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Effects of Unemployment on Wages: Differences between Types of Reemployment and Types of Occupation

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DFG Research Center (SFB) "From Heterogeneities to Inequalities"

Whether fat or thin, male or female, young or old – people are different. Alongside their physical features, they also differ in terms of nationality and ethnicity; in their cultural preferences, lifestyles, attitudes, orientations, and philosophies; in their competencies, qualifications, and traits; and in their professions. But how do such heterogeneities lead to social inequalities? What are the social mechanisms that underlie this process? These are the questions pursued by the DFG Research Center (Sonderforschungsbereich (SFB)) "From Heterogeneities to Inequalities" at Bielefeld University, which was approved by the German Research Foundation (DFG) as "SFB 882" on May 25, 2011.

In the social sciences, research on inequality is dispersed across different research fields such as education, the labor market, equality, migration, health, or gender. One goal of the SFB is to integrate these fields, searching for common mechanisms in the emergence of inequality that can be compiled into a typology. More than fifty senior and junior researchers and the Bielefeld University Library are involved in the SFB. Along with sociologists, it brings together scholars from the Bielefeld University faculties of Business Administration and Economics, Educational Science, Health Science, and Law, as well as from the German Institute for Economic Research (DIW) in Berlin and the University of Erlangen-Nuremberg. In addition to carrying out research, the SFB is concerned to nurture new academic talent, and therefore provides doctoral training in its own integrated Research Training Group. A data infrastructure project has also been launched to archive, prepare, and disseminate the data gathered.

Research Project B4 "Companies and Inequality: The Synchronic and Diachronic Inequality Effects of Temporary Layoffs (Recalls)"

Project B4 studies discontinuous employment in the context of employing organizations and households. First, it analyzes how and why flexible employment relationships arise from heterogeneous individual and organizational characteristics and preferences. Second, it examines the impact of interrupted membership in employing organizations upon inequality over time. Thus, different mechanisms that give rise to inequality (exclusion/inclusion, hierarchization, exploitation, and opportunity hoarding) are analyzed in more detail using a mixed-method design.

During the initial funding period, the project concentrates on "recalls" that can be characterized as discontinuous employment relationships with an interrupted membership in the same employing organization, i.e., when employees leave a company and are re-contracted after some time. Research on labor market flexibility and organizational boundaries mainly ignores this longitudinal form of atypical work. Our secondary analysis of the Linked Employer-Employee Data from the IAB shows that about 20% of new hires in a firm are recalls. Analyzing the German Socio-Economic Panel we additionally find that 10% of all people who changed a job during the last year are recalled. The analysis provides new insights into flexible work and discontinuous employment, the blurring of organizational boundaries, and mechanisms that generate inequality within organizations.

The mixed-method design combines qualitative and quantitative approaches as well as secondary analysis and field research. First, secondary analyses of the German Socio-Economic Panel Study (SOEP) and data from the German Institute for Employment Research (SIAB, BHP, and LIAB) aim to deliver results on individual and operational determinants of recalls and their consequences. Second, expert interviews within companies and a combination of narrative and semi-structured interviews with recalled employees are conducted to gain further insights into their rationale, appraisals, and practices. Information about recalls, individuals, and households included in the SOEP is used to obtain access to recalled employees within different contrast groups. A similar strategy is used for the expert interviews as sampling is based on information about the firm-specific use of recalls that is provided by the IAB's Establishment History Panel (BHP). The third component is a standardized telephone survey of employees that will be linked with information about employers in the IAB's Linked Employer-Employee Dataset (LIAB). This is used to analyze the statistical effect of different determinants and outcomes of recalls which have been discovered during the qualitative research.

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Effects of Unemployment on Wages:
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Susanne Edler, Peter Jacobebbinghaus, and Stefan Liebig

ABSTRACT

In this article, we examine the effects of unemployment on reentry wages in Germany. Based on the theories of signaling effects, human capital, and occupational segmentation, we discuss the heterogeneity of reemployment wages among different types of reemployment and among different occupations. The empirical analysis is based on the German social security records of the Linked Employer–Employee Data from IAB (LIAB). Our results indicate that the wage effects of unemployment vary considerably across occupations. First, occupations characterized by higher rates of participation in further education showed stronger negative effects of unemployment on reentry wages. This finding indicates that occupations that involve less technological change are associated with a slower depreciation of specific human capital. Second, the lost wages after unemployment are higher in occupations with a typically higher rate of unemployment, indicating that an oversupply of employees leads to lower bargaining power on the part of workers. Third, the negative effect of unemployment is reduced if employees are reemployed by a former employer within one year of dismissal. This finding reflects the fact that employers already know the productivity of former employees and can thus retain company-specific human capital.

Keywords: *unemployment, wage losses, occupational segmentation, recall employment, reemployment*

Being unemployed and living on unemployment benefits are usually related to a loss of wages and a decrease in social status. Even after reemployment, an employee's wages tend to be lower than they were before dismissal (Jacobson et al., 1993). In particular, the effect of lost wages can be severe if the period of unemployment is long or recurrent (Gregory and Jukes, 2001; Stevens, 1997). Previous research offers two major explanations for these negative effects of unemployment on wages, human capital theory (HCT) and signaling theory (ST). According to HCT, these negative effects arise because of an actual decrease in the employee's productivity due to the devaluation of human capital in times of unemployment (Becker, 1964; Mincer, 1974), whereas according to ST the decline in productivity does not have to be real but is an associated outcome. This latter interpretation means that previously unemployed workers suffer wage losses because the employee's unemployment status acts as a negative signal to employers because it suggests lower productivity (Spence, 1973; Connelly et al., 2011). Previous research based on these theories is founded mainly on the assumptions that there is homogeneity (a) across occupations and (b) among types of recruitment. These assumptions imply that the loss of human capital due to technological development is the same for different occupations, and that there are no differences regarding the type of reemployment whether someone is recalled by the same organization or takes a position in a different one.

Neither of these assumptions is plausible, however. Occupations differ with regard to the devaluation of skills and competencies due to technological change. The pace at which requisite human capital changes is related to innovation within the respective occupations. For example, in occupations that are more deeply affected by structural technological changes, professional knowledge becomes obsolete faster. Moreover, there are different types of reemployment. From the

perspective of ST, it should matter whether employees return to their previous employer who has already witnessed their productivity, or whether they enter a new company where such experience is lacking. In both cases, unemployment penalties should not be homogeneous regarding occupations and types of reemployment. This conclusion is the central assumption of this article.

