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Characteristics Contributing to Low- and Minimum-Wage Labour in Germany

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Abstract: In this article we examine the correlation between characteristics of individuals, companies, and industries involved in low-wage labour in Germany and the risks workers face of earning hourly wages that are below the minimum-wage or low-wage thresholds. To identify these characteristics, we use the Structure of Earnings Survey (SES) 2014. The SES is a mandatory survey of companies which provides information on wages and working hours from about 1 million jobs and nearly 70,000 companies from all industries. This data allows us to present the first systematic analysis of the interaction of individual-, company-, and industry-level factors on minimum- and low-wage working in Germany. Using a descriptive analysis, we first give an overview of typical low-paying jobs, companies, and industries. Second, we use random intercept-only models to estimate the explanatory power of the individual, company, and industry levels. One main finding is that the influence of individual characteristics on wage levels is often overstated: Less than 25 % of the differences in the employment situation regarding being employed in minimum-wage or low-wage jobs can be attributed to the individual level. Third, we performed logistic and linear regression estimations to assess the risks of having a minimum- or low-wage job and the distance between a worker's actual earnings and the minimum- or low-wage thresholds. Our findings allow us to conclude that several determinants related to individuals appear to suggest a high low-wage incidence, but in fact lose their explanatory power once controls are added for factors relating to the companies or industries that employ these individuals.

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1 Introduction

Since the end of the twentieth century, and above all since reunification, the German system of industrial relations has come under considerable pressure. Before reunification, the rate of coverage by collective agreements was around 85 % (Visser 2015). Most companies belonged to an employers' association, and even companies not bound by collective agreements tended to use the collectively agreed-upon pay rates as points of reference (Bosch 2018). But certain trends clearly indicated the reduced significance of industrial relations after reunification: declining union membership and collective bargaining coverage, along with a decrease in the importance of codetermination in organizations. Further developments leading to significant changes in the German labour market can be traced back to transnationalization processes within the economy and also to deregulation policies. Transnationalization meant that companies were more and more exposed to cost pressures and faced expectations of rising returns (Neubäumer/Tretter 2008; Struck 2006). As a result, production processes were subdivided and parts of companies were outsourced. These changes contributed to reduced elasticity in the face of fluctuations in demand (Picot/Wigand 2001). Additionally, the speed of innovation increased, while on the other hand product cycles became shorter. Deregulation, in the form of the German Law on Labour Leasing and the Part-Time and Fixed-Term Act, also left its mark on the labour market. The "Hartz" laws, aimed at a policy of activating the unemployed by increasing the pressure to work and to accept non-standard jobs (Eichhorst/Marx 2011: 74), in turn increased wage pressure for jobs with easily replaceable staff.

Low wages are a consequence of the structural changes mentioned and are particularly common among basic service providers in small, regionally oriented companies without international competition and collective bargaining (Brenke/Müller 2013). In these companies, the pressure on lower- and medium-skilled groups is particularly high (Sesselmeier 2015). In Germany, the low-wage sector has grown since 1995 to a level that is above average among developed countries. The incidence of low pay in 2016 in all OECD countries amounted to 15.8 %, but in Germany it was 18.9 % (OECD 2018). Wages at the bottom end of the wage distribution scale have plunged sharply

downwards since 1995 so that the average gap between the pay levels of low-wage workers and the low-wage threshold is greater in Germany than in any other European country. The trend of increasing wage inequality was a key argument behind the introduction of a statutory minimum wage in Germany (Bosch/Weinkopf 2014: 185; Dustmann et al. 2014: 185).

Against the background of these developments, we explore the individual and structural determinants that were correlated with the risks of earning wages below the minimum-wage and low-wage thresholds in 2014, the year prior to the introduction of the statutory minimum wage. We consider both minimum-wage jobs, which pay below 8.50 euros gross per hour, and low-wage employment, which is defined as work that pays up to two-thirds of the median wage (9.80 euros); although the former is a subgroup of the latter labour market segment, we focus on both as part of our aim is to assess whether minimum-wage and low-wage work differ structurally. These considerations are crucial for understanding the effects of the new minimum wage on specific groups of workers and companies. Up to now only a few studies have aimed at characterizing these segments of the German labour market (Bosch/Kalina 2008; Bruttel et al. 2017; Kalina/Weinkopf 2015, 2017). Moreover, they have either only explored the significance of individual factors in the risk of becoming a low-wage earner or they have given descriptive analyses that focused on structural determinants. Thus, although Coleman (1990) and Esser (1996) have pointed to the importance of the broader social context for individual behaviour, research on the low-pay sector has not systematically provided that context. Thus, the impact of company-specific factors and disparities between industries on low-wage working has remained largely unexplored.

To investigate the risk factors which are correlated with low-wage and minimum-wage working, we use a rich dataset containing information on about 1 million jobs and about 70,000 companies from all industries. This data allows us to assess not only the significance of individual determinants but also company-level and industry-level determinants, which we present here in detail for the first time. Thus, the risk factors acting as determinants of low wages can be estimated by using a rich set of individual-, company-, and industry-level characteristics.

In the next section we provide a comprehensive review of the current state of research on this topic, present theoretical assumptions, and derive several hypotheses. Data and the estimation strategy are described in Section 3. Section 4 contains the empirical results, and Section 5 discusses the findings and concludes.

2 State of research and theoretical assumptions

In order to understand minimum- and low-wage employment and its implications for individual employment careers, recent research has focused on four topics. The first addresses the determinants of being in a low-wage job, or the individual characteristics that are typical for low-wage employment (Bosch/Kalina 2008; Bruttel et al. 2017; Kalina/Weinkopf 2015, 2017). The second topic deals with the question of how long employees remain in low-wage positions and whether they successfully achieve the transition into regular employment (through the stepping stone effect) or become unemployed and end up in the “low-pay, no-pay cycle” (Fok et al. 2015; Mosthaf et al. 2011; Knabe/Plum 2013; Schnabel 2016; Schank et al. 2009). The third topic is the body of studies examining the consequences of low-wage employment for employees’ well-being and health (Appelbaum 2010; Gallie 2007; Kalleberg 2011). The 4th topic is on possible alternatives to taking up a low-wage job or remaining in the low-wage sector through strategies such as searching longer and more intensely for better paid employment or participating in further training (Schnabel 2016). The aim of this paper is to contribute to the first topic by focusing not only on low-wage labour, but also on minimum-wage jobs in Germany using multivariate estimation strategies which control for determinants at the individual, company, and industry levels.

Only a few studies have dealt with minimum-wage and low-wage employment and its characteristics in Germany. Kalina and Weinkopf (2015) have identified individual characteristics of low-wage workers based on the German Socio-economic Panel (GSOEP) and have shown that the incidence of low pay is nearly twice as high for female workers as it is for male workers. Also, a higher level of educational achievement reduces the risks of working for low wages. The incidence of low-wage employment is higher for younger workers, foreigners, workers with fixed-term contracts, and those in marginal employment. These findings were in accordance with the results reported by Bosch and Kalina (2008), who use data from the employment panel of the Federal Employment Agency. Descriptive analyses based on the Structure of Earnings Survey 2014 suggest that the risk of low-wage employment is most often associated with working for small companies or those not bound by a collective agreement (Bruttel et al. 2017). Low-wage work is more concentrated in the sectors comprising “agriculture, forestry, and fishing”, “accommodation and food service activities”, and “retail” (Bosch/Kalina 2008; Kalina/Weinkopf 2015, 2017). Further studies assessed possible changes in the composition of the low-wage sector after the introduction of a statutory minimum wage in Germany. Kalina and Weinkopf (2017), in their study based on the GSOEP, found no clear effect of the introduction of a minimum wage

on the share and composition of low-wage employment. Bruttel et al. (2017) have shown that the group of workers facing the risk of earning low wages is almost identical to the group earning minimum wage. The latter group faces a similar risk but at an even lower level.

With regard to characteristics on the individual level that act as determinants of employment in low-wage jobs, several theoretical assumptions have been made in recent literature. The first deals with wage differences between men and women. One prominent empirical finding is that women earn less than men. Three reasons for the existence of the gender pay gap are discussed. First, few women hold certain positions at the upper end of the career ladder or occupy certain professions and labour sectors because of the horizontal and vertical segregation of the labour market along gender lines. Second, women often interrupt their employment careers and reduce their working time for family reasons, and this occurs more frequently and for longer periods than it does among men. This disparity leads to a devaluation of the acquired human capital. Third, company and sectoral collective wage negotiations have not yet successfully increased wage levels in traditionally female-dominated professions. Furthermore, the gender pay gap remains or even widens over the life course due to losses in the stock of human capital and shorter job tenure (Cahuc et al. 2014: 481f.). Thus, we draw the following hypothesis:

Hypothesis 1: Women face greater risks than men of being paid below the minimum- or low-wage threshold.

According to human capital theory, individuals' qualifications and skills are closely linked to their productivity (Becker 1962, 1975; Mincer 1962; Oi 1962). A higher stock of human capital therefore leads to better career opportunities and higher wages. The amount of human capital accumulation is regarded as an important factor in explaining social inequalities. Referring to the human capital approach, we hypothesize:

Hypothesis 2: The incidence of minimum- or low-wage employment among workers with low education levels is higher than the incidence of this type of employment among workers with higher levels of education.

Another factor influencing employees' productivity and wages is age (Becker 1962, 1975). It is well known that in developed countries wages grow substantially over the life cycle (Lagakos et al. 2018). Under the condition that no serious illness or longer period of unemployment occurs during the life course, age is highly correlated with job experience. Additionally, it is assumed that trained workers receive lower earnings during the training period and higher earnings at

later ages, because the return is collected then. The combined effect of paying for and collecting the return from training constitutes the age earnings curve of trained workers (Becker 1962, 1975). The following hypothesis can be derived:

Hypothesis 3: The older a worker is, the lower the probability of that worker earning below the minimum-wage or low-wage threshold.

According to Lazear (1981), employers and employees enter into implicit contracts whereby workers receive a wage that is less than the value of their marginal product at the beginning of the contract and larger than the value of the marginal product at the end. This results in both an incentive for employees not to lower their work effort and a restraint on any inclination they may have to quit their jobs because employees who change their jobs or are dismissed by their employers lose their acquired entitlements. The assumption of a positive correlation between tenure and employees' wage profiles leads to the following hypothesis:

Hypothesis 4: The shorter an employee's job tenure, the higher the probability of earning below the minimum-wage or low-wage threshold.

