Andreas Damelang*, Michael Stops** and Martin Abraham***

Occupations as labour market institutions

Occupational regulation and its effects on job matching and occupational closure****

Abstract: We define occupations as labour market institutions that link the education system with the labour market and argue that occupations represent ideal-typical requirement profiles of job vacancies. On this theoretical basis, we elaborate distinct mechanisms how occupational institutions and their regulation define occupational qualifications and influence both access to occupations and mobility between occupations. We argue that the extent of occupational regulation varies considerably between occupations. Next, we analyse the labour market effects induced by occupational regulation. We illustrate that regulatory effects are twofold. First, occupational regulation enhances information for both employers and job seekers and thus reduces uncertainty in the matching process. Second, it creates 'closed shops' by restricting access to occupations. To date, studies that include both positive and negative effects of occupational regulation are scarce. We fill this gap by examining two central labour market processes: job matching and occupational closure. Empirically, we use an innovative indicator for occupational regulation and test our hypotheses with German data. The results show that the more pronounced the regulation of an occupation is the less effort the contracting parties must expend within the matching process. By contrast, transitioning into a new occupation become less likely the more an occupation is regulated.

Keywords: Occupational regulation, Matching, Occupational Mobility, Occupational Closure

* Dr. Andreas Damelang, Friedrich-Alexander University Erlangen-Nürnberg, Chair of Sociology and Empirical Research Methods, Findelgasse 7/9, 90402 Nuremberg, Germany, E-Mail: andreas.damelang@fau.de.

** Dr. Michael Stops, Institute for Employment Research of the German Federal Employment Agency, Research group "Occupational Labour Markets", Regensburger