those in Addison *et al.* (2001) who reported about 15 percent higher wages. Our results show that one standard deviation increase in AKM person effects is associated with a wage increase of 11 percent (column 3), conditional on the percentage of skilled jobs.

The interaction effect of council existence and collective agreements is zero (column 4), which, from the background of the positive interaction effect in productivity, implies that entering a collective agreement makes sense for an employer whose workers established a works council. What is more, adding AKM person effects does not shape the coefficient of this interaction term (column 6). As in the productivity estimates, the interaction between council existence and AKM person effects is insignificant (column 5) and we therefore find no evidence for the notion that high-wage workers earn a higher wage premium relative to low wage workers in council firms.

4.4 Profit estimates

Finally, Table (4) presents our estimates for the quasi rent, where we interpret regression coefficients as profit effects because we always condition on capital intensity. Again, the table follows the same structure as the other two output tables, uses the same sample, and coefficients of controls make all sense. Confirming Mueller (2011), we report a positive link between council existence and profits across all specifications. Controlling for skill generally reduces the works council coefficient but the reduction is modest so that the

council coefficient is still in the range of 0.12 to 0.16 (in the specifications without interaction terms). Hence, councils are *ceteris paribus* associated with about 15 percent higher profits. This is in the same order of magnitude as reported in Mueller (2011) who estimated a council coefficient of 7,200 Euro and an average quasi rent of 33,300 Euro.

We also find some statistically insignificant confirmation of the positive interaction between works councils and collective wage agreements as theoretically suggested by Freeman and Lazear (1995) and empirically confirmed in Mueller (2011). Interestingly, AKM person effects are themselves positively related to profitability. This suggests that employers capture part of the additional productivity high-wage workers bring to the company, which provides a rational for employers to hire such workers although they earn higher wages. As in the productivity and wage regressions, we can't find any clear interaction effect between councils and high-wage workers.

4.5 Robustness checks and heterogeneity

It has been repeatedly shown in the literature that works council effects on productivity are smaller in small firms (Addison *et al.* 2001, Jirjahn and Mueller 2014). Potential explanations are that council rights are weaker in small firms and that coordination problems may be smaller in those firms even in absence of a works council. In Table (5), we weakly confirm these results by showing that the council coefficient drops from 0.11 to 0.10 when we exclude firms with 100 or more employees (column 1). Similarly, council coefficients modestly decline also for wages (column 4) and profits (column 7) if larger firms are dropped from the sample.

In columns 2, 5, and 8, we check whether results are different in the manufacturing sector. We generally find that council effects on all three outcome variables show the same sign but are smaller in magnitude in the manufacturing sector. The magnitude of our productivity estimates in the manufacturing sector is in line with Mueller (2012) who identified a productivity effect of about 6 percent in that sector. Notably, only in the wage regression we identify statistically significant results for manufacturing.

Finally, we drop the years of the 'Great recession' to check robustness. We find in

columns 3, 6, and 9 that the coefficient of the works council dummy stays nearly unchanged for all outcome variables. We conclude from our heterogeneity analysis that the coefficients of works council and worker quality never change sign regardless of specifications and subsamples. The only marked heterogeneity we find are muted council coefficients in the manufacturing sector.

5 Conclusions

In this study, we take stock of the mounting literature on the economic effects of works councils and this literature's overall positive assessment of worker participation to ask whether high-quality workers sort into council establishments, whether the positive economic effects remain once such sorting is taken into account, and whether there is a complementarity between worker participation and worker quality becoming visible in the form of excess productivity premia. We document substantial sorting in the sense that high-quality workers sort into works council establishments. Importantly, this sorting is only modestly muting the positive link between works councils and labor productivity, wages, and profits, respectively. We conclude that worker sorting is not invalidating the general result of positive council effects as documented in the mounting literature on works councils.

While we show strong positive productivity contributions of high-wage workers, we do not find that works councils make a difference here. This is not lending support to the notion that worker quality and worker participation as a form of high performance management practices are complements in productivity. One conclusion is that the observed sorting of high-quality workers to works council firms is neither improving nor deteriorating allocative efficiency and aggregate productivity.