Here we will address these issues and extend the current theoretical framework of HCT and ST by (a) adding the theory of occupational segmentation and (b) considering that reemployment can be either with the same company or a different one. This will allow us to explain differences in wage losses due to unemployment not only by nonhomogeneous decreases in the real or anticipated productivity of the employee but also by the occupation-specific labor markets. Occupational segmentation leads to variations in the supply of and demand for labor among the employees within the occupation. Moreover, wage losses can be avoided if employees return to an organization and an employer with whom they already had a work relationship.

The data used for the analysis consisted of German social security records contained in the Linked Employer–Employee Data (LIAB), as provided by the Institute for Employment Research (IAB). These data provide detailed information about workers' employment histories, enabling us to differentiate between types of reemployment and between occupations. Being able to observe all the employees in the workplace permitted us to estimate firm-fixed effect models, to control for unobserved company heterogeneity, and to investigate the reentry wages within work organizations.

In the next section, we discuss previous research on the wage effects of discontinuous employment in Germany and the theoretical explanations for these effects. There follows a discussion of theoretical arguments in which we develop our hypotheses for understanding wage differences among occupations and among types of reemployment. Thereafter, the data, methods, and variables used in the empirical analysis are described. In the main section, we present our empirical findings, and the final section summarizes the central findings.

EFFECTS OF UNEMPLOYMENT ON WAGES

Most research on the effects of unemployment shows that after the loss of a job, the wage-earning status of an unemployed individual is reduced, and future wages are likely to be lower than the wages received before the period of unemployment (Jacobson et al., 1993). Although earnings setbacks eventually decrease (Farber, 1993; Schmieder et al., 2010) and wage status can be recovered if the period of unemployment is fairly short, such setbacks can become irreversible as the duration and frequency of unemployment increase (Gregory and Jukes, 2001; Stevens, 1997).

Based on cross-national comparative research, the decrease in wages due to unemployment in Germany is not as great as it is in other developed countries, such as the United States or the United Kingdom. This can be explained by the enhanced type of unemployment insurance in Germany, which permits employees a longer time to find appropriate employment (Gangl, 2004, 2006). Results of studies of the effect on wages after a period of unemployment in Germany depend on the length of time the individual is unemployed and on the definition of the reference group. Bender et al. (2002) compared pre-displacement wages with wages received after reentry into the labor market for employees who were dismissed because of plant closure or for unknown reasons.

They found that the difference was much greater for employees who had been unemployed for more than one year; for these employees, the wage decrease was about 20 percent, in contrast to a decrease of only about 1 to 2 percent for employees who were reemployed within one year of dismissal. Similar results are found by Schmieder et al. (2010).

The theoretical approaches used in previous research have been based largely on human capital theory (HCT) and signaling theory (ST). In both cases, wages are considered to be set according to an employee's actual or anticipated productivity. Apart from educational attainment, human capital comprises on-the-job training and work experience. An individual invests in such human capital to achieve higher wages (Becker, 1964; Mincer, 1974). Thus, from the perspective of HT, after one enters the labor market, human capital continues to improve the longer one remains employed. In the case of unemployment, human capital that would be accrued on the job is interrupted. In addition, human capital may become reduced or obsolete owing to technological changes and advances. If the unemployment period is combined with a change of employer, the company-specific human capital typically acquired with increasing tenure is lost. From the perspective of ST, an employer anticipates a reduction in productivity after a worker has been unemployed. ST states that at the time of recruitment, employers usually have incomplete information about an employee's actual productivity. Employers therefore look for indicators of productivity (Spence, 1973), such as the course of an employee's career. Employers may attempt to obtain information about a worker's actual productivity from that individual's previous employers, and they assume that employees lacking abilities, skills, or motivation are more likely to lose their jobs. Therefore, having been dismissed in the past can be interpreted as a negative signal indicating lower productivity in the employee's future career path.

However, if one applies the arguments put forward in HCT and ST, the negative effect of unemployment on wages is likely to vary among different groups of employees. Losses of human capital during periods of unemployment may differ between employees because of the varying combinations and extent of human capital. Furthermore, at the time of recruitment, the full extent of an employee's human capital resources may not be available. And, if employers rely on signals such as employees' previous career courses to assess their productivity, it is possible that certain signals may be relevant whereas others are not. Previous studies of the effects of unemployment that differ among employee groups focus on gender aspects (Licht and Steiner, 1992; Mavromaras, 2003; Strauss and Hillmert, 2011;), differences in educational level (Farber et al., 1993), and age groups (Bender et al., 2002), but no studies of unemployment have explicitly considered its varying effects on wages among occupations, and research on unemployment effects among different types of reemployment is scarce (Edler and Hense, 2015; Kodrzycki, 2007; Burda and Mertens, 2001; Mavromaras, 2003).

Occupational Segmentation

The German labor market is largely structured according to occupations. The country's system of highly specialized training and vocational education is responsible for the tight closure of the labor market along occupational boundaries (Allmendinger, 1989; Esping-Andersen, 1993). Such strict segmentation results in occupations that encompass certain combinations of knowledge and skills that are in accordance with the functional division of labor in organizations. However, the demand

for such combinations of occupation-specific skills changes over time. Shifts in production technology require that certain skills be adapted and have caused a shift in the demand for labor from unskilled to skilled (Acemoglu, 2002). (In the research literature, this shift is known as "skill-biased technological change.") The faster these innovations occur, the more continuing education and on-the-job training will be needed. If quickly changing competencies are required, devaluation due to unemployment will also be greater. In occupations more severely affected by such changes, professional knowledge becomes obsolete faster because employees cannot update their skills in the workplace quickly enough (Grassinger, 1993). Hence, we propose the following hypothesis:

Hypothesis 1: The devaluation of human capital through unemployment is higher in occupations with faster technological development or changes in work procedures.

