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zur Zukunft der Arbeit
Institute for the Study
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ABSTRACT

Monopsonistic Competition, Low-Wage Labour Markets, and Minimum Wages: An Empirical Analysis*

This paper investigates the degree of monopsony power of employers in different industries against the background of a statutory minimum wage introduction in Germany in January 2015. A semi-structural estimation approach is employed based on a dynamic model of monopsonistic competition. The empirical analysis relies on a linked employer-employee data set which allows to control for heterogeneity both on the worker and on the firm side. The results show important differences in monopsonistic competition among low-wage industries: While retailing, the hotel and restaurant industry as well as agriculture can be described as monopsonistic labour markets, this is not true for other services and manufacturing of food products. From a policy point of view, the introduction of a uniform minimum wage may therefore lead to different employment reactions in industries with a similar minimum wage bite.

JEL Classification: J42, J31, J38

Keywords: monopsony, minimum wage, low-wage industries, labor-supply elasticities, Germany

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1 Introduction

The institutional framework governing minimum wages in Germany changed drastically on 1st January 2015 when a countrywide minimum wage was introduced at €8.50 per hour. Previously, minimum wages only existed for a selected number of industries and were based on collective bargaining agreements declared generally binding. The statutory minimum wage affects 15 percent of all West German employees and 27 percent of all East German employees (Brenke and Müller, 2013), and is relatively high compared to other industrialized countries (Kluve, 2013). Consequently, there is a widespread fear that many jobs are at risk of getting destroyed, especially when economic conditions deteriorate.

However, the expected employment effects of minimum wages depend not only on its bite, but also on the prevailing labour market structure. Under perfect competition, the wage elasticity of labour supply to the firm is infinite, the wage equals the marginal product of labour, and an exogeneous increase in the wage therefore unambiguously leads to a decrease in employment (Neumark and Wascher, 2008). In a monopsonistic labour market, by contrast, the wage elasticity of labour supply to the firm is relatively low due to limited mobility of workers. As a consequence, firms can use their market power to set the wage below a worker's productivity (Manning, 2003*a*). Minimum wages may therefore lead to a reduction in firms' profits without a corresponding decrease in employment.[1]

In this paper, we therefore analyse if and to what extent industries are characterized by differing degrees of monopsonistic competition. For this purpose we follow the semi-structural estimation approach based on the dynamic model of monopsonistic competition proposed by Manning (2003*a*) and use a unique linked employer-employee data set which allows to control for worker heterogeneity, firm heterogeneity and demand side effects. Our analysis yields estimates of the wage elasticity of labour supply to the firm, which provides a measure of monopsony power, for different industries and for East and West Germany. These estimates provide an important indication for the risk of job losses which may materialize because of the minimum wage introduction, and can therefore be understood as ex-ante evidence for its effects on the German labour market. Furthermore, the methodology used in our paper could easily be adopted to obtain ex-ante evidence on the likely effects of minimum wage introductions or raises in other countries.

The empirical studies on employment effects of (sectoral) minimum wages for Germany (König and Möller, 2009; Frings, 2013; Vom Berge, Frings and Paloyo, 2013) are as inconclusive as those for the US (Card and Krueger, 1994;

[1] Similar results can arise in search and matching models of the labour market (Flinn, 2011).

Dube, Lester and Reich, 2010; Neumark and Wascher, 2008) or the UK (Machin and Wilson, 2004; Metcalf, 2008; Dolton, Bondibene and Wadsworth, 2012). However, there is a tendency towards reporting neutral employment effects[2].

In the political discourse and in academic discussion prior to the introduction of the statutory minimum wage in 2015, the monopsonistic structure of the labour market was repeatedly brought forward as a theoretical explanation for the non-negative employment effects of the existing minimum wages at the industry level.[3] Contrary to the Robinsonian model of monopsony, employer concentration is not the main - and not even necessary - source of employer's bargaining power in modern models on monopsonistic competition. Instead, imperfect information, non-wage preferences for a specific employer and limited mobility of workers are decisive. Monopsony, thus, not only occurs in particular labour market segments (regional, occupational etc.), but is potentially an underlying characteristic of labour markets in general. However, no empirical evidence exists on the relevance of this argument in the German minimum wage debate.

Evidence for monopsony power on the German labour market as a whole is provided by Hirsch, Schank and Schnabel (2010*a*) who estimate the wage elasticity of labour supply to the individual firm to lie in the range of 1.9 – 3.7 in West Germany. While this result is interesting by itself, the more relevant question in the context of the minimum wage is to which extent low-wage industries, in which the minimum wage bites hard, are characterized by monopsonistic competition. Thus, we contribute to the literature not only by estimating the extent of monopsony power by sector – which is of interest because wage-setting takes place at the sectoral level to a large extent – but especially by analysing the interplay of monopsony power and wages at the sectoral level. This simultaneous analysis is crucial in order to develop expectations on the employment effects of minimum wages, even ex ante to the policy implementation. Therefore, our results are of high relevance to policy makers.

Heterogeneity in monopsony power at the firm level has recently been analyzed by Webber (2015). We further develop this new strand of literature by not only providing the first evidence on sectoral heterogeneity of monopsony power in Europe, but also by providing reasons for these differences in market structure across industries. While our results directly apply to the German minimum

[2]This is especially true for a large-scale evaluation of the existing industry-specific minimum wages in Germany by the Ministry of Labour and Social Affairs. The reports (in German only) containing detailed results can be downloaded at: `http://www.bmas.de/DE/Themen/Arbeitsrecht/Meldungen/evaluation-mindestloehne.html`.

[3]Clearly, monopsony is just one among many possible reasons for non-negative employment effects. Factors such as substitution of high-skilled for low-skilled labour, pass-through of increased labour costs to product prices, reduced non-wage benefits, or non-compliance may be equally important.

wage introduction, they are equally important for increasing our understanding of the functioning of labour markets in developed countries worldwide.

We find that, first, the labour supply elasticity to the individual firm is considerably lower than expected in a perfectly competitive labour market, which is in line with existing estimates. Second, we find important differences in the degree of monopsonistic competition between industries, which are related to worker composition and the presence of works councils. While monopsony power may mitigate adverse employment effects in some low-wage industries, such as the hotel and restaurants industry, retailing or agriculture, this is not the case for other services or manufacturing of food products where the minimum wage also severely compresses the wage distribution. The employment effects of the minimum wage introduction will therefore be unevenly distributed across low-wage industries.

The remainder of the paper is structured as follows: The next section reviews the dynamic monopsony model and develops hypotheses on the determinants of sectoral differences in monopsonistic competition. Section 3 presents details of the semi-structural estimation approach, and Section 4 describes the data set. Section 5 discusses the empirical results and their implications for the expected employment effects of the statutory minimum wage. The final section concludes.

2 Theoretical considerations and empirical evidence

The source of monopsony power in dynamic models of monopsonistic competition results from search frictions as well as heterogeneous preferences over non-wage employer characteristics (Bhaskar, Manning and To, 2002; Boal and Ransom, 1997).[4] First, search frictions constitute any factor that lengthens the time firms and workers need to find each other. For example, job seekers have only limited information available about job openings and the characteristics of such jobs, including the offered wage. At the same time employers suffer from information asymmetries in terms of job seekers available to firms. Second, preferences that are relevant for monopsony power mainly refer to non-wage employer characteristics such as flexible working time arrangements, commuting time, training and career opportunities, or the general working atmosphere. Finally, even though firm concentration in local labour markets is not a central source of monopsony power, it further advances monopsony power of employers due to limited mobility of workers across labour market regions.

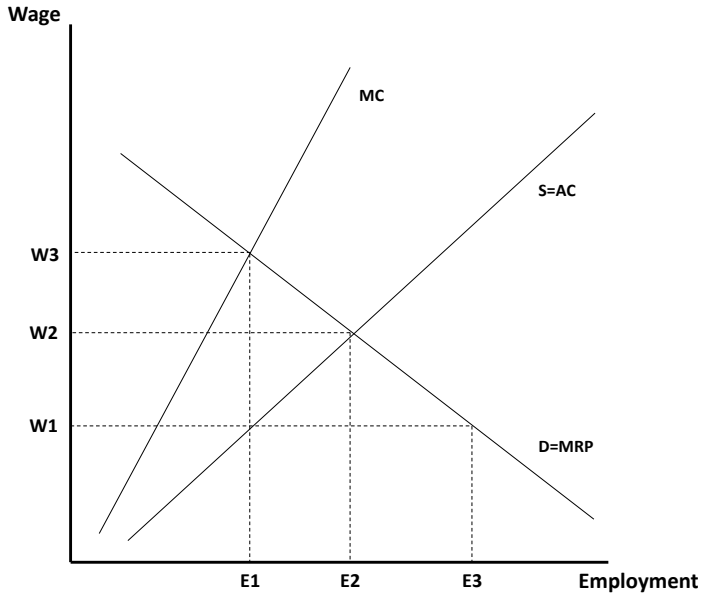
[4] Manning (2003*b*) and Hirsch, König and Möller (2013) propose models of geographic oligopsony, in which a combination of regional employer concentration and limited mobility of workers are the sources of monopsony power. However, in the majority of modern monopsony models employer concentration is irrelevant.

