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Monopsony power and the demand for low-skilled workers

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Abstract
This study analyses firms' labour demand when employers have at least some monopsony power. It is argued that without taking into account (quasi-)monopsonistic structures of the labour market, wrong predictions are made about the effects of minimum wages. Using switching fractional panel probit regressions with German establishment data, I find that slightly more than 80% of establishments exercise some degree of monopsony power in their demand for low-skilled workers. The outcome suggests that a 1% increase in payments for low-skilled workers would, in these firms, increase employment for this group by 1.12%, while firms without monopsony power reduce the number of low-skilled, by about 1.63% for the same increase in remuneration. The study can probably also be used to explain the limited employment effects of the introduction of a statutory minimum wage in Germany and thus leads to a better understanding of the labour market for low-skilled workers.

JEL Codes: J23, J42, C23, D24

Keywords
Monopsony, labour demand, low-skilled workers, low wages

Introduction

In 2015, the German government introduced a new statutory minimum wage. This adoption was accompanied by several ex-ante studies predicting the impact of increasing remuneration on the employment of low-wage workers. Studies using the standard labour demand model projected a loss of more than 900,000 jobs following the introduction of a

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minimum wage (cf. Knabe et al., 2014). Nevertheless, the employment level of workers has hardly changed after the introduction of the minimum wage (Bossler and Gerner, 2020), calling into question the use of orthodox labour market models. Therefore, the goal of this study is to analyse the reasons why these labour demand models are not able to project the correct behaviour of the labour market.

I argue that without taking into account (quasi-)monopsonistic structures of the labour market, wrong predictions are made about the effects of minimum wages. Following the analysis of Boal and Ransom (1997), I will argue, that, at least for low-skilled workers, structural breaks exist and that the calculation of a unitary, downward sloping labour demand curve is biased because of these breaks. If employers have some monopsony power, we observe positive labour supply elasticities rather than negative labour demand elasticities. According to the theory, I estimate a model with two regimes using fractional panel probit regressions and German establishment panel data from 1996 to 2018, where residual wage levels are used as a threshold value to identify the different parts of the market. The threshold value is determined through separate model estimations.

Since the seminal works by Card and Krueger (1994) and Manning (2003), the analysis of monopsonistic labour markets has been based mainly on two approaches. The first evaluates the effect of the introduction of, or changes in, minimum wages with difference-in-differences, respectively, using regression discontinuity models. The second estimates labour supply elasticities from individual data and duration models as firms' wage setting power enables them to pay their workers according to the labour supply curve. Both methods are rather popular in analysing labour markets and have extremely elevated the insights of labour markets behaviour.

The results of the research outlined below show that switching regression models are superior to estimations of a homogenous model. The preferred outcome suggests a threshold at the 82nd percentile of the wage distribution. On average, the calculated elasticities are positive at the lower bound of the labour demand curve for low-skilled workers, indicating some monopsony power. However, about 20% of firms reduce employment when wages rise because of negative labour demand elasticities.

This study contributes to the existing literature in several ways. Firstly, it contributes to a better understanding of the functioning of the labour market for low-skilled workers. Secondly, the results possibly provide an explanation for the small employment effects of the introduction of a statutory minimum wage in Germany. Finally, it applies the idea of Neumark and Wascher (1994) and Boal and Ransom (1997) to an empirical labour demand model with microeconomic establishment panel data and shows the consequences of firms' wage setting power for a standard approach with a flexible cost function. Nevertheless, this indicates that not all low-skilled workers are affected by monopsonistic labour market structures.

The rest of the paper is organised as follows. Section 2 provides a review of the relevant literature. Section 3 contains the theoretical considerations and derives some hypotheses for the empirical research. Section 4 describes the data and introduces the regression model. The results of the analysis are discussed in Section 5, and Section 6 contains a summary of the paper and implications for further research.

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Review of literature

The existing literature on monopsonies has mainly referred to two related topics. The first is the estimation of employers' labour market power, and the second analyses the impact of minimum wages on the employment of low-wage workers. The vast majority of studies that deal with the identification of monopsony power rely on the empirical framework of a dynamic monopsony model introduced by Manning (2003).[1] The modern view of monopsony power is based on the ability of employers to push wages below those in competitive labour markets. As the classical definition relies on a limited number of firms in (regional) labour markets, this is sometimes called a quasi-monopsony. Unlike competitive markets, some labour market frictions allow employers to determine the number of applicants by setting wages at a certain level. This also means that wages and employment are set at the same time. The labour market frictions are then identified by the estimation of finite labour supply elasticities.

