Germany’ national minimum wage – Implications for regional disparities

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Abstract
This paper analyses the short-run effects of the statutory minimum wage introduced in Germany in 2015 on regional labour, goods, and housing markets. Using a difference-in-differences estimation strategy and employing administrative data, we find that the wage bill increased in municipalities with a high minimum wage bite, i.e. a high share of workers earning less than the minimum wage in 2014. As expected, this increase is driven by wage adjustments in the left tail of the distribution. The policy led to a compression of the wage distribution and accelerated an ongoing trend of spatial wage convergence. It did not reduce employment in high-bite regions, nor did it cause out-migration. However, we find an increase in cross-municipality commuting. Firms on the non-tradable goods market pass on some of the increased labour cost onto consumers via higher goods prices. The remainder materializes in reduced firm profits, proxied for by corporate tax revenues. The increased local demand due to the higher wage bill leads to a proportionate increase in the cost of housing, consistent with short-run inelastic housing supply. The distributional consequences of the policy are complex. The minimum wage has, in relative terms, benefitted low-wage workers in high-bite municipalities. Surplus has been transferred from firms to workers, but also to landlords. As a result of the policy, workers also face higher cost in terms of increased commuting and higher prices of housing and non-tradable goods. The short-run effects of the German minimum wage are best described by a model combining monopsony power on the labour market, monopolistic competition on the non-tradable goods market, perfect competition on the tradable goods market, and inelastic supply on housing markets.

JEL classification: J31, J58, R12

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1 Introduction

While there is a vast and controversial literature about the implications of minimum wages for employment and the distribution of wages, little is known about the spatial implications of such a policy. With productivity and, hence, wage differences across locations, the introduction of a national minimum wage affects regions to different extents. While the policy bites hard in poor places, there is only a small fraction of workers earning less than the minimum in rich places.

We follow this idea when exploring effects of the federal minimum wage that was introduced in Germany in 2015. Since then, German employers have to pay at least 8.50 euros per hour corresponding to 48 percent of the median salary of full-time workers. This level is high compared to the US (36 percent) and because no similar regulation preceded the statutory wage floor, it represented a potentially significant shock to regions in the left tail of the regional wage distribution. Building on Ahlfeldt et al (2018), we assess the impacts of this policy on regional labour market outcomes such as wages and employment, but extend this analysis to take into consideration responses in the form of regional mobility. Beyond that, we also address how the minimum wage has affected corporate tax revenue and consumer prices.

To identify the differential effects across locations, we exploit the variation in the fraction of workers who earned less than the minimum in 2014 across German counties. We compare municipalities subject to different intensities of treatment in a difference-in-differences (DD) strategy that accounts for heterogeneity in pre-treatment outcome trends. In doing so, we use administrative data on employment and unemployment in Germany from 2011 to 2016.

We show that the minimum wage policy raised the wages of low-wage workers without affecting employment. In this sense, the policy has contributed to a transfer of producer surplus to workers in low-wage regions, indicating that the former were paid below their marginal value product (Machin, Manning, and Woodland, 1993, Machin and Manning, 2004). While we do not find any evidence that the minimum wage led to migration into or out of municipalities where a large share of workers initially earned below the minimum wage, our results show that there is an increase in the share of commuters. The increase in the wage bill experienced by low-wage regions occurs alongside a reduction in corporate tax revenue suggesting that surplus has been shifted from employers to employees. However, higher labour costs faced by firms have partly been shifted on to consumers as indicated by an increase in consumer prices for non-tradable goods and services in low-wage regions.

This paper contributes to the literature on the labour market implications of minimum wages that largely builds on experience in the US. Our evidence is novel in that it is based on the largest European economy, focuses on the regional implications of a national minimum wage, and addresses the impacts of the minimum wage beyond the labour market.

