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WORKING CONDITIONS IN MINIMUM WAGE JOBS*

by Matthias Dütsch, Oliver Bruttel

There is abundant research on the effects of minimum wages and on the characteristics of minimum wage workers, but there is a lack of evidence on the working conditions in minimum wage jobs. However, this is a highly relevant issue because health research indicates that poor working conditions can lead to severe health problems. Based on the BIBB/BAuA Employment Survey 2018, a nationwide representative study of the German workforce comprising approximately 20,000 individuals, we provide insights into the physical working conditions of workers in minimum wage jobs, and characterise their work situation. Using propensity score matching, we compare workers in minimum wage jobs with workers in higher-paid jobs, controlling for factors such as sociodemographic, industry, and company-level characteristics. Our results show that workers in minimum wage jobs face detrimental working conditions. They must cope with unfavourable physical and environmental working conditions, often have little say in how their work is organised, and are less socially embedded in their workplaces than workers in higher-paid jobs.

Keywords: minimum wage work, low pay, working conditions, propensity score matching.

Numerose ricerche sono state condotte sugli effetti del salario minimo e sulle caratteristiche dei lavoratori che lo percepiscono. Tuttavia, mancano evidenze relativamente alle condizioni di lavoro nelle tipologie di impiego in cui trova applicazione il salario minimo. Questa tematica è quantomai importante dal momento che la ricerca condotta in ambito sanitario mostra come condizioni di lavoro inadeguate possano comportare problemi di salute di notevole entità. Stando all'Indagine sull'occupazione BIBB/BAuA del 2018 (uno studio rappresentativo di portata nazionale riguardante la forza lavoro tedesca, che ha visto il coinvolgimento di circa 20.000 individui), il presente contributo fa luce sulle condizioni materiali di lavoro in quelle tipologie di impiego in cui trova applicazione il salario minimo, e ne descrive il contesto lavorativo. Facendo ricorso al *propensity score matching*, viene condotta una comparazione tra, da un lato, i lavoratori che svolgono tali tipologie di impiego e, dall'altro, i lavoratori che hanno invece un'occupazione con una retribuzione più elevata, controllando fattori quali le caratteristiche a livello socio-demografico, settoriale e aziendale. I risultati dell'analisi mostrano come i lavoratori che svolgono un impiego in cui trova applicazione il salario minimo si trovino spesso a fare i conti con condizioni di lavoro sfavorevoli, tanto a livello materiale quanto a livello ambientale, abbiano scarsa influenza sull'organizzazione del lavoro, e risultino meno integrati, dal punto di vista sociale, sul posto di lavoro rispetto ai lavoratori che hanno un'occupazione con una retribuzione più elevata.

Parole chiave: impiego con salario minimo, bassa retribuzione, condizioni di lavoro, *propensity score matching*.

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1. Introduction

Minimum wage is one of the most researched topics in economics. Starting with the seminal work of Card and Krueger (1994) on the effects of minimum wage in the fast-food industry in New Jersey and Pennsylvania, the so-called "new minimum wage research" has produced a large amount of evidence on the causal effects of minimum wage on various indicators (see, for instance, the surveys by Belman and Wolfson, 2014, and Neumark and Wascher, 2008). Most of this research has focused on the employment effects of minimum wages (*ibid.*). Recent analyses have broadened the focus to other adjustment channels, such as reduced working hours, improved productivity, or increased prices (Metcalf, 2008; Schmitt, 2015; Bruttel *et al.*, 2018), which helps to explain the limited aggregate employment effects identified in many studies. Further studies have examined wage effects, and found that minimum wage leads to a significant increase in the lower tail of the wage distribution (Dolton *et al.*, 2012; Autor *et al.*, 2016; Burauel *et al.*, 2018).

While there is abundant research on the effects of minimum wage, there is less research on the characteristics of minimum wage jobs. Most publications address only the sociodemographic characteristics of workers in minimum wage jobs, such as age, gender, qualification, or employment status (Low Pay Commission, 2015; Dütsch and Himmelreicher, 2020; United States Bureau of Labor Statistics, 2018; Rycx and Kampelmann, 2013). In general, such studies have found that low-skilled, younger, and female workers, along with employees of smaller companies and those in the service sector or in companies not covered by collective agreements, have an above-average probability of earning minimum wage. This finding is in line with more general findings on the low-wage workforce (Mason and Salverda, 2010; McKnight *et al.*, 2016).

To our knowledge, there is no evidence thus far on the physical working conditions of workers performing a minimum wage job. There are very few contributions that examine – within a broader discussion on the situation of low-wage workers – the working conditions of low-wage workers, but they do not examine those of minimum wage workers. Kalleberg (2011) and the volume edited by Gautié and Schmitt (2010) provide insights into the situation of low-wage workers and those in "bad jobs" (Kalleberg, 2011), and emphasise that low pay or jobs in low-paying industries, respectively, are often associated with less favourable working conditions. However, they do not provide analyses based on individual-level data and different parameters of working conditions. Instead, they either provide descriptive data on the situation in occupations such as service/sales workers or plant/machine operators and assemblers that are – on average – associated with low wages, or draw insights from qualitative case studies from low-wage industries such as retail, room cleaning, cleaning and nursing in hospitals, food-processing, and call centres.

From a theoretical point of view, the correlation between working conditions and wages can move in two directions. On the one hand, following the theory of compensating wage differentials, workers in poor working conditions should – *ceteris paribus* – receive higher wages (Rosen, 1986; Smith, 1979; Abowd and Ashenfelter, 1981). On the other hand, theories on labour market segmentation (Doeringer and Piore, 1971) or newer approaches of human resource management (Hendry, 2003; Kaufman, 2013) argue that favourable and unfavourable working conditions cumulatively occur, which means that minimum wage jobs are also associated with poor working conditions.