In a competitive market, labour supply elasticities should be infinitely elastic. This model is applied to different issues (cf. Manning, 2011). Among others, Webber (2016) identifies lower supply elasticities for women. Therefore, they argue that at least a part of the gender wage gap is generated by employers' monopsony power. Similar results occur for supply elasticities and monopsony structures to explain discrimination against immigrants (eg. Hirsch and Jahn, 2015). Alongside other studies, Méndez and Sepúlveda (2019), Falch (2017), and Dube et al. (2018) find relevant positive labour supply elasticities for some occupational groups. Depew and Soerensen (2013) and Hirsch et al. (2018) show that supply elasticities are not constant over time and reflect changes in labour market power during a business cycle.

Another approach to calculating monopsony power is to estimate markdowns using production functions. Hershbein et al. (2019) find an average difference between market wage and marginal product of 78% for the United States (US). Other studies use concentration measures and thus show the market power of companies on the labour market. (cf. Azar et al., 2020; Berger et al., 2019; Jarosch et al., 2019).

Further analyses have used various methods of the difference-in-differences or regression discontinuity models to examine the employment effects of minimum wages. Since the preliminary work of Card and Krueger (1994, 1995), a large number of studies have contributed to the still-controversial discussion about the impact of minimum wages on employment. Recent surveys by de Linde Leonard et al. (2014), Hafner et al. (2017), Belman and Wolfson (2014), Lukiyanova and Vishnevskaya (2016) and Chletsos and Giotis (2015) for several international studies including in the US, United Kingdom (UK) and other countries are not able to identify large employment effects. Only Hafner et al. (2017) find some negative employment effects for part-time workers in the UK. In addition, Neumark et al. (2014) state that there are still some problems with methodological issues and some reduction in labour demand for particular groups like teenagers. Jung et al. (2020) show a positive influence of rising minimum wages on retail trade sales in Canada and, therefore, higher welfare of the recipients of minimum wages.

In 2015, the German government introduced a new statutory minimum wage of EUR 8.50 per hour. Since then, the minimum wage has been raised three times to an hourly

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wage of EUR 9.35 in 2020. Most studies find little or no evidence for an overall reduction of employment (eg. Bonin et al. 2019; Bossler and Gerner, 2020; Bruttel, 2019; Caliendo et al. 2018; Garloff, 2019; Heise and Pusch, 2020; Herr et al. 2017; Herzog-Stein et al. 2020). Among these, Bossler and Gerner (2020) is the only study that explicitly estimates labour demand elasticities using the German minimum wage as an instrument. If negative effects do occur, they belong to the marginally employed, but the loss for these workers is partly balanced by a rise of regular employment (Bonin et al. 2019; Bruttel, 2019; Caliendo et al. 2018; Garloff, 2019). Nevertheless, some ex-ante studies and projections that have predicted strong job losses of up to 900,000 workers due to the introduction of the minimum wages in Germany – outcomes that have not occurred since 2015 (eg. Knabe et al. 2014). These analyses are based on the estimation of neoclassical labour demand models and rely heavily on the assumption of constant own-wage elasticities on the labour market. Since the quality of the empirical results is rather low, the neoclassical model of labour demand is often rejected, especially by heterodox economists (eg. Heise, 2020). Possibly, the poor quality of the projections can also be derived from a misapplication of the model. Low-skilled workers are more likely to face labour non-competitive market conditions with a high probability of wage setting power for the employer, because of a small share of jobs for low-skilled workers, limitations in mobility and a higher unemployment rate for these workers. Following the notions of Boal and Ransom (1997) and Neumark and Wascher (1994), I will argue, that there are structural breaks in the demand for low-skilled workers. Having reviewed the existing literature, I now turn to some theoretical aspects in the next section and derive some hypotheses for the empirical research.

Theory and hypotheses

In the following, I apply a neoclassical model of labour demand. This is usually derived from profit maximising or cost minimising behaviour by firms. Normally, own-wage elasticities η_{ii} have been calculated from the outcome of these strategies. A commonly used method is to minimise a cost function according to all its inputs (Hamermesh, 1993: 34). It is quite obvious that in a monopsony labour, demand is also determined by the supply side of the market, and the employment outcome does not reflect the labour demand curve (Manning, 2003) and will be a source of endogeneity in the empirical part of the study. Hence, we observe labour supply elasticities ε_{Lw} on a monopsonistic labour market. The supplement contains the derived elasticities. These elasticities are defined as:

$$\frac{b_{ii}}{s_i} + s_i - 1 = \begin{cases} \eta_{ii} \text{ for a competitive labour market} \\ \varepsilon_{Lw} \text{ for a monopsony labour market} \end{cases} \quad (1)$$

With b_{ii} as parameter of wages for qualification level i on the employment of qualification level i in the cost function and si as wage share of qualification level i of total costs (see supplement for derivation). The η_{ii} are defined as negative values and the ε_{Lw} are larger than zero, and the estimation of labour demand functions that do not take into account these breaks is probably misleading if only the own-wage elasticities η_{ii} are the focus of the