2 Data

The empirical analysis is based on the Employment Histories (BeH) and the Integrated Employment Biographies (IEB) provided by the Institute of Employment Research (IAB) which contain individual-level data on labour market participants in Germany. Despite their comprehensiveness, the data do

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1 The level is comparable to many other developed economies, see https://stats.oecd.org.
2 See Brown (1999) and Neumark and Wascher (2008) for reviews and Dube, Lester, Reich (2010), Baek and Park (2016) and Caliendo et al. (2017) for more recent evidence.
not include information about the number of hours worked. We therefore impute average working hours separately for full-time and part-time workers from an auxiliary regression that accounts for sector of employment, federal state of employment, and various socio-demographic attributes and uses a 1% sample from the 2012 census. We find that full-time employees work approximately 40 hours per week while the number is lower for regularly employed (21 hours) and for marginally employed part-time workers (10 hours). Combining working hours with average daily earnings delivers hourly wages from which we compute the 2014 (the year prior to the policy change) share of workers (at the workplace) below the minimum wage for each of the 4,460 municipalities (Verbandsgemeinden) in Germany. Since labour markets are integrated across municipal borders, we define the minimum-wage bite as the average of the shares of below-minimum-wage workers at all municipalities, weighted by the bilateral commuting flows from the year 2010. Table 1 provides an overview of the key variables, while Figure 1 shows the variation in the minimum wage bite at the municipality level.

**Table 1: Descriptive statistics**

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) mean</th>
<th>(2) sd</th>
<th>(3) p10</th>
<th>(4) p25</th>
<th>(5) p75</th>
<th>(6) p90</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014 minimum wage bite</td>
<td>26,760</td>
<td>15.26</td>
<td>6.991</td>
<td>11.12</td>
<td>12.50</td>
<td>17.45</td>
</tr>
<tr>
<td>Ln hourly wage at the 10th percentile</td>
<td>26,760</td>
<td>1.957</td>
<td>1.131</td>
<td>1.776</td>
<td>1.878</td>
<td>2.057</td>
</tr>
<tr>
<td>Ln hourly wage at the 25th percentile</td>
<td>26,760</td>
<td>2.320</td>
<td>1.834</td>
<td>2.159</td>
<td>2.246</td>
<td>2.401</td>
</tr>
<tr>
<td>Ln hourly wage at the 50th percentile</td>
<td>26,760</td>
<td>2.709</td>
<td>2.107</td>
<td>2.489</td>
<td>2.623</td>
<td>2.810</td>
</tr>
<tr>
<td>Ln labour force</td>
<td>26,760</td>
<td>8.252</td>
<td>4.382</td>
<td>7.137</td>
<td>7.624</td>
<td>8.758</td>
</tr>
<tr>
<td>Ln employment</td>
<td>26,760</td>
<td>8.166</td>
<td>4.290</td>
<td>7.075</td>
<td>7.545</td>
<td>8.673</td>
</tr>
<tr>
<td>Unemployment rate (percentage points)</td>
<td>26,760</td>
<td>8.041</td>
<td>0.928</td>
<td>3.683</td>
<td>4.843</td>
<td>9.860</td>
</tr>
</tbody>
</table>

*Notes: Unit of observation is municipality-year. 4,460 municipalities are repeatedly observed over 2011-2016.*

In addition to labour market outcomes, this paper also addresses the effect of the minimum wage on other measures at the regional level. In order to empirically assess how the introduction of the minimum wage affected firm profits, we make use of information on corporate tax revenue at the municipality level. Regions in which a larger share of workers earn below the minimum wage are likely to experience a larger change in wages – at least for some part of the wage distribution. Higher labour costs may in turn reduce profits in which case we would expect the minimum wage bite to have a negative effect on corporate tax revenue. Increases in labour costs may themselves be passed on to consumers in the form of higher prices. We therefore also assess the effect of the minimum wage on consumer prices. Information on corporate taxes and prices indexes are provided by the German Statistical Office.
Figure 1: Minimum wage bite
3 Empirical strategy