The above-mentioned alignment of vocational qualification, occupations, and organization of work (Jacob and Kupka, 2005: 28) creates occupational barriers that impede mobility among different occupations, a process referred to in the literature as "occupational closure" (Weeden, 2002). In this situation, a shortage of labor in one occupation cannot be offset by an oversupply of labor in another occupation, at least in the short run. Instead, occupational wages adapt if there is an imbalance between labor supply and demand. Moreover, employees who have been unemployed for longer periods have less bargaining power when negotiating their wages because employers may assume that they have no alternative job opportunities. This leads us to the next hypothesis:

Hypothesis 2a: The unemployment experience of employees in occupations with a relatively high level of unemployment is associated with wage losses.

However, an alternative hypothesis can be derived based on ST: the signaling effect of unemployment can also become less important if periods of unemployment are prevalent in the respective occupation. In cases in which macro-level factors are responsible for the high unemployment rate in a certain occupation, employers in these fields cannot fairly assess an employee's productivity based on that worker's period(s) of unemployment. Since in certain occupations levels of unemployment are more likely to be high, not only those employees who lack abilities, skills, or motivation will lose their jobs but also those employees who are highly productive. In this context, employers are not likely to perceive unemployment as a "signal" of lower productivity. With this argument in mind, we propose the following hypothesis:

Hypothesis 2b: In occupations characterized by a high level of unemployment, the incidence of unemployment loses its signaling function, and unemployment is not associated with lower reemployment wages.

Recall Employment and Company-Specific Human Capital

Although some studies have shown that recall employment is quantitatively important (Katz and Meyer, 1990; Nivorozhkin, 2008; Böheim, 2006), the issue of recall employment in studies of wage disparities after unemployment has rarely been considered. However, in the studies that do address this factor, it was shown that recalls can avert some of the negative effects of unemployment on wages (Kodrzycki, 2007; Burda and Mertens, 2001; Mavromaras, 2003; Edler and Hense, 2015). One explanation for higher wages after recalls is that "composite rents" can be captured (Edler and

Hense, 2015). Composite rents are created by a unique match between the specific human capital an employee possesses and that which an employer demands. With increasing tenure, employees accumulate company-specific human capital that generates composite rents. When employees who experienced unemployment become reemployed by a new employer, wage losses can be expected to be higher because of the loss of company-specific human capital. From the perspective of ST, wage losses due to unemployment are also higher for employees who move on to a new employer. Thus, unemployment loses its relevance as an indicator of productivity at the time of recruitment by a recall because employers already know the productivity level of a former employee. Since an employer does not want to lose company-specific human capital, and the unemployment of recalled employees no longer signals lower productivity, we can expect that employers will value the work of recalled employees more than the work of the newly employed. Therefore, we propose the following hypothesis:

Hypothesis 3: The negative effect of unemployment is smaller for recalled employees than for employees moving to a new employer.

DATA AND METHODS

Data

The main data source used in this study was the Linked Employer–Employee Data (LIAB) provided by the German Institute for Employment Research (IAB).[1] The LIAB data consist of process-generated data on employees from the German social security records that are linked with the IAB Establishment Panel, an annual panel survey of workplaces conducted by IAB. The sampling of the IAB Establishment Panel is stratified by region, industry, and company size and is representative of all workplaces in Germany with at least one employee who is subject to social security contributions (Fischer et al., 2008).

We used the LIAB Longitudinal Model 1993–2010 (LIAB LM 9310) (Klosterhuber et al., 2013), which is based on a sample of workplaces that took part in the IAB Establishment Panel in the years 2000 through 2008. The employment biographies of all employees who worked at some time between 1993 and 2010 can be linked if they were employed in one of these workplaces for at least one day during the years 1999 through 2009. We thus have information on all the employees who worked at these companies, and we are able to observe all entries and exits, as well as the complete wage structure, for any given day during this period of time.

Because civil servants, family employees, and the self-employed are not subject to social security contributions, they are not included in the sample. We selected all employees who had an employment interruption; were hired between June 30, 2007, and June 30, 2008; and were still employed at the end of that period. In order to exclude hires whose work was interrupted for parental leave, we used the approximation proposed by Schönberg (2009). Since we did not consider

[1] There are different versions of the Linked Employer–Employee Data from IAB (LIAB). We used the Longitudinal Model 1993–2010 (LIAB LM 9310). Access to the data was provided onsite at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) and subsequently by remote access.

numbers of hours worked, we restricted the sample to full-time employees 18 to 65 years of age. Finally, we limited the sample to companies with five or more recruitments in order to control for firm-fixed effects with sufficient accuracy. Our analysis sample consisted of 38,930 observations conducted at 1,323 companies.

To test Hypotheses 1 and 2, we needed data that related to occupations. Data from the German Socio-Economic Panel (Socio-Economic Panel, 2013) were used to calculate the extent of further training by occupation as a proxy for changing knowledge. The share of unemployment according to occupation was calculated using the Sample of Integrated Labour Market Biographies (SIAB) (vom Berge et al., 2013), a representative 2-percent sample of all employees subject to social security contributions.

Variables

Our dependent variable was the *log monthly wage* in euros. Since wages in the LIAB data are censored at the social security contribution threshold, we imputed the wages above the social security contribution threshold by means of Tobit regressions, as described in Gartner (2005).

As central explanatory variables we used unemployment experience, occupational group, and an indicator for recall employment, as well as two occupation–specific variables, namely (a) share of workers who take part in further training and (b) share of unemployment.

To measure unemployment experience, we included three explanatory variables. One was *duration of unemployment directly before the current job*, which was measured by a categorical variable with three categories: (1) no unemployment, (2) unemployment lasting up to one year, and (3) unemployment lasting longer than one year. Two additional variables were calculated: *frequency of unemployment incidences* and *share of days in unemployment during the employee's entire working life*. These two variables took into account all unemployment periods except the most recent one.

For the aggregation of occupations, we used the scheme developed by Germany's Federal Institute for Vocational Education and Training (BIBB). This scheme aggregates occupations into 54 groups, with each group exhibiting common core skills. The dimensions that clearly separate the occupational groups from one another are main professional activities, level of requirements, industries, and economic sectors (Tiemann et al., 2008).