Part-time work and marginal employment primarily serve the purpose of an internal flexibilization of a company's staff (Dütsch/Struck 2011). Female employees often take these part-time and marginal jobs to be able to balance work and family life and care for older relatives (Wanger 2011). For the same reasons, women often change occupations (Hall 2011), thereby losing or devaluing some of their acquired human capital (Becker 1962, 1975). Additionally, marginal and part-time employees have fewer opportunities for promotion and wage increases than full-time workers.

Hypothesis 5: Part-time or marginal workers have a higher probability of being paid below the minimum-wage or low-wage threshold.

A significant factor in low-wage work is whether the employee is permanent or regular, on the one hand, or temporary or working for a fixed term, on the other hand. Temporary and fixed-term employment is intended as an instrument of external flexibility of staff that allows the employer to respond quickly to demand and production fluctuations (Brehmer/Seifert 2008). Temporary and fixed-term workers mostly carry out routine tasks (Dütsch/Struck 2011) and are "outsiders" in the internal labour market who have not had to meet the same rigorous qualifications of regular employees and generally occupy inferior positions in their companies (Cahuc et al. 2014: 883).

Hypothesis 6: The incidence of minimum- and low-wage workers in nonpermanent (fixed-term or temporary) jobs is higher than the incidence of minimum- or low-wage workers in permanent positions.

Beyond these individual factors, it is important to take contextual conditions into account, as Coleman (1990) and Esser (1996) have pointed out. Just as it is important to recognize that individuals act within specific contexts, this also applies to the labour market. To some extent, employees' options for decisions and actions depend on the resources and limitations of the companies and industries that employ them. Regarding company size, it is generally agreed that smaller companies have a more limited capacity to adapt to changing market conditions than larger companies have. Larger companies are in a better position to cope with sudden fluctuations in sales revenue, for example, because they can balance out lost sales in one product area through gains in another (Struck 2006). Furthermore, compared to smaller companies, large companies can offer more employment opportunities, promotion prospects, and benefits; hence, they promote job mobility, both laterally and vertically. We therefore draw the following hypothesis:

Hypothesis 7: Employees working in smaller companies have a higher probability of earning below the minimum-wage or low-wage threshold than employees working in larger companies.

Besides the size of a company, its location is a further crucial factor because economic and social inequality also has a spatial dimension. Extensive regional inequalities arising from German reunification and the transformation process in eastern Germany still persist (Himmelreicher 2016). Hence, the labour structure and economic power in Germany feature an unequal distribution in large areas of northern, southern, eastern, and western Germany, and the differences have even increased over the past few years (Albrech et al. 2017). Notably less favourable economic conditions prevail in eastern and northern Germany compared to the federal states and regions in the south of the country, and these weaker economic conditions directly affect the regional wage levels.

Hypothesis 8: The incidence of minimum- or low-wage labour in northern and eastern Germany is higher than in other regions, particularly in southern Germany.

Working conditions and wages are partly determined by the types of collective agreements to which employees and companies are bound. Companies tied to collective agreements have higher wage levels and lower levels of internal wage inequality (Addison et al. 2010; Dustmann et al. 2009). One reason for this is that less skilled workers benefit from collective agreements because such agreements

regulate the lowest pay grades and level out wage differences within the workforce (Jirjahn/Stephan 2006). In fact, according to Dustmann et al. (2009) and Antonczyk et al. (2010), the decline in collective bargaining has led to a rise in wage inequality, particularly at the lower end of the wage distribution. From this, the following hypothesis can be derived:

Hypothesis 9: The risk of earning low wages is higher in companies not bound by a collective agreement than in companies with sectoral or company agreements.

As a social phenomenon, the gender pay gap is well known. Based on the theoretical discussion above concerning the lower pay of women compared to men, it can be assumed that the distribution of men and women in companies has an impact on wage levels. It follows, then, that a larger share of women in a company may negatively affect the internal wage structure.

Hypothesis 10: The incidence of minimum- or low-wage employment in companies with a greater share of women is higher than in male-dominated companies.

The industry to which a company belongs and industry-specific productivities have a strong impact on workers' wages. Against this backdrop, a wide discussion has taken place on sector-specific minimum wages in Germany. In 1997 sector-specific minimum wages were introduced (e. g. in main construction, roofing, and nursing). Moreover, descriptive evidence prior to the introduction of the statutory minimum wage in Germany already indicated the significance of industries: amongst the 20 sectors with the highest incidence of jobs paying wages under 8.50 euros per hour, the levels ranged from about 70 % of affected jobs in the taxi trade to about 22 % in retail; however, in sectors such as the engine building industry there were hardly any jobs that paid below the minimum wage (see Mindestlohnkommission 2016 for a list of these industries). This correlation is confirmed by several studies focusing on Germany (Bispinck 2017; Mindestlohnkommission 2018). This indicates that the creation of value, and thus the scope of profit distribution, is comparatively high in the manufacturing industry, while this is less the case in the service sector. Accordingly, in the manufacturing industry the average wage level is higher than in other sectors, especially the service sector (Bispinck 2017; Mindestlohnkommission 2018).

Hypothesis 11: Minimum- or low-wage workers are more concentrated in the service sector than in manufacturing industries.

In the following chapter we describe our data and methods, after which we present the empirical results and test the derived hypotheses.

3 Data and methods

The empirical basis for answering our questions is the most recent version of the Scientific Use File of the Structure of Earnings Survey (SES) 2014. The SES is an official, mandatory survey conducted in companies (Günther 2013; Statistisches Bundesamt 2013). The collected data mainly refers to employment relationships in the surveyed companies (linked employer-employee data). Data collected on employment relationships by the SES primarily stems from the respective companies' payroll accounting. For most of the civil service employees, the data is taken from the staff statistics, which also include data from payroll accounting. Hence, wage information gathered there is comparatively accurate and corresponds with the wages paid through company's internal accounting (Statistisches Bundesamt 2017). SES data collected on working hours, however, is less accurate since the documentation on working hours outside manufacturing is often incomplete (Statistisches Bundesamt 2016b). For the special case of companies which only have marginal employees, information on marginal employment is entirely generated by means of nearest-neighbour-imputation using information on marginal employment from companies that additionally employ workers subject to social security contributions. The last regular SES was conducted in April 2014 for those employees who were employed during the entire month (ibid.). In 2014, the SES survey was broadened to also include very small businesses with fewer than 10 employees and to cover companies in the economic sectors of agriculture and forestry as well as fishing. The SES data comprises nearly all sectors, with the exception of private households, extraterritorial organizations, and corporate bodies. Employees working in extraterritorial organizations and corporate bodies make up a very small group of workers. Only 18,000 out of more than 32 million employees subject to social insurance contributions in Germany (31.06.2017) work in these specific sectors (Destatis 2018: 371). These employees are often well-educated and earn well above the low-wage threshold. However, things are different for employees who work in private households. In June 2018 more than 300,000 persons worked as marginal employees in private households in Germany. Experts estimate that about 3 million persons work illegally in private households. These employees, mostly women, do not contribute to social insurances and thus have no claim to social insurance benefits. However, they typically have health insurance through their partners or receive unemployment benefits which include health insurance. Their actual earnings and future pensions are low (Faller 2018). However, compared to other data the SES fulfils the prerequisites for evaluating the minimum-wage and low-wage sectors.

The linked employer-employee SES data permits simultaneous analyses of employees and companies. It provides information on 1 million employment relationships (jobs) in approximately 70,000 companies. Regarding employment relationships, it needs to be specified that the SES is a case and not a personal or individual survey and that it does not provide information on the number of employees or whether a given job is held as the main occupation or a second job. We restricted our sample to employees older than 18 years of age and excluded those who were partially retired as well as apprentices, trainees, and interns. This leaves us with a sample of 978,817 jobs in 70,303 companies.¹ Due to the large sample size and the large set of characteristics, the SES allows for sophisticated analyses on both individual and organizational levels (Amlinger/Bispinck 2013).

The SES data makes it possible to calculate gross hourly wages based on the gross monthly wages and working hours surveyed. The information it provides on earnings uses the month of April of the year 2014. The SES data allows us to separately identify total overtime pay (including overtime premiums) and the sum of other premium payments (for shift work; night work; and work on Saturdays, Sundays, and public holidays). We use the total gross earnings, without overtime pay and without annual bonuses, as the main variable to calculate gross hourly wages. The survey of working hours in the SES 2014 refers to different working hour concepts in the reference period April 2014. Firstly, it gathers information on regular weekly working hours. This refers to the working hours agreed to under the employment contract, if applicable. Secondly, monthly paid working hours (without overtime) are surveyed. Thirdly, the companies are asked about their employees' monthly hours of paid overtime. Where companies do not provide information on the monthly hours paid, those hours are approximated using the contractually agreed-upon weekly working hours multiplied by the number of weeks per month (Statistisches Bundesamt 2016a). We use monthly paid working hours without paid overtime in this study to calculate the monthly working time and obtain our figure for gross hourly wages by dividing the total gross earnings by the monthly working time (Mindestlohnkommission 2018: 32 f.).²

1 The weighted number of jobs in our sample amounts to 35.4 million. This is roughly the number reported by the German Federal Employment Agency (FEA). The statistics of the FEA establish about 36 million employees for April 2014 (Bundesagentur für Arbeit 2015).

2 Additionally, to check the robustness of our results, we calculated hourly wages by dividing monthly paid hours, including overtime pay but without annual bonuses, by paid monthly working hours and paid overtime. We then replicated some of the estimations (see Figures 5–7 in the appendix). These robustness checks indicate only slightly different results. In summary, our findings remain the same irrespective of the method of calculating the hourly wages.

As dependent variables we use different income thresholds which are based on gross hourly wages. One of these is the statutory minimum wage of 8.50 euros gross per hour, introduced in Germany in 2015, and the other is the low-pay threshold, which is defined as two-thirds of the median wage. In 2014 the low-wage threshold amounted to a gross hourly wage of 9.80 euros. Thus, we calculated 2 dummy variables to specify whether a job pays more or less than 8.50 euros and more or less than 9.80 euros. Additionally, 2 metric variables indicate the distance between the hourly wage and the minimum- or low-wage threshold for jobs paying below these thresholds.