As a result of these different sources of monopsony power, the labour supply to the firm is not perfectly elastic, and the degree of monopsonistic competition is defined by the wage elasticity of labour supply or, put differently, the slope of the labour supply curve. The flatter this curve, i.e. the higher the wage elasticity of labour supply, the more competitive the labour market. Figure 1 shows the situation of the individual firm in a monopsonistic labour market facing an upward sloping labour supply curve. In contrast to the competitive model of the labour market, firms are wage setters and can choose any wage-employment combination on the upward sloping labour supply curve. Intuitively, this means that some - but not all - workers will leave the firm if the wage is reduced by a small amount.

All existing empirical studies on monopsonistic competition find relatively low wage elasticities of labour supply to the individual firm. The lowest elasticities are reported in studies analysing specific labour market segments in which employer concentration is an important source of monopsony. For example, Falch (2010) exploits an exogenous variation in wages for school teachers in Norway and finds an elasticity of 1.4. Staiger, Spetz and Phibbs (2010) follow a similar identification strategy but focus on nurses employed in Veteran Hospitals in the US. Their results indicate an extremely low elasticity of 0.1. While the identification strategy in these studies is credible, the estimated elasticities are only valid in the short term, the external validity is low and the degree of inference that can be drawn for the more general functioning of the labour market is limited.

A second strand of the literature employs a semi-structural estimation approach based on Manning's model of dynamic monopsony. These studies estimate the long-term elasticity of labour supply to the firm. Naturally, the estimated elasticities are higher, but still far from infinite: Ransom and Oaxaca (2010) find labour supply elasticities in the range of 1.4 – 3.0 for the grocery retail industry in the US, and Ransom and Sims (2010) report an elasticity of 3.7 for school teachers in the US. The external validity of the study by Ransom and Oaxaca (2010) is higher compared to the other results discussed up to this point. The reason is that search frictions or heterogeneous preferences are more likely reasons for monopsony power than pure employer concentration in the retail grocery industry compared to school teachers or nurses. Hirsch, Schank and Schnabel (2010*a*) present one of the few analyses for an entire labour market. Using linked employer-employee data for Germany, the authors provide separate estimations for men and women, showing that the labour supply elasticity to the firm lies in the range of 1.9 – 3.7. Booth and Katic (2011) also find evidence for monopsonistic competition for the entire Australian labour market using individual level data. The estimated labour supply elasticity is 0.71.

Figure 1: The firm in a monopsonistic labour market



Legend: S = Labour supply; AC=Average cost of labour; MC= Marginal cost of labour; D=Demand for labour; MRP=Marginal revenue product of labour.
Source: Own illustration, based on Manning (2003*a*).

In addition to a finite labour supply elasticity to the firm, the monopsony model as in Manning (2003*a*) provides further insights, in particular with respect to employment, wages, and the expected effects of minimum wages. In this context, the central assumption is that workers with identical observable characteristics receive the same wage *within* one firm. Consequently, if a firm wants to increase its employment level, the higher wage has to be paid not only to the additional worker, but also to all existing employees of the same type. In other words, the marginal cost of labour includes the wage paid to the new employee as well as the wage increases of the workers already employed. Therefore, the marginal cost (MC) of labour exceeds the average cost (AC) of labour. A profit-maximizing firm will choose its employment level such that marginal costs are equal to the marginal revenue product (MRP) of labour. Thus, the firm depicted in Figure 1 will choose employment level E1. The wage that needs to be paid to obtain this employment level equals W1.

This has several important implications. First, wage W1 and employment E1 are lower in the monopsonistic equilibrium compared to the equilibrium under perfect competition (W2 and E2). Second, workers earn less than their marginal product because the marginal cost exceeds the average cost of labour. Third, the firm operates with a constant amount of vacancies, i.e. at the going wage

rate W1 the firm would like to employ workers up to E3. Thus, the equilibrium is supply-side constrained.

Finally, the model implies that a moderate minimum wage which is slightly above the going wage rate could increase wages and employment simultaneously while decreasing firms' profits. For example, increasing the wage rate exogenously above W1 implies moving upwards the labour supply curve. Yet, this relationship only holds until labour supply equals labour demand. At wage rates exceeding W2, labour demand is the decisive factor in determining the employment level. While employment is maximized at wage rate W2, a minimum wage up to W3 still implies employment gains compared to the free market equilibrium under monopsonistic competition. A minimum wage exceeding W3 would lead, exactly as under perfect competition, to employment losses. Therefore, the effects of a minimum wage depend on its level as well as the degree of monopsonistic competition in the labour market.

Despite the high relevance of monopsony for the empirical minimum wage literature, Dube, Lester and Reich (2013) is the only existing study that explicitly links minimum wages to monopsonistic competition in the labour market by exploiting discontinuities at state borders in federal minimum wage rates in the US to estimate wage elasticities of accession and separation rates. The minimum wage elasticities of the separation rate are small, with an increase of 1 percent in the minimum wage leading to a decrease in separations of -0.24 percent for teenage workers in the entire economy and of -0.32 percent for restaurant workers. The remaining parameters of the Burdett and Mortensen (1998) equilibrium search model are then estimated drawing on these wage elasticities. The results point towards a significant degree of search frictions in the low-wage labour market in the US, which Dube, Lester and Reich (2013) interpret as an explanation for non-negative employment effects of the minimum wage.

A factor that has been completely neglected in this context by both the theoretical and the empirical literature is the sectoral dimension. This is, however, likely to be of great importance especially for the recent introduction of a statutory minimum wage in Germany. The reason for this is that wage-setting often takes place at the sectoral and regional level, resulting in inter-industry wage differentials. This leads to large differences in the bite of the minimum wage across industries. All else equal, industries with lower average wages can be expected to show a stronger reaction to the uniform minimum wage in terms of employment. However, the employment effects of the minimum wage will also depend on the degree of monopsony power in the different industries. For example, if all low-wage industries were characterized by a relatively high degree of monopsonistic competition, the overall employment effect of the minimum wage would be neg-

ligible. If the opposite was the case, i.e. if monopsony power was relatively low in low-wage industries, one would expect large employment effects. Finally, if the picture was more diverse, i.e. if there were large differences in monopsonistic competition among low-wage industries, this could explain different employment reactions in these industries, despite similar wage levels prior to the introduction of the statutory minimum wage.

There are at least three reasons to expect varying degrees of monopsonistic competition across industries: Worker composition, job-specific human capital, and collective bargaining coverage. First, the degree of monopsonistic competition is expected to be higher in industries with a high share of women, migrants and/or low-skilled workers. All three groups are less regionally mobile than the associated comparison group. In addition, preferences for non-wage employer characteristics may be more important for women compared to men (e.g. flexible working time arrangements). Migrants and low-skilled workers are assumed to face stronger information asymmetries. The empirical literature is in line with these expectations: Hirsch, Schank and Schnabel (2010*a*) and Sulis (2011) show that the wage elasticity of labour supply to the individual firm is lower for women than for men in Germany and Italy, respectively; Hirsch and Jahn (2015) estimate labour supply elasticities of 1.9 for natives and of 1.6 for immigrants in Germany. No studies exist on differences in the degree of monopsonistic competition faced by workers of different skill levels. However, the expectation that low-skilled workers are subject to a higher degree of monopsony power is in line with low-skilled workers generally featuring lower transition rates in the labour market (Bachmann, 2005).

Second, the job-specificity of human capital is likely to vary between economic sectors because the production process exhibits dissimilar levels of complexity and because learning on the job differs between sectors. In sectors with a high degree of job-specific human capital, workers may be less inclined to switch employers because the probability that a new employer equally values the accumulated human capital is lower.