Finally, we show a positive link between council existence and establishment profitability even after controlling for worker quality. Councils seem to make sure that the productivity gains associated with them are split equally between labor and capital. In that sense, they contribute to a stable labor share in income at plant level. Summing up our evidence, we conclude that councils contribute to productivity, wage, and profit

dispersion between establishments first by their positive effect on all three outcomes and, second, by attracting high-quality workers.

Having said that, our study comes with at least one major shortcoming: as most studies in the works council literature we do not tackle endogeneity issues beyond controlling for a wide range of covariates. While we overcome the issue of unobserved firm heterogeneity in terms of employee sorting there are other unobservables as e.g. differences in management quality that could explain both council existence and firm performance. A promising avenue of future research is thus to proceed along the lines of Mueller and Stegmaier (2017) by conducting event study analyses to see what happens within firms before and after introducing a works council in terms of sorting and firm performance. Due to the few council introductions, such analysis requires long time series and currently the link between the IAB establishment panel and AKM effects is not spanning a sufficiently long time span to do an event study convincingly.

Tables

Table 1: Summary statistics

	All		Works Council		no Works Council	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Log(Labor Productivity)	11.088	0.65	11.28	0.587	10.955	0.658
Log(Wage bill per worker)	10.194	0.49	10.389	0.393	10.058	0.505
Log(Profit per worker)	10.083	1.264	10.291	1.195	9.939	1.29
Log(Employment)	4.142	1.552	5.463	1.194	3.224	1.018
Log(Capital intensity)	10.784	1.207	11.088	1.157	10.572	1.195
Works Council (Dummy)	0.41	0.492	1	0	0	0
Collective bargaining (Dummy)	0.566	0.496	0.825	0.38	0.385	0.487
Worker Quality	0	1	0.206	0.794	-0.143	1.099
Skilled employees as share of all employees	0.644	0.255	0.662	0.253	0.631	0.257
Part-time employees as share of all employees	0.147	0.181	0.101	0.156	0.179	0.19
Apprentices as share of all employees	0.047	0.061	0.039	0.038	0.052	0.072
Female employees as share of all employees	0.327	0.245	0.273	0.216	0.364	0.257
Churning-rate	0.055	0.258	0.04	0.063	0.065	0.332
Export status (Dummy)	0.498	0.5	0.699	0.459	0.358	0.48
Single establishment (Dummy)	0.695	0.46	0.509	0.5	0.825	0.38
Technical state of machinery						
excellent	0.208	0.406	0.183	0.387	0.225	0.418
good	0.514	0.5	0.513	0.5	0.514	0.5
fair	0.252	0.434	0.271	0.444	0.239	0.427
poor	0.026	0.16	0.033	0.18	0.021	0.145
N	13,824		5,669		8,155	

Notes: IAB Establishment Panel, 1998–2009. Summary of 13,824 plant-year observations. Worker quality is the year-specific mean of the demeaned person effects (α_i) at the plant level (see equation (1)) provided by Card *et al.* (2013) and standardized for the sample with a mean of zero and a standard deviation of one.

Table 2: Labor productivity OLS regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Works council	0.150***	0.133***	0.114***	0.097***	0.112***	0.079***
	(0.024)	(0.024)	(0.023)	(0.030)	(0.023)	(0.029)
Skilled employees		0.350***	0.221***	0.353***	0.218***	0.223***
		(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
Worker quality			0.123***		0.120***	0.123***
			(0.010)		(0.010)	(0.010)
Collective Bargaining	-0.032**	-0.041***	-0.041***	-0.059***	-0.041***	-0.058***
	(0.016)	(0.016)	(0.016)	(0.019)	(0.016)	(0.019)
Works council ×				0.056*		0.055*
Collective Bargaining				(0.033)		(0.032)
Works council ×					0.015	
Worker quality					(0.017)	
Log(Capital intensity)	0.103***	0.099***	0.094***	0.099***	0.094***	0.094***
	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Export status	0.105***	0.106***	0.091***	0.106***	0.091***	0.090***
	(0.018)	(0.018)	(0.017)	(0.017)	(0.017)	(0.017)
Single establishment	-0.137***	-0.124***	-0.107***	-0.123***	-0.107***	-0.106***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Technical state = good	-0.055***	-0.049***	-0.047***	-0.049***	-0.047***	-0.047***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Technical state = fair	-0.106***	-0.088***	-0.081***	-0.088***	-0.082***	-0.082***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Technical state = poor	-0.090**	-0.067*	-0.060*	-0.067*	-0.061*	-0.060*
	(0.037)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
Part-time employees	-0.993***	-0.915***	-0.874***	-0.915***	-0.874***	-0.873***
	(0.061)	(0.058)	(0.057)	(0.058)	(0.057)	(0.057)
Apprentices	-0.783***	-0.727***	-0.755***	-0.716***	-0.759***	-0.744***
	(0.128)	(0.127)	(0.123)	(0.127)	(0.123)	(0.123)
Female employees	-0.111**	-0.056	-0.061	-0.055	-0.061	-0.061
	(0.050)	(0.049)	(0.048)	(0.049)	(0.048)	(0.048)
Churning-rate	-0.017	-0.008	0.002	-0.008	0.002	0.002
	(0.038)	(0.030)	(0.027)	(0.030)	(0.027)	(0.027)
Constant	10.529***	10.353***	10.520***	10.354***	10.525***	10.521***
	(0.136)	(0.126)	(0.136)	(0.125)	(0.137)	(0.135)
R^2	0.391	0.405	0.427	0.406	0.427	0.427
N	13,824	13,824	13,824	13,824	13,824	13,824