Two variables were generated at the occupation level. The purpose of the first indicator was to measure the degree of technological development and change in the working procedures associated with a particular occupation. At regular four-year intervals, the German Socio-Economic Panel (GSOEP) provides information about employees' participation in further training *with the aim of adjusting skills to new demands in the current job*.[2] For each occupational group we calculated the

[2] Two questions were posed by the GSOEP:
1. "There are different opportunities available if one wants to educate oneself further. Think back on the last three years. Have you done any of the following in that time period to further your professional education?" The response category of interest in our study was "Participation in professionally oriented courses, including those which are still in progress."

share of participating individuals (see Table 3 in the Appendix). Because of the small number of observations in some occupations, we pooled the data for the years 2000, 2004, and 2008 to get a more robust indicator. We labeled this proxy variable 'share of further training in occupation'.

The purpose of the second indicator was to measure the degree of unemployment associated with an occupation. Because official statistics do not provide unemployment rates according to occupation, we created a proxy variable based on the SIAB data, defined as follows. First, we selected all employees per occupational group; then we computed the percentage of workers who still had no job one year later. Parental leaves were excluded from the calculation. Because information about the reason for the loss of employment was lacking, we did not know how many of these employees were available in the labor market. Therefore, it can be assumed that this indicator overestimated the true occupational unemployment rate. We labeled this variable 'share of unemployment in occupation' (see Table 3 in the Appendix).

We differentiated between two types of employees in reemployment: *employees who move on to another employer* and *recalled employees* who were reemployed by a former employer. A second variable was developed that captured the frequency of recall employments experienced throughout an employee's working life.

As control variables we included gender, formal education, age, federal state, and occupation. Formal education was coded into three groups: (1) low-skilled employees who did not complete vocational training (with or without a secondary or intermediate school-leaving certificate), (2) medium-skilled employees who completed vocational training (with or without a secondary or intermediate school-leaving certificate), and (3) highly-skilled employees who had graduated from a university of applied science or from a college or university. Age was divided by 10 to allow a better interpretation of the results.

Besides formal education, work experience is often used as a measure of human capital. Since we included age and share of days of unemployment during individuals' entire working life, work experience was indirectly measured and would be multicollinear. The variable 'occupational change' signifies observations that took place in an occupation that differed from the employee's last job. It is added as a control variable because human capital depreciation occurs if employees change their occupation.

Table 1, as well as Table 3 in the Appendix, provide the descriptive statistics for all the variables included in the analysis.

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2. "What was the purpose of this instruction?" The relevant response category was "Adjusting to new demands in my current job."

Table 1. Descriptive statistics for the variables analyzed

Variable	Mean	Std. Dev.	Min.	Max.
Monthly wage (€)	2,673.50	1,431.77	398.09	14,328.86
Gender				
Female	0.32	0.47	0.00	1.00
Male	0.68	0.47	0.00	1.00
Formal education				
Low	0.13	0.34	0.00	1.00
Medium	0.66	0.47	0.00	1.00
Higher	0.21	0.40	0.00	1.00
Age (divided by 10)	3.63	1.09	1.80	6.50
Federal state				
Schleswig-Holstein	0.02	0.14	0.00	1.00
Hamburg	0.04	0.19	0.00	1.00
Lower Saxony	0.07	0.25	0.00	1.00
Bremen	0.01	0.10	0.00	1.00
North Rhine–Westphalia	0.16	0.37	0.00	1.00
Hessen	0.05	0.21	0.00	1.00
Rhineland–Palatinate	0.06	0.24	0.00	1.00
Baden–Württemberg	0.09	0.29	0.00	1.00
Bavaria	0.13	0.33	0.00	1.00
Saarland	0.00	0.05	0.00	1.00
Berlin	0.05	0.22	0.00	1.00
Mecklenburg–Western Pomerania	0.05	0.23	0.00	1.00
Brandenburg	0.05	0.21	0.00	1.00
Saxony–Anhalt	0.08	0.27	0.00	1.00
Saxony	0.06	0.24	0.00	1.00
Thuringia	0.09	0.28	0.00	1.00
BIBB* occupational groups	*(See Table 3 in the Appendix)*			
Duration of unemployment				
No unemployment	0.54	0.50	0.00	1.00
1–365 days of unemployment	0.33	0.47	0.00	1.00
> 365 days of unemployment	0.13	0.34	0.00	1.00
Frequency of unemployment	2.65	2.75	0.00	36.00
Share of unemployment in the working life	0.17	0.20	0.00	0.97
Occupational change	0.53	0.50	0.00	1.00
Recall	0.17	0.37	0.00	1.00
Frequency of recalls	0.33	1.27	0.00	31.00
Share of unemployment in occupation	0.08	0.07	0.02	0.24
Share of further training in occupation	0.22	0.13	0.03	0.52
Number of observations	38,930			

* The German Federal Institute for Vocational Education and Training

Method

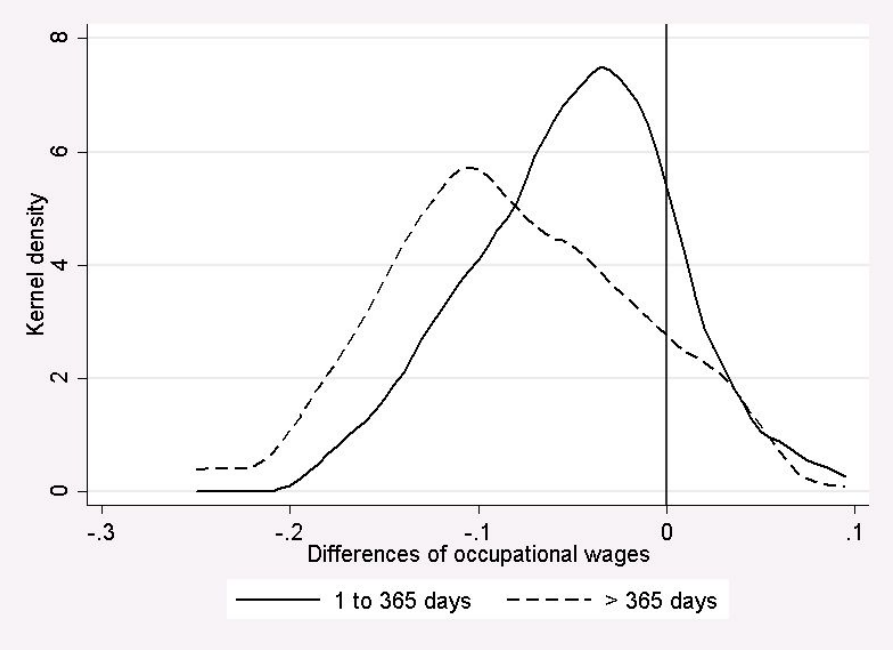
Since our focus was on the short-term effects of unemployment on reemployment wages, we restricted our sample to newly hired employees. We estimated a firm fixed effects regression model as a means of controlling for all company-level factors that determine the general (entry) wage level of a company and affect all that company's recruitments in the same way. Using this method, we controlled for a large share of the unobserved company-level heterogeneity and achieved unbiased estimates. We also conducted a Hausman specification test, which supports the use of a fixed-effect model by rejecting the null hypothesis of no company-specific fixed effects.