Third, union coverage itself does not directly influence the degree of monopsonistic competition but acts in the same way as a minimum wage does: Wages are simply pushed above the free market equilibrium. In the German system of industrial relation, unions mostly act through collective bargaining at the industry level, although, collective bargaining agreements at the firm level are gaining in importance, especially in East Germany. In contrast, works councils represent workers' interests directly within the firm. They are equipped with far-reaching rights to information and co-determination at the firm level. Thus, works councils appear to be more decisive for the degree of monopsonistic competition through the reduction of information asymmetries on the workers' side

(Mohrenweiser, Marginson and Backes-Gellner, 2012). Members of works councils are well informed about the industry's wage structure and the existence of vacancies through regular contact with works councils' members of other firms. At the same time, they frequently communicate with their colleagues within the firm they are representing.

In summary, industries with (i) a high share of women, migrants, and/or low-skilled workers, (ii) a high degree of job-specific human capital, and (iii) a low share of firms with works councils are hypothesized to be characterized by a high degree of monopsonistic competitions.

3 Estimation Strategy

Estimating the labour supply elasticity to the individual firm at first sight appears to be straightforward and involves regressing the firm's employment level on the wage paid. However, such a regression would be endogenous as the firm decides simultaneously on wages and employment. Thus, to analyse the degree of monopsonistic competition in Germany across sectors, one would ideally exploit an exogenous wage variation to identify the labour supply elasticity of the individual firm. Seemingly, minimum wages or collective bargaining agreements appear to offer such a variation at the industry level in Germany. Unfortunately, all firms are equally affected by this wage increase which implies that the wage distribution over firms and workers is just shifted to the right or compressed from below. Since no convincing exogenous wage change exists that only affects some firms in a specific industry, we follow the semi-structural approach proposed by Manning (2003*a*).

This approach is based on the dynamic model of monopsonistic competition (Manning, 2003*a*) which in turn heavily draws from the Burdett and Mortensen (1998) equilibrium search model. The underlying idea is that a stable equilibrium distribution of wages exists, both over workers and over firms. Each worker receives job offers at an exogenously determined job offer rate. If the offered wage is higher than the wage paid in the current job, the worker accepts and moves up the job ladder. This implies that firms have a constant flow of hirings and separations. The separation rate $s(w_t)$ depends negatively on the wage, simply because there are fewer firms that will make a better wage offer in comparison to the current wage paid. The opposite is true for the number of recruits $R(w_t)$. The number of workers in a firm N_t can be expressed as the sum of workers who were already employed in the firm in the previous period N_{t-1} and the number of recruits in period t minus the number of separations $s(w_t)N_{t-1}$.

$$N_t = [1 - s(w_t)]N_{t-1} + R(w_t) \tag{1}$$

Note that both, the separation rate $s(w_t)$ and the number of recruits $R(w_t)$ depends on the wage rate offered by the firm. In the steady state, firm size should be constant which means that the number of separations should be equal to the number of recruits:

$$N(w) = R(w)/s(w) \tag{2}$$

This implies that the long-term elasticity of labour supply to the individual firm ϵ_{Nw} can be expressed as:

$$\epsilon_{Nw} = \epsilon_{Rw} - \epsilon_{sw} \tag{3}$$

Thus, in order to estimate the labour supply elasticity, it is sufficient to estimate the recruitment elasticity as well as the separation rate elasticity. Under the assumption that recruitment from and separations to non-employment are wage inelastic, only the separation rate elasticity of job-to-job transitions has to be estimated.[5] The reason is that in this case, the recruit of one firm must be a separation to another firm, which implies that $\epsilon_{sw} = -\epsilon_{Rw}$. The long-term elasticity of labour supply can therefore be expressed as:

$$\epsilon_{Nw} = -2\epsilon_{sw} \tag{4}$$

Estimating the wage elasticity of labour supply to the individual firm thus amounts to estimating the wage elasticity of job-to-job transitions. The focus on job-to-job transitions has the additional advantage that the majority of job-to-job transitions is voluntary from the point of view of the worker, i.e. they are mostly supply-side driven. By contrast, many transitions to non-employment are due to dismissals and thus involuntary, i.e. they are more likely to be due to demand-side factors. This is crucial because the aim is to identify the labour supply, not the labour demand curve, of the individual firm. The specification additionally controls for firm characteristics to ensure that demand-side shocks do not bias the results. This is especially important for the comparison of different industries as the macroeconomic situation may vary.

We model the instantaneous separation rate of employment spell i in firm j at duration time t as:

$$s_i(x_i(t), z_j(t)) = h_0 \exp(x_i(t)'\beta + z_j(t)'\gamma) \tag{5}$$

where s is a dummy variable which takes the value 1 if a separation takes place

[5] Clearly, the assumption that separations to non-employment are wage inelastic may not be true for all workers. However, the empirical literature shows that estimated labour supply elasticities change little when this assumption is relaxed (Hirsch, Schank and Schnabel, 2010*a*).

and 0 otherwise. Thus, the instantaneous separation rate depends on a constant baseline hazard h_0 as well as worker characteristics $x_i(t)$ and firm attributes $z_j(t)$ that shift the baseline hazard. Worker characteristics include sex, age, educational attainment, and the current wage. On the firm side, profitability, the existence of re-organisation or outsourcing measures, as well as the share of women and temporary workers among total employment are included as control variables. As a robustness check, the presence of a works council and collective bargaining coverage are included as additional covariates.

Time-variant control variables enter at a yearly frequency. Thus, profitability is measured each year for the last financial year, outsourcing activities refer to the 12 months preceding the interview and re-organisation activities may have taken place during the last two years prior to the interview. The remaining indicators on the firm side as well as the worker characteristics are measured at the time of the interview. Furthermore, the regression equation includes year dummies to control for aggregate year-specific effects, such as business cycle conditions. All estimations are carried out separately for East and West Germany as well as for specific industries. The wage rate is specified in logs which enables the direct interpretation of the coefficient as the wage elasticity of job-to-job transitions. The absolute value of the separation elasticity multiplied by two equals the wage elasticity of labour supply to the individual firm.

The exponential model with a constant baseline hazard has the advantage that tenure is explicitly not included as a control variable. In the model of monopsonistic competition, higher wages induce lower separation rates, thereby increasing tenure. Thus, including tenure would take away variation from wages and therefore bias the estimated wage elasticity (Hirsch, Schank and Schnabel, 2010*a*; Booth and Katic, 2011). Still, tenure is also known to be an important determinant of the separation probability itself. Therefore, as a robustness check, we estimate a Cox Model with a variable baseline hazard in order to explicitly take into account tenure. The results do not change in qualitative terms; i.e., they indicate that the same industries are characterized by relatively low or high degrees of monopsonistic competition when controlling for tenure.[6]

Having estimated the labour supply elasticities at the industry level, we check whether they are in line with the theoretical framework of monopsonistic competition. This is done by correlating the industry-specific labour supply elasticities with (i) indicators on worker composition, (ii) the average degree of worker representation and (iii) the amount of vacancies. Note that a high share of vacancies in a monopsonistic labour market is a direct prediction of the theoretical model, while our hypothesis in terms of worker composition and

[6]These results are not included in the paper, but can be obtained from the authors upon request.

worker representation are based on existing empirical studies (cf. Section 2).

A key prediction of the monopsonistic model of the labour market is that firms are supply-side constrained in equilibrium and therefore operate with a constant amount of vacancies. Given this theoretical prediction, the existence of vacancies in an industry constitutes an indicator for the existence of monopsony power. We therefore expect to find higher degrees of monopsonistic competition in industries with a larger share of vacancies among total employment.

Furthermore, we expect the degree of monopsonistic competition in an industry to depend on worker composition, because specific groups of workers are exposed to a higher degree of monopsonistic competition. To the extent that e.g. men not only make more transitions per se but are also more sensitive to the wage in their decision, the average estimated wage elasticity will be higher with increasing shares of men in the firm. The same is true at the industry level, because the wage elasticity of the separation rate for each industry amounts to a weighted average of separation rate elasticities to the firm. Therefore, we expect the degree of monopsonistic competition to be higher with increasing shares of women, migrants, and/or low-skilled individuals in an industry's the workforce.

4 Data

The data set used to estimate Equation 5 is the LIAB, a linked employer-employee data set for the German labour market.[7] The basis of the worker history is the integrated notification procedure for health insurance, the statutory pension scheme, and unemployment insurance (*Employment Statistics Register*). At the beginning and at the end of any employment spell, employers have to notify the social security agencies. This information is exact to the day. For spells spanning more than one calendar year, an annual report for each employee registered within the social insurance system is compulsory and provides an update on, for example, the wage and the current occupation of the employee. Further worker characteristics included are the year of birth, sex, and nationality.