Notes: IAB Establishment Panel, 1998–2009. The dependent variable is the logarithm of value added per worker. Worker quality is the year-specific mean of the demeaned person effects (α_i) at the plant level (see equation (1)) estimated by Card *et al.* (2013) and standardized for the sample with a mean of zero and a standard deviation of one as described in section 3.2. Table shows coefficients from equation (2) with standard errors (in parentheses) clustered at the plant level. ***/**/* denotes statistical significance at the 1%/5%/10% level. Further covariates included in all specifications are establishment size dummies, region dummies, two-digit sector dummies and time dummies.

Table 3: Wages OLS regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Works council	0.125***	0.105***	0.088***	0.089***	0.088***	0.072***
	(0.014)	(0.013)	(0.012)	(0.017)	(0.012)	(0.015)
Skilled employees		0.392***	0.275***	0.393***	0.275***	0.276***
		(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Worker quality			0.111***		0.111***	0.111***
			(0.007)		(0.007)	(0.007)
Collective Bargaining	-0.002	-0.013	-0.012	-0.021*	-0.012	-0.020*
	(0.010)	(0.010)	(0.009)	(0.012)	(0.009)	(0.012)
Works council ×				0.026		0.025
Collective Bargaining				(0.019)		(0.017)
Works council ×					0.002	
Worker quality					(0.009)	
Log(Capital intensity)	0.057***	0.052***	0.049***	0.052***	0.048***	0.048***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Export status	0.082***	0.084***	0.070***	0.084***	0.070***	0.070***
	(0.011)	(0.011)	(0.010)	(0.011)	(0.010)	(0.010)
Single establishment	-0.067***	-0.053***	-0.038***	-0.053***	-0.038***	-0.037***
	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Technical state = good	-0.027***	-0.020**	-0.018**	-0.020**	-0.018**	-0.018**
	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Technical state = fair	-0.035***	-0.015	-0.009	-0.015	-0.009	-0.009
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Technical state = poor	-0.043*	-0.017	-0.011	-0.017	-0.011	-0.011
	(0.024)	(0.023)	(0.021)	(0.023)	(0.021)	(0.021)
Part-time employees	-0.881***	-0.794***	-0.757***	-0.794***	-0.757***	-0.756***
	(0.047)	(0.043)	(0.041)	(0.043)	(0.041)	(0.041)
Apprentices	-0.866***	-0.803***	-0.829***	-0.798***	-0.829***	-0.824***
	(0.084)	(0.079)	(0.076)	(0.079)	(0.076)	(0.076)
Female employees	-0.219***	-0.158***	-0.163***	-0.158***	-0.163***	-0.163***
	(0.034)	(0.031)	(0.030)	(0.031)	(0.030)	(0.030)
Churning-rate	-0.024	-0.014	-0.005	-0.014	-0.006	-0.006
	(0.037)	(0.028)	(0.025)	(0.028)	(0.025)	(0.025)
Constant	10.500***	10.303***	10.454***	10.304***	10.455***	10.454***
	(0.078)	(0.083)	(0.075)	(0.083)	(0.075)	(0.076)
R^2	0.544	0.576	0.607	0.576	0.607	0.607
N	13,824	13,824	13,824	13,824	13,824	13,824