Against the backdrop of such theoretical ambiguity and our little empirical knowledge on the working conditions of workers in minimum wage jobs, this paper aims to close this gap, and raises the following research question: do the working conditions of workers carrying out minimum wage jobs significantly differ from those of workers in higher-paid jobs?

To this end, we focus on physical working conditions, work organisation, and the extent to which workers are socially embedded in their work environment. This issue is highly relevant because the extant health research indicates that such poor working conditions lead to severe health problems (Da Costa and Vieira, 2010; Walker-Bone and Cooper, 2005; Cox *et al.*, 2004). To investigate the working conditions in minimum wage jobs, we focus on Germany, where a statutory minimum wage of 8.50 € per hour was introduced in January 2015. It covers all employees, except for youths under 18 years, apprentices, trainees and/or interns, the long-term unemployed in their first six months after starting a new job, and non-profit and/or voluntary workers. Its first uprating to 8.84 € per hour took effect in 2017; the second and third upratings to 9.19 € and 9.35 € per hour were effective from January 2019 and January 2020, respectively.

We address our research question by using a unique cross-sectional dataset for Germany, the BIBB/BAuA Employment Survey 2018.[1] It includes a broad range of questions on working conditions, and, additionally, contains an identification variable for minimum wage earners. Because workers carrying out minimum wage jobs differ from the workforce, in general, regarding sociodemographic, industry, and company-level characteristics, we minimise such observable selection biases using a propensity score matching approach (Rosenbaum and Rubin, 1983; Dehejia and Wahba, 2002) to compare the working conditions in minimum wage jobs with those in structurally similar higher-paid jobs. Given the cross-sectional structure of the data, we can provide correlations but no causal interference.

2. Theoretical considerations

Jobs are characterised by a set of tasks and specific working conditions. Conceptually, the latter include multidimensional bundles of rewards and burdens, and reflect job quality (Kalleberg, 2011, p. 5). Different theories lead to varying predictions regarding the correlation between wages and working conditions. The economic literature often uses earnings and fringe benefits or health insurance as key indicators in the debate concerning good and bad jobs (see, for instance, Wessels, 1980; Acemoglu, 2001; Schmitt, 2007). Approaches of compensating wage differentials then allow for an interrelation between economic rewards and non-economic working conditions, independent of other important factors such as age, gender, and human capital (Abowd and Ashenfelter, 1981; Rosen, 1986; Smith, 1979). A wage differential is – *ceteris paribus* – defined as the additional amount of earnings or fringe benefits that workers must be offered to motivate them to accept undesirable job characteristics. Thus, wages directly depend on working conditions. Wages compensate, among other things, not only for the risks of being laid off and of

[1] The acronyms "BIBB" and "BAUA" stand for "Bundesinstitut für Berufsbildung" (in English: "Federal Institute for Vocational Education and Training") and "Bundesanstalt für Arbeitsschutz und Arbeitsmedizin" (in English: "Federal Institute for Occupational Safety and Health").

subsequent unemployment but also for unfavourable working conditions and risks to life and health (*ivi*). Therefore, the following can be hypothesised:

– H1: unfavourable working conditions are compensated for by higher pay.

Segmentation theories consider a different perspective of labour markets (Doeringer and Piore, 1971; Kerr, 1954). They, on the one hand, distinguish between internal and external labour markets, with external labour markets functioning according to conventional economic theory. This means that the market determines both the allocation of labour and wages. By contrast, in internal labour markets, administrative rules and procedures (e.g. career ladders) take on this function. On the other hand, the labour market is also divided in a vertical dimension into a primary and a secondary sector. In the former, employees benefit from comparatively high wages, stable employment, and good career opportunities. In the secondary sector, the chances of vertical job mobility are limited, and wages are lower. Empirical research on inter-industry and intra-industry wage differentials found evidence for such a dualisation of the economy and, correspondingly, the labour market, which is indicated by high-wage and low-wage businesses (Dickens and Katz, 1987; Dickens and Lang, 1993). Another strand of research examined several factors of belonging to secondary labour markets, e.g. gender, citizenship, or the type of work (Constant and Massey, 2005; Hudson, 2007). Furthermore, Reid and Rubin (2003) showed that the structural position in the labour market (e.g. in primary labour market jobs at the core of the economy) continues to be a significant determinant of wages. More recently, classical segmentation theories have been criticised because they take only a macro-perspective on different sectors of the labour market but do not consider the meso-level of the labour market, i.e. companies, which can simultaneously have internal or closed positions as well as external or open positions. Thus, newer approaches to human resource management theorise that organisations show distinct patterns of internal structure, with respect to jobs, in the way in which they are grouped together, with regard to the vertical and lateral movement between jobs, as to the degree of linkage with external market forces, and in the manner in which these job clusters are coordinated and managed. These different patterns are called employment systems (Hendry, 2003; Kaufman, 2013). Employment systems differ in their degree of "openness" or "closeness" to external labour markets, and directly affect workers' employment situation and career options. This can be traced back to employees' resources and relative power, such as their professional knowledge and skills or the specificity of their profession learnt, and the relative power of employers to attract and retain employees. Since employment relations are determined by the relative power of employers and employees to control tasks, negotiate the conditions of employment, and terminate employment, various aspects of job quality covary (Kalleberg, 2011, p. 11). If employers are interested in binding employees to the company for a longer period of time, they can achieve this through secure and higher-paid jobs, good working conditions, and further training opportunities. This creates closed positions in the employment system (Hendry, 2003; Kaufman, 2013). In open employment systems, the problem of worker availability is limited to the quantitative dimension and thus to the existence of a sufficiently large number of employees in external labour markets. Employers tend to make little or no investment in the human capital of these workers, and employees can be recruited and dismissed according to the current workload, without so-called "sunk costs" (Williamson, 1981). Employees in open employment systems have little power of action in the labour market due to the competitive situation in their