The LIAB combines this information on workers' employment and unemployment history with plant-level information from the IAB Establishment Panel, an annual representative survey of German establishments that employ at least one worker who pays social security contributions. Starting in 1993, the establishments covered by the survey were questioned each year about various issues, such as the number of employees, the composition of the workforce, sales, and

[7]The LIAB is described in Alda, Bender and Gartner (2005) Detailed information on the data on individual workers can be obtained from Klosterhuber, Heining and Seth (2013), while a discussion of the data on the firm side (IAB Establishment Panel) is provided by Ellguth, Kohaut and Möller (2014).

investments. Using the unique establishment identification number, one can match the information on workers with the establishment panel, and obtain a linked employer-employee data set providing detailed information on individual and establishment characteristics.

The longitudinal version of the LIAB ("LIAB LM2") allows to follow firms and workers over time and thereby to control for heterogeneity at both levels.[8] This data set is constructed as follows: First, establishments who participated in the IAB Establishment Panel between 2000 and 2002 are selected.[9] This time period equals the observation period for which the data are representative. Thus, the minimum wage introduction took place more than 10 years after the end of the observation period. The results still allow to draw inference on likely employment effects of the minimum wage introduction in 2015, because, first, the degree of monopsonistic competition is a structural characteristic of each labour market segment that only changes in the very long-term. And second, the low-wage sector in 2015 still comprises the same industries as it did during the observation period, although nominal wages are naturally higher in all industries in 2015. This is confirmed by the fact that the sectoral minimum wage bite measured in 2014 – directly prior to the minimum wage introduction – and the average wage at the industry level measured in 2000-2002 are highly correlated. The correlation coefficient equals -0.88 (-0.78) in West Germany (East Germany) and is statistically significant at the 0.1 percent (1 percent) level.

In a second step, the Employment Statistics Register is used to link the sample of establishments with the employee history information for all individuals who worked at least one day in one of the selected establishments between 1997 and 2003. At the individual level, the information is updated at least once a year when the annual notification is supplied by the employer. At the establishment level, a new wave is provided each year as of June 30. The analysis is thus able to include time-varying covariates.

This sampling design of the "LIAB LM2" leads to a stock sample, instead of a conceptually preferable inflow sample, of employment spells. A potential problem is that workers who have been employed at the same firm for a long time are more likely to be included in the sample, and are most probably characterized by different wage elasticities of job-to-job transitions at the same time (Cameron and Trivedi, 2005). Without dealing with this issue any further, the estimated elasticities would be biased. Therefore, the estimates are corrected for delayed

[8] The longitudinal LIAB versions "LM3" as well as the "LM9310" both offer data for more recent years; however, in these versions the matching between firms and workers is poor (i.e. a significant share of workers is matched to the wrong establishment). We therefore opt for "LM2'.

[9] To be exact, establishment that participate in the time period 1999-2001 or 2000-2002 are selected. Because weights are only available for the second group, the analysis is restricted to these establishments.

entry by analyzing the remaining employment spell during the observation period conditional on having stayed with the same employer until the beginning of the observation period.

To compute separation elasticities from the LIAB, labour market states and direct job-to-job transitions as well as workers' wages have to be identified at an individual level. At each point in time, three labour market states can be differentiated: employment (E) covered by social security, unemployment (U), if the worker is receiving transfer payments, and non-participation (N). Non-participants are those individuals not recorded in the data sets. Therefore, this state includes individuals out of the labour market and workers not covered by social security legislation, e.g. civil servants and self-employed workers. As the distinction between unemployment and non-participation is not relevant for the analysis, these two labour market states are considered jointly as non-employment. Employment spells ending in non-employment are dropped from the dataset since the focus of interest is on job-to-job transitions.

Both, firms' reports of a new employee and individuals' notifications of moving into or out of unemployment, are not always exactly consistent with the actual change of labour market state. For example, workers might report to the unemployment office only a few days after having been laid off. These potential measurement errors are dealt with as follows: A direct job-to-job transition is defined as a worker making a transition from one firm to another with the two employment records being less than 8 days apart. In cases where the gap equals or exceeds 8 days, the transition is from employment to non-employment. Recalls are defined as one single employment spell if the time gap between two employment notifications at the same firm does not exceed 120 days. If the non-employment spell is equal to or larger than 120 days, the worker in question is completely dropped as a distinction between a transition from employment to non-employment and a continuous employment would be arbitrary. Additionally, all employment spells that are shorter than three days are eliminated, as are individuals with more than 300 employment spells. Treating recalls as continuous employment spells as well as the focus on job-to-job transitions ensures that seasonal effects, that obviously differ among industries and may affect wages and transitions into/from non-employment simultaneously, do not distort the results.

The data provide precise information on the daily wage of every spell. However, no information on working hours is available. To ensure comparability between daily wage rates, the analysis is restricted to regular, full-time employees. Workers in vocational training, marginal employees, and part-time workers are thus excluded. Furthermore, all employment spells with wages in the bottom one percent of the wage distribution are excluded. This procedure is not

sufficient for the upper end of the wage distribution because wages are right-censored at the social security contribution limit. To avoid possible biases in the estimated wage elasticity of labour supply, all workers whose wages are at this limit at least once during the observation period are dropped. Under the assumption that high-wage workers are subject to a lower degree of monopsonistic competition than low-wage workers, all labour supply elasticities consequently will be underestimated. By definition, this problem is more severe in high-wage compared to low-wage industries. Since the focus of this paper is on low-wage industries and the likely employment effect of the minimum wage introduction, given the degree of monopsonistic competition at the sectoral level, this estimation bias will not distort the conclusions drawn from the analysis. Finally, in order to exclude transitions to non-employment due to (early) retirement, only individuals aged 16 to 55 on 1 January 2000, the beginning of our observation period, are included in the analysis.

The resulting sample contains a total of 669,186 (211,886) employment spells in West Germany (East Germany) of which 100,493 (33,618) end in a job-to-job transition (Table 1). The remaining spells are right-censored. The annual transition probability is similar in East (9 percent) and West Germany (11 percent). Note that the number of workers is only slightly below the number of spells. At first sight this seems odd as a job-to-job transition would result in at least two employment spells per worker. This is however not entirely true for the discussed sample because the subsequent employment spell is only fully observed if the establishment also participates in the IAB Establishment Panel. As we observe the majority of workers in only one establishment and as the data constitute a short, wide panel, the variation in wages used to identify the labour supply elasticity is cross-sectional in nature. Thus, at each point in time similar workers employed in the firms of the same type, but earning different wages, are compared in terms of their job mobility.

The descriptive evidence on the main explanatory variables is in line with expectations – although it should be taken into account that the sample is conditioned on individuals in employment who do not make a transition to non-employment. Not surprisingly, the average daily wage is higher in West Germany (€86.11) than in East Germany (€63.13). The average educational attainment is higher in East compared to West Germany which may be partly explained by focusing on employment spells ending in job-to-job transitions. As for firms, about equal shares report low, normal and high profitability during the last year. While reorganisation measures are more common in West Germany compared to East Germany, almost 7 percent of all firms are engaged in outsourcing activities. Worker representation in terms of works councils and collective bargaining coverage is, as expected, higher in West Germany, where a works council exists

Table 1: Sample Description

	East Germany		West Germany	
	Mean	sd	Mean	sd
Daily wage	63.13	23.82	86.11	29.51
Log(Daily wage)	4.07	0.38	4.39	0.37
Age	39.74	9.22	37.66	9.46
Non-German	0.51	7.14	7.18	25.82
Female	38.92	48.76	32.77	46.94
Educational attainment: School degree	3.13	17.42	13.30	33.96
Educational attainment: Vocational training	83.57	37.06	76.97	42.10
Educational attainment: University degree	13.30	33.95	9.73	29.64
Firm profitability: Low	24.23	36.35	27.28	38.60
Firm profitability: Normal	26.03	35.22	28.36	37.15
Firm profitability: High	26.20	38.13	25.97	37.35
Firm profitability: Non-response	3.62	14.13	3.36	14.94
Firm profitability: Not applicable	19.91	38.57	15.03	34.85
Reorganisation: yes	25.64	39.74	36.14	43.96
Reorganisation: no	74.23	39.75	63.59	44.01
Reorganisation: Non-response	0.13	2.82	0.27	4.32
Outsourcing	6.70	20.19	6.81	20.10
Share of women	41.22	29.46	37.15	27.24
Share of temp. workers	7.38	16.86	4.48	9.75
Works council: yes	47.79	48.65	57.85	48.42
Works council: no	50.12	48.63	39.87	47.92
Works council: Non-response	2.09	12.09	2.28	12.78
Collective bargaining: Industry level	45.30	46.87	66.86	44.43
Collective bargaining: Firm level	11.33	28.14	6.77	22.73
Collective bargaining: No agreement	43.10	46.36	26.26	41.63
Collective bargaining: Non-response	0.27	3.70	0.12	2.73
Spell duration (in days)	2,014	1,351	1,906	1,347
Transition probability	0.0872		0.1065	
Number of job-to-job transitions	33,618		100,493	
Number of employment spells	211,886		669,186	
Number of workers	210,302		663,611	
Number of firms	3,254		4,398	

Notes: The unit of observation are continuous employment spells that do no result in non-employment. Shares are expressed in percent. Weighted calculations, except for the observation numbers.
Source: LIAB, version "LM2". Authors' calculations.

in almost 58 percent of firms, and roughly 67 percent of firms are covered by a collective bargaining agreement at the industry level. Finally, the coverage rate of collective bargaining agreements at the firm level is at 11 percent almost twice as high in East compared to West Germany (Table 1).