Notes: IAB Establishment Panel, 1998–2009. The dependent variable is the logarithm of the wage bill per worker. Worker quality is the year-specific mean of the demeaned person effects (α_i) at the plant level (see equation (1)) estimated by Card *et al.* (2013) and standardized for the sample with a mean of zero and a standard deviation of one as described in section 3.2. Table shows coefficients from equation (2) with standard errors (in parentheses) clustered at the plant level. ***/**/* denotes statistical significance at the 1%/5%/10% level. Further covariates included in all specifications are establishment size dummies, region dummies, two-digit sector dummies and time dummies.

Table 4: Profits OLS regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Works council	0.159***	0.144***	0.125***	0.114*	0.122**	0.096
	(0.048)	(0.048)	(0.048)	(0.061)	(0.048)	(0.061)
Skilled employees		0.308***	0.178***	0.310***	0.171***	0.180***
		(0.061)	(0.062)	(0.061)	(0.062)	(0.062)
Worker quality			0.124***		0.118***	0.124***
			(0.019)		(0.020)	(0.019)
Collective Bargaining	-0.060*	-0.068**	-0.067**	-0.082**	-0.068**	-0.082**
	(0.032)	(0.032)	(0.032)	(0.039)	(0.032)	(0.038)
Works council ×				0.046		0.045
Collective Bargaining				(0.066)		(0.065)
Works council ×					0.030	
Worker quality					(0.035)	
Log(Capital intensity)	0.172***	0.169***	0.165***	0.169***	0.164***	0.164***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Export status	0.153***	0.154***	0.138***	0.153***	0.139***	0.138***
	(0.035)	(0.035)	(0.034)	(0.035)	(0.034)	(0.034)
Single establishment	-0.205***	-0.194***	-0.177***	-0.193***	-0.177***	-0.176***
	(0.035)	(0.034)	(0.034)	(0.035)	(0.034)	(0.035)
Technical state = good	-0.093***	-0.087***	-0.086***	-0.088***	-0.086***	-0.086***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
Technical state = fair	-0.188***	-0.172***	-0.166***	-0.173***	-0.166***	-0.166***
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
Technical state = poor	-0.153*	-0.132*	-0.126	-0.133*	-0.127	-0.126
	(0.080)	(0.079)	(0.079)	(0.079)	(0.079)	(0.079)
Part-time employees	-1.272***	-1.204***	-1.162***	-1.203***	-1.163***	-1.161***
	(0.109)	(0.108)	(0.107)	(0.107)	(0.107)	(0.107)
Apprentices	-0.653***	-0.603**	-0.632***	-0.595**	-0.640***	-0.623***
	(0.244)	(0.244)	(0.242)	(0.244)	(0.242)	(0.242)
Female employees	0.030	0.078	0.073	0.079	0.074	0.073
	(0.091)	(0.091)	(0.090)	(0.091)	(0.090)	(0.090)
Churning-rate	0.003	0.010	0.020	0.010	0.020	0.020
	(0.045)	(0.040)	(0.037)	(0.040)	(0.037)	(0.037)
Constant	8.514***	8.359***	8.527***	8.360***	8.538***	8.528***
	(0.303)	(0.293)	(0.308)	(0.292)	(0.310)	(0.307)
R^2	0.200	0.203	0.209	0.203	0.209	0.209
N	13,824	13,824	13,824	13,824	13,824	13,824

Notes: IAB Establishment Panel, 1998–2009. The dependent variable is the logarithm of the quasi rent per worker. Worker quality is the year-specific mean of the demeaned person effects (α_i) at the plant level (see equation (1)) estimated by Card *et al.* (2013) and standardized for the sample with a mean of zero and a standard deviation of one as described in section 3.2. Table shows coefficients from equation (2) with standard errors (in parentheses) clustered at the plant level. ***/**/* denotes statistical significance at the 1%/5%/10% level. Further covariates included in all specifications are establishment size dummies, region dummies, two-digit sector dummies and time dummies.