To evaluate the effects of the minimum wage policy on an outcome $y_{c,g,t}$ in municipality $c$ in region $g$ at time $t$, we use a difference-in-difference specification with a continuous treatment variable (Ahlfeldt et al., 2017). It allows for treatment effects on both the level and the trend of an outcome (Ahlfeldt and Feddersen, 2018) and controls for county-specific time trends. In particular, we have

$$y_{c,g,t} = \beta_1 T_c \times I(t \geq 2015) + \beta_2 T_c \times I(t \geq 2015) \times (t - 2015) + \mu_c + \varrho_{g,t} + (\eta_c \times t) + \epsilon_{c,g,t}$$

(1)

where $T_c$ is the treatment variable (the minimum wage bite) that interacts with time through an indicator variable $I(.)$ that takes the value of one if the observation refers to years 2015 or 2016, and zero otherwise. Further, the inclusion of the second term allows us to identify time-specific treatment effects. $\mu_c$ are municipality effects, $\varrho_{g,t}$ denote region (East Germany, West Germany) effects interacted with year effects and $\epsilon_{c,g,t}$ is a random error. We also control for municipality-specific effects that interact linearly with time $t$, $(\eta_c \times t)$, to absorb unobserved spatio-temporal heterogeneity that could induce a non-parallel-trends problem. The time-specific treatment effect we estimate is $\frac{\partial y_{c,g,t}|_{t=1}}{\partial T_c} - \frac{\partial y_{c,g,t}|_{t=0}}{\partial T_c} = \hat{\beta}_1 + \hat{\beta}_2(t - 2015)$, where hats indicate estimated values.

To depict the temporal pattern of the treatment effect without imposing parametric constraints, we use an intervention-study design of the following form:

$$y_{c,g,t} = \sum_{Z \neq 2014} \beta_Z T_c \times I(t = Z) + \mu_c + \varrho_{g,t} + \epsilon_{c,g,t}$$

(2)

The estimated time-varying effects $\hat{\beta}_Z$ capture the effect of the treatment on the outcome $\frac{\partial y_{c,g,t}|_{Z}}{\partial T_c} - \frac{\partial y_{c,g,t}|_{2014}}{\partial T_c}$ and the effects of a time-trend that interacts with unobserved municipality-specific effects, $\eta_c$ in (1). To control for a confounding effect if $cov(\eta_c, T_c) \neq 0$, we compute the treatment effect at time $t=Z$ as the difference between $\hat{\beta}_Z$ and a linear extrapolation of the trend in $\hat{\beta}_Z$ during the pre-treatment period. The counterfactual is then the same as in specification (1). The treatment effects for $Z>2014$ are identical in both specifications in this setting with two post-intervention periods.\(^4\) We report clustered standard errors (by municipality).

4 Results

4.1 Spatial wage convergence

Before discussing the results of estimating model (1), we show descriptive evidence that the introduction of the minimum wage was followed by spatial wage convergence. As can be seen from the left panel of Figure 2, there is a sharp drop in the coefficient of variation of hourly wages at the 10th percentile between German municipalities which suggests that lower-tail wages increased in low-wage regions relative to high-wage regions. The second and third panel provide corresponding evidence for hourly wages at the 25th percentile and at the median. While a drop in the coefficient of variation can also be observed in the former case, it is comparatively small. The impact on spatial wage convergence therefore appears limited to the lower end of the wage distribution.

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\(^3\) While in most analyses subscript $c$ represents municipalities, it refers to federal states in the analysis of consumer prices as the former are only available at the state level.

\(^4\) Notice that we do not add $(\eta_c \times t)$ to specification (2) because this means we have to drop another $\beta_2 T_c \times I(.)$ interaction term and the point estimates are no longer the same.
4.2 Wages and (un-)employment

We first use the specification of our empirical model to estimate the effect that the minimum wage bite has on hourly wages at different points along the wage distribution. Figure 3 shows the estimated treatment effect of the minimum wage as the vertical difference between the estimated coefficient and the dashed line representing the linear extrapolation of the pre-treatment outcome trend.