5 Results

In the following, we present estimates of the labour supply elasticity to the firm using the exponential model for job-to-job transitions described in Section 3. Tables 2 and 3 contain the results of the baseline specification, which pools all industries, for East and West Germany respectively, using four different models: While Model 1 only contains industry and year dummies in addition to log wages, Model 2 adds individual-level controls and Model 3 also includes controls at the establishment level in order to account for demand-side effects. Model 4 additionally controls for the existence of a works council and collective bargaining coverage.

The coefficients of the control variables do not differ qualitatively in East and West Germany and are in line with the existing literature on labour market transitions in Germany (Bachmann, 2005; Kluve, Schaffner and Schmidt, 2009). Women are less likely than men to change employers. The transition probability decreases with age but at a diminishing rate as workers get older. In contrast, employees with a university degree are more likely to make a job-to-job transition compared to individuals who received vocational training or completed their education after high school. Non-Germans also show – as expected – a lower separation probability in West Germany, while the opposite is true in East Germany. The East German sample on migrants is highly selective, however, as the share of non-Germans among all workers is extremely low in general and is further reduced by focusing on employment spells not ending in non-employment.

Turning to the establishment-level controls, workers in firms pursuing outsourcing have a higher separation probability (Model 3 in Tables 2 and 3). The same is true for workers in firms reporting low profitability during the last year as well as in firms not answering the corresponding questions. Thus, non-response is likely to amount to a weak performance. Both results, the role of outsourcing and firm profitability, show the importance of controlling for demand-side factors: Some workers change employers with an increasing threat of job loss. This decision is independent of the wage. Reorganisation within the establishment during the last year has, in contrast, no statistically significant and robust influence on the likelihood to change employers.

Collective bargaining coverage is negatively correlated with the job-to-job transition probability in West, but not in East Germany. The missing relevance

Table 2: Separation rate to employment in East Germany

	Model 1	Model 2	Model 3	Model 4
Log(Daily wage)	−0.825*** (0.095)	−0.789*** (0.110)	−0.894*** (0.105)	−0.694*** (0.107)
Female		−0.336*** (0.058)	−0.275*** (0.047)	−0.262*** (0.047)
Age		−0.137*** (0.017)	−0.131*** (0.016)	−0.135*** (0.016)
Age^2		0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Educational attainment:				
School degree		−0.012 (0.116)	−0.018 (0.113)	0.022 (0.111)
University degree		0.308*** (0.077)	0.356*** (0.071)	0.324*** (0.072)
Non-German		0.495* (0.269)	0.523** (0.257)	0.558** (0.257)
Profitability:				
Low			0.149 (0.094)	0.159* (0.091)
High			−0.053 (0.087)	−0.062 (0.086)
Non-response			1.129*** (0.186)	1.150*** (0.187)
Not applicable			−0.057 (0.169)	0.057 (0.177)
Reorganisation:				
yes			0.147 (0.092)	0.205** (0.094)
Non-response			−0.030 (0.608)	−0.034 (0.618)
Outsourcing			0.706*** (0.147)	0.748*** (0.147)
Share of women			−0.004* (0.002)	−0.004* (0.002)
Share of temp. workers			0.008*** (0.002)	0.007*** (0.002)
Works council:				
yes				−0.416*** (0.092)
Non-response				−0.209 (0.170)
Collective bargaining:				
Industry level				−0.031 (0.088)
Firm level				0.119 (0.112)
Non-response				0.198 (0.425)
Industry dummies	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes
Federal states dummies	yes	yes	yes	yes
Log likelihood	-87,736	-85,643	-83,458	-83,396
Observations	543,730	543,730	543,730	543,730

Legend: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Notes: Clustered standard errors at the establishment level in parentheses. Weighted estimations.
Source: LIAB, version "LM2". Authors' calculations.

Table 3: Separation rate to employment in West Germany

	Model 1	Model 2	Model 3	Model 4
Log(Daily wage)	-1.014^{***} (0.081)	-1.035^{***} (0.083)	-1.011^{***} (0.080)	-0.925^{***} (0.071)
Female		-0.237^{***} (0.050)	-0.219^{***} (0.044)	-0.212^{***} (0.043)
Age		-0.079^{***} (0.010)	-0.080^{***} (0.010)	-0.082^{***} (0.010)
Age^2		0.001^{***} (0.000)	0.001^{***} (0.000)	0.001^{***} (0.000)
Educational attainment:				
School degree		-0.072 (0.069)	-0.103 (0.067)	-0.093 (0.066)
University degree		0.362^{***} (0.061)	0.344^{***} (0.059)	0.316^{***} (0.058)
Non-German		-0.146^{***} (0.052)	-0.164^{***} (0.051)	-0.152^{***} (0.052)
Profitability:				
Low			0.180^{***} (0.066)	0.174^{***} (0.065)
High			-0.053 (0.086)	-0.062 (0.085)
Non-response			0.771^{***} (0.125)	0.783^{***} (0.125)
Not applicable			-0.291^{**} (0.123)	-0.195 (0.126)
Reorganisation:				
yes			-0.114^{*} (0.064)	-0.08 (0.065)
Non-response			-0.026 (0.286)	0.016 (0.297)
Outsourcing			0.353^{***} (0.105)	0.395^{***} (0.102)
Share of women			0.001 (0.002)	-0.001 (0.002)
Share of temp. workers			0.009^{***} (0.002)	0.010^{***} (0.002)
Works council:				
yes				-0.147^{**} (0.067)
Non-response				-0.138 (0.120)
Collective bargaining:				
Industry level				-0.171^{***} (0.064)
Firm level				-0.162 (0.099)
Non-response				-0.105 (0.445)
Industry dummies	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes
Federal states dummies	yes	yes	yes	yes
Log likelihood	-268,500	-262,775	-259,659	-259,350
Observations	1,722,067	1,722,067	1,722,067	1,722,067

Legend: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Notes: Clustered standard errors at the establishment level in parentheses. Weighted estimations.
Source: LIAB, version "LM2". Authors' calculations.

of collective bargaining for the separation probability in East Germany can be explained by much lower coverage rates (Table 1). The point estimate of the presence of a works council is negative and statistically significant in East and West Germany alike, which is in line with the literature on workers' voice and the labour turnover rate. For example, Hirsch, Schank and Schnabel (2010*b*) show for Germany that the separation rate is reduced by the presence of a works council through voice, monopoly (i.e. wage) and insurance effects.

The coefficient of interest is the one on the (log) daily wage. It can directly be interpreted as the wage elasticity of the separation rate of job-to-job transitions (see Section 3). The estimation results show that a wage increase of one percent leads to a decrease in the probability to make a separation, conditional on job survival until time t, of 0.69 – 0.89 percent in East Germany and of 0.93 – 1.04 percent in West Germany. Therefore, the estimated elasticities show bigger differences between East and West Germany than across the four specifications.

Assuming that separations to non-employment are wage inelastic, the labour supply elasticity to the individual firm is twice the wage elasticity of separations to employment (see Equation 4). Thus, taking values of 1.4 – 1.8 in East Germany and 1.8 – 2.1 in West Germany, the average labour supply elasticity to the individual firm is considerably lower than expected in a perfectly competitive labour market. This result is in line with other estimates of the labour supply elasticity (Ransom and Oaxaca, 2010; Hirsch, Schank and Schnabel, 2010*a*).