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analysis. On the other hand, if a monopsony determines significant parts of the market, the estimations of the η_{ii} for the competitive part of the market will be downwards biased if we attempt to calculate a singular η_{ii} for the whole market. In case of a monopsony, employment is determined by the labour supply curve if wages are below the level of a competitive market. If payments increase beyond that level, employment is set according to the labour demand curve. In addition, the empirical literature suggests elasticities for low-wage workers that are rather small compared to the expected outcomes and other calculations of labour demand elasticities (cf. Addison et al. 2008). Moreover, the idea of a completely monopsonistic market (as well as a completely competitive market) is clearly unrealistic. Like oligopolies and monopolistic competition on the goods markets, we can argue that labour markets are most likely described as oligopsonies or with a kind of monopsonistic competition (Manning, 2021). The previous analysis leads to the following hypotheses:

Hypothesis I: If monopsony power is relevant for the labour market for low-skilled workers, there should be a structural break in the estimations as the labour demand curve determines the competitive labour market and the labour supply curve determines the monopsony labour market.
Hypothesis II: If monopsony power determines labour demand for some establishments, the observed elasticities should be positive for these firms.
Hypothesis III: The probability of observing positive elasticities should increase with employers' labour market power, i.e., there should be a larger markdown of wages. The introduction of minimum wages should reduce this power and *ceteris paribus*. increase the share of labour costs in total costs for factors of production.

Empirical model and data

From equation (1), it is obvious that the parameter b_{ii} is needed to calculate the elasticities of interest. As the endogenous variable is a share, it is not useful to estimate a linear model. One way to estimate the model using panel data is the fractional panel probit regression (Papke and Wooldridge, 2008). The Mundlak/Chamberlain device (Mundlak, 1978; Chamberlain, 1982) is used to control for the unobserved heterogeneity as a normally distributed variable conditional on the averages of the time-varying exogenous regressors. Wooldridge (2019) proposes a linear function of the time averages with different coefficients for each number of observations for an entity if unbalanced data is used[2]. The empirical model is the given by:

$$\left(s_{it}\middle|lnw_{it}, lnw_{jt}, lnY_t, z_{it}\right) = \Phi\left(b_{ii}\cdot lnw_{it} + \sum_{i\neq j} b_{ij}\cdot lnw_{jt} + d_i\cdot lnY_{it} + \delta i\cdot zit + \sum_r\left(\psi_r + \overline{z}_i\xi_r\right) + a_i\right) \quad (2)$$

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with Φ as the standard normal cumulative distribution function (cdf), z_{it} as additional exogenous variables of the model that are introduced later, $\bar{z}_i$ as averages of all time-varying z_{it} including $\ln w_i$, $\ln w_j$ and $\ln Y_i$, δ and ξ as additional parameters, r as the number of observations for each firm in the data and ψ_r becomes 1 if r observations are available for an establishment and zero otherwise.

Although Manning (2006) argues that dynamic labour demand models probably indicate employers' monopsony power, the labour demand model used here is a static model and does not contain lagged variables. Moreover, the data subsequently used in the analysis consist of yearly data, ie. the gap between two employment figures is 12 months. Therefore, it is not possible to observe the job turnover that occurs within that year. Some points justify the static approach. First, from theory we can identify labour supply elasticities with a static model. Second, we know from other studies that most of the adjustment process takes place within a few months (Brenzel et al. 2016). Due to the short time span associated with filling vacancies, it is rather unlikely that the data will allow for the monitoring of adjustment processes. Thus, in the vast majority of cases the observed employment level corresponds to the desired level and deviations from it are probably random. Then, annual data is over-aggregated, and it is impossible to identify dynamic labour demand behaviour (Hamermesh, 1993: 253). Finally, the use of lagged dependent variables to model labour demand dynamics is caused by a specific quadratic adjustment of the cost function. This is very restrictive and questionable, as empirical studies with other cost functions, like lumpy or linear costs, illustrate results with at least the same efficiency (Hamermesh, 1993).

The representative data used in the investigations comes from the Institute of Employment Research (IAB) Establishment Panel and consists of observations of German establishments from 1996 to 2018 (Fischer et al. 2008, 2009). This data is augmented with information from the Establishment History Panel, which is official data from the social security system that provides detailed information about different qualifications and their respective daily remuneration in the observed firms (Eberle and Schmucker, 2017). Please see the Supplemental file for further details about the sample.