The effect is sizeable at the bottom end of the wage distribution with an increase in the minimum wage bite by one percentage point leading to an increase in 10th percentile hourly wage by approximately 1.3% in the year 2016. Comparing municipalities at the 10th and the 90th percentile of the distribution of the minimum wage bite implies an increase in lower-tail wages by approximately 9.5% (\(=\exp(0.0096*(20.65-11.12)-1)\)). The impact of the minimum wage is considerably less pronounced further up the wage distribution. While the effect is still statistically significant for median wages, it no longer distinguishable from zero at the 90th percentile. As high-bite municipalities experienced a larger increase in 10th percentile hourly wages, the introduction of the minimum wage appears to have led to spatial wage convergence in the lower end of the wage distribution.
Notes: Each panel illustrates the results of separate municipality-year-level difference-in-differences regressions of an outcome against treatment-year interactions (excluding the 2014 base year), municipality effects and year-by-East Germany effects. The treatment variable is given by the 2014 minimum wage bite (commuting-flow weighted average of employment shares below the minimum wage level in surrounding municipalities). Dots represent the estimated coefficients of the treatment variable and the vertical error bars are the corresponding 95% confidence intervals. The red solid line is the linear fit into treatment-year effects up until 2014 and the dashed line is a linear extrapolation. The treatment effect for the year 2016 is given by the vertical difference between the estimated coefficient of the treatment variable and the dashed line.

Potentially, the positive effect on 10th percentile hourly wages could reflect that in high bite regions employees at the bottom end of the wage distribution are becoming unemployed as a result of the minimum wage. The results shown in Figure 4, however, do not support this hypothesis. The 2016 treatment effect on the municipal unemployment rate is negative, suggesting that the former experienced a relative decline in high-bite municipalities. The estimated effect is statistically insignificant and small with an increase in the minimum wage bite equal to the interdecile range leading to a reduction in the unemployment rate of approximately 0.3 percentage points. Similarly, the estimated 2016 treatment effect on employment and the labour force turns out positive, but is economically and statistically insignificant. The increase in the wages at the lower end of the wage distribution therefore do not seem to have come at the cost of lower employment or a higher unemployment rate.
These findings allow a first reconciliation with standard labour market models. The neoclassical labour market model where neither employers nor employees are able to influence the going wage rate predicts a decline in employment and rise in unemployment when binding minimum wages are introduced. Wages would mechanically increase as payments below the minimum are no longer feasible. In contrast, if firms have market power on (local) labour markets, as in the monopsonistic model, a statutory minimum would lead to higher wages and higher employment. Our results imply that the neoclassical labour market model fails to describe the economic mechanisms in the lower part of the wage distribution. In contrast, higher employment levels are in line with the monopsonistic labour market theory.

4.3 Regional mobility

To better understand individual responses to the introduction of the minimum wage, we proceed to estimate the effect of the minimum wage bite on different measures of regional mobility. As displayed in Figure 5, the share of employees commuting to work increased significantly in high bite municipalities. In contrast, we do not find any evidence that the minimum wage has caused migration either into or out of high bite municipalities. While lower-tail wages increased in high-bite municipalities without reducing employment, the increase in the share of employees working outside their place of residence may be an indicator that the minimum wage has created costs that are borne in the form of more commuting.
4.4 Corporate outcomes

To better understand the effects of the minimum wage, we next turn to outcomes at the corporate level. In line with the finding that an increase in the minimum wage bite led to significantly higher wages at the lower tail of the wage distribution without reducing the level of employment, we find that the wage bill increased in high-bite municipalities. Specifically, we estimate the treatment effect in 2016 to be 0.3% for each additional percentage of the minimum wage bite. In the second and third part of Figure 6 we assess the impact of the minimum wage bite on municipal corporate tax revenue as well as tax revenue per worker. The estimated treatment effects in the year 2016 are negative in both cases suggesting that tax revenue fell in high-bite municipalities. Taken together the evidence of Figure 6 is suggestive of the minimum wage reducing corporate profits due to an increase in the wage bill.