The observation that the degree of monopsonistic competition is higher in East compared to West Germany may be explained by the same factors that are important to explain differences between industries, especially worker composition and worker representation. As for worker composition, the share of women among employment is much higher in East than in West Germany (Table 1). With women being subject to a higher degree of monopsonistic competition, a higher share of women in East Germany therefore is in line with the observed higher degree of monopsonistic competition in this part of the country. However, non-German and low-skilled workers also face higher degrees of monopsonistic competition, and are more prevalent in West compared to East Germany. Therefore, the overall role of worker composition in explaining differences in monopsonistic competition between East and West Germany remains unclear. The importance of worker representation is, in contrast, less ambiguous. As for types of representation, both works councils and collective bargaining coverage are significantly less common in East Germany compared to West Germany (Table 1), which is in line with a higher degree in monopsonistic competition in East Germany.

In addition, East Germany is characterized to a higher degree by rural areas

with very few employers. While regional employer concentration is not the prime source of a high degree of monopsonistic competition, it augments monopsony power that stems from workers' limited mobility, which in turn is especially relevant for women.

To obtain the wage elasticity of labour supply by sector, we estimate the baseline specification separately for each industry and East and West Germany. We do so using Model 3 which is our preferred specification because it controls for worker-level heterogeneity and demand-side factors by including firm-level variables. Concerning Model 4, it is unclear whether the existence of a works council and coverage by a collective bargaining agreement should be used as additional control variables at the establishment level. While works councils and union coverage tend to increase wages and reduce separation rates (Hirsch, Schank and Schnabel, 2010*b*), this variation might be part of the explanation for differences in the degree of monopsonistic competition. In any case, Model 3 provides more conservative estimates than Model 4 since the inclusion of collective bargaining coverage and the existence of a works council further reduces the estimated wage elasticities of labour supply. Further, the results are qualitatively robust when using Model 4. In West Germany, this is true for the large majority of industries, in East Germany for those industries which are characterized by an especially high or low degree of monopsonistic competition.[10]

The estimation results of the labour supply elasticities for East and West Germany are presented in Tables 4 and 5. These results reveal considerable differences between industries, ranging from elasticities that are not significantly different from zero (wholesale, retailing, hotels and restaurants) to 3.4 (manufacturing of consumer goods) in East Germany and from zero (agriculture, hotels and restaurants) to 3.5 (education) in West Germany. Industries with especially low labour supply elasticities, and consequently a higher degree of monopsonistic competition, include wholesale, retailing, as well as hotels and restaurants. In contrast, mining, electricity and utilities, education, and all types of manufacturing are characterized by relatively high labour supply elasticities in East and West Germany alike.

One of the key predictions of the monopsony model is that firms operate with a constant amount of vacancies because labour demand exceeds labour supply at the going wage rate. Therefore, we test the internal validity of the model by analyzing if those industries with a high estimated labour supply elasticity are characterized by few vacancies and vice versa. The amount of vacancies in an

[10]These results are not included in the paper, but can be obtained from the authors upon request.

Table 4: Wage elasticity by industry - East Germany

	Wages[a]		Minimum	Elasticity of[c]			Observations	
	Mean	sd	wage bite[b]	Job-to-job transitions		Labour supply	Spells	Transitions
Agriculture	45.19	16.12	12.7	−0.646*	(0.391)	1.292	3,496	647
Mining and utilities	70.91	22.86	0.2	−1.140**	(0.574)	2.280	13,992	2,827
Manufacturing of food products	48.47	20.34	10.0	−1.241***	(0.433)	2.482	5,001	938
Manufacturing of consumer products	53.04	23.75	2.8	−1.685***	(0.544)	3.369	3,842	348
Manufacturing of industrial goods	57.46	20.10	0.9	−0.671*	(0.347)	1.343	16,885	2,426
Manufacturing of capital goods	61.24	21.46	0.7	−1.254***	(0.211)	2.507	32,595	3,761
Construction	55.18	16.68	0.3	−1.381***	(0.345)	2.762	9,961	2,628
Wholesale	55.57	20.47	2.1	−0.359	(0.341)	0.717	3,993	540
Retailing	50.89	19.17	11.9	−0.172	(0.351)	0.344	2,120	392
Transportation	55.82	18.25	8.3	−0.714**	(0.344)	1.427	10,482	1,676
Hotels and restaurants	36.08	12.18	17.6	0.548	(0.506)	−1.095	383	150
Financial services	81.79	23.76	0.5	−0.897**	(0.439)	1.794	5,699	877
Liberal professions	55.59	26.05	4.9	−0.948***	(0.231)	1.896	8,193	1,998
Education	66.87	32.62	2.5	−1.459***	(0.222)	2.918	16,161	4,499
Health	61.68	23.24	2.3	−1.055***	(0.264)	2.109	23,782	3,441
Other services	47.56	27.05	11.7	−1.393***	(0.339)	2.786	4,309	352
Non-industrial organizations	54.28	23.64	1.8	−0.466	(0.702)	0.932	3,284	515
Public administration	71.10	20.86	0.2	−0.781	(0.492)	1.563	46,873	5,247
All Industries	63.13	23.82	4.4	−0.894***	(0.105)	1.788	211,886	33,618

Legend: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Notes: **(a)** Descriptive evidence at the industry level. The average wage level is calculated based on a different sample, i.e. before employment spells resulting in non-employment are excluded.**(b)** Figures taken from Bellmann et al. (2015). **(c)** Results from separate, weighted estimations of Model 3 by industry. The elasticity of job-to-job transitions is the coefficient of log(daily wage). Clustered standard errors at the establishment level in parentheses. The elasticity of labour supply equals the elasticity of job-to-job transitions multiplied by −2. Results for the communication industry cannot be provided, because the number of firms in the sample is too low.
Source: LIAB, version "LM2". Authors' calculations.

Table 5: Wage elasticity by industry - West Germany

	Wages[a]		Minimum	Elasticity of[b]			Observations	
	Mean	sd	wage bite	Job-to-job transitions		Labour supply	Spells	Transitions
Agriculture	57.25	18.66	12.7	−0.441	(1.308)	0.883	748	142
Mining and utilities	95.63	25.52	0.2	−1.288***	(0.440)	2.577	25,729	6,620
Manufacturing of food products	69.90	28.05	10.0	−1.113***	(0.218)	2.227	14,744	1,931
Manufacturing of consumer products	80.74	28.72	2.8	−0.878***	(0.303)	1.757	19,928	3,741
Manufacturing of industrial goods	88.88	27.48	0.9	−1.125***	(0.275)	2.249	108,949	16,404
Manufacturing of capital goods	91.46	28.04	0.7	−1.420***	(0.160)	2.841	195,909	22,992
Construction	76.89	22.15	0.3	−1.084***	(0.261)	2.167	15,561	3,211
Wholesale	82.81	30.73	2.1	−0.864***	(0.152)	1.728	18,189	3,247
Retailing	65.79	24.79	11.9	−0.369**	(0.181)	0.737	10,687	2,432
Transportation	74.70	26.55	8.3	−1.089***	(0.174)	2.178	38,194	3,583
Hotels and restaurants	51.66	21.92	17.6	−0.137	(0.239)	0.274	2,104	711
Financial services	101.10	29.01	0.5	−1.263***	(0.237)	2.526	57,533	9,000
Liberal professions	75.42	35.78	4.9	−1.237***	(0.158)	2.473	30,326	8,280
Education	85.09	29.81	2.5	−1.749***	(0.337)	3.498	10,226	1,730
Health	72.45	27.74	2.3	−0.703***	(0.195)	1.407	46,801	6,828
Other services	66.36	35.44	11.7	−0.722	(0.503)	1.445	6,265	759
Non-industrial organizations	78.18	32.73	1.8	−0.804**	(0.333)	1.607	5,116	829
Public administration	85.97	23.49	0.2	−0.798***	(0.306)	1.597	59,444	6,841
All Industries	86.11	29.51	4.4	−1.011***	(0.080)	2.021	669,186	100,493

Legend: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Notes: **(a)** Descriptive evidence at the industry level. The average wage level is calculated based on a different sample, i.e. before employment spells resulting in non-employment are excluded.**(b)** Figures taken from Bellmann et al. (2015). **(c)** Results from separate, weighted estimations of Model 3 by industry. The elasticity of job-to-job transitions is the coefficient of log(daily wage). Clustered standard errors at the establishment level in parentheses. The elasticity of labour supply equals the elasticity of job-to-job transitions multiplied by −2. Results for the communication industry cannot be provided, because the number of firms in the sample is too low.
Source: LIAB, version "LM2". Authors' calculations.

industry is measured by the number of vacancies all firms offer divided by the total number of jobs. These figures are derived from the establishment-side information contained in the data. The expected negative correlation between the estimated labour supply elasticities and the amount of vacancies can be observed in both East and West Germany, although it is only statistically significant in East Germany (Table 6). Tables A.1 and A.2 provide all industry-level indicators that were used to calculate the correlation coefficients in Table 6. For example, hotels and restaurants show the lowest estimated labour supply elasticity and have at almost 4 percent the highest share of vacancies among total employment in both East and West Germany. In contrast, mining and utilities are characterized by one of the highest estimated labour supply elasticities, while only slightly more than 0.5 percent of all jobs are vacant.