I follow the strategy of most extant empirical work in this field and replace the total cost by the firm's turnover Y in the share of labour costs (cf. Hamermesh, 1993: 92, Lichter et al., 2015). This implies the assumption of competitive markets. Therefore, the estimates include the Herfindahl–Hirschman Index (HHI) as an additional exogenous variable to control for market concentration and imperfect competition. Moreover, I focus on the demand for low-skilled labour in the subsequent regressions, where low-skilled employees are defined as individuals with a lower secondary, intermediate secondary or upper secondary school completion certificate but no vocational qualifications. Therefore, w_i and L_i are the remuneration and the employment of low-skilled workers. I assume that this group receives the lowest wages and experiences the most difficult labour market conditions, which means they are the most likely to face employers' wage-setting power. This information is taken from the Establishment History Panel, while turnover is observed in the IAB Establishment Panel. Establishments without low-skilled employees are excluded from the analysis.

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The Establishment History Panel contains the number for each qualification level with full- or part-time contracts. We know the number of part-time workers for each skill level, but, unfortunately, the data does not provide the exact number of working hours. Therefore, in order to calculate the amount of full-time low-skilled employees, part-time workers are assigned a value of 0.5. Table 1 contains the average shares of different skill levels in the surveyed sample.

The majority of the workforce consists of medium-skilled workers, with more than 70% belonging to this group. The shares of low-skilled and high-skilled workers are much lower. The share of highly skilled is larger than the value of low-skilled (15.4% vs. 13.1%). The remaining workers have an unknown qualification. Therefore, I analyse a rather small share of the workforce. Please note that the difference between low- and medium-skilled workers is not about school completion, but about vocational qualification. This indicates the high influence of the domestic vocational training system on the labour market in Germany.

The Establishment History Panel also offers information about the mean and the median daily remuneration of full-time employees for each observed qualification level. Additionally, the regressions contain the wage information for other qualification levels, as I have to take into account complementary or substitutionary relationships between skill levels, ie. the cross-wage elasticities. For this analysis, the median of wages is used as it is less affected by coincidental inferences and censoring. The variable includes special payments, such as holiday pay or 13th monthly salary, but only contains values up to the upper earnings limit for statutory pension insurance contributions. This means that about 10% of the data is censored and the earnings means are biased. To remedy this censoring problem, the data provider regularly imputed the information on daily wages according to the procedure of Card et al. (2015) before the medians were calculated. This inaccuracy of the data is probably a negligible problem for wages of low-skilled workers.

The empirical model is expanded with additional variables z_i. The IAB Establishment Panel contains information about firms' value added in the year prior to the interview. Establishments that do not report value added, including banks, insurance companies, and public administrations, are excluded from the database. Other variables used from the IAB Establishment Panel are shares of part-time workers, female workers, temporary employees, employees subject to the social insurance scheme, and dummies for coverage by a collective bargaining agreement; Western Germany; establishment size; the firms' profitability, the firms' state of machinery; industries; and years. Profitability and state of machinery are based on a self-rating of the establishments on a range from 1 (very low response up to date) to 3 (very high response outdated). Moreover, the Establishment History Panel contains information about employees' age and nationality. Therefore, the regressions also include the shares of workers that are younger than 25 and older than 50. I also use the shares of foreign workers from within the European Union (EU) countries and from beyond the EU.

The inclusion of a variable for the costs of capital on the micro level is problematic. For example, there are no observations of the firms' interest rates they are required to pay for credits. On the other hand, one can assume that the firms' capital costs depend on

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market conditions and firm-specific indicators (Kölling, 2012). Market conditions are regularly expressed through interbank rates, like the Euro Interbank Offered Rate (Euribor). Firm-specific indicators that influence credit worthiness include variables like firm size, profitability and industry that are already included in the regressions. The variable indicating market concentration, HHI, is calculated as a weighted sum of market shares based on the stratifications of the random sample of the IAB Establishment Panel.

To control for structural changes due to the new minimum wage law, I defined a dummy variable that becomes one for observations from 2015 on. In addition, the estimations use interaction variables between this dummy and the wage variables for all qualifications to identify changes in the calculated elasticities. As already mentioned, the firms' monopsony power is probably the source of endogeneity that prevents to observe the downward sloping labour demand curve and therefore, I apply a two-step 'control function' or 2RSI approach (Wooldridge, 2015). The intuition to control for endogeneity is to analyse whether the positive wage elasticities are related to monopsonies or not. After applying such a model, the labour demand curve should be estimated with negative wage elasticities and it is probably possible to conclude that the original results are due to monopsonistic structures. On the first step, I estimate three models with the particular wage levels as endogenous variables. Then, I calculate the residual of each regression and add them to the model in equation (3). This requires the use of additional variables that explain the wage levels and fulfil the exclusion restriction. A strong instrument requires (partial) correlation with the potentially endogenous variable and must not be correlated with the error term of the main regression. This means that the instrument should be correlated with the median wages of workers, but not with the firm wage share of low-skilled workers, in order to control for the potential endogeneity of the wage level. No further causal relationship between the instrument and the potentially endogenous variable is required. A possible instrument is the regional unemployment rate that indicates the conditions on the local labour market. Although the unemployment rate results from the interaction of labour supply and demand, and would therefore possibly continue to be endogenous in the regression model. However, the influence of a firm's labour demand on the unemployment rate should be negligible. According to the Federal Statistical Office, there are currently more than 41 million people in employment in the German labour market. Across the 401 districts, this results in an average labour market of more than 100,000 employees. In addition, more than 97% of the companies employ less

Table 1. Average share of different qualifications in firms' employment.