RESULTS

Descriptive Results

The kernel density estimates in Figure 1 confirm that the effect of unemployment on reemployment wages varies according to occupation. Controlling for human capital, we estimated the effect of unemployment on the log monthly wage for each occupation. The plots show the distribution of these unemployment effects for two categories based on the duration of unemployment: 1 to 365 days and more than 365 days. As one would expect, occupational wages after longer periods of unemployment tend to be lower when compared with the wages of employees moving to another employer without a long period of unemployment. Longer unemployment leads to a higher wage loss. For some occupations, we see a positive wage effect of unemployment. This effect can be attributed to unobserved factors at the individual level that we did not control for. Nevertheless, the plot shows that there are substantial differences in wage penalties among occupations. We then sought to find out what factors determine these differences.

Figure 1. Kernel density estimates of differences in occupational reemployment wages by duration of unemployment



Fixed-Effects Model

Table 2 shows the results when we examined fixed-effects regression models of the determinants of log monthly wages. Model 1 constitutes the basic model; in Models 2 and 3, interaction effects have been added. Because the dummies for occupations and the two occupation-level indicators (‘share of further training in occupation’ and ‘share of unemployment in occupation’) are multicollinear, Model 2 includes only occupational dummies, whereas Model 3 includes these two indicators. The results for Models 2 and 3 are very similar.

Table 2. Fixed-effects models (determinants of log monthly wages)

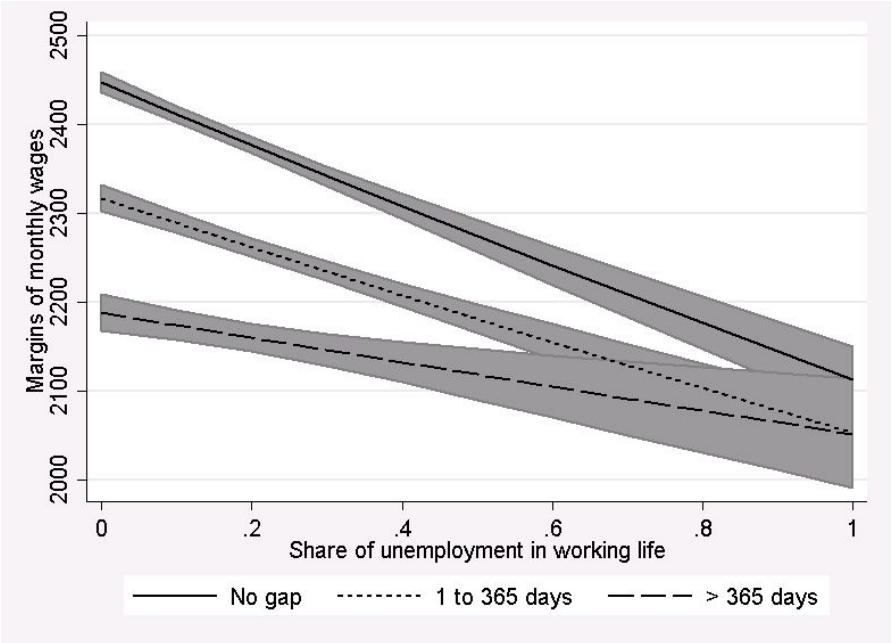
	Model 1	*Model 2*	*Model 3*
Women (ref.: men)	−0.098***	−0.097***	−0.109***
Education (ref.: low formal education)			
Medium formal education	0.071***	0.076***	0.081***
High formal education	0.242***	0.245***	0.326***
Age (divided by 10)	0.836***	0.944***	1.045***
(Age divided by 10)²	−0.169***	−0.187***	−0.210***
(Age divided by 10)³	0.011***	0.012***	0.014***
Federal German state	*controlled*	*controlled*	*controlled*
Unemployment before recruitment (ref.: no unemployment)			
1–365 days of unemployment	−0.044***	0.467***	0.512***
> 365 days of unemployment	−0.098***	0.527**	0.430*
Frequency of unemployment	−0.010***	−0.009***	−0.009***
Share of unemployment in the working life	−0.126***	−0.143***	−0.147***
Occupational change	−0.034***	−0.034***	−0.036***
BIBB occupational groups	*controlled*	*controlled*	-
Share of unemployment in occupation		-	0.168**
Share of further training in occupation		-	1.779***
Share of further training in occupation²		-	−1.421***
Recall (ref.: move on to a new employer)	0.012**	0.024***	0.020***
Frequency of recalls	0.005**	0.006***	0.006***
1–365 days of unemployment × woman		0.010	0.014**
> 365 days of unemployment × woman		−0.007	−0.001
1–365 days of unemployment × medium level of formal education		−0.004	−0.002
1–365 days of unemployment × high level of formal education		−0.003	−0.004
> 365 days of unemployment × medium level of formal education		−0.007	−0.005
> 365 days of unemployment × high level of formal education		−0.001	0.002
1–365 days of unemployment × age		−0.207*	−0.237*
1–365 days of unemployment × age²		0.032	0.040
1–365 days of unemployment × age³		−0.001	−0.002
> 365 days of unemployment × age		−0.227	−0.125
> 365 days of unemployment × age²		0.036	0.008
> 365 days of unemployment × age³		−0.002	0.001
1–365 days of unemployment × share of unemployment in the working life		0.020	0.026
> 365 days of unemployment × share of unemployment in the working life		0.079***	0.082***
1–365 days of unemployment × share of unemployment in occupation		−0.269**	−0.226*
> 365 days of unemployment × share of unemployment in occupation		−0.560***	−0.616***
1–365 days of unemployment × share of further training in occupation		−0.922***	−0.983***
1–365 days of unemployment × share of further training in occupation²		1.303***	1.354***
> 365 days of unemployment × share of further training in occupation		−1.493***	−1.586***
> 365 days of unemployment × share of further training in occupation²		2.337***	2.412***
1–365 days of unemployment × recall		−0.018*	−0.016*
> 365 days of unemployment × recall		−0.041***	−0.045***
_cons	*6.376****	*6.214****	*5.830****
N	*38,930*	*38,930*	*38,930*
r2_w	*0.443*	*0.450*	*0.399*
r2_b	*0.522*	*0.528*	*0.522*
r2_o	*0.477*	*0.479*	*0.470*
** p < 0.05; ** p < 0.01; *** p < 0.001*			