The source of the differences in the degree of monopsonistic competition across industries lies in the behaviour of workers who do not change jobs to obtain a higher wage, in the importance of job-specific human capital, and in the extent of workers representation at the firm level (see Section 2). Local employer concentration, in contrast, is not necessary for explaining differences in monopsonistic competition across industries. We therefore expect to find higher degrees of monopsonistic competition in industries with a low share of firms with a works council and collective bargaining coverage or with a high share of women, migrants, and low-skilled workers. The previous empirical literature has shown that these three groups are characterized by lower separation rate elasticities due to non-wage employer preferences, imperfect mobility or incomplete information.

To analyse the importance of the sources of monopsonistic competition for each industry, Table 6 shows simple correlation coefficients of the estimated wage elasticities of labour supply and the share of women, the share of non-Germans, the share of low skilled, and the share of high skilled workers. Additionally, the labour supply elasticities are correlated with the share of workers employed in firms with works councils as well as the share of firms with collective bargaining coverage at the industry and at the firm level. All correlation coefficients have the expected sign, although only half of them are statistically significant at least at the 10 percent level. This is, however, easily explained by the low number of observations that is determined by the number of industries for which the labour supply elasticities were estimated (see Tables A.1 and A.2).

A strong relationship exists between worker composition and the degree of monopsonistic competition: Industries with a high share of women, non-Germans and/or low-skilled workers are characterized by a higher degree of monopsonistic competition (Table 6). While the correlation of the estimated labour supply elasticities and the share of non-Germans and highly-skilled workers is statistically significant at least at the 10 percent level in East and West Germany, the

Table 6: Degree of monopsonistic competition and vacancies, worker representation and worker composition

	East Germany		West Germany	
	Correlation	p-value	Correlation	p-value
Share of vancanies among all jobs	−0.4552	0.0577	−0.3722	0.1283
Share of workers in firms with works council	0.3525	0.1513	0.5694	0.0136
Share of firms with CB coverage (industry level)	0.1867	0.4581	0.0209	0.9343
Share of firms with CB coverage (firm level)	0.4765	0.0456	0.1692	0.5022
Share of women	−0.1974	0.4324	−0.2698	0.2789
Share of non-Germans	−0.6304	0.0050	−0.5419	0.0202
Share of workers with high school diploma	−0.2991	0.2279	−0.2844	0.2527
Share of workers with university diploma	0.4248	0.0789	0.4556	0.0574

Notes: Correlation coefficient of industry-specific labour supply elasticities (see Tables 4 and 5) and weighted industry-level indicators (see Tables A.1 and A.2). Note that the share of vacancies among all jobs is calculated based on the firm-side information ('Betriebspanel') in our data.
Source: LIAB, version "LM2". Authors' calculations.

correlation coefficient with the share of women remains statistically insignificant.

This result is somewhat surprising, as it is well established in the empirical literature that women are exposed to a higher degree of monopsonistic competition than men (Hirsch, Schank and Schnabel, 2010*a*; Sulis, 2011). One explanation is that part-time employment has been excluded from the estimation sample (Section 4) and those women working part-time might have stronger non-wage employer preferences and face higher limited regional mobility than women working full-time. Another explanation lies in the interaction of worker composition with worker representation. Some industries, such as education or financial services, show relatively high labour supply elasticities and a high share of women at the same time, thereby distorting the expected negative correlation between the share of women in an industry and its average labour supply elasticity. However, worker representation – in terms of works councils and collective bargaining coverage – is strong in exactly the same industries (Tables A.1 and A.2). Thus, the importance of worker representation might simply be higher in these industries compared to the importance of worker composition for the degree of monopsonistic competition.

Indeed, the share of workers in firms with a works council (West Germany) and the share of firms with a collective bargaining agreement at the firm level (East Germany) are both positively correlated with the estimated labour supply elasticities. Interestingly, the share of firms covered by a collective bargaining agreement at the industry level is neither in terms of statistical, nor in terms of economic significance, correlated with our measure of monopsony power (Table 6). Therefore, collective wage setting at the firm level as well as the existence of works councils appear to be associated with a lower degree of monopsonistic competition in the labour market. In East Germany, mining and utilities, manu-

facturing of consumer products, and liberal professions are noticeable examples of industries with a high labour supply elasticity and a high coverage rate of collective bargaining at the firm level (Table A.1). In West Germany, mining and utilities, manufacturing of industrial goods and manufacturing of capital goods are all characterized by high labour supply elasticities and a high share of workers in firms with a works council (Table A.2).

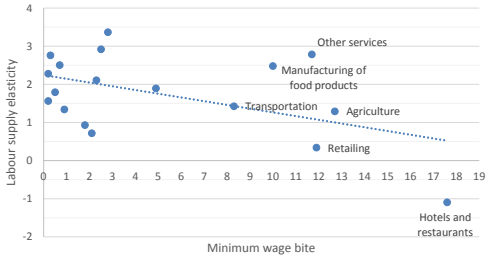
As noted above, not all dimensions of worker representation and worker composition necessarily have to occur simultaneously in order for a sectoral labour market segment to be characterized by a high degree of monopsonistic competition. This is, however, the case for a typical low-wage industry in West Germany that shows a high degree of monopsonistic competition: hotels and restaurants. In this industry only 13 percent of workers are employed in firms with a works council, and the collective bargaining coverage rate at the industry level amounts to 41 percent. Both numbers are far below the West German average. Further, Table A.2 shows that the industry's workforce is composed of an above-average share of women (47 percent), non-Germans (26 percent) and low-skilled workers (25 percent).

As for the expected effects of the introduction of a uniform minimum wage at €8.50 in 2015, the key question is to which extent low-wage industries that are strongly affected by the minimum wage introduction are characterized by monopsonistic competition. To answer this question, Tables 4 and 5 show the average wage in an industry in addition to the estimated elasticities. Since the average wage is not necessarily informative on the minimum's wage impact on the wage distribution, both tables additionally contain the share of workers earning less than €8.50 in 2014; i.e. the minimum wage bite. The information on the minimum wage bite is taken from Bellmann et al. (2015) and does not differentiate between East and West Germany. Thus, compared to the figures in Tables 4 and 5, the true minimum wage bite will be higher in East and lower in West Germany for the majority of industries.

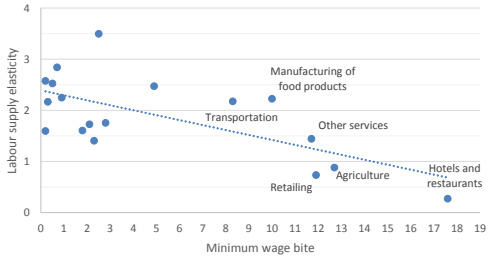
To facilitate interpretation, Figure 2 plots the estimated labour supply elasticities against the minimum wage bite. In general, industries with a higher minimum wage bite tend to be characterized by lower labour supply elasticities, and vice versa. The correlation coefficient is statistically significant at the 5 percent level and equals -0.67 in West and -0.49 in East Germany. Thus, the relationship between low average wages and the degree of monopsonistic competition in an industry is stronger in West compared to East Germany. This is a crucial observation, because the minimum wage has a much stronger impact on the wage distribution in East Germany. Stated differently, the risk of job loss due to the minimum wage is higher in East Germany, because, first, the mini-

Figure 2: Minimum wage bite and degree of monopsonistic competition by industry

(a) East Germany



(b) West Germany



Notes: Figures on the minimum wage bite by industry, i.e. the share of workers earning less than €8.50 in 2014, do not differentiate between East and West Germany and are taken from Bellmann et al. (2015). The labour supply elasticities by industry are taken from Table 4 and 5.
Source: LIAB, version "LM2". Authors' calculations.

mum wage's bite is much higher, and second, low-wage labour market segments feature a lower degree of monopsonistic competition.

This observation is confirmed when focusing only on low-wage industries in Figure 2, i.e. those industries with a minimum wage bite exceeding 5 percent.[11] Hotels and restaurants, retailing, and agriculture all show rather low labour-supply elasticities in East and West Germany alike, while more than 10 percent of the entire workforce is affected by the minimum wage. Despite this severe cut into the wage distribution, our results thus suggest that adverse employment effects might be lower than expected because these three industries are simultaneously characterized by a high degree of monopsonistic competition.