Notes: See Figure 3.
4.5 Consumer prices

Increases in labour costs may be passed on to consumers in the form of higher prices. To investigate this hypothesis we employ data on the consumer price index (CPI) which is available at the state level only. The analysis from which the subsequent results are derived therefore use a state-level minimum wage variable. In addition to the overall price level, the CPI is also available for a number of different categories. We define ‘Clothes and shoes’, ‘Furniture’, ‘Health’, ‘News’, ‘Education’ as well as ‘Other goods and services’ as tradable goods and compute a weighted average of the respective price indexes. Likewise, we define non-tradables as ‘Food and drink’, ‘Alcohol and tobacco’, ‘Housing expenditures’, ‘Transport’, ‘Entertainment and culture’ as well as ‘Hotels and restaurants’. While a more disaggregated differentiation is not available, we would expect that categorising goods that are partly tradable in the non-tradable category would bias downwards the estimated treatment effect. The estimate can therefore be interpreted as a lower bound of the true effect.

In terms of the overall CPI, we find that the estimated 2016 treatment effect is positive but not statistically significant. However, the absence of an effect on the overall price level masks a heterogeneous impact on the prices of tradable and non-tradable goods and services. The second and third panel of Figure 7 show that the price of tradable goods is not significantly affected by the minimum wage, whereas there is a positive effect on the price of goods and services that are not tradable. In the latter case, an increase in the minimum wage bite by one percentage point is estimated to increase the price by about 0.1%. These results suggest that the minimum wage imposed costs on consumers in high-bite areas in the form of higher prices for non-tradable goods and services.

Figure 7: Effects of the minimum wage: Consumer prices

Notes: Each panel illustrates the results of separate state-year-level difference-in-differences regressions of an outcome against treatment-year interactions (excluding the 2014 base year), state effects and year-by-East Germany effects. The treatment variable is given by the 2014 minimum wage bite (commuting-flow weighted average of employment shares below the minimum wage level in surrounding states). Dots represent the estimated coefficients of the treatment variable and the vertical error bars are the corresponding 90% (grey) and 95% (black) confidence intervals, respectively. The red solid line is the linear fit into treatment-year effects up until 2014 and the dashed line is a linear extrapolation. The treatment effect for the year 2016 is given by the vertical difference between the estimated coefficient of the treatment variable and the dashed line.
5 Conclusion

This paper evaluates the broader implications that the introduction of a statutory minimum wage has had in Germany. For this purpose, we use administrative data on labour market participants which allows us to compute the share of workers initially earning less than the minimum wage at a low level of spatial aggregation. Comparing municipalities, our measure of the minimum wage bite varies between 7% and 38%.

We show that the introduction of the minimum wage led to spatial wage convergence in the lower end of the wage distribution as high-bite municipalities experienced a relative increase in the 10th percentile hourly wages. Effects on points further up the wage distribution are economically small, though. Importantly, the relatively larger increase in the wages in high-bite municipalities is not accompanied by reductions in the level of employment or by increases in the unemployment rate.

However, the minimum wage has also imposed costs on some workers in the form of commuting. We find that the share of commuters increases significantly in high-bite municipalities. On the firm side, the wage bill is found to increase and corporate tax revenue to fall in regions with a higher minimum wage bite. Finally, we show that the higher wage costs are partly passed on to consumers in the form of higher prices for non-tradable goods and services.

We conclude that in addition to leading to spatial wage convergence, the introduction of the minimum wage has benefitted low-wage workers relative to high-wage workers, while also transferring wealth from firms to workers.

References