Qualification level	Share
Low-skilled	0.131
Medium-skilled	0.703
High-skilled	0.154
Unknown	0.012

Note: IAB-Establishment Panel 1996–2018; 234,642 observations.

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than 50 employees. The local unemployment rate information is available since 1998 and therefore, used as additional instrument in the subsequent wage regressions of the first step of the control function approach.

Equation (1) indicates a probable structural break because of a change from a competitive labour market to a monopsony and vice versa. I identify this break, through a dummy indicator variable to conduct switching regressions. Then, the empirical model in equation (2) becomes,

$$\left(s_{it}\middle|lnw_{it}, lnw_{jt}, lnY_t, z_{it}\right) = \begin{cases} \Phi\left(b_{ii}\cdot lnw_{it} + \sum_{i\neq j} b_{ij}\cdot lnw_{jt} + d_i\cdot lnY_{it} + \delta_i\cdot z_{it} + \sum_r\left(\psi_r + \overline{z}_i\xi_r\right) + a_i\right) \; if\; w^{res} \leq w* \\ \Phi\left(b'_{ii}\cdot lnw_{it} + \sum_{i\neq j} b'_{ij}\cdot lnw_{jt} + d'_i\cdot lnY_{it} + \delta'_i\cdot z_{it} + \sum_r\left(\psi'_r + \overline{z}_i\xi'_r\right) + a'_i\right) \; if\; w^{res} > w* \end{cases} \tag{3}$$

with w^{res} as residual wages and w* as threshold value. The ' indicates the different parameter estimates in the two regimes. Technically, all covariates are multiplied with this indicator to create additional exogenous variables.

Empirical research implies that the wage level is correlated with firms' labour market power (Hershbein et al. 2019; Azar et al. 2020; Benmelech et al., 2018). It is obvious that labour markets are not simply defined by wages and salaries, and could vary over regions, industries and other variables. On the other hand, the observed workers in the analysis do not have vocational training and therefore job opportunities are very restricted. Hence, I apply a two-stage procedure, controlling for firm-specific differences in payments for low-skilled workers. The wage regression for the low-skilled workers is also used to calculate the residual for each entity. The lower the estimated residual, the lower is cp. the remuneration compared to similar firms and, thus, the larger is the probable markdown of wages. The residual wages are used to find the threshold indicator identifying the model of highest validity.

Moreover, according to the Mundlak/Chamberlain device and Wooldridge (2019), the regressions contain the means of all time-varying exogenous variables multiplied by a dummy, indicating the number of observations of each establishment in the unbalanced panel. Finally, all variables that are nominal values are discounted by the producer price index. Moreover, the data set is checked for outliers. The Supplemental file contains the descriptive statistics for the principal variables. The following section presents the estimation outcomes of the regressions and the calculations of the particular marginal effects and elasticities.

Econometric results

The econometric work starts with identifying a threshold to detect firms with competitive and monopsonistic labour market conditions. A detailed description of the procedure can be found in the Supplemental file. From the regressions, the model with the threshold at

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the 82nd percentile of residual wage distribution shows the lowest values for the Akaike and Bayesian information criterion (AIC, BIC) respectively the highest pseudo maximum likelihood. Moreover, I found a higher explanatory power of the threshold model compared to a base model without the interaction variables. An LR-test of the interaction variables indicates a joint significance on the 1% level [$\chi^2(107) = 868.35^{**}$]. This outcome is in line with hypothesis I and confirms the need to consider a structural break in the regressions. After determining the optimal threshold value, I turn to the estimation of the main model. Table 2 contains the marginal effects of the parameters in the base model and the switching regression:

The first column contains the results for the base model without a threshold. The estimate for the wages of low-skilled workers is significant but close to zero. This does not mean that the calculated own-wage elasticity is also zero. Then, from equation (2), the elasticities are negative and near to ($s_i - 1$). Subsequently, these results will be presented in Table 3. The outcome for the wages of medium-skilled workers is positive and significant at a 1%-level. This indicates a substitutional relationship among low- and medium-skilled workers (Hamermesh, 1993: 41). The variables indicating the introduction of the statutory minimum wage have no significant influence on the low-skilled wage share. Probably, the number of low-skilled workers had reduced to compensate for the larger remuneration. At least, I cannot find a significant positive or negative effect on the wage share and therefore support for hypothesis III. Also, I cannot find significant positive partial effects for capital costs. The negative partial effect value for the log of value added seems odd in the beginning. But, as I used the observable turnover instead of the unobservable total costs, and value added is defined as turnover reduced by intermediate materials, the specific elasticity calculations contain analogues to the calculation of the demand elasticities, the addition of 1, and I will receive a positive influence of firms' production on the demand for low-skilled labour[3]. The share of workers covered by the German social insurance scheme have a significant positive influence on labour demand for low-skilled work. This also applies to, both shares indicating foreign workers, the share of younger workers and the dummy for Western Germany. When interpreting these outcomes, we have to take into account that the shares belong to total employment instead of shares of low-skilled. Unfortunately, the data does not provide this specific information. The results in the two columns under (b) contain the results of the switching regression with the threshold at the 82nd percentile of wage distribution. As said before, an LR-Test of joint significance of all interacting variables shows a highly significant value indicating that the switching regression has a higher validity compared to the base model. While the first column on the left side of (b) contains the average partial effects of the variables without interaction, the second column indicates the values including the effect from the interaction variable. The grey shaded boxes indicate significant differences between both regimes at a 5% level. The dummy indicating a constant effect of low-wage firms on the wage share is statistically different from zero, indicating a 4.8%-point larger wage share of low-skilled for those firms with low wages for these workers and showing the importance of low-skilled workers in low-wage firms. Additionally, there are also some remarkable outcomes of the switching regression. The marginal effect of the wages for low-skilled workers is significantly negative for establishments paying wages above the threshold, while the opposite occurs for

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the other establishments. This could be an indicator for differences in the own-wage elasticities as this parameter is used to calculate the values. Moreover, medium- and low-skilled workers are substitutes in the sample with payments above the threshold, but, independently from the introduction of the minimum wage, the relation becomes insignificant for firms with low remuneration. Other significant differences according to the threshold are given for value added, the shares of temporary workers and for establishments in Western Germany. The other results are comparable to parameters of the base model. The results in (c) show the average partial effects when I control for the probable endogeneity of the wage variables. The outcome of the wage regressions on the first step of the control function approach are presented in the Supplemental file. The residuals of the low-skilled wage regression are significant for both parts of the regression. Because of this, it is not possible to reject the hypothesis of endogeneity of wages of low-skilled. Probably, as the parameters have opposite signs, there are different sources of endogeneity. From the partial effects in Table 2, I now calculate the average elasticities as in equation (1):

Table 3 contains the calculated observed elasticities for the demand of low-skilled workers in the estimated models. The first three rows belong to the base model. The outcome in this model is quite homogenous. The overall mean is −0.640, indicating that a 1% increase in wages leads to a 0.64% decrease in low-skilled employment. If I distinguish between firms that pay more or less than the wages at the threshold, I find only small differences to the overall outcome.

This picture changes completely if we look at the switching regression model. The mean elasticity for establishments that pay less than threshold is positive, indicating an increase in low-skilled employment of about 1.12% if wages increase 1%. This outcome supports the assumption of monopsonistic structures in low-wage firms on the labour market. The average elasticities for firms paying wages to low-skilled that are larger than the 82nd percentile is negative of about −1.627, indicating a reduction of more than 1.5% of low-skilled employment if the wages for these workers rise by 1%. The results before and after the introduction of the statutory minimum wage hardly differ from the overall results. This indicates that the minimum wage has little influence on the structure of the labour market.

From the empirical model, I identified the influence of monopsonies on labour demand as a kind of endogeneity. Hence, I applied a control function method and use the residuals of wage regressions as additional covariates in the switching regression model. This has some effects on the calculated elasticities in the last three rows of Table 3. Now, both results are negative and quite elastic. It seems that the predominant source of endogeneity is the wage level and the method used controls for this bias in the own-wage labour demand elasticities. Hence, the outcomes support the proposition of hypothesis II.

The result for the parameters concerning the observations since the introduction of a statutory minimum wage in Germany in 2015 are mainly insignificant for both regimes. This is in line with Kölling's (2020) results that the introduction of the statutory minimum wage did not change the own-wage elasticities and that monopsonistic structures on the labour market for low-skilled have continued since 2015. This means that I cannot confirm Hypothesis III, directly.

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Table 2. Average partial effects of labour demand regressions for low-skilled workers (fractional panel probit, dependent variable: Share of labour costs to total revenue).