Table 5: Robustness Checks and Heterogeneity OLS regressions

	Labor Productivity			Wages			Profits		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	< 100 employees	Manu–facturing	1998–2007	< 100 employees	Manu–facturing	1998–2007	< 100 employees	Manu–facturing	1998–2007
Works council	0.099***	0.045	0.113***	0.074***	0.053***	0.089***	0.109*	0.040	0.117**
	(0.030)	(0.028)	(0.025)	(0.015)	(0.015)	(0.012)	(0.061)	(0.062)	(0.051)
Skilled employees (%)	0.256***	0.036	0.213***	0.312***	0.156***	0.269***	0.250***	-0.150*	0.164**
	(0.038)	(0.041)	(0.033)	(0.025)	(0.027)	(0.021)	(0.075)	(0.091)	(0.065)
Worker quality	0.118***	0.117***	0.122***	0.106***	0.087***	0.112***	0.114***	0.148***	0.115***
	(0.011)	(0.012)	(0.011)	(0.008)	(0.008)	(0.007)	(0.022)	(0.028)	(0.020)
Collective Bargaining	-0.036**	-0.041**	-0.043***	-0.014	-0.009	-0.015	-0.064*	-0.083*	-0.074**
	(0.018)	(0.019)	(0.017)	(0.011)	(0.012)	(0.010)	(0.038)	(0.043)	(0.035)
R^2	0.383	0.444	0.431	0.549	0.568	0.613	0.179	0.194	0.212
N	8,741	6,634	11,516	8741	6634	11,516	8741	6634	11,516

Notes: IAB Establishment Panel, 1998–2009. Labor productivity is defined as the logarithm of value added per worker, wages are the logarithm of the wage bill per worker, and profits are measured as the logarithm of the quasi rent per worker. Worker quality is the year-specific mean of the demeaned person effects (α_i) at the plant level (see equation (1)) estimated by Card *et al.* (2013) and standardized for the sample with a mean of zero and a standard deviation of one as described in section 3.2. Table shows coefficients from equation (2) with standard errors (in parentheses) clustered at the plant level. ***/**/* denotes statistical significance at the 1%/5%/10% level. Further covariates included in all specifications are establishment size dummies, region dummies, two-digit sector dummies and time dummies.

Appendix

Table A.1: Worker quality OLS regressions

	(1)	(2)	(3)
Works council	0.205***	0.153***	0.148***
	(0.034)	(0.031)	(0.041)
Skilled employees		1.049***	1.049***
		(0.048)	(0.048)
Collective Bargaining	0.023	-0.005	-0.008
	(0.027)	(0.026)	(0.033)
Works council ×			0.008
Collective Bargaining			(0.046)
Log(Capital intensity)	0.047***	0.035***	0.035***
	(0.012)	(0.011)	(0.011)
Export status	0.120***	0.123***	0.123***
	(0.030)	(0.027)	(0.027)
Single establishment	-0.176***	-0.140***	-0.139***
	(0.026)	(0.024)	(0.024)
Technical state = good	-0.035	-0.015	-0.015
	(0.026)	(0.025)	(0.025)
Technical state = fair	-0.106***	-0.053*	-0.053*
	(0.032)	(0.030)	(0.030)
Technical state = poor	-0.124**	-0.055	-0.055
	(0.057)	(0.054)	(0.054)
Part-time employees	-0.572***	-0.339***	-0.339***
	(0.098)	(0.094)	(0.094)
Apprentices	0.059	0.227	0.229
	(0.208)	(0.198)	(0.198)
Female employees	-0.121	0.042	0.042
	(0.080)	(0.071)	(0.071)
Churning-rate	-0.106**	-0.080**	-0.080**
	(0.053)	(0.031)	(0.031)
Constant	-0.828***	-1.355***	-1.355***
	(0.241)	(0.270)	(0.270)
R^2	0.338	0.392	0.392
N	13,824	13,824	13,824

Notes: IAB Establishment Panel, 1998–2009. The dependent variable is worker quality measured as the year-specific mean of the demeaned person effects (α_i) at the plant level (see equation (1)) estimated by Card *et al.* (2013) and standardized for the sample with a mean of zero and a standard deviation of one as described in section 3.2. Table shows coefficients from equation (2) with standard errors (in parentheses) clustered at the plant level. ***/**/* denotes statistical significance at the 1%/5%/10% level. Further covariates included in all specifications are establishment size dummies, region dummies, two-digit sector dummies and time dummies.