The estimates for Model 1 show that unemployment has a significant negative effect on wages. The wage declines on average by 4.4 percent for employees who experienced an unemployment period of up to one year (1–365 days) and by 9.8 percent for employees who experienced an unemployment period lasting longer than one year (> 365 days). Furthermore, wages decline by 1.0 percent with each additional unemployment period experienced throughout the working life. Wages decline by 1.3 percent if the percentage of days an employee was unemployed in the previous working life increases by 10 percentage points. If the reemployment was a recall, the negative effects on wage were weakened.

Models 2 and 3 show that the wage effect of the last unemployment period varies according to (1) the accumulation of unemployment throughout the working life, (2) the share of further training in the occupation, (3) the share of unemployment in the occupation, and (4) whether the worker was recalled or not. To facilitate interpretation of the interaction effects and polynomials, we plotted marginal effects based on Model 3 for the central variables that relate to our hypotheses (see Figures 2 to 5).

Figure 2 shows that reemployment wages decrease with an increasing share of days in unemployment during the employee's previous working life. Wages are lower for both categories of recent unemployment duration. If the employee had already accumulated a large share of days in unemployment during his or her previous working life, the effect of the last unemployment period is smaller.

Figure 2. Marginal effects of the share of unemployment in one's previous working life on reemployment wages according to incidence and length of unemployment

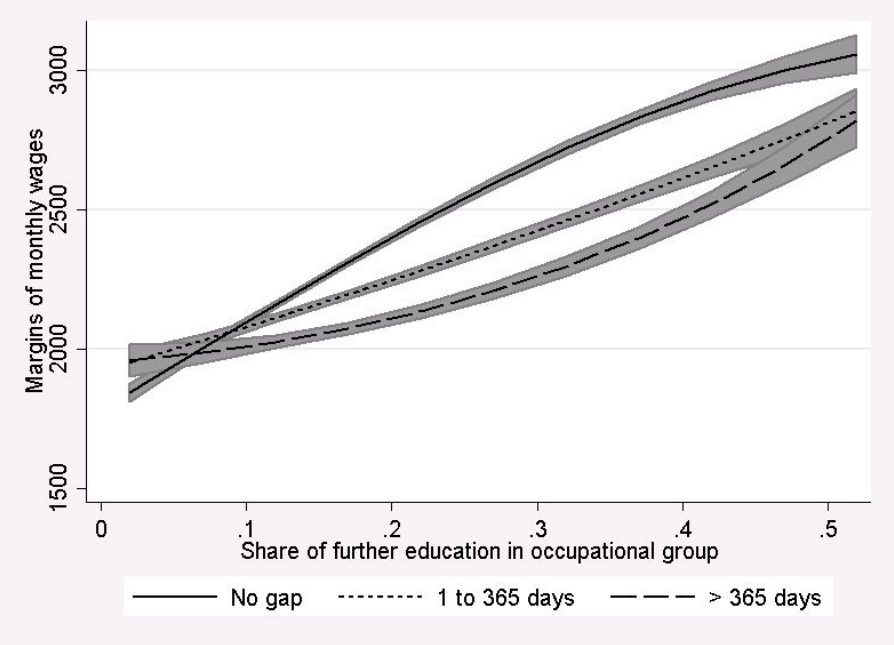


Hypotheses 1, 2a, and 2b suggest that the effect of unemployment on reemployment wages varies according to occupation-specific factors: (1) the speed of changes in the requested human capital and (2) the extent of unemployment.

Figure 3 shows how the occupation-specific share of further education influences reemployment wages depending on the category of recent unemployment. With an increasing share of employees' participation in further training in the respective occupations, reemployment wages increase. Thus, in occupations with constantly changing requirements, the wage level is generally higher.

Furthermore, the gap in reemployment wages between employees who have been unemployed and employees who have not been unemployed becomes larger as the occupation-specific share of further education increases. Regarding the length of unemployment, the wage gap is greatest for employees who experienced a spell of unemployment of more than a year. This is in accordance with Hypothesis 1. We used the share of further training in the occupation as a proxy for the need to adjust competencies to new demands at the job. The varying wage loss according to occupation can be explained in part by differences in the extent of devaluation of human capital due to

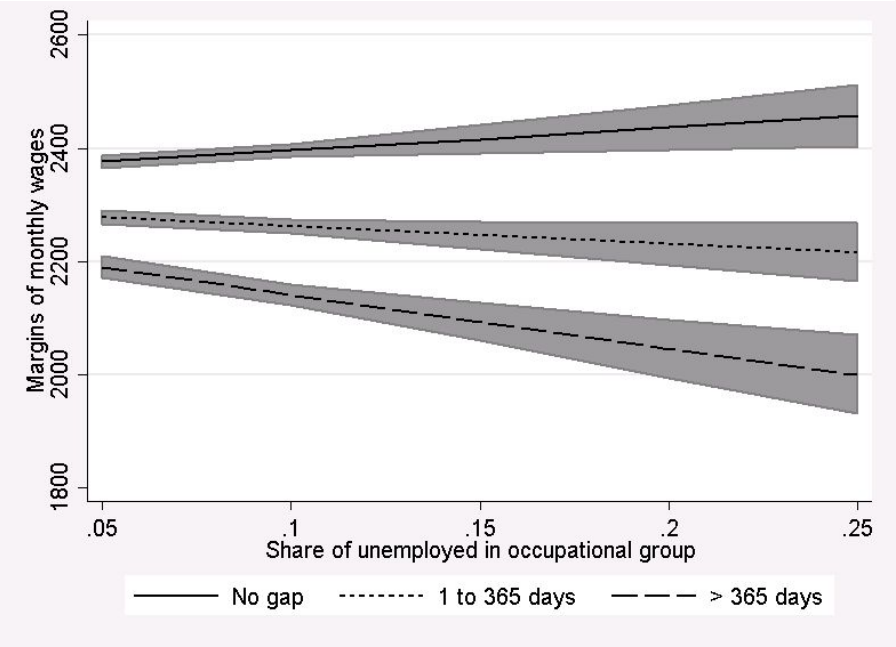
Figure 3. Marginal effects of share of further education in one's occupation on reemployment wages according to incidence and length of unemployment