		(b) Switching regression		(c) Switching regression (endogeneity)	
	(a) Base model	Above 82nd percentile	Below 82nd percentile	Above 82nd percentile	Below 82nd percentile
Residual of low-skilled wage regression				−0.026**	0.034**
				(0.006)	(0.003)
Residual of medium-skilled wage regression				−0.025**	−0.007
				(0.008)	(0.005)
Residual of high-skilled wage regression				0.002	−0.002
				(0.004)	(0.003)
Dummy for wages below 82nd percentile			0.048**		0.031
			(0.015)		(0.020)
Log. of wages for low-skilled per capita	0.002**	−0.003**	0.015**	−0.017**	−0.003
	(0.001)	(0.001)	(0.001)	(0.004)	(0.003)
Log. of wages for medium-skilled per capita	0.007**	0.020**	0.000	0.030**	0.010
	(0.002)	(0.003)	(0.002)	(0.007)	(0.005)
Log. of wages for high-skilled per capita	0.000	0.000	0.000	−0.003	0.002
	(0.001)	(0.001)	(0.001)	(0.004)	(0.003)
Observation since introduction of statutory minimum wage 2015 (yes = 1)	0.006	−0.028	0.006	−0.043	0.011
	(0.007)	(0.021)	(0.007)	(0.023)	(0.007)
… interaction with log. of wages for low-skilled per capita	0.001	−0.003	0.002	0.007	0.003
	(0.001)	(0.003)	(0.002)	(0.005)	(0.002)
… interaction with log. of wages for medium-skilled per capita	0.000	0.010**	−0.001	0.004	−0.003
	(0.002)	(0.004)	(0.002)	(0.004)	(0.002)
… interaction with log. of wages for high-skilled per capita	−0.002	−0.001	−0.002	−0.002	−0.003*
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)
Log. of mean Euribor in particular year	0.000	−0.001	0.001	−0.001	0.000
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Log. of value added	−0.006**	−0.005**	−0.006**	−0.004**	−0.006**
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Share of part-time workers	0.000	0.000	0.000	0.008*	−0.001
	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)
Share of temporary employed	0.001	0.006	−0.001	0.004	0.000
	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)

(continued)

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Table 2. (continued)

		(b) Switching regression		(c) Switching regression (endogeneity)	
	(a) Base model	Above 82nd percentile	Below 82nd percentile	Above 82nd percentile	Below 82nd percentile
Share of employed persons subjected to the social insurance scheme	0.010**	0.012**	0.008**	0.008	0.009**
	(0.003)	(0.004)	(0.003)	(0.005)	(0.003)
Share of female workers	0.000	−0.003	0.001	−0.008*	−0.002
	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)
Share of foreign EU workers	0.042**	0.039**	0.040**	0.036**	0.039**
	(0.004)	(0.005)	(0.004)	(0.006)	(0.004)
Share of foreign non-EU workers	0.034**	0.035**	0.036**	0.029**	0.036**
	(0.003)	(0.004)	(0.004)	(0.006)	(0.004)
Share of workers older than 50	−0.003	−0.003	−0.002	−0.007	−0.004
	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)
Share of workers younger than 25	0.042**	0.044**	0.040**	0.051**	0.041**
	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)
Coverage by collected bargaining agreement	0.000	0.000	−0.001	−0.001	−0.001*
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Herfindahl-Hirschman-Index	−0.004	−0.006	−0.003	−0.008	−0.001
	(0.004)	(0.007)	(0.007)	(0.010)	(0.010)
Western Germany	0.013**	0.006**	0.016**	0.013**	0.016**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Pseudo-R^2	0.1193	0.1246		0.1316	
Log pseudolikelihood	−7479.3194	−7434.8258		−6511.8255	
LR-Test χ^2 (df.)	16245.49 **	23516.97**		73896.78**	
	(643)	(750)		(753)	
Observations	84,599	84,599		73,786	

Source: IAB Establishment Panel 1996–2018.

Note: Second column of (b) and (c) indicate the average partial effects of the interaction variables, ie. the differences to the first column. The model also includes the following dichotomous and auxiliary variables: establishment size (7 dummies), firm profitability (2), state of machinery (2), industry (42), year of observation (21) and a constant. The Chamberlain/Mundlak approach requires inclusion of the means of the time-varying covariates and an indicator that identifies the number of observations of each unit respectively of the interactions of both in the regression. Robust standard errors adjusted for clustering on establishments in parentheses. ** and * denote significance at the .01 and .05 levels, respectively. Grey shaded boxes indicate significant differences for both samples in the switching regression on a .05 level.

Hence, from the empirical outcomes, I identified two different areas of the labour market. When employers have some wage-setting power, the labour demand elasticity is dominated by monopsonistic structures and shows positive values. If the firms pay wages that are larger than the median, the labour market becomes (im)perfectly competitive and increasing payments lead to lower employment. This means that the majority of, but not all,

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Table 3. Average labour demand elasticities η for low-skilled workers.