References

Abowd, J. M., Kramarz, F., and Margolis, D. N. (1999). High wage workers and high wage firms. *Econometrica*, 67(2), 251-333.

Adam, Julian B. (2019). Voluntary Quits: Do Works Councils Matter? An Analysis of the Reform of the German Works Constitution Act 2001. *Jahrbücher für Nationalökonomie und Statistik*, 239(1), 67-109.

Addison, J. T. (2009). The economics of codetermination: Lessons from the German experience. Springer.

Addison J. T., Schank T., Schnabel, C., Wagner J. (2006). Works Councils, Labor Productivity and Plant Heterogeneity: First Evidence from Quantile Regressions. *Journal of Economics and Statistics (Jahrbuecher fuer Nationaloekonomie und Statistik)*, 226(5), 505–518.

Addison, J. T., Schnabel, C., and Wagner, J. (2001). Works councils in Germany: their effects on establishment performance. *Oxford economic papers*, 53(4), 659-694.

Addison, J. T., Teixeira, P., Zwick, T. (2010). German Works Councils and the Anatomy of Wages. *ILR Review*, 63(2), 247-270.

Addison, J. T., and Wagner, J. (1997). Der Einfluss von Betriebräten auf Profitabilität und Produktinnovationen: neue Untersuchungsergebnisse auf den Basis von Betriebsdaten. *Jahrbücher für Nationalökonomie und Statistik*, 216(1), 1-20.

Andrews, M. J., Gill, L., Schank, T., Upward, R. (2008). High wage workers and low wage firms: negative assortative matching or limited mobility bias? *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, 171(3), 673–697.

Andrews, M. J., Gill, L., Schank, T., Upward, R. (2012). High wage workers match with high wage firms: Clear evidence of the effects of limited mobility bias *Economics Letters*, 117(3), 824–827.

Behrens, M. (2009). Still married after all these years? Union organizing and the role of works councils in German industrial relations. *ILR Review*, 62(3), 275-293.

Bender, S., Bloom, N., Card, D., Van Reenen, J., and Wolter, S. (2018). Management practices, workforce selection, and productivity. *Journal of Labor Economics*, 36(S1), 371-S409.

Bonhomme, S., Lamadon, T., and Manresa, E. (2019). A distributional framework for matched employer employee data. *Econometrica*, 87(3), 699-739.

Brändle, T. (2017). Flexible Collective Bargaining Agreements: Still a Moderating Effect on Works Council Behaviour? *Managerial and Decision Economics*, 38(8), 1137–1153.

Card, D., Heining, J., and Kline, P. (2013). Workplace heterogeneity and the rise of West German wage inequality. *The Quarterly journal of economics*, 128(3), 967-1015.

Dobbelaere, S., Hirsch, B., Mueller, S., Neuschaeffer, G. (2020). Does organised Labour Matter? Labour market imperfections and industrial relations in Germany, unpublished manuscript.

Ellguth, P., and Kohaut, S. (2016). Tarifbindung und betriebliche Interessenvertretung: Ergebnisse aus dem IAB-Betriebspanel 2015. *WSI-Mitteilungen*, 69(4), 283-291.

Ellguth, P., Kohaut, S., Möller, I. (2014). The IAB Establishment Panel - methodological essentials and data quality. *Journal for Labour Market Research*, 47(1-2), 27–41.

Firpo, S., Fortin, N. M., and Lemieux, T. (2009). Unconditional quantile regressions. *Econometrica*, 77(3), 953-973.

FitzRoy, F. R., and Kraft, K. (1987). Effciency and Internal Organization: Works Councils in West German Firms. *Economica*, 493-504.

Freeman, R. (1976). Individual Mobility and Union Voice in the Labor Market. *American Economic Review*, 66(2), 361–68.

Freeman, R. B., and Lazear, E. P. (1995). An Economic Analysis of Works Councils. In J. Rogers and W.Streeck (Eds.), Works Councils: Consultation, Representation, and Cooperation in Industrial Relations (pp. 27-52). University of Chicago Press.

Frick, B. (1996). Co-determination and Personnel Turnover: The German Experience. *Labour*, 10(2), 407-430.