unemployment according to occupation. Our findings indicate that in occupations in which more employees take part in further training to renew their occupation-specific knowledge, the devaluation of human capital during periods of unemployment occurs more quickly, and the negative unemployment effects on wages also become stronger.

Figure 4 shows how the occupation-specific unemployment rate influences the reemployment wage depending on the category of recent unemployment. Entry wages increase with higher unemployment rates for hires with no history of unemployment, but they decrease if there was a short unemployment period, and they decrease even more if the period of unemployment is long. Thus, the effect of recent unemployment increases with a higher occupational unemployment rate. These results are not in accordance with Hypothesis 2b, which suggests that in occupations with a high level of unemployment, the effect of unemployment on wages is smaller because the incidence of unemployment loses its signaling effect. In fact, these results are in accordance with Hypothesis

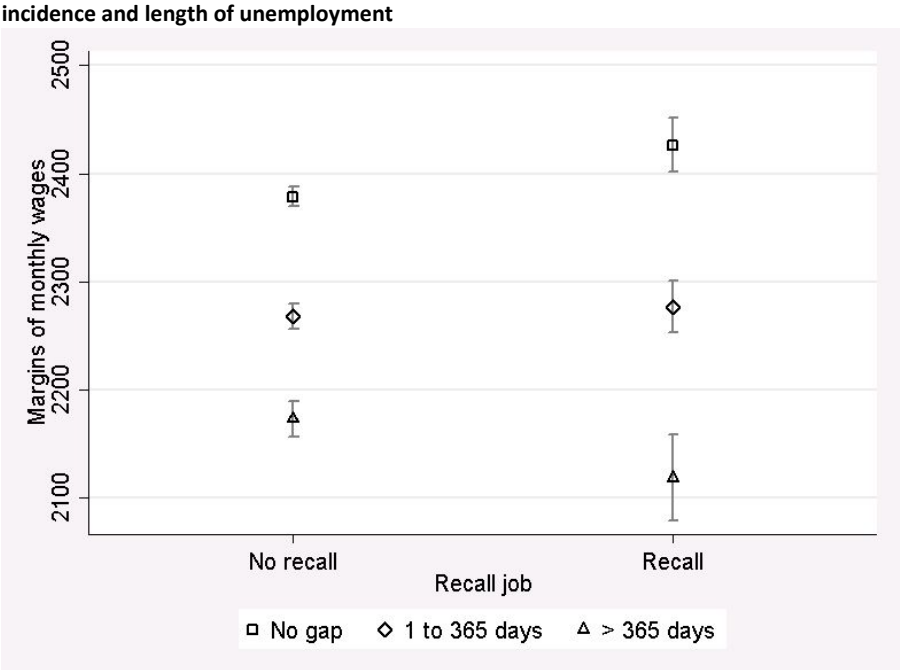
Figure 4. Marginal effects of occupation-specific share of unemployed on reemployment wage according to incidence and length of unemployment



2a: when unemployment in certain occupations is rising, employers can reduce wages for employees who have experienced unemployment in the past because such employees have no alternative options. This is also in line with the results of Protsch (2008), who found that the extent of earnings losses also depends on structural conditions, such as demand for labor relative to supply of labor, and that with increasing unemployment rates, wage losses of employees who experienced unemployment also increase.

Figure 5 shows how the effect of recall employment on reemployment wages depends on the category of recent unemployment. According to our Hypothesis 3, we would expect the

Figure 5. Marginal effects of recall employment on reemployment wage according to incidence and length of unemployment



unemployment effect to be lower if workers are recalled. This can only be observed for recalled workers who experienced an unemployment period of up to one year immediately before the recall, whereas the negative wage effect of unemployment that lasted more than a year is even larger for recall jobs. A possible explanation for this finding could be a lack of suitable job alternatives, so that employees return to their former employer even though the wages they are offered are lower than those of comparable employees who were not recalled.

Figure 5 also shows that job changers who return directly to a former employer without a period of unemployment gain slightly higher wages than employees who move on to another employer. This indicates not only that the negative signaling effect of unemployment loses significance but also that recalled employees can retain company-specific human capital.

SUMMARY AND DISCUSSION

In this study, we examined the effects of unemployment on reemployment wages, with a focus on occupational differences and differences in the type of reemployment. The hypotheses regarding systematic wage differences were inferred based on three theoretical approaches—human capital, signaling, and occupational segmentation—and by considering organizations as actors within labor markets. While many studies that examine post-unemployment wages do not differentiate between occupations, we argue that the effects of unemployment differ according to occupation because of differences in the pace of change in skill requirements, as well as because of differences in the relationship between demand for labor and supply of labor in occupation-specific labor markets. Furthermore, we differentiate between employees who return to a former employer (i.e., are recalled) after a period of unemployment and employees who move on to a new employer, because recalled employees have already acquired company-specific skills and knowledge during their preceding tenure within the work organization and thus employers already know the abilities these employees bring to the job.

In general, our results show that the negative effects of unemployment on wages vary between occupations. Differences in the rate of participation in further occupation-specific training were identified as a factor that explains differing unemployment effects. The depreciation of human capital during the time of unemployment depends on the occupation, so that occupations in which unemployment occurs in response to more frequent environmental changes or technological developments suffer greater negative effects on employees' earnings. This finding supports our hypothesis that devaluation due to unemployment is greater when quickly changing competencies are required.