Model	η_{mean}	η_{mean} (before 2015)	η_{mean} (since 2015)
Base model	−0.640	−0.660	−0.527
Below 82nd percentile	−0.658	−0.681	−0.535
Above 82nd percentile	−0.571	−0.582	−0.482
Switching regression: Threshold at the 82nd percentile	+0.547	+0.534	+0.621
Below 82nd percentile	+1.117	+1.130	+1.051
Above 82nd percentile	−1.627	−1.597	−1.885
Switching Regression: Threshold at the 82nd percentile (Controlled for endogeneity)	−1.551	−1.633	−1.121
Below 82nd percentile	−1.355	−1.431	−0.950
Above 82nd percentile	−3.507	−3.711	−2.600

low-skilled workers faced a monopsonistic labour market and the introduction of a statutory minimum wage in Germany did not change this situation.

Summary

The study at hand investigates labour demand elasticities for low-skilled workers in Germany. I assume that this group has a high probability of experiencing a markdown of wages according to monopsony wage setting of firms. Applying a theoretical model with a flexible translog cost function, I can show that the observed elasticities are the particular labour supply elasticities if monopsonistic market structures occur. This finding is confirmed with a review of the existing literature as the introduction of minimum wages do not lead to large losses in employment and empirical studies show that labour supply is not infinitely elastic as it should be in competitive markets. Coming from this, I derive three hypotheses for further analysis. Firstly, following Neumark and Wascher (1994) and Boal and Ransom (1997), if monopsony power is relevant, there should be some structural breaks in the observed labour demand curve. Secondly, if labour supply determines a part of the labour demand curve, then the calculated elasticities should be positive.

I use large panel data of German establishments from 1996 to 2018 to validate the hypotheses. A switching regression fractional panel probit estimation is applied to identify a break between competitive and monopsonistic labour market structures. The specific effects of the introduction of a statutory minimum wage in Germany are measured through additional interaction variables. From the regressions, I calculate the particular wage elasticities of interest. Moreover, a two-step instrument variable procedure was used to correct for endogeneity of wages and the particular wage elasticities of interest from the regression outcomes were calculated.

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As a main outcome, the regressions indicate that the demand for low-skilled labour differs with the compensation level, taking into account firm-specific differences in payments. I calculate positive average elasticities for firms paying lower wages compared to similar firms. The effect on total employment is positive at an observed demand elasticity of about +1.117, which is similar to comparable studies for the total employment (eg. Manning, 2011; Hirsch et al., 2018). This reflects the higher probability of monopsonistic market structures for this group and questions the use of neoclassical models of the labour market at least for low-skilled workers. Also, I find that the majority of, but not all, low-skilled workers are affected by monopsonistic structures. Some share of low-skilled workers that receive a relatively high remuneration participate in competitive labour markets, with a negative influence of wages on employment for these workers, similarly to competitive labour markets. Further, if we control for endogeneity of the remuneration, the differences between the firms below and above the threshold diminish. The calculated elasticities become negative for all low-skilled workers. This probably indicates the influence of monopsonistic structures on the labour market.

The variables that reflect the influence of the newly introduced statutory minimum wage in Germany are insignificant in most cases. This means that minimum wages do not increase the particular wage share even if I observe monopsonistic market structures with positive wage elasticities. Furthermore, the minimum wage changes the measured elasticities only slightly. Therefore, I conclude that there are probably some other adjustment processes like less working hours, substitution with other qualifications or the retention of the minimum wage that prevent the increase of the wage share and a more just distribution of income. Nevertheless, the study illustrates the low employment effects of the introduction of a statutory minimum wage in Germany. Since the results are consistent with most of the findings of international studies, it is likely that the results can be generalised to other countries.

Moreover, I can identify several implications for further research and practice from the investigations. It seems that it could be important for research to take into account the workforce heterogeneity. It is also possible that the labour market for other qualifications have partly monopsonistic structures. On the other hand, this leads to some limitations that arise from the available data. Firstly, I observe qualifications instead of occupation or operations in the data. The first relies on formal education that was probably acquired a long time ago, while the latter describes the present situation and is therefore a better instrument for the workers labour market situation. Secondly, I simply use the residual wage level as an indicator for structural breaks. This is possibly too elementary, as the markdown of wages is determined by other variables (cf. Hershbein et al. 2019). Hence, the threshold of the switching regression should be determined endogenously with an elaborated model. Moreover, the use of linked employer-employee data can help to overcome these problems. These issues should be addressed in future research. Despite these caveats, I can show in the analysis that labour markets structures are not homogenous for comparable workers as it is possible that some face monopsonistic structures while others are paid according to competitive markets.

Availability of data and material

This study uses the IAB Establishment Panel, Waves 1996 - 2018. The Data is confidential and cannot be published. Data access was provided via on-site use at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) and subsequently remote data access (Project-No. FDZ1045).

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Notes

1. Please see the Supplemental file for a short non-technical description of monopsonies.
2. Please see Supplemental file for details.
3. Please see Supplemental file for detailed calculation.
4. Please see Supplemental file for details.
5. Please see Supplemental file for calculation.
6. Please see Supplemental file for calculation.

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Supplemental file

Supplemental material for this article is available online.

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