The monopsonistic model of the labour market applies much less to other low-wage industries. Bellmann et al. (2015) calculate that the minimum wage affects 12 percent of all workers in manufacturing of food products, while our estimated labour supply elasticities are high with 2.5 in East and 2.3 in West Germany. The same is true for other services, where the minimum wage bite amounts to 11.7 percent, and the estimated labour supply elasticities equal 2.8 in East and 1.5 in West Germany. Although no pre-defined critical value exists above which a labour market can unambiguously be described as perfectly competitive, an elasticity higher than two shows that workers react strongly to the wage when considering job-to-job transitions. In the above-mentioned industries that simultaneously faces low wages and high labour supply elasticities, the minimum wage therefore poses a serious threat to employment.

[11] The low-wage sector still comprises the same industries today as it did during the observation period, because Tables 4 and 5 show that those industries with the highest minimum wage bite in 2014, have the lowest average wages in 2000-2002.

6 Conclusion

In this paper, we have analysed the degree of monopsony power of German employers following a semi-structural approach based on the dynamic model of monopsonistic competition proposed by Manning (2003*a*). In doing so, we compute the degree of monopsony power for different industries separately for East and West Germany. Using a unique linked employer-employee data set for Germany allows to control for heterogeneity of both firms and workers, and for demand side effects.

Our findings are that, first, the labour supply elasticity to the individual firm is considerably lower than expected in a perfectly competitive labour market, which is in line with existing estimates. Second, we find important differences in labour supply elasticities between industries. Therefore, the labour markets of individual industries are characterized by varying degrees of monopsony power. Worker composition and worker representation through works councils appear to be the central reasons. Finally, we show that the estimated labour supply elasticities are negatively correlated with the amount of vacancies at the sectoral level. This is consistent with the monopsonistic model of the labour market which predicts the existence of a positive stock of vacancies.

Since the degree of monopsony power is one important determinant of the employment effects of minimum wages, our results have crucial policy implications. Given our finding of monopsony power on the German labour market, the negative employment effects of the minimum wage introduction may be less severe than expected in a perfectly competitive labour market. However, as large inter-industry differences in monopsony power exist, the employment effects of the minimum wage are likely to be unevenly distributed across labour market segments. While monopsony power may mitigate adverse employment effects in some low-wage industries, such as hotels and restaurants, retailing or agriculture, this is not the case for other services and manufacturing of food products where the minimum wage also severely compresses the wage distribution.

First ex-post evidence of the employment effect of the minimum wage introduction using survey data show a strong, positive wage effect (+4.8 percent) and a moderate, negative employment effect (−1.9 percent) for affected firms (Bossler and Gerner, 2016). Unfortunately, the data are not rich enough to allow separate estimation by industry, but the aggregate result can be well explained by our findings: Wages increase in all low-wage industries, but the employment effect depends on the underlying market structure that differs.

In summary, our findings should be understood as an ex-ante analysis of the *industry-specific* employment effects of an *uniform* minimum wage introduction. Next to the obvious heterogeneity of the minimum wage bite at the industry

level, differences in market structure due to worker composition and varying degrees of worker representation are decisive in this context. The results do not, however, lend support to a minimum wage introduction per se as they are based on a partial equilibrium analysis and therefore remain silent on general welfare effects. Very close monitoring and a rigorous ex-post evaluation of the minimum wage as well as – if necessary – swift political action therefore remain of high importance.

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A Appendix

Table A.1: Vacancies, worker representation and worker composition by industry - East Germany

	Vacancies among all jobs	Workers in firms with: Works council	CB coverage (industry)	(firm)	Women	Non-Germans	High school diploma	University diploma	Labour supply elasticity
Agriculture	1.12	14.63	12.73	4.88	31.05	1.40	6.68	6.56	1.292
Mining and utilities	0.54	83.49	47.13	11.39	27.32	0.31	2.88	16.21	2.280
Manufacturing of food products	1.15	43.99	32.74	6.09	53.14	0.67	5.28	4.47	2.482
Manufacturing of consumer products	0.79	51.19	18.55	11.15	45.38	0.45	4.78	6.08	3.369
Manufacturing of industrial goods	2.24	55.13	17.29	3.47	28.13	0.64	5.57	10.31	1.343
Manufacturing of capital goods	1.99	41.71	14.10	4.12	21.23	0.48	3.33	11.35	2.507
Construction	1.70	25.66	34.94	5.69	9.79	0.23	2.88	5.05	2.762
Wholesale	0.99	23.73	25.66	5.84	28.02	0.10	2.09	5.11	0.717
Retailing	0.87	41.94	25.28	5.12	62.96	0.60	2.43	4.20	0.344
Transportation	1.19	54.26	11.84	8.63	14.61	0.09	4.90	4.32	1.427
Hotels and restaurants	3.67	5.98	14.03	*n.a.*	66.04	7.91	7.93	0.90	−1.095
Financial services	2.10	90.05	36.60	*n.a.*	66.22	0.08	2.01	14.74	1.794
Liberal professions	2.58	33.80	18.22	5.01	44.76	1.07	3.58	20.64	1.896
Education	0.86	64.11	40.69	10.60	54.82	0.84	5.04	43.24	2.918
Health	1.17	76.33	25.24	6.30	76.21	0.49	3.98	11.88	2.109
Other services	1.88	32.89	42.33	6.17	62.03	0.87	4.59	15.31	2.786
Non-industrial organizations	3.17	47.24	42.08	7.67	57.65	0.50	6.08	13.05	0.932
Public administration	0.44	92.67	86.82	6.33	63.78	0.32	3.30	14.59	1.563
All Industries	1.55	49.87	26.09	5.78	39.76	0.66	3.89	11.97	1.788

Notes: Descriptive evidence at the industry level, expressed in percent. All figures are weighted. Some shares may not be published (n.a.) due to data protection rules. Results for the communication industry cannot be provided, because the number of firms in the sample is too low. The labour supply elasticity is taken from Table 4.
Source: LIAB, version "LM2". Authors' calculations.

Table A.2: Vacancies, worker representation and worker composition by industry - West Germany

	Vacancies among all jobs	Workers in firms with: Works council	CB coverage (industry)	(firm)	Women	Non-Germans	High school diploma	University diploma	Labour supply elasticity
Agriculture	2.99	14.87	57.66	*n.a.*	22.65	19.43	25.78	2.52	0.883
Mining and utilities	0.62	87.66	58.71	16.38	10.34	4.81	20.14	6.49	2.577
Manufacturing of food products	1.09	56.88	54.25	3.79	36.76	10.50	21.22	2.56	2.227
Manufacturing of consumer products	0.91	72.81	64.17	1.90	32.64	8.40	21.78	4.89	1.757
Manufacturing of industrial goods	0.89	84.94	56.54	2.91	18.12	12.60	25.03	6.94	2.249
Manufacturing of capital goods	1.48	77.05	41.89	3.63	16.34	11.54	18.76	7.58	2.841
Construction	2.25	28.05	75.63	0.97	8.74	8.37	13.44	3.34	2.167
Wholesale	1.60	45.25	55.41	2.13	24.96	7.28	11.20	5.66	1.728
Retailing	2.13	40.67	55.60	2.44	54.68	6.99	8.91	3.50	0.737
Transportation	2.47	49.40	50.02	4.06	18.95	8.71	17.34	3.34	2.178
Hotels and restaurants	3.99	12.98	41.20	*n.a*	46.95	25.55	24.50	1.35	0.274
Financial services	1.40	86.77	73.72	1.56	48.60	2.04	5.66	9.31	2.526
Liberal professions	4.49	38.47	20.37	1.97	36.44	7.88	11.77	21.48	2.473
Education	1.60	76.40	59.17	3.84	57.45	3.92	8.35	29.23	3.498
Health	1.73	71.33	54.30	3.81	69.27	5.89	11.61	9.49	1.407
Other services	2.84	53.08	51.56	1.18	51.16	7.97	15.13	16.73	1.445
Non-industrial organizations	1.30	63.72	54.24	12.02	55.07	6.29	15.98	22.68	1.607
Public administration	1.00	95.69	84.50	12.18	41.65	2.57	13.23	10.26	1.597
All Industries	1.93	60.28	52.54	2.92	33.31	8.46	15.08	8.96	2.021

Notes: Descriptive evidence at the industry level, expressed in percent. All figures are weighted. Some shares may not be published (n.a.) due to data protection rules. Results for the communication industry cannot be provided, because the number of firms in the sample is too low. The labour supply elasticity is taken from Table 5.
Source: LIAB, version "LM2". Authors' calculations.