Frick, B. and Möller, I. (2003). Mandated works councils and firm performance: Labor productivity and personnel turnover in German establishments. *Schmollers Jahrbuch (Journal of Applied Social Science Studies)*, 123(3), 423–454.

Grund, C., Martin, J., Schmitt, A. (2016). Works councils, quits and dismissals. *German Journal of Human Resource Management*, 30, 53-75.

Gürtzgen, N. (2009). Rent–sharing and Collective Bargaining Coverage: Evidence from Linked Employer–Employee Data. *Scandinavian Journal of Economics*, 111, 323–349.

Heining, J., Klosterhuber, W., Seth, S. (2014). An overview on the Linked Employer-Employee Data of the Institute for Employment Research (IAB). *Schmollers Jahrbuch*, 134(1), 141–148.

Hirsch, B. and Mueller, S. (2020), 'Firm Wage Premia, Industrial Relations, and Rent Sharing in Germany', *Industrial and Labor Relations Review (conditionally accepted).*

Hirsch, B., Schank, T., and Schnabel, C. (2010). Works councils and separations: Voice, monopoly, and insurance effects. *Industrial Relations*, 49(4), 566–592.

Hirschman, A. O. (1970). Exit, voice, and loyalty: Responses to decline in firms, organizations, and states (Vol. 25). Harvard university press.

Hübler, O., and Jirjahn, U. (2003). Works councils and collective bargaining in Germany: the impact on productivity and wages. *Scottish Journal of Political Economy*, 50(4), 471-491.

Jensen, M., and Meckling, W. (1979). Rights and Production Functions: An Application to Labor-Managed Firms and Codetermination. *The Journal of Business*, 52(4), 469-506.

Jirjahn, U., Kraft, K. (2011). Do spillovers stimulate incremental or drastic product innovations? Evidence from German establishment data. *Oxford Bulletin of Economics and Statistics*, 73(4), 209–538.

Jirjahn, U., and Mueller, S. (2014). Non-union worker representation, foreign owners, and the performance of establishments. *Oxford Economic Papers*, 66(1), 140-163.

Jirjahn, U., and Smith, S. C. (2018). Nonunion Employee Representation: Theory and the German Experience with Mandated Works Councils. *Annals of Public and Cooperative Economics*, 89(1), 201-233.

Lopes de Melo, R. (2018). Firm wage differentials and labor market sorting: Reconciling theory and evidence *Journal of Political Economy*, 126(1), 313-346.

Mueller, S. (2008). Capital stock approximation using firm level panel data. *Jahrbücher für Nationalökonomie und Statistik*, 228(4), 357-371.

Mueller, S. (2010). Capital stock approximation with the perpetual inventory method * stata code for the IAB establishment panel. *FDZ-Methodenreport*, 02/2010, Nuremberg.

Mueller, S. (2011). Works Councils and Firm Profits Revisited. *British Journal of Industrial Relations*, 49, s27-s43.

Mueller, S. (2012). Works councils and establishment productivity. *ILR Review*, 65(4), 880-898.

Mueller, S. (2015). Works Councils and Labour Productivity: Looking Beyond the Mean. *British Journal of Industrial Relations*, 53(2), 308–325.

Mueller, S. (2017). Capital stock approximation with the perpetual inventory method: An update. *FDZ-Methodenreport* 05/2017, Nuremberg.

Mueller, S., and Stegmaier, J. (2017). The dynamic effects of works councils on labour productivity: First evidence from panel data. *British Journal of Industrial Relations*, 55(2), 372-395.

Mueller, S., and Stegmaier, J. (2018). Why is there resistance to works councils in Germany? An economic perspective. *Economic and Industrial Democracy.*

Oberfichter, M. and Schnabel. C. (2019).The German model of industrial relations: (where) does it still exist? *Jahrbücher für Nationalökonomie und Statistik*, 239(1), 5–37.

Pfeifer, C. (2011). Works councils, union bargaining and quits in German firms. *Economic and Industrial Democracy*, 32(2), 243â“260.

Schnabel, C., and Wagner, J. (1994). Industrial relations and trade union effects on innovation in Germany. *Labour*, 8(3), 489-504.

Syverson, C. (2011). What determines productivity?. *Journal of Economic literature*, 49(2), 326-65.