Central indicators of the analyses are various individual and company characteristics as well as information on the industrial sector. Individual characteristics include sex, age, the highest attained education level, tenure, employment status (full-time, part-time, or marginal),³ type of contract (fixed-term or permanent), and whether the employment is temporary or regular. Company-level characteristics include the region where the company is located (northwest – including Berlin –, northeast, west, and south), information on whether or not the company is bound by sectoral collective or company collective agreement, the size of the company (whether the number of jobs is < 5, 5–49, 50–249, or 250 and more), and gender distribution. Industrial sectors are classified according to the Statistical Classification of Economic Activities (NACE, Rev. 2), excluding the categories “Activities of households as employers, undifferentiated goods- and services-producing activities of households for own use” and “Activities of extraterritorial organizations and bodies” because they are not part of the sample. Regression models additionally control for sub-major occupational groups of the ISCO-08 classification. Because we use occupations only for control reasons, we do not display them in our tables and figures.

First, descriptive analyses give an overview of low-paid workers and low-wage companies as well as minimum-wage workers and minimum-wage companies. In a second step, random intercept-only models are estimated to assess the explanatory power of the individual, company, and industry levels. Finally, logistic and linear regressions are performed to estimate individual and company-level characteristics on the risk of earning minimum wage or low wages and on the distance between a worker’s actual earnings and the minimum- and low-wage thresholds. The multivariate analyses are performed using data covering jobs, companies, and industries. This structuring of the data from the level of jobs to industries is an important aspect when choosing an estimation procedure. Moulton (1986, 1990) has noted that the inclusion of meso- and macro-level variables in a standard

³ Marginal employment refers to jobs with maximum earnings of 450 euros gross per month, which are exempt from social security contributions for employees.

regression analysis in which observations are assumed to be independent leads to an inefficient estimation of the coefficients and to biased standard errors. Therefore, in the first step, multilevel models are estimated because they allow a grouping of jobs i within companies j nested in industries k by considering residuals at the company and industry levels. These residuals represent unobserved characteristics that cause correlations between outcomes for jobs from the same company and industry. The empirical analyses are performed with the following 3-level random intercept-only model (Rabe-Hesketh/Skrondal 2008):

$$y_{ijk} = \beta_0 + C_{jk}^{(2)} + C_k^{(3)} + \varepsilon_{ijk}$$

in which β_0 represents the regression constant; $C_{jk}^{(2)}$ and $C_k^{(3)}$ denote the random effects that are assumed to be independent not only of each other but also across clusters. $C_{jk}^{(2)}$ is also assumed to be independent across units. ε_{ijk} is the error term. In the third step we estimate logit models for binary variables and linear OLS models with cluster-robust standard errors (Wooldridge 2012a, b).

4 Empirical findings

4.1 Descriptives

In Germany for the observed period in 2014, about 11 % of jobs pay below the minimum-wage threshold of 8.50 euros and about 21 % below the low-wage threshold of 9.80 euros (Table 1).⁴ The average gross hourly wage amounts to 16.99 euros. In the minimum-wage and low-wage ranges, the mean wages are 7.01 euros and 7.99 euros, respectively. Taking all jobs into account, the median wage is 14.70 euros; in the minimum-wage and low-wage sectors, the median wages are 7.40 euros and 8.30 euros, respectively. Overall, about 49 % of workers are female; about 14 % of women earn less than 8.50 euros and about 26 % less than 9.80 euros. This percentage of working women in minimum- or low-wage jobs is significantly higher than the corresponding share of men. On average, women earn 4.14 euros less than men; however, there is almost no difference in remuneration levels for males and females in minimum-wage and low-wage jobs.

⁴ The deviation from the share of low-wage earners of 18.9 percent in the OECD (2018) report can mainly be explained by the fact that OECD's number is based on full-time employees only.

Table 1: Individual-level characteristics of jobs in Germany, 2014.

		All jobs	Minimum-wage jobs < 8.50 euros	Low-wage jobs < 9.80 euros
	Percentage of all workers	100 %	11.01 %	21.02 %
	<i>Mean wage in euros</i>	16.99	7.01	7.99
	<i>Median wage in euros</i>	14.70	7.40	8.30
Gender	Women	49.34 %	13.77 %	26.38 %
	<i>Mean wage in euros</i>	14.89	7.06	8.02
	Men	50.66 %	8.32 %	15.79 %
	<i>Mean wage in euros</i>	19.03	6.95	7.94
Age	18–24 years old	6.14 %	26.38 %	42.99 %
	<i>Mean wage in euros</i>	10.99	6.88	7.71
	25–34 years old	20.48 %	10.32 %	19.87 %
	<i>Mean wage in euros</i>	15.17	7.03	8.00
	35–44 years old	21.70 %	8.47 %	17.56 %
	<i>Mean wage in euros</i>	17.93	7.08	8.12
	45–54 years old	30.32 %	8.45 %	17.26 %
	<i>Mean wage in euros</i>	18.68	7.10	8.11
	55–64 years old	18.37 %	10.95 %	20.68 %
	<i>Mean wage in euros</i>	17.90	7.04	8.00
	65 years and older	2.98 %	29.09 %	49.11 %
	<i>Mean wage in euros</i>	12.11	6.79	7.71
Highest attained education level	No vocational training	8.61 %	18.38 %	35.94 %
	<i>Mean wage in euros</i>	12.44	6.96	7.99
	Vocational training/ master craftsman	55.73 %	7.64 %	15.22 %
	<i>Mean wage in euros</i>	16.37	7.15	8.11
	Polytechnic/university degree	15.56 %	1.47 %	2.73 %
	<i>Mean wage in euros</i>	27.22	6.84	7.87
	unknown	20.10 %	24.60 %	44.85 %
<i>Mean wage in euros</i>	12.74	6.92	7.89	
Employment status	Full-time employment	59.57 %	4.19 %	9.33 %
	<i>Mean wage in euros</i>	19.70	7.27	8.26
	Part-time employment	24.14 %	10.02 %	21.35 %
	<i>Mean wage in euros</i>	15.42	7.24	8.23
	Marginal employment	16.29 %	37.42 %	63.26 %
<i>Mean wage in euros</i>	9.39	6.82	7.73	
Type of contract	Permanent contract	87.26 %	10.23 %	19.26 %
	<i>Mean wage in euros</i>	17.53	7.02	7.98
	Fixed-term contract	12.74 %	16.39 %	33.07 %
	<i>Mean wage in euros</i>	13.25	6.98	8.04

(continued)

Table 1: (continued)

		All jobs	Minimum-wage jobs < 8.50 euros	Low-wage jobs < 9.80 euros
Temporary vs. regular work	Regular work	98.26 %	11.00 %	20.66 %
	<i>Mean wage in euros</i>	17.08	7.00	7.97
	Temporary work	1.74 %	11.79 %	41.35 %
	<i>Mean wage in euros</i>	11.56	7.71	8.59
Tenure	0–4 years	42.05 %	18.47 %	34.52 %
	<i>Mean wage in euros</i>	13.68	6.98	7.95
	5–9 years	18.54 %	10.15 %	19.87 %
	<i>Mean wage in euros</i>	16.59	7.08	8.06
	10 and more years	39.40 %	3.46 %	8.94 %
	<i>Mean wage in euros</i>	20.71	7.11	8.14
Number of observations	978,817	110,019	234,720	

All indicators are population-weighted to correct for sex, region, type of employment, and company size.

Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014; own calculations.

Although only 6 % of employees are younger than 25, their share in the minimum-wage range (26 %) or low-pay range (43 %) is very high. This also applies to workers older than 64 years. About 9 % of employees have not completed vocational training; they have the largest share in the minimum-wage range (18 %) or low-wage range (36 %), but also about 15 % of those with a vocational qualification receive low pay. About 60 % of jobs in Germany are full time, 24 % are part time, and 16 % are marginal positions. With regard to the marginal employees, 37 % are paid below the minimum wage and 63 % below the low-pay threshold. They earn significantly lower hourly wages (9.39 euros) than part-time workers (15.42 euros) or full-time workers (19.70 euros). Furthermore, the average remuneration for the marginally employed, who are paid in the minimum-wage or low-wage range, only amounts to 6.82 euros and 7.73 euros, respectively. Marginal employment applies to all branches, even in higher-wage industries, and to varying extents. The marginally employed often earn less than minimum wage, even in firms with higher sectoral or company collective agreements (see Table 5). Sixteen percent of workers with fixed-term contracts find themselves in minimum-wage employment, and 33 % are in low-paid employment. These are significantly higher shares than for permanent employees. About 41 % of temporary work consists of low-wage jobs, but the proportion of temporary jobs below the

minimum-wage threshold is not above average. This is due to sectoral collective agreements negotiated for this branch of the economy. Job tenure seems to be an important factor regarding minimum- and low-wage employment: the share of minimum-wage jobs (18 %) and low-wage jobs (35 %) in short-tenured employment clearly exceeds the percentage of such jobs in longer-tenured employment.

In Table 2 company-level characteristics of jobs in Germany are described. It becomes obvious that the larger the company, the smaller the proportion of jobs below the minimum-wage and low-wage thresholds. Small companies with fewer than 5 employees have the highest share of minimum-wage jobs (23 %) or low-wage employment (42 %). They also pay the lowest average wages in total as well as the lowest average minimum wage (6.95 euros) and low wage (7.93 euros). Regarding regional differences, Table 2 shows that companies located in the northeastern part of Germany have the greatest proportions of minimum-wage jobs (23 %) and low-wage employment (34 %); these companies

Table 2: Company-level characteristics of jobs in Germany, 2014.

		All jobs	Minimum-wage jobs < 8.50 euros	Low-wage jobs < 9.80 euros
Size of company	Percentage of all workers	100 %	11.01 %	21.02 %
	<i>Mean wage in euros</i>	16.99	7.01	7.99
	Fewer than 5 employees	7.98 %	23.48 %	41.86 %
	<i>Mean wage in euros</i>	11.88	6.95	7.93
	5–49 employees	32.94 %	16.37 %	29.13 %
	<i>Mean wage in euros</i>	14.11	7.06	8.16
	50–249 employees	24.13 %	9.37 %	19.93 %
	<i>Mean wage in euros</i>	16.79	7.12	8.16
	250 and more employees	18.21 %	4.75 %	11.04 %
	<i>Mean wage in euros</i>	20.61	6.78	8.12
Region in Germany	unknown number of employees	16.75 %	3.71 %	7.54 %
	<i>Mean wage in euros</i>	21.42	6.74	7.97
	Northeast, excluding Berlin	13.53 %	22.54 %	34.05 %
	<i>Mean wage in euros</i>	13.66	6.87	7.61
	Northwest, including Berlin	19.90 %	10.83 %	21.53 %
	<i>Mean wage in euros</i>	16.62	7.05	8.05
	West	35.17 %	9.67 %	19.83 %
	<i>Mean wage in euros</i>	17.54	7.08	8.10
South	31.40 %	7.65 %	16.40 %	
<i>Mean wage in euros</i>	18.03	7.08	8.15	

(continued)

Table 2: (continued)

		All jobs	Minimum-wage jobs < 8.50 euros	Low-wage jobs < 9.80 euros
Presence or type of collective agreement	Company not bound by a collective agreement	42.22 %	18.22 %	31.99 %
	<i>Mean wage in euros</i>	14.46	6.98	7.87
	Sectoral collective agreement	32.49 %	5.14 %	13.47 %
	<i>Mean wage in euros</i>	18.77	7.28	8.42
	Company collective agreement	5.39 %	3.31 %	6.99 %
	<i>Mean wage in euros</i>	19.90	6.84	8.04
	unknown	19.90 %	7.39 %	13.87 %
	<i>Mean wage in euros</i>	18.65	6.93	7.92
Gender distribution	More men in company	13.72 %	8.83 %	16.27 %
	<i>Mean wage in euros</i>	17.85	6.88	7.86
	More women in company	86.28 %	11.36 %	21.77 %
	<i>Mean wage in euros</i>	16.85	7.03	8.01
Number of observations		978,817	110,019	234,720

West = North Rhine-Westfalia, Hesse, Rheinland-Palatinate, Saarland; South = Baden-Wuerttemberg, Bavaria. All indicators are population-weighted to correct for sex, region, type of employment, and company size.

Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014; own calculations.

also pay below-average wages. About 42 % of all jobs are in companies that are not bound by a collective agreement. Of these jobs, 32 % pay below the low-wage threshold, and 18 % even pay below the minimum-wage threshold. In comparison, employees in companies bound by sectoral or company collective agreements are much better protected from low wages. This is also shown in the Pen's Parade in Figure 1, which depicts the distribution of hourly wages according to collective bargaining coverage. However, as the Pen's Parade illustrates, company collective agreements lead to higher earnings in the lower income bracket up to the 4th decile compared to sectoral collective agreements. For a similar illustration of the Pen's Parade, see Burauel et al. (2018). While the low-wage threshold is reached at the 7th percentile in the case of company collective agreements, it is not reached until the 13th percentile by sectoral collective

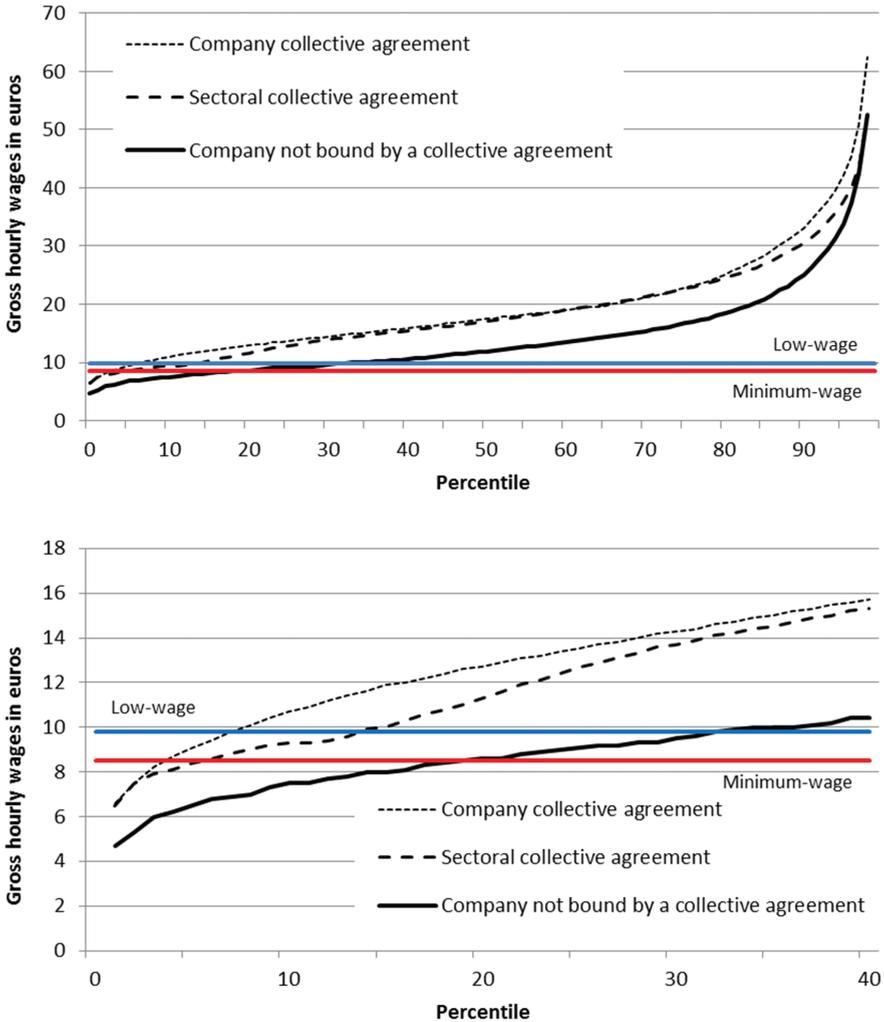


Figure 1: Distribution of hourly wages according to collective bargaining coverage (Pen’s Parade).

All indicators are population-weighted to correct for sex, region, type of employment, and company size.

Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014; own calculations.

agreements. If the company is not bound by a collective agreement, the low-wage threshold is reached at the 32th percentile. According to Table 2, the distribution of men and women in companies is also correlated with wages

levels. In companies where men make up most of the workforce, smaller proportions of workers receive pay that is below the minimum-wage or low-wage thresholds.

Table 3 shows the sectoral characteristics of jobs in Germany. It becomes clear that in some sectors jobs that pay below the minimum-wage and low-wage thresholds are relatively rare. This is true of the following sectors: “Public administration and defence as well as compulsory social security”, “Mining and quarrying”, “Electricity, gas, steam, and water supply”, “Financial and insurance activities”, and “Education”. However, there are large proportions of low-wage and minimum-wage jobs in the sectors “Accommodation and food service activities”, “Agriculture, Forestry, and Fishing”, “Arts, entertainment, and recreation”, “Administrative and support service activities”, and “Transportation and storage”. One notable point is that in the sectors with large proportions of workers earning low and minimum wages, the share of marginally employed is also comparatively high (see Table 5). In summary, with regard to the sectors, there is great heterogeneity in low-pay risk factors and wage levels.

Table 3: Sectoral characteristics of jobs in Germany, 2014.

	All jobs	Minimum-wage jobs < 8.50 euros	Low-wage jobs < 9.80 euros
Percentage of all workers	100 %	11.01 %	21.02 %
<i>Mean wage in euros</i>	<i>16.99</i>	<i>7.01</i>	<i>7.99</i>
Agriculture, Forestry, and Fishing	0.91 %	33.42 %	53.79 %
<i>Mean wage in euros</i>	<i>10.62</i>	<i>7.08</i>	<i>7.81</i>
Mining and quarrying	0.18 %	1.12 %	3.72 %
<i>Mean wage in euros</i>	<i>20.83</i>	<i>7.42</i>	<i>8.60</i>
Manufacturing	18.59 %	5.32 %	10.70 %
<i>Mean wage in euros</i>	<i>20.09</i>	<i>7.10</i>	<i>8.09</i>
Electricity, gas, steam, and water supply	1.33 %	2.00 %	7.52 %
<i>Mean wage in euros</i>	<i>20.92</i>	<i>7.08</i>	<i>8.48</i>
Construction	4.98 %	4.59 %	10.34 %
<i>Mean wage in euros</i>	<i>15.27</i>	<i>6.99</i>	<i>8.18</i>
Wholesale and retail trade; repair of motor vehicles and motorcycles	13.95 %	15.15 %	26.22 %
<i>Mean wage in euros</i>	<i>14.82</i>	<i>7.12</i>	<i>7.94</i>
Transportation and storage	5.38 %	21.08 %	31.98 %
<i>Mean wage in euros</i>	<i>13.88</i>	<i>6.61</i>	<i>7.44</i>
Accommodation and food service activities	4.39 %	44.76 %	67.84 %
<i>Mean wage in euros</i>	<i>9.37</i>	<i>6.95</i>	<i>7.63</i>
Information and communication	2.85 %	7.91 %	12.46 %

(continued)

Table 3: (continued)

	All jobs	Minimum-wage jobs < 8.50 euros	Low-wage jobs < 9.80 euros
<i>Mean wage in euros</i>	23.45	6.61	7.50
Financial and insurance activities	2.78 %	2.60 %	5.46 %
<i>Mean wage in euros</i>	24.07	7.04	8.10
Real estate activities	1.28 %	15.30 %	31.17 %
<i>Mean wage in euros</i>	14.79	6.93	7.99
Professional, scientific, and technical activities	5.82 %	7.07 %	13.25 %
<i>Mean wage in euros</i>	20.84	6.66	7.78
Administrative and support service activities	7.40 %	16.28 %	49.26 %
<i>Mean wage in euros</i>	11.83	7.42	8.57
Public administration and defence; compulsory social security	6.69 %	1.36 %	2.73 %
<i>Mean wage in euros</i>	19.56	6.85	8.00
Education	6.21 %	2.93 %	6.55 %
<i>Mean wage in euros</i>	19.60	6.75	8.04
Human health and social work activities	12.93 %	7.25 %	16.47 %
<i>Mean wage in euros</i>	16.18	7.18	8.25
Arts, entertainment, and recreation	1.24 %	30.90 %	44.01 %
<i>Mean wage in euros</i>	13.02	6.76	7.42
Other service activities	3.11 %	17.61 %	31.45 %
<i>Mean wage in euros</i>	14.94	7.04	7.91
Number of observations	978,738	110,019	234,720

All indicators are population-weighted to correct for sex, region, type of employment, and company size.

Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014; own calculations.

Against this backdrop, in the next section the significance of the individual, company, and sectoral levels regarding their power to explain low-wage or minimum-wage employment are assessed.

4.2 Examination of the variance components

We use estimates for 3-level logistic random intercept models to analyse the probability of being employed in the low-wage or minimum-wage sector and to assess the distance to both thresholds. In models without explanatory variables (intercept-only models), the variance in the outcome variable can be decomposed into proportions associated with the individual level, the company level,

and the industry level. For this purpose, the random part of the 3-level models is explored by considering the estimated residual intraclass correlation ρ of the latent responses. It is assumed that in models on the risk of earning minimum wage or low wages, the level-1 error variance is equal to $\pi^2/3$ for the logistic link function while $\psi^{(2)}$ is the variance between companies and $\psi^{(3)}$ the variance between industrial sectors (Rabe-Hesketh/Skrondal 2008). We thus obtain for the similarity of employees i within the same industrial sector k :

$$\rho(\text{sector}) = \frac{\psi^{(3)}}{\psi^{(2)} + \psi^{(3)} + \pi^2/3}.$$

Within the same company j (and the same industrial sector k), we get:

$$\rho(\text{company}) = \frac{\psi^{(2)}}{\psi^{(2)} + \psi^{(3)} + \pi^2/3}.$$

In the linear intercept-only models on the distance between a worker's actual earnings and the minimum- and low-wage thresholds, the level-1 error variance is θ . Thus, the similarity of employees i within the same industrial sector k is:

$$\rho(\text{sector}) = \frac{\psi^{(3)}}{\psi^{(2)} + \psi^{(3)} + \theta}.$$

Within the same company j (and the same industrial sector k), we get:

$$\rho(\text{company}) = \frac{\psi^{(2)}}{\psi^{(2)} + \psi^{(3)} + \theta}.$$

Table 4 shows random-intercept models without explanatory variables. The values of the random part denote that 46.85 % of the differences in the employment situation regarding being employed in a low-wage job or being not is explained by the company level, 28.35 % by industrial sectors level, and 24.80 % by the individual level. Regarding the employment situation of being employed in a minimum-wage job or not, 52.06 % and 23.85 % of the differences can be attributed to the company level and industrial sector level, respectively; 24.09 % relate to the individual level. Regarding the differences in the distance between earnings and the low-wage threshold, 46.83 percent can be traced back to the company level, 4.26 % to the industrial sector level, and 48.9 % to the individual level. The company level and the industrial sector level account for 48.37 % and 3.45 %, respectively, of the differences in the distance to the minimum-wage threshold, and

Table 4: Estimation results for intercept-only models (3-level random intercept models without explanatory variables).

	Probability of earning low wage	Probability of earning minimum wage	Distance to low-wage threshold	Distance to minimum-wage threshold
Residual variance (industrial sectors)	3.762	3.111	0.086	0.055
Residual variance (companies)	6.216	6.791	0.944	0.772
Residual variance (individual level)	3.289	3.289	0.986	0.769
Relative importance of industrial sectors	28.35	24.09	4.26	3.45
Relative importance of companies	46.85	52.06	46.83	48.37
Relative importance of individual level	24.80	23.85	48.91	48.18
Number of industrial sectors*	45	45	45	45
Number of companies	70,303	70,303	46,829	28,804
Number of jobs	978,817	978,817	196,851	110,019
LR test vs. logistic model	653.02	430.40	447.70	218.39
Prob > chi ²	0.000	0.000	0.000	0.000

*In the intercept-only models all 45 industries contained in the dataset were used.

Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014; own calculations.

the individual level accounts for the remaining 48.18 %. These results indicate – in line with findings from Card et al. (2013) – strong explanatory power of the company level regarding the risk of being employed in the minimum-wage or low-wage segment of the workforce and regarding the distance to both thresholds in the German labour market. Industrial sectors especially influence the risk of earning low or minimum wages, but they are to a lesser extent associated with the distance to low- and minimum-wage thresholds. Individual characteristics explain more variance in the wage gap than in the probability of earning more or less than a low wage or minimum wage. However, it must be taken into account that these cross-sectional findings could be biased due to unobserved characteristics at the individual level or self-selection of employees with “good” characteristics into higher paying companies or industries. This would mean that the explanatory power of the company level and the sectoral level is overestimated to some extent.

Against the backdrop of the significance of the individual, company, and industry levels for being employed in the low-wage and minimum-wage

ranges, we discuss the determinants of these probabilities in the next section. Additionally, the hypotheses derived in Section 2 are tested there.

4.3 Estimates on individual-, company-, and industry-specific characteristics

In the left parts of Figures 2 to 4, the marginal effects of logit estimates on the probability of earning below the low-wage threshold (blue circles) and the minimum-wage threshold (red diamonds) are depicted. The right parts of the figures display coefficients from linear OLS regressions which indicate the distance between the gross hourly wage and the low-wage threshold (blue circles) and the minimum-wage threshold (red diamonds).⁵ Although the results are presented in 3 figures, they come from one estimation that included variables on individual, company, and industry levels (and controlled for occupations). In the following, only effects which are significant at the 95 % level at least are interpreted.

Individual determinants are shown in Figure 2. It clearly indicates that women are at a higher risk of being employed in the low-wage and minimum-wage sectors. However, the distance between actual earnings below minimum wage to the minimum-wage threshold is smaller for women. These findings are in line with hypothesis 1, that the incidence of minimum-wage and low-wage employment is higher among women than among men. An employee's highest attained educational level is a strong indicator of low- and minimum-wage risks. Both risks are greatly increased for workers who have not earned a vocational degree. Additionally, their wage gaps relative to both thresholds are comparatively large. In contrast, highly skilled employees exhibit lower risks of earning below the low- and minimum-wage thresholds. Thus, our findings support hypothesis 2, that the minimum and low-wage incidences of unskilled workers are higher compared to the incidences among higher-skilled workers. With increasing age, the probability of earning below the low-wage and the minimum-wage thresholds decreases, but so does the distance to both thresholds. Hence, hypothesis 3, that the probability of earning below the minimum-wage and low-wage thresholds decreases as workers age, cannot be rejected. With increasing tenure, the probability of earning below the low-wage and the minimum-wage thresholds as well as the wage gap to both thresholds slightly decreases. This is in line with hypothesis 4. Among the individual determinants, employment status has the strongest impact on the low-pay and minimum-wage risks. Employees in part-time jobs and especially those in marginal employment suffer from significantly higher low-wage and minimum-wage risks

⁵ The corresponding point estimates and standard errors are given in the Appendix in Table 6.

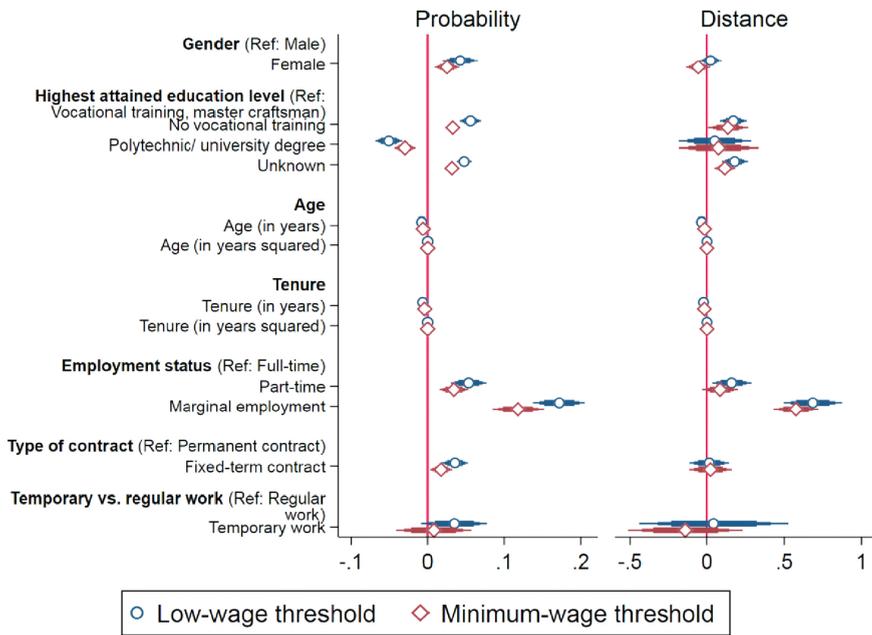


Figure 2: Estimates on individual determinants of earning below the low-wage and minimum-wage thresholds.

Standard errors are clustered at the industry level. The dependent variables “probability” are coded as dummy variables. The value 1 represents a job paying less than 9.80 euros (low-wage threshold) or 8.50 euros (minimum-wage threshold); the dependent variables “distance” are metric and denote the gap between the hourly wage and the low or minimum wage. In the case of binary logit estimates, the average marginal effects are shown. Although the results are presented in Figures 2–4, they come from one estimation that included individual-, company-, and industry-level variables. Regression models additionally control for 40 sub-major occupational groups of the ISCO-08 classification. Spikes are drawn for 99.9 %, 99 %, and 95 % confidence intervals.

Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014; own calculations.

compared to full-time employees. Wages in marginal employment, in particular, are far below both thresholds. Thus, hypothesis 5 cannot be rejected. The probability of minimum- and low-wage employment is increased in fixed-term jobs; the latter risk also applies to temporary employment. These findings support hypothesis 6, which predicts higher risks of low earnings for workers in atypical jobs.

Company-level determinants are displayed in Figure 3. Estimates on company size indicate that the likelihood of jobs paying below the low- or minimum-wage threshold increases in small companies with fewer than 5 or between 5 and 49

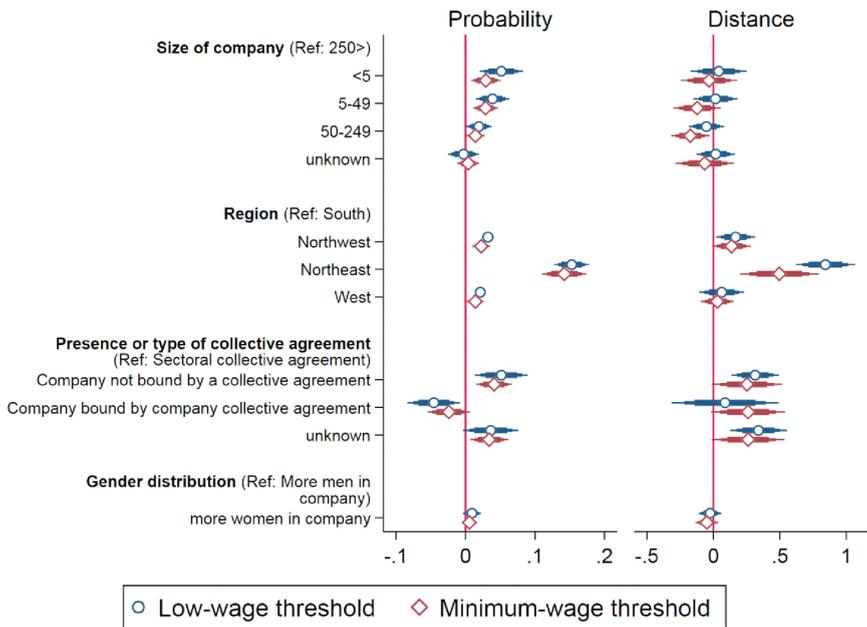


Figure 3: Estimates on company-level determinants of earning below the low-wage and minimum-wage thresholds.

Standard errors are clustered at the industry level. The dependent variables “probability” are coded as dummy variables. The value 1 represents a job paying less than 9.80 euros (low-wage threshold) or 8.50 euros (minimum-wage threshold); the dependent variables “distance” are metric and denote the gap between the hourly wage and the low or minimum wage. In the case of binary logit estimates, the average marginal effects are shown. Although the results are presented in Figures 2–4, they come from one estimation that included individual-, company-, and industry-level variables. Regression models additionally control for 40 sub-major occupational groups of the ISCO-08 classification. Spikes are drawn for 99.9%, 99%, and 95% confidence intervals. Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014; own calculations.

employees compared to large companies. This is line with hypothesis 7, which assumes a higher minimum- and low-wage incidence in smaller companies. The region in which a company is based also plays a major role. Especially in the northeast of Germany and to a lesser extent in the northwest, the risk of earning below the low-wage and minimum-wage thresholds is significantly higher compared to in the south. Furthermore, in the northeast of the country, the gap between low-wage earners’ pay and the low-wage threshold is remarkably big. These findings support hypothesis 8. The existence of collective agreements represents a significant

factor. Companies not bound by a collective agreement are more likely to pay wages below the low- or minimum-wage threshold. Additionally, the distances between hourly pay and the low- and minimum-wage thresholds are comparatively large. Company collective agreements reduce the low- and minimum-wage risks. These results are in line with hypothesis 9. Hypothesis 10 predicts a higher minimum- and low-wage incidence in female-dominated companies. Although the correlation is comparatively small, hypothesis 10 cannot be rejected.

Figure 4 illustrates the estimates on industry-specific determinants of earning below the low-wage and minimum-wage thresholds. These risks are strongly

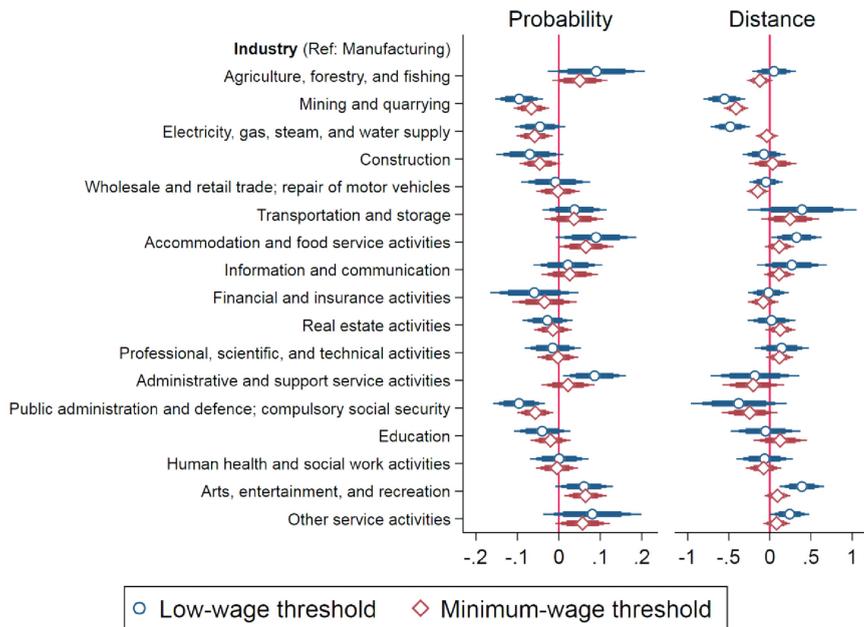


Figure 4: Estimates on industry-specific determinants of earning below the low-wage and minimum-wage thresholds.

Standard errors are clustered at the industry level. The dependent variables “probability” are coded as dummy variables. The value 1 represents a job paying less than 9.80 euros (low-wage threshold) or 8.50 euros (minimum-wage threshold); the dependent variables “distance” are metric and denote the gap between the hourly wage and the low or minimum wage. In the case of binary logit estimates, the average marginal effects are shown. Although the results are presented in Figures 2–4, they come from one estimation that included individual-, company-, and industry-level variables. Regression models additionally control for 40 sub-major occupational groups of the ISCO-08 classification. Spikes are drawn for 99.9%, 99%, and 95% confidence intervals.

Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014; own calculations.

increased in the industries “Accommodation and food service activities”, “Agriculture, forestry, and fishing”, “Other service activities”, and “Arts, entertainment, and recreation”. The wage gap in relation to both thresholds is particularly large in the industries “Transportation and storage”, “Accommodation and food service activities”, “Information and communication”, and “Arts, entertainment, and recreation”. These findings are in line with hypothesis 11.

5 Discussion of results and conclusions

Since the mid-1990s, the low-wage sector in Germany has gained in size to a level that is above average among developed countries (OECD 2018). In particular, earnings at the bottom end of the wage distribution have plunged sharply downwards. The resulting huge wage inequality in Germany was a decisive reason for the introduction of the statutory minimum wage in Germany in January 2015 (Bosch/Weinkopf 2014; Dustmann et al. 2014: 185).

Against this background, our aim was to empirically characterize the low-wage and the minimum-wage sectors in the year prior to the introduction of the statutory minimum wage. By now only a few studies have described these segments of the German labour market; they have explored the importance of individual factors in the incidence of low-wage labour but have only assessed structural determinants descriptively (Bosch/Kalina 2008; Bruttel et al. 2017; Kalina/Weinkopf 2015, 2017). For this reason, we took as our point of departure Coleman’s (1990) and Esser’s (1996) conceptual comments on the importance of the broader social context for individual behaviour and systematically explored the correlation between individual determinants, company-specific factors, and disparities between industries and the risks of earning wages below the minimum-wage and low-wage thresholds. Our descriptive and multivariate analyses were based on the Structure of Earnings Survey 2014, a rich dataset containing information on about 1 million jobs and about 70,000 companies from all industries.

First, we could descriptively show that in 2014, one year before the introduction of the German minimum wage, about 11 % of all jobs paid below the minimum-wage threshold of 8.50 euros gross per hour, and about 21 % of jobs paid below 9.80 euros, the threshold defining low-wage earnings.

Second, using estimated random-intercept models without explanatory variables, we could assess the explanatory power of the individual, company, and industry levels. The findings indicated that with regard to both the minimum- and the low-wage thresholds the company level shows the greatest explanatory power, followed by the industrial sector level and then the individual level. However,

differences in the distances between a worker's actual wage and the minimum- or low-wage thresholds can mainly be traced back to the individual and company level, while industrial sectors lose importance. These results sustainably confirm the conceptual considerations of Coleman (1990) and Esser (1996) that structural determinants are highly important when assessing individual behaviour.

Third, estimations of logit models for binary variables and linear OLS models indicated that women are at a higher risk of being employed in the low-wage and minimum-wage sectors. This is in line with gender pay gap research which explains wage differences between men and women as the result of interrupted employment careers and the associated losses in the stock of human capital and shorter job tenure (Cahuc et al. 2014: 481 f.). Low- and minimum-wage risks greatly increased and wage gaps relative to both thresholds were comparatively large for workers without a vocational degree; however, highly skilled employees were at lower risk of earning below the low- and minimum-wage thresholds. These results support the assumptions of human capital theory (Becker 1962, 1975; Mincer 1962; Oi 1962) that the amount of qualifications and skills workers possess are closely linked to their productivity and thus lead to higher wages. Age and tenure were slightly correlated with the likelihood of being minimum- or low-wage earners. Thus, the theoretical arguments of wage growth over the life cycle and seniority-based wage increases do not play an important role with regard to minimum and low wages. Part-time and especially marginally employed workers had the highest risks of earning low wages. These findings strongly indicate that marginal employment occupies a segment of companies' employment systems which serves to increase internal flexibility (Dütsch/Struck 2011), but at the same time it involves considerable disadvantages in terms of the earnings of the employees concerned. Fixed-term as well as temporary jobs exhibit a higher probability of low wages; these atypical forms of employment thus obviously form parts of the internal employment segment that serve to enhance the external flexibility of the staff (Brehmer/Seifert 2008) and provide inferior positions in companies.

Company-level determinants indicated that the probability of low pay was increased in small companies; this is in line with the assumption that they can provide employment opportunities, promotion prospects, and additional benefits only to a limited extent (Struck 2006). Our findings confirmed that economic and social inequality has a spatial dimension (Albrech et al. 2017), because companies based in northeast Germany more often offered low-paying jobs than companies in other regions. Additionally, companies not bound by a collective agreement were more likely to pay low wages. We can thus infer that companies tied to a collective agreement have a higher wage level (Addison 2016; Addison et al. 2010; Dustmann et al. 2009). That is because such agreements serve to regulate the lowest pay grades (Jirjahn/Stephan 2006). An important impact emanated from the specific sectors to

which companies belong. The risks of earning lower wages were strongly increased in the industries “Accommodation and food service activities”, “Agriculture, forestry, and fishing”, “Other service activities”, and “Arts, entertainment, and recreation”. The fact that the majority of these industries belong to the service sector confirms that the creation of value and the scope of distribution of profits are comparatively low in the service sector compared to the manufacturing industry.

From these findings we can conclude that although current research points to the significance of individual determinants in explaining low wages (Bosch/Kalina 2008; Bruttel et al. 2017; Kalina/Weinkopf 2015, 2017), fewer than 25 % of the differences in the employment situation regarding being employed in a minimum- or low-wage job are attributable to the individual level. On the contrary, characteristics of companies and large disparities between industries are significantly correlated with the risks of earning low pay or minimum wage. This picture changes a little when the gap between a worker’s actual earnings and the minimum-wage or low-wage threshold is considered, because in this instance the individual level acquires more explanatory power. With regard to substantive statements, future research should pay particular attention to the fact that several individual determinants, which descriptively suggest a high low-wage incidence, lose their explanatory power when company factors and industries are additionally controlled for in multivariate analyses. More generally, working in the “right” company in a high-wage industry reduces the risks of earning low pay to a greater extent than individual characteristics. On the other hand Mosthaf et al. (2011) show that there are “dead-end” companies which diminish the probability of escaping low-paying work.

As regards content, our study showed that highest attained educational level and employment status are particularly important factors in explaining low earnings. At the company level, the region in which a company is located and the company’s size both have a strong impact. After all, industries play a significant role in wage levels due to their great differences in employment conditions. Against this backdrop, it is important to note that risk-promoting circumstances often occur cumulatively. For instance, staying at a small company as a marginal employee can lead to low pay becoming a permanent state.

Our study has some limitations. One consideration is that the explanatory power of the company and sectoral levels could to some extent be overestimated in our empirical approach because the cross-sectional SES data does not allow us to account for either unobserved characteristics at the individual level or the self-selection of employees into certain kinds of companies. Furthermore, our data contains information on jobs, not on workers; this means that we cannot distinguish between primary and secondary jobs. Marginal employment in particular often constitutes a second job that is performed to obtain additional income. Also, there is no information in the dataset on household size, household characteristics,

work arrangements of other household members, etc. As Grunow et al. (2012) point out, women often take responsibility for child-rearing and tend to be disadvantaged in the labour market. They therefore face a higher probability than men of working in low-wage jobs. The significance of further household factors for employees' poverty risks are discussed by Bruckmeier and Becker (2018). Additionally, in Germany institutional settings such as the joint taxation of dual-earner couples provide an incentive for one of both partners to work in marginal jobs. Moreover, the SES does not contain information on the migration status; however, recent research has emphasized the significance of the migration status as a factor in types of employment (Kalina/Weinkopf 2018). Employees working in the private household sector are not included in the SES 2014. Given that these tend to be low-wage workers, the share of employees below the minimum-wage or low-wage threshold is even larger than our data indicates. In addition, the SES is only cross-sectional data and cannot be used for longitudinal questions. For example, earlier SES did not contain information about small companies and whole industries, as a result of which the data would not provide a good basis for retrospective comparisons. For these reasons, there are conceptual considerations for linking the SES with administrative longitudinal data of the Federal Employment Agency to increase the potential for analysis (Himmelreicher et al. 2017).

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Appendix

Table 5: Marginal employment across sectors in Germany, 2014.

	All jobs	Share of marginal employment	Share of marginal employment < 8.50 euros
Percent of all workers	100%	11.01%	25.63%
<i>Mean wage in euros</i>	16.99	7.01	8.36
Agriculture, Forestry, and Fishing	0.91%	26.17%	42.11%
<i>Mean wage in euros</i>	10.62	8.95	6.95
Mining and quarrying	0.18%	3.89%	18.25%
<i>Mean wage in euros</i>	20.83	10.74	7.38
Manufacturing	18.59%	6.73%	35.20%
<i>Mean wage in euros</i>	20.09	9.50	6.97
Electricity, gas, steam, and water supply	1.33%	4.66%	22.12%
<i>Mean wage in euros</i>	20.92	10.22	6.82
Construction	4.98%	12.32%	19.07%
<i>Mean wage in euros</i>	15.27	10.56	6.81
Wholesale and retail trade; repair of motor vehicles and motorcycles	13.95%	21.40%	45.61%
<i>Mean wage in euros</i>	14.82	9.12	7.03
Transportation and storage	5.38%	21.57%	59.36%
<i>Mean wage in euros</i>	13.88	8.01	6.31
Accommodation and food service activities	4.39%	44.77%	59.19%
<i>Mean wage in euros</i>	9.37	8.08	6.79
Information and communication	2.85%	12.13%	46.18%
<i>Mean wage in euros</i>	23.45	9.27	6.47
Financial and insurance activities	2.78%	6.62%	21.41%
<i>Mean wage in euros</i>	24.07	10.51	7.06
Real estate activities	1.28%	44.91%	26.08%
<i>Mean wage in euros</i>	14.79	9.97	6.85
Professional, scientific, and technical activities	5.82%	15.64%	27.80%
<i>Mean wage in euros</i>	20.84	10.42	6.51
Administrative and support service activities	7.40%	26.88%	24.36%
<i>Mean wage in euros</i>	11.83	9.33	7.08
Public administration and defence; compulsory social security	6.69%	3.38%	37.95%
<i>Mean wage in euros</i>	19.56	8.99	6.89
Education	6.21%	11.34%	12.99%
<i>Mean wage in euros</i>	19.60	10.89	6.96

(continued)

Table 5: (continued)

	All jobs	Share of marginal employment	Share of marginal employment < 8.50 euros
Human health and social work activities	12.93 %	13.38 %	25.46 %
<i>Mean wage in euros</i>	<i>16.18</i>	<i>10.28</i>	<i>6.95</i>
Arts, entertainment, and recreation	1.24 %	40.87 %	49.37 %
<i>Mean wage in euros</i>	<i>13.02</i>	<i>9.08</i>	<i>6.63</i>
Other service activities	3.11 %	27.03 %	30.55 %
<i>Mean wage in euros</i>	<i>14.94</i>	<i>10.11</i>	<i>6.82</i>
Number of cases	978,738	159,479	59,385

Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014. All indicators are population-weighted to correct for sex, region, type of employment, and company size; own calculations.

Table 6: Estimates on individual and structural determinants of earning below the low-wage and the minimum-wage thresholds.

	Probability of low-wage job	Probability of minimum-wage job	Distance to low-wage threshold	Distance to minimum-wage threshold
Gender (Ref.: male)				
female	0.042*** (0.007)	0.025*** (0.005)	0.024 (0.021)	-0.056* (0.023)
Highest attained education level (Ref.: Vocational training, master craftsman)				
No vocational training	0.056*** (0.004)	0.033*** (0.003)	0.173*** (0.025)	0.137*** (0.037)
Polytechnic/ university degree	-0.051*** (0.005)	-0.029*** (0.004)	0.051 (0.067)	0.076 (0.073)
Unknown	0.047*** (0.003)	0.031*** (0.003)	0.181*** (0.024)	0.117*** (0.019)
Age				
Age (in years)	-0.008*** (0.001)	-0.006*** (0.001)	-0.034*** (0.004)	-0.015*** (0.003)
Age (in years squared)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Tenure				
Tenure (in years)	-0.006*** (0.001)	-0.004*** (0.000)	-0.021*** (0.004)	-0.016** (0.005)

(continued)

Table 6: (continued)

	Probability of low-wage job	Probability of minimum- wage job	Distance to low-wage threshold	Distance to minimum-wage threshold
Tenure (in years squared)	0.000* (0.000)	0.000 (0.000)	0.000*** (0.000)	0.001*** (0.000)
Employment state (Ref.: Full-time)				
Part-time	0.053*** (0.007)	0.034*** (0.006)	0.161*** (0.036)	0.086* (0.033)
Marginal employment	0.172*** (0.010)	0.118*** (0.010)	0.687*** (0.054)	0.577*** (0.042)
Type of contract (Ref.: Permanent contract)				
Fixed-term contract	0.035*** (0.005)	0.017*** (0.004)	0.016 (0.037)	0.024 (0.039)
Temporary vs. regular work (Ref.: Regular work)				
Temporary work	0.035** (0.013)	0.008 (0.015)	0.044 (0.137)	-0.140 (0.106)
Size of company (Ref.: 250 >)				
< 5	0.052*** (0.010)	0.029*** (0.007)	0.040 (0.060)	-0.033 (0.061)
5-49	0.039*** (0.007)	0.029*** (0.005)	0.015 (0.047)	-0.123* (0.050)
50-249	0.019*** (0.006)	0.014*** (0.004)	-0.053 (0.038)	-0.174*** (0.041)
unknown	-0.003 (0.007)	0.004 (0.005)	0.018 (0.041)	-0.066 (0.063)
Region (Ref.: South)				
Northwest	0.032*** (0.003)	0.023*** (0.004)	0.167*** (0.042)	0.136** (0.041)
Northeast	0.153*** (0.008)	0.142*** (0.010)	0.843*** (0.064)	0.496*** (0.085)
West	0.021*** (0.002)	0.014*** (0.004)	0.062 (0.048)	0.029 (0.035)
Collective agreement (Ref.: Company bound by a sectoral collective agreement)				
Company not bound by a collective agreement	0.052*** (0.012)	0.041*** (0.008)	0.314*** (0.051)	0.252** (0.075)
Company bound by a company collective agreement	-0.046*** (0.012)	-0.024* (0.009)	0.087 (0.114)	0.261** (0.079)

(continued)

Table 6: (continued)

	Probability of low-wage job	Probability of minimum- wage job	Distance to low-wage threshold	Distance to minimum-wage threshold
unknown	0.036** (0.012)	0.034*** (0.008)	0.338*** (0.060)	0.262** (0.078)
Gender distribution (Ref.: more men in company)				
more women in company	0.009* (0.004)	0.006 (0.003)	-0.025 (0.024)	-0.050* (0.024)
Industry (Ref.: Manufacturing)				
Agriculture, forestry, and fishing	0.090* (0.036)	0.051* (0.020)	0.050 (0.075)	-0.120* (0.045)
Mining and quarrying	-0.096*** (0.018)	-0.066*** (0.013)	-0.552*** (0.073)	-0.410*** (0.043)
Electricity, gas, steam, and water supply	-0.046* (0.019)	-0.059*** (0.013)	-0.482*** (0.069)	-0.036 (0.039)
Construction	-0.070** (0.025)	-0.046** (0.015)	-0.071 (0.075)	0.035 (0.083)
Wholesale and retail trade; repair of motor vehicles	-0.008 (0.025)	-0.002 (0.016)	-0.046 (0.058)	-0.148*** (0.038)
Transportation and storage	0.038 (0.024)	0.036 (0.022)	0.392* (0.189)	0.247* (0.100)
Accommodation and food service activities	0.090** (0.030)	0.065** (0.020)	0.326*** (0.088)	0.116* (0.051)
Information and communication	0.022 (0.025)	0.026 (0.021)	0.267* (0.120)	0.114* (0.053)
Financial and insurance activities	-0.059 (0.032)	-0.035 (0.024)	-0.016 (0.071)	-0.080 (0.053)
Real estate activities	-0.028 (0.019)	-0.014 (0.014)	0.021 (0.083)	0.127* (0.052)
Professional, scientific, and technical activities	-0.015 (0.021)	-0.003 (0.015)	0.144 (0.094)	0.118* (0.047)
Administrative and support service activities	0.086*** (0.023)	0.022 (0.020)	-0.181 (0.154)	-0.202 (0.107)
Public administration and defence; compulsory social security	-0.096***	-0.057***	-0.378*	-0.245*

(continued)

Table 6: (continued)

	Probability of low-wage job	Probability of minimum- wage job	Distance to low-wage threshold	Distance to minimum-wage threshold
	(0.019)	(0.013)	(0.165)	(0.097)
Education	-0.040*	-0.020	-0.052	0.126
	(0.021)	(0.015)	(0.121)	(0.093)
Human Health and social work activities	0.001	-0.005	-0.064	-0.076
	(0.022)	(0.015)	(0.097)	(0.061)
Arts, entertainment, and recreation	0.061**	0.064***	0.390***	0.093*
	(0.021)	(0.016)	(0.077)	(0.045)
Other service activities	0.081*	0.057**	0.241***	0.083
	(0.036)	(0.020)	(0.067)	(0.047)
Constant	-1.096***	-2.447***	1.876**	0.992*
	(0.086)	(0.090)	(0.559)	(0.428)
Number of observations	978,817	978,817	196,851	110,019
Pseudo R ² /R ²	0.476	0.410	0.191	0.129
AIC	514,729	406,179	154.913	151.913
BIC	515,295	406,733	154.913	151.913
Wald-Chi ² /F-test	59,078	43,663	139,82	83.87
p	0.000	0.000	0.000	0.000
Correctly classified	88.12 %	90.67 %	-/-	-/-
Log pseudolikelihood (final)	-257,317	-214,231	-/-	-/-

Standard errors (in parentheses) are clustered at the company level. The dependent variables “probability” are coded as dummy variables. The value 1 represents a job paying less than 9.80 euros (low-wage threshold) or 8.50 euros (minimum-wage threshold); the dependent variables “distance” are metric and denote the gap between the hourly wage and the low or the minimum wage. In the case of binary logit estimates, the average marginal effects are shown. Regression models additionally control for 40 sub-major occupational groups of the ISCO-08 classification. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014; own calculations.

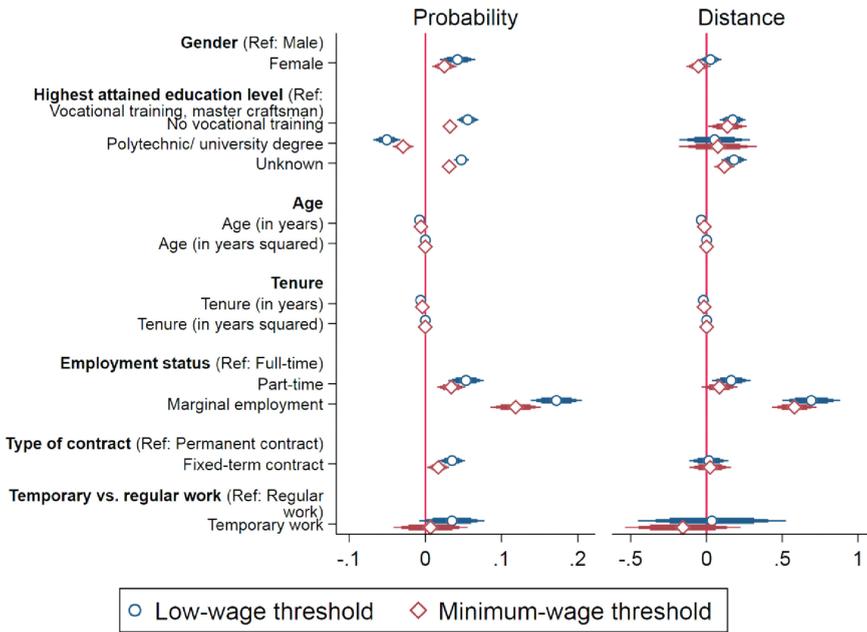


Figure 5: Robustness check for estimates on individual determinants of earning below the low-wage and minimum-wage thresholds using monthly wages including overtime pay and paid hours including overtime.

Standard errors are clustered at the industry level. The dependent variables “probability” are coded as dummy variables. The value 1 represents a job paying less than 9.80 euros (low-wage threshold) or 8.50 euros (minimum-wage threshold); the dependent variables “distance” are metric and denote the gap between the hourly wage and the low or minimum wage. In the case of binary logit estimates, the average marginal effects are shown. Although the results are presented in Figures 5–7, they come from one estimation that included individual-, company-, and industry-level variables. Regression models additionally control for 40 sub-major occupational groups of the ISCO-08 classification. Spikes are drawn for 99.9%, 99%, and 95% confidence intervals.

Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014; own calculations.

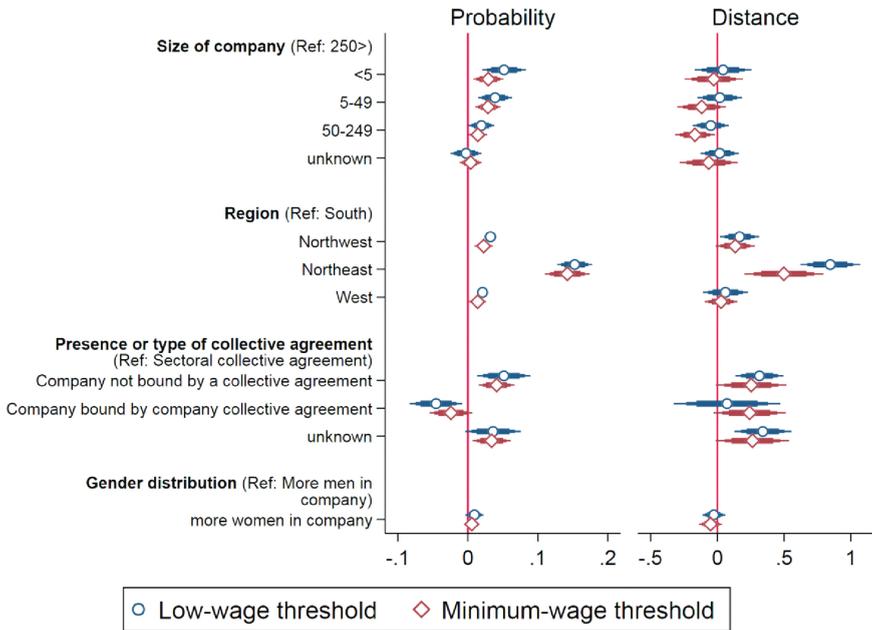


Figure 6: Robustness check for estimates on company-level determinants of earning below the low-wage and minimum-wage thresholds using monthly wages including overtime pay and paid hours including overtime.

Standard errors are clustered at the industry level. The dependent variables “probability” are coded as dummy variables. The value 1 represents a job paying less than 9.80 euros (low-wage threshold) or 8.50 euros (minimum-wage threshold); the dependent variables “distance” are metric and denote the gap between the hourly wage and the low or minimum wage. In the case of binary logit estimates, the average marginal effects are shown. Although the results are presented in Figures 5–7, they come from one estimation that included individual-, company-, and industry-level variables. Regression models additionally control for 40 sub-major occupational groups of the ISCO-08 classification. Spikes are drawn for 99.9%, 99%, and 95% confidence intervals.

Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014; own calculations.

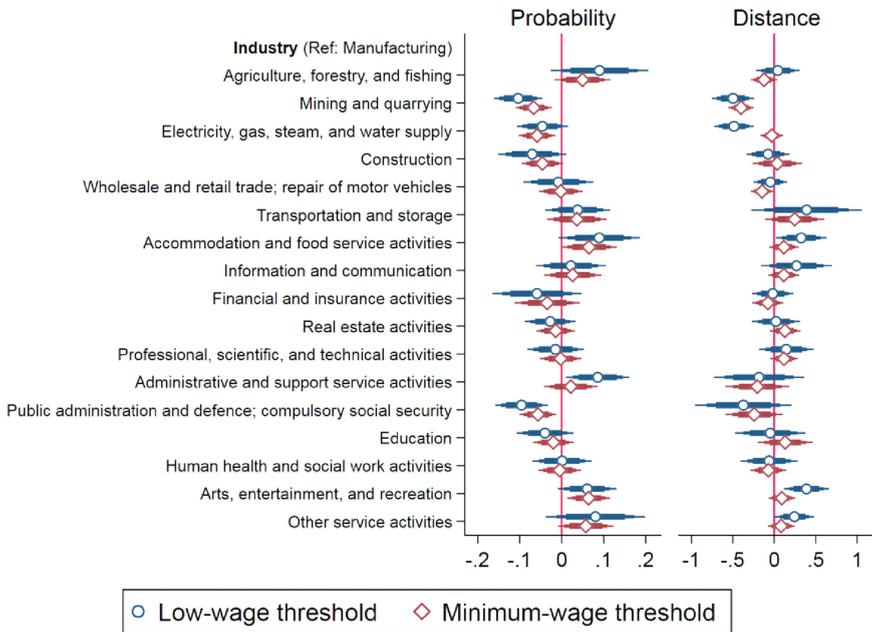


Figure 7: Robustness check for estimates on industry-specific determinants of earning below the low-wage and minimum-wage thresholds using monthly wages including overtime pay and paid hours including overtime.

Standard errors are clustered at the industry level. The dependent variables “probability” are coded as dummy variables. The value 1 represents a job paying less than 9.80 euros (low-wage threshold) or 8.50 euros (minimum-wage threshold); the dependent variables “distance” are metric and denote the gap between the hourly wage and the low or minimum wage. In the case of binary logit estimates, the average marginal effects are shown. Although the results are presented in Figures 5–7, they come from one estimation that included individual-, company-, and industry-level variables. Regression models additionally control for 40 sub-major occupational groups of the ISCO-08 classification. Spikes are drawn for 99.9 %, 99 %, and 95 % confidence intervals.

Source: Research data centres of the Statistical Offices of the Federation and the Länder, SES, 2014; own calculations.