The negative effects of unemployment on the wages of reemployed workers are reinforced in occupations associated with high rates of unemployment. There might also be a reduction of the signaling effect of unemployment if the occupational unemployment rate is high. But the effect of lower employee's bargaining power due to an oversupply of employees clearly dominates the signaling effect. Differences in wages according to occupation can be explained by the presence of occupational barriers that severely limit an employee's chances of finding a job in another occupation. Such occupational barriers prevent the prompt adaption of labor supply and demand in the general labor market. Finally, by increasing unemployment, an employer can undermine wages,

since the probability that employees can secure an alternative job in the occupation-specific labor market is lower.

With regard to recall employment, our results only partly support the hypothesis that recalls lead to weakened negative signaling effects. The estimates show that the negative unemployment effect decreases only for employees who experienced unemployment for up to one year before the recall. We also find a positive wage effect for recalled employees without a period of unemployment. Thus, it can be suggested not only that the negative signal of lower productivity is weakened by a recall but also that the actual productivity of recalled employees is higher than that of employees moving on to a new employer, since the company-specific human capital can be retained.

However, contrary to our hypotheses, the predicted wages for recalled employees who have been unemployed longer than a year are even lower than those for non-recalled employees. This means that only for recalled employees with an unemployment period of one year or shorter can the company-specific human capital be retained and the negative signaling effect loses significance.

Overall, our results show that the occupational level is relevant and should be included in the analyses of unemployment effects. It becomes evident that the occupationally segmented labor market in Germany leads to different post-unemployment earning prospects according to one's occupation.

Our study is restricted to reemployment wages. The advantage of this restriction is that we did not have to appropriately model the internal career ladders or seniority compensation that varies between organizations and leads to company-specific compensation of tenure and thus to distinct wage losses due to unemployment.

One limitation of our data, however, is the lack of data on the reasons for job changes. Employees can leave their jobs voluntarily or involuntarily. Because voluntary changes may be related to wage improvements and also occur more frequently among employees who do not experience a spell of unemployment, the effects of unemployment on wages can be overestimated. In this case, if we compare the reemployment wages of workers who have been unemployed with the wages of workers in continuous employment, the analysis would show higher wage losses due to unemployment. Further research that compares pre-unemployment wages with post-unemployment wages would be useful to determine whether unemployment leads to corresponding variations in wage losses among different occupations and types of reemployment.

Further research on the long-term effects of occupation-specific unemployment would be valuable and would indicate whether the differences among occupations in terms of wage losses due to unemployment are short-lived after reemployment or whether they have occupation-specific scarring effects throughout the working life.

Complementary research in the future could focus on the degree of formalization of licenses and educational credentials specific to one's occupation. Research has shown that the German education system is highly specialized, and certification confirming that general and vocational training has been completed is generally regarded as a key indicator of a job applicant's productivity. Weeden (2002) demonstrates that licensing, formal educational credentials, and voluntary certification also govern entry into occupations and therefore influence occupational closure. These credentials not

only certify that an employee has acquired certain skills but will influence hiring decisions, in that employers use these credentials as signals of employees' particular knowledge and skills (Weeden, 2002; Bol and Weeden, 2014). Thus, the effect of unemployment may vary according to occupation because of the different degrees of formalization that employees can use to assess workers' productivity.

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APPENDIX

Table 3. Descriptive statistics of BIBB occupational groups

Variable	Relative frequency	Share of unemployment	Share of further training
Agriculture, cattle industry, forestry, gardening	0.016	0.168	0.164
Mining	0.002	0.049	0.135
Masonry, material production, ceramics and glass	0.004	0.079	0.086
Chemistry and synthetics	0.019	0.052	0.123
Paper manufacturing and processing, printing	0.003	0.062	0.101
Metal production and processing	0.031	0.051	0.124
Metal, plant and sheet metal construction, installation, assembly workers	0.060	0.067	0.137
Industrial and tools mechanics	0.033	0.058	0.167
Vehicle and aircraft construction, servicing occupations	0.009	0.051	0.232
Precision mechanics, related occupations	0.010	0.049	0.233
Electrical occupations	0.200	0.054	0.222
Spinning, textile manufacturing and processing	0.001	0.085	0.043
Textile manufacturing, leather production	0.002	0.103	0.069
Production of pastries, confectionary, and candy	0.001	0.079	0.103
Butcher	0.003	0.082	0.040
Cooks/chefs	0.006	0.103	0.038
Beverages and luxury food production, other food and nutrition occupations	0.006	0.084	0.025
Construction occupations, wood and plastic working and processing	0.034	0.140	0.101
Product tester, dispatcher	0.014	0.090	0.085
Unskilled laborers in general	0.106	0.243	0.031
Engineers	0.038	0.027	0.386
Chemists, physicists, natural scientists	0.013	0.029	0.273
Technicians	0.033	0.036	0.346
Draftsmen, related occupations	0.003	0.049	0.217
Surveying and mapping	0.001	0.046	0.368
Technicians, specialists	0.004	0.029	0.212
Sales occupations (retail)	0.008	0.073	0.099
Wholesale and retail clerks	0.010	0.051	0.185
Financial and insurance clerks	0.071	0.019	0.359
Other clerical occupations (except wholesale, retail, banking)	0.012	0.054	0.220
Advertising specialists	0.003	0.077	0.208
Transport occupations	0.038	0.076	0.112
Aeronautic and navigation occupations	0.003	0.046	0.368
Packagers, warehousers and transport workers	0.044	0.103	0.086
Business management, auditing, business consulting	0.023	0.035	0.314
Public administration occupations	0.018	0.040	0.520
Finance and accounting	0.005	0.040	0.282
Core IT occupations	0.015	0.037	0.397
Clerical occupations	0.121	0.045	0.274
Office help, operators	0.014	0.057	0.187
Personal security and security guards	0.005	0.123	0.107
Facility managers	0.003	0.090	0.074
Safety and security occupations	0.001	0.027	0.440
Legal professions	0.001	0.048	0.376
Artists and musicians	0.003	0.091	0.168
Designers, photographers, advertising professionals	0.023	0.086	0.158
Health professions with accreditation	0.039	0.020	0.402
Health professions without medical license	0.032	0.027	0.347
Social occupations	0.009	0.048	0.371
Teachers	0.008	0.035	0.449
Publishing, librarians, translation, and associated research occupations	0.006	0.047	0.198
Personal care occupations	0.014	0.054	0.314

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