occupational field, irrespective of whether they are well-qualified or low or inadequately qualified. Therefore, these employees often perform routine tasks in standardised jobs with little responsibility. This employment system is therefore characterised by frequent transitions between (atypical forms of) employment and unemployment, low wages, and unfavourable non-economic working conditions (*ibid.*). Empirical research actually found differences in quit and dismissal rates according to employees' positioning in open or closed jobs in the employment system (Batt and Colvin, 2017). Furthermore, Kalleberg (2003 and 2011) and Kalleberg *et al.* (2000) showed a division between organisational insiders in standard employment relations, and outsiders who have non-standard work arrangements, in which workers are less likely to exercise much control over their employment situations, and thus are often in bad jobs that pay less, and do not provide fringe benefits. Therefore, from classical segmentation theories as well as from the approach of employment systems, the following can be hypothesised:

– H2: minimum wage jobs provide less favourable working conditions than higher-paid jobs.

In the following section, we will describe the data, operationalisation, and method before we present our findings on the working conditions in minimum wage jobs.

3. Data and operationalisation

The BIBB/BAuA Employment Survey 2018 is a cross-sectional survey covering approximately 20,000 employees in Germany (Kantar Public, 2018). It is representative of the German labour force, including both employed and self-employed individuals who work at least 10 hours per week, and are at least 15 years old. The survey focuses on questions regarding education and training, as well as the workplace (main areas of activity, work requirements, workloads, etc.), and on physical strains. For our purposes, we excluded the following individuals: those below the age of 18; self-employed, freelancers, and family workers; those for whom the statutory minimum wage does not apply in Germany; and those above the age of 65, which is the general retirement age in Germany. Furthermore, the sample is restricted to individuals with valid data for the included variables. These requirements leave us with an analysis sample consisting of 12,271 individuals.

To identify workers in minimum wage jobs, the BIBB/BAuA Employment Survey 2018 contains the following retrospective question: "In January 2015, the statutory minimum wage was introduced in Germany. Did you earn a gross hourly wage of less than 8.50 € [in your main job] before that date?" Thus, we define workers in minimum wage jobs as those who earned less than 8.50 € gross per hour before the new minimum wage took effect in Germany on 1 January 2015. Since we wanted to focus only on workers who have not changed jobs in the meantime with a view to linking the observed working conditions to minimum wage labour, we restricted the minimum wage group to those employees who were working in the same job in 2018 as they were in 2015. Furthermore, it must be considered that the respondents to this retrospective question may have answered inaccurately, whether deliberately or inadvertently. Since we cannot directly scrutinise this issue, we descriptively cross-checked our minimum wage group by comparing it with the German Socio-Economic Panel (GSOEP) 2014, which has been widely used in the extant minimum wage research. In our sample, 4.4% of workers stated that they earned less than

8.50 € before the introduction of minimum wage. This number is approximately only half of what is reported by GSOEP (Mindestlohnkommission, 2018, p. 67), which is not surprising for three reasons. First, the BIBB/BAuA Employment Survey 2018 does not contain employees who worked less than 10 hours per week. This definition excludes, in particular, the so-called "mini-jobs", which are a specific form of employment in Germany in which employees can earn 450 € per month, free of income tax and social security contributions; however, they receive no health insurance and only optional pension insurance. In these jobs, the number of working hours is generally low (Mindestlohnkommission, 2018, p. 110 and ff.). Second, employment slightly decreased due to the introduction of minimum wage (Bruttel, 2019, p. 8). Third, in Germany, the yearly labour turnover rate amounts to approximately 30% (Stettes, 2011). Even though the 4.4% figure in the BIBB/BAuA Employment Survey is lower than the 10.8% figure in GSOEP-based studies, the incidence of minimum wage working in various categories is consistent across both data sources (see Appendix, Table A1). Thus, we can identify workers in minimum wage jobs by using this retrospective question and by controlling for job tenure with some confidence. However, we may underestimate the correlation between minimum wage working and unfavourable working conditions when those having left the workforce or their job since 2015 were employed in bad working conditions previously. Another reason for an underestimation may be traced back to our sample design, which does not include individuals with less than 10 working hours per week.

4. Method

As mentioned in the introduction, the characteristics of workers carrying out minimum wage jobs differ from those of workers in higher-paid jobs. To correct for these discrepancies and for selection effects, we use a propensity score matching approach to minimise observable selection biases (Dehejia and Wahba, 2002; Rosenbaum and Rubin, 1983). The matching approach allows for the comparison of workers in minimum wage jobs with a control group, which is similar to the aforementioned group with regard to those characteristics that have been identified as relevant – such as age, gender, household and company-level characteristics, and the industries in which individuals are employed. This approach ensures that "statistical twins" are compared regarding only their working conditions. The advantage of the non-parametric propensity score matching method is that it requires fewer assumptions than a parametric regression, and is more robust to biases due to specification errors.[2] This facilitates the interpretation of the results of our 23 outcome variables since only the mean values of both groups have to be compared.

Before the matching procedure can be used in the following analyses, the plausibility of two central assumptions – the conditional independence assumption (CIA) and the stable-unit-treatment-value assumption (SUTVA) – must be checked (Rosenbaum and Rubin, 1983). A precondition for the analysis is that the assignment of individuals

[2] Propensity score matching is a non-parametric (sometimes also denoted as semi-parametric) method. Propensity scores are typically estimated using parametric models for binary outcomes, such as logistic or probit regression, but the difference in the outcome variable is estimated non-parametrically in the matched sample. Thus, in contrast to common regression methods, non-parametric methods require no or comparatively little restrictive statistical assumptions (Caliendo and Kopeinig, 2008; Krug, 2017).

to both groups occurs at random, so the groups do not systematically differ in their characteristics, and no self-selection of individuals into one of the groups takes place. Analyses based on survey data, in contrast to experimental research, do not allow one to assume such a random assignment to the group of workers in minimum wage jobs and higher-paid jobs. However, the CIA can be met by selecting covariates that are unaffected by the outcome variables to form the control group. In addition, no self-selection of employees in the respective groups on the basis of their preferences regarding working conditions should take place. We consider the CIA to be fulfilled because our dataset contains a wide range of sociodemographic variables as well as information on households, company-level characteristics, and industry, which explain both minimum wage work and working conditions. The SUTVA consists of two components. The first component is that minimum wage working is defined identically for all units to allow for the formation of distinct groups, which is the case in our analysis. The second component is that the assignment of an individual to minimum wage work does not affect the potential outcomes of any other individual, which means that no "spill-over" effects should occur. This assumption can be considered fulfilled because assignment to both groups is based on individuals' affectedness by the introduction of the minimum wage in 2015 and because a rich set of confounding variables is surveyed, which can be used in matching to adjust both groups.

The propensity scores used to perform the matching are obtained from a selection model. For this purpose, a logit model that mirrors the probability of subjects being included in the group of workers carrying out a minimum wage job has been estimated. The corresponding dummy variable assumes a value of 0 for the higher-paid group. A value of 1 is assigned to workers in minimum wage jobs. Relevant covariates must be included in the selection model, and these explain employees' affiliation with the group of minimum wage workers, and must be adjusted according to their distribution for further analysis. Our selection of covariates is based on the previous findings from labour market research and on labour market theories. The central indicators are various individual and household characteristics, as well as industry and company-level information. Individual characteristics include gender, nationality, age, and the highest professional degree. The determinants describing the household comprise marital status, information on children below the age of 18, and the place of residence. Jobs are characterised by the form of employment, information on the type of contract, temporary work, additional jobs, tenure, company size, and industry. The results of the multiple logit analysis are shown in Appendix, Table A2. Accordingly, female workers, those without a professional degree, singles, employees living in East Germany, part-time and marginal employees, temporary workers, and those operating in smaller or middle-sized companies and in the trade sector have a greater probability of having earned less than 8.50 € prior to the introduction of minimum wage in 2015 in Germany.

The generated propensity score is used to establish the control group with the help of various matching algorithms (see Caliendo and Kopeinig, 2008, for a survey of different matching algorithms).[3] The analyses are based on a calliper matching method combined with the "nearest neighbour" (NN) method. In this approach, the oversampling of up to

[3] The implementation is done using the PSCORE program by Becker and Ichino (2002), along with the PSMATCH2 procedure by Leuven and Sianesi (2003) and the Stata statistics software.

five nearest neighbours is applied. This ensures that five workers in higher-paid jobs with structurally identical features, which have been identified as relevant, are assigned to each worker in a minimum wage job. Oversampling allows for the reduction in the variance in parameter estimates, and thus a gain in precision of the estimates (Caliendo and Kopeinig, 2008). Matching is carried out with a maximum deviation distance of $\Psi = 0.001$ to ensure a strong balancing of all covariates under scrutiny, and thereby to attain a high bias reduction (Dehejia and Wahba, 2002).[4]

The quality of the matching is crucial for the validity of the results generated (Dehejia and Wahba, 2002). To this end, a sufficient number of subjects need to be present in the dataset to enable control groups that reflect the sociodemographic and occupational characteristics of workers performing minimum wage jobs to comply with the "common support" condition (Caliendo and Kopeinig, 2008). Before matching, 379 employees in minimum wage jobs, and 11,892 higher-paid employees were included in the dataset. The large number of cases in the latter group, from which the controls are drawn, is an ideal foundation for the quality of the matching. To assess the quality of the matching, various statistical values and tests are available that help to establish whether the matching process has led to satisfactory balancing between the identified variables, which is necessary to fruitfully compare workers in minimum wage jobs to the control group (Caliendo and Kopeinig, 2008; Dehejia and Wahba, 2002). All assessments with regard to balancing the covariates presented in Table 1 reveal positive results; the matching procedures that are applied can therefore be considered successful.

Table 1. Overall measures of covariate imbalance

Sample	Pseudo R^2	Likelihood ratio test chi^2	Likelihood ratio test p-value	Rubin's R[1]	Mean bias[2]	Median bias[2]
Before matching	0.281	949.70	0.000	0.87	29.0	23.3
After matching	0.026	24.22	0.718	1.34	4.8	4.1

Notes: [1] Rubin (2001) recommends that R should be between 0.5 and 2 for the samples to be considered sufficiently balanced; [2] A score of less than 5% indicates that the matching process has sufficiently minimised the differences among the identified variables (Caliendo and Kopeinig, 2008, p. 48).
Source: BIBB/BAuA Employment Survey (2018); own calculations.

5. Results

In the following, we first present descriptions regarding the physical working conditions, work organisation, and social relationships at work for selected groups of employees. Second, the results of the matching analyses are presented.

[4] The sensitivity of results with regard to the selected matching process has been tested in great detail. The analysis included one-NN processes with and without replacement, alongside five and 10-NN, Kernel, and Radius methods without maximum deviation distances, and values of $\Psi = 0.001$, $\Psi = 0.0005$, and $\Psi = 0.0001$.

5.1. Descriptive results

According to Table 2, approximately 57% of workers in our sample report that they frequently have to stand at work. This value is considerably higher among minimum wage workers (77%), those without a professional degree (69%), and temporary workers (66%). The same pattern is evident regarding working conditions characterised by: frequently lifting and carrying heavy loads; frequently performing manual labour; frequently working in cold, hot, wet, damp, or draughty conditions; frequently working in oily, greasy, or dirty conditions; and frequently working around smoke, gas, dust, or fumes. Comparatively lower incidences show up among the mentioned groups with regard to frequently sitting at work. Above-average shares of jobs in which one frequently works with microbiological substances are denoted among minimum wage workers and female employees. Temporary workers comparatively often state frequently working in bright, poor, or dim lighting. While minimum wage workers more rarely mentioned frequently working in noisy conditions, male workers, those with a vocational qualification or no professional degree, as well as temporary workers indicate comparatively higher rates.

Descriptive results for work organisation and social relationships at work are shown in Table 3. Thus, 63% of all employees report that they frequently can plan or organise their own work. Less freedom to plan and organise their own work is reported by minimum wage workers (50%), employees without a professional degree (42%), fixed-term workers (49%), and temporary workers (41%). These groups of workers additionally less frequently state that they can influence their workload, and are allowed to decide when to take a break. Comparatively few differences between the observed groups of workers occur with regard to receiving information as well as help and support from colleagues or supervisors. Male employees and those with a technical school or master's degree mention less recognition from superiors for good work. Minimum wage workers, employees without a professional degree, and fixed-term and temporary workers comparatively less frequently feel that they are part of the workplace community and that their own job is important.

These descriptive findings indicate that – in addition to differences in the probability of having earned less than 8.50 € prior to the introduction of a minimum wage in 2015 in Germany (see Section 4) – there are also various differences between groups of employees in terms of the physical working conditions, the work organisation, and social relationships at work. Against this backdrop, comparisons of the working conditions between, on the one hand, the group of workers in minimum wage jobs, and, on the other, the control group in higher-paid jobs that are adjusted with regard to confounding variables are presented in the next section.

Table 2. Descriptive results for physical working conditions

Item	Full sample	*Wage level*		*Gender*		*Highest professional degree*				*Type of contract*		*Temporary work*	
		Higher-paid workers	Minimum wage workers	Male workers	Female workers	Vocational degree	Technical school, master	Polytechnic/ University degree	No professional degree	Permanent contract	Fixed-term contract	No temporary work	Temporary work
Frequently standing at work (1 = yes)	0.569	0.557	0.772	0.592	0.540	0.642	0.499	0.338	0.691	0.568	0.606	0.566	0.659
Frequently sitting at work (1 = yes)	0.491	0.501	0.284	0.477	0.509	0.415	0.571	0.754	0.301	0.492	0.465	0.499	0.298
Frequently lifting and carrying heavy loads (1 = yes)	0.252	0.247	0.380	0.270	0.230	0.304	0.229	0.069	0.364	0.252	0.267	0.250	0.313
Frequently performing manual labour (with high levels of dexterity, fast sequences of movements, or significant exertion) (1 = yes)	0.421	0.412	0.592	0.431	0.409	0.496	0.380	0.173	0.544	0.420	0.456	0.420	0.468
Frequently working in a kneeling or bending position or while reaching overhead (1 = yes)	0.181	0.180	0.182	0.193	0.165	0.216	0.146	0.066	0.246	0.179	0.209	0.180	0.209
Frequently working in cold, hot, wet, damp, or draughty conditions (1 = yes)	0.229	0.225	0.343	0.294	0.144	0.268	0.237	0.071	0.328	0.228	0.245	0.225	0.323

(continued on next page)

Table 2. Descriptive results for physical working conditions *(continued from previous page)*

Frequently working in oily, greasy, or dirty conditions (1 = yes)	0.199	0.199	0.210	0.272	0.105	0.237	0.221	0.049	0.270	0.198	0.211	0.195	0.298
Frequently working around smoke, gas, dust, or fumes (1 = yes)	0.147	0.147	0.161	0.205	0.072	0.178	0.130	0.041	0.202	0.146	0.162	0.146	0.176
Frequently working with microbiological substances (1 = yes)	0.134	0.131	0.198	0.080	0.203	0.149	0.131	0.103	0.101	0.134	0.143	0.135	0.104
Frequently working in bright, poor, or dim lighting (1 = yes)	0.101	0.101	0.117	0.115	0.083	0.111	0.125	0.066	0.087	0.101	0.102	0.100	0.135
Frequently working in noisy conditions (1 = yes)	0.301	0.302	0.282	0.358	0.227	0.338	0.281	0.177	0.362	0.299	0.309	0.296	0.410
Frequently working under disturbing noises (1 = yes)	0.268	0.270	0.268	0.307	0.218	0.296	0.275	0.184	0.264	0.268	0.267	0.267	0.300
Cases	6,845	6,455	260	3,614	3,231	4,100	663	1,693	384	6,580	260	6,663	182

Source: BIBB/BAuA Employment Survey 2018; own calculations; all descriptive results are weighted.

Table 3. Descriptive results for work organisation and social relationships at work

Item	Full sample	*Wage level*		*Gender*		*Highest professional degree*				*Type of contract*		*Temporary work*	
		Higher-paid workers	Minimum wage workers	Male workers	Female workers	Vocational degree	Technical school, master	Polytechnic/ University degree	No professional degree	Permanent contract	Fixed-term contract	No temporary work	Temporary work
Own work can frequently be planned and organised (1 = yes)	0.631	0.637	0.503	0.604	0.665	0.583	0.727	0.811	0.415	0.638	0.488	0.640	0.407
Frequently have influence over your workload (1 = yes)	0.290	0.292	0.254	0.292	0.288	0.271	0.309	0.351	0.250	0.291	0.279	0.294	0.201
Are frequently allowed to decide when to take a break (1 = yes)	0.601	0.608	0.487	0.611	0.588	0.581	0.655	0.684	0.475	0.604	0.552	0.608	0.425
Frequently do not receive timely information about important decisions, changes, or future plans (1 = yes)	0.181	0.180	0.214	0.196	0.162	0.188	0.194	0.140	0.215	0.182	0.139	0.180	0.209
Frequently do not receive all the information necessary to perform your own job properly (1 = yes)	0.115	0.115	0.110	0.125	0.101	0.121	0.109	0.093	0.131	0.116	0.077	0.114	0.137
Frequently receive help and support for your own work by colleagues (1 = yes)	0.789	0.790	0.727	0.786	0.792	0.782	0.767	0.818	0.787	0.789	0.791	0.788	0.804
Frequently receive help and support for your own work by the supervisor (1 = yes)	0.574	0.572	0.569	0.574	0.574	0.567	0.560	0.600	0.571	0.575	0.557	0.575	0.545
Frequently receive recognition from your supervisor for good work (1 = yes)	0.293	0.290	0.284	0.250	0.349	0.291	0.229	0.311	0.343	0.290	0.373	0.291	0.346
Frequently feel that you are part of the workplace community (1 = yes)	0.801	0.803	0.732	0.777	0.831	0.799	0.829	0.826	0.713	0.805	0.714	0.807	0.636
Frequently feel that teamwork is good (1 = yes)	0.862	0.865	0.823	0.858	0.869	0.860	0.873	0.896	0.780	0.862	0.872	0.866	0.779
Frequently feel that your own job is important (1 = yes)	0.775	0.778	0.716	0.765	0.786	0.777	0.815	0.773	0.712	0.778	0.706	0.779	0.662
Cases	6,845	6,455	260	3,614	3,231	4,100	663	1,693	384	6,580	260	6,663	182

Source: BIBB/BAuA Employment Survey 2018; own calculations; all descriptive results are weighted.

5.2. Matching results

In the following, we compare workers in minimum wage jobs with a control group in higher-paid jobs, which are structurally identical to the former regarding various observable individual, household, industry, and company-level characteristics (Appendix, Table A2). Thus, when controlling for these variables, the two groups only differ in their wage levels. After matching, the mean wages amount to 8.51 € among workers in minimum wage jobs and to 16.55 € among those in the higher-paid control group; the low-wage threshold is 11.94 € in our sample. We group our matching results into two broad clusters. First, we present evidence on the physical working conditions. Second, we show results on work organisation and social relationships at work.

According to our findings in Table 4, minimum wage work is often associated with a variety of occupational physical exposures. Workers carrying out minimum wage jobs spend significantly more time working in standing positions than those in the control group (0.718 vs. 0.563, respectively). Both the fact that 71.8% of minimum wage employees work in standing positions, and the difference against the control group of 15.6 percentage points represent the largest values. The higher physical strain in minimum wage jobs can be traced back to the fact that these workers lift or carry heavy loads (0.333 vs. 0.231) and perform manual labour that requires high levels of dexterity, fast sequences of movements, or significant exertion (0.521 vs. 0.425). Minimum wage jobs are, to a greater extent, characterised by adverse frame conditions or hazardous substances, including cold, hot, wet, steamy, or draughty working conditions (0.319 vs. 0.172) or oil, grease, dirt, or air pollution (0.201 vs. 0.144). Moreover, employees performing those jobs more often work around smoke, gas, dust, or fumes (0.147 vs. 0.097). Additionally, sitting at work is less common among workers in minimum wage jobs (0.342 vs. 0.471) than in the control group. Finally, for some parameters of physical working conditions, we do not find any difference between minimum wage and higher-paid work. This lack of difference is found for those working in a kneeling or bending position, working with microbiological substances, or working under inadequate lighting or noisy conditions.

Our second topic concerning working conditions relates to work organisation and social relationships at work. Table 5 indicates that workers in minimum wage jobs have less autonomy than those in the control group regarding their ability to plan and organise their workloads (0.495 vs. 0.642) or make their own decisions about when to take their breaks (0.485 vs. 0.603). Both restraints to minimum wage jobs show the proportionately largest values. Furthermore, employees in the minimum wage sector are significantly less likely to receive timely information about important decisions, changes, or future plans that will affect their workplaces (0.237 vs. 0.168) than those in the control group. However, we found no significant differences regarding their influence over their own workload and obtaining the necessary information to perform their jobs properly.

With respect to their social integration in their working environment, most of our indicators show no differences between workers performing minimum wage jobs, and their higher-paid counterparts. Employees belonging to the former group receive a similar level of support from colleagues and supervisors, and are recognised by their supervisors for their contributions. Nevertheless, workers in minimum wage jobs are less likely than those in the control group to see themselves as part of their workplace communities (0.708 vs. 0.786), and they are also less likely to state that they frequently consider their own work important (0.704 vs. 0.797).

Table 4. Matching results for physical working conditions

Item	Minimum wage workers	Control group	Difference	Standard error	Z-score	Cases
Frequently standing at work (1 = yes)	0.718	0.563	0.156***	0.038	4.05	338
Frequently sitting at work (1 = yes)	0.342	0.471	–0.129***	0.037	–3.44	339
Frequently lifting and carrying heavy loads (1 = yes)	0.333	0.231	0.102***	0.034	2.93	339
Frequently performing manual labour (with high levels of dexterity, fast sequences of movements, or significant exertion) (1 = yes)	0.521	0.425	0.095***	0.037	2.61	338
Frequently working in a kneeling or bending position or while reaching overhead (1 = yes)	0.186	0.185	0.001	0.029	0.01	339
Frequently working in cold, hot, wet, damp, or draughty conditions (1 = yes)	0.319	0.172	0.147***	0.031	4.67	339
Frequently working in oily, greasy, or dirty conditions (1 = yes)	0.201	0.144	0.057**	0.029	1.98	339
Frequently working around smoke, gas, dust, or fumes (1 = yes)	0.147	0.097	0.050**	0.021	2.30	339
Frequently working with microbiological substances (1 = yes)	0.169	0.173	–0.004	0.028	–0.16	338
Frequently working in bright, poor, or dim lighting (1 = yes)	0.124	0.111	0.013	0.022	0.62	339
Frequently working in noisy conditions (1 = yes)	0.271	0.249	0.022	0.032	0.67	339
Frequently working under disturbing noises (1 = yes)	0.240	0.222	0.018	0.031	0.57	339

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: BIBB/BAuA Employment Survey 2018; own calculations.

Table 5. Matching results for work organisation and social relationships at work

Item	Minimum wage workers	Control group	Difference	Standard error	Z–score	Cases
Own work can frequently be planned and organised (1 = yes)	0.495	0.642	–0.147***	0.037	–3.97	339
Frequently have influence over your workload (1 = yes)	0.225	0.270	–0.045	0.032	–1.40	337
Are frequently allowed to decide when to take a break (1 = yes)	0.485	0.603	–0.118***	0.038	–3.06	328
Frequently do not receive timely information about important decisions, changes, or future plans (1 = yes)	0.237	0.168	0.069**	0.031	2.25	337
Frequently do not receive all the information necessary to perform your own job properly (1 = yes)	0.135	0.101	0.034	0.025	1.39	339
Frequently receive help and support for your own work by colleagues (1 = yes)	0.710	0.754	–0.044	0.030	–1.48	335
Frequently receive help and support for your own work by supervisor (1 = yes)	0.531	0.579	–0.048	0.037	–1.29	331
Frequently receive recognition from your supervisor for good work (1 = yes)	0.283	0.301	–0.018	0.035	–0.51	332
Frequently feel that you are part of the workplace community (1 = yes)	0.708	0.786	–0.078**	0.036	–2.17	339
Frequently feel that teamwork is good (1 = yes)	0.799	0.841	–0.042	0.029	–1.46	329
Frequently feel that your own job is important (1 = yes)	0.704	0.797	–0.093***	0.033	–2.78	338

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: BIBB/BAuA Employment Survey (2018); own calculations.

In summary, evidence on the physical working conditions, work organisation, and social relationships at work indicates that hypothesis 1 – namely, that unfavourable working conditions are compensated for by higher pay – must be rejected. However, our findings are in line with hypothesis 2, which is derived from theories of labour market segmentation and approaches of employment systems, that minimum wage jobs provide less favourable working conditions than higher-paid jobs.

6. Discussion of results and conclusion

In our article, we aimed to provide an answer to the question of whether the working conditions in minimum wage jobs differ from those in higher-paid jobs. We drew from a rich, representative German dataset, which included a large number of working condition variables, and allowed us to identify workers carrying out minimum wage jobs. We performed propensity score matching to minimise observable selection biases that can be traced back to sociodemographic, industry, and company-level characteristics.

Our results support the extant predictions from theories on segmented labour markets, which correlate undesirable working conditions with low wages. Workers performing minimum wage jobs not only face material risks from working in low-paying jobs, but also must cope with unfavourable physical and environmental working conditions. These include, for instance, working in standing positions, lifting or carrying heavy loads, and being exposed to cold, hot, wet, steamy, or draughty working conditions or to oil, grease, dirt, or air pollution. In addition, compared with the control group, the minimum wage workforce has less control over its work organisation, including limited planning reliability and limited discretion about when to take breaks. Furthermore, employees in the minimum wage sector are significantly less likely to receive timely information about important decisions, changes, or future plans that will affect their workplaces. Although there are no apparent differences regarding the actual amount of support received from colleagues and supervisors, or the degree to which supervisors recognise their contributions, workers in minimum wage jobs are less likely than those in the control group to see themselves as part of their workplace communities, and they are also less likely to state that they frequently consider their own work important. Our results support the hypotheses derived from the theories of segmented labour markets and employment systems: working conditions occur in a complementary way. Employees earning low wages additionally face greater risks of having unfavourable working conditions. We do not find any evidence that wages compensate for unfavourable working conditions.

Before we present our conclusions, we will discuss the limitations, strengths, and remaining questions regarding this study. A well-known limitation to the propensity score matching method is that it can control only for observable characteristics to form a higher-paid group being structurally equal to that of workers in minimum wage jobs. Unobserved factors, which affect the assignment into one of the two groups, can lead to biased estimations of the treatment effects. Another limitation of our study comes from the available data. We had to use a retrospective question to identify workers performing minimum wage jobs. Even though this setting is not optimal, we have shown that the structure of our sample of minimum wage workers is in line with that of other data available for Germany. Furthermore, the obtained results that workers performing in minimum wage jobs face greater risks of having physical strain and detrimental

working conditions are likely to be underestimated for two reasons. First, because we use a retrospective question to identify minimum wage workers, we underestimate the correlation between minimum wage jobs and adverse working conditions when those having left the workforce or their job since 2015 were previously employed in poor working conditions. The second reason is a possible positive sample selection, as the BIBB/BAuA Employment Survey is restricted to only those employees who worked at least 10 hours per week, and thus excludes most mini-jobs that are associated with above-average non-compliance regarding various aspects of labour regulations (see Mindestlohnkommission, 2020, p. 70, for further references).

The major strength of our analysis is its novelty. To the best of our knowledge, this study is the first to examine the physical and workplace-related working conditions in minimum wage jobs using individual-level data. This approach was possible because the BIBB/BAuA Employment Survey constitutes a rich dataset that includes working conditions variables as well as an indicator question on minimum wage work. In the future, it would be worth looking more closely at similar surveys in other countries to identify datasets that could be used to conduct similar analyses on the link between minimum wage and working conditions. A further road for future research should be to expand the analyses to low-wage work more generally, as this has become a relevant phenomenon in many countries (see, for instance, the survey by McKnight *et al.*, 2016, for Europe). With respect to low-wage work, there mostly exist qualitative case studies rather than quantitative analyses based on individual-level data.

What conclusions can be drawn from our findings? First, risks obviously cumulate for workers carrying out minimum wage jobs. In addition to the financial risk resulting from low wages, workers in minimum wage jobs obviously have to deal with detrimental physical working conditions and unfavourable work organisation, and they assess their social integration in the work environment as being worse compared with higher-paid but structurally similar workers. Other research on health outcomes indicates that poor working conditions lead to health problems (Da Costa and Vieira, 2010; Walker-Bone and Cooper, 2005; Cox *et al.*, 2004). This influence on health is particularly problematic if minimum wage and low-wage work is a persistent rather than transitional phenomenon. The existing evidence suggests that those who receive low wages have a higher probability of being low-paid in the future (see Schnabel, 2016, for an overview) and that their health is comparatively worse (Coupaud, 2017). Second, in the past, several political measures have been taken in an attempt to address low wages through social and labour market policies, such as the statutory minimum wage in Germany. This policy actually led to a significant increase in hourly wages at the lower end of the wage distribution (Burauel *et al.*, 2018); however, since job quality consists of a set of factors (Kalleberg, 2011), it would be necessary to maintain employees' health and productivity by means of further measures and regulations. This approach in turn would help to avoid economic costs (Sobocki *et al.*, 2006; Greenberg *et al.*, 2003).

Third, we focused on physical working conditions, workplace organisation, and social relationships at work. However, future research should also address other aspects, such as working time patterns or mental health. The joint analyses of wages and working conditions can help to broaden our understanding of the bottom end of the labour market, including the particular challenges and the potential need for public interventions.

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Appendix

Table A1. Share of jobs paying below 8.50 € per hour prior to the introduction of a minimum wage (given in percentages) in Germany

	GSOEP	BIBB/BAuA Employment Survey 2018
Total	10.8	4.4
Region		
West Germany	9.1	3.3
East Germany	18.1	9.0
Gender		
Women	15.5	6.7
Men	6.3	2.6
Age		
18 to 24	30.1	9.0
25 to 34	11.2	5.9
35 to 44	8.7	3.9
45 to 54	8.2	4.0
55 to 65	9.5	4.0
Highest professional degree		
No vocational training	14.9	9.2
Vocational training	12.5	4.8
University degree	2.7	1.3
Form of employment		
Full time	6.5	2.8
Part time	10.7	6.5
Marginal employment	55.2	34.0
Type of contract		
Permanent contract	9.1	4.0
Fixed-term contract	18.3	13.1

Source: data for GSOEP are taken from Mindestlohnkommission (2018, p. 67); data for BIBB/BAuA Employment Survey 2018 are based on our own calculations.

Table A2. Estimates of the probability of having earned less than 8.50 € prior to the introduction of a minimum wage in 2015 in Germany

Items	Marginal effect	Standard error
Gender (1 = female)	0.020***	(0.006)
Nationality (1 = foreign)	–0.004	(0.013)
Age	0.001	(0.002)
Age (squared)	–0.000	(0.000)
Highest professional degree (ref.: vocational degree)		
Technical school, master	–0.003	(0.010)
Polytechnical/University degree	–0.034***	(0.005)
No professional degree	0.029**	(0.015)
Marital status (ref.: married)		
Single	0.017**	(0.007)
Divorced	0.004	(0.007)
Widowed	–0.015*	(0.009)
Children under 18 years in the household (1 = yes)	–0.013**	(0.006)
Place of residence (ref.: West Germany)	0.046***	(0.005)
Form of employment (ref.: full time)		
Part time	0.022***	(0.007)
Marginal employment	0.158***	(0.030)
Type of contract (1 = fixed-term contract)	0.013	(0.012)
Temporary work (1 = yes)	0.035***	(0.012)
Tenure (in years)	–0.003***	(0.001)
Tenure (in years squared)	0.000	(0.000)
Additional job	0.002	(0.008)
Size of company (ref.: more than 500 employees)		
Fewer than 9 employees	0.045***	(0.010)
10-49 employees	0.026***	(0.007)
50-499 employees	0.017***	(0.006)
Industry (ref.: manufacturing – excluding construction)		
Agriculture, forestry, and fishing	0.011	(0.020)
Construction	–0.004	(0.011)
Trade, transport, hospitality, and information	0.038***	(0.008)
Financing, rental, and business services	0.012	(0.009)
Public and private services	0.004	(0.006)
Observations	12,271	
Pseudo R^2	0.281	
Akaike information criterion (AIC)	2,946.520	
Bayesian information criterion (BIC)	3,168.970	

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses.
Source: BIBB/BAuA Employment Survey (2018); own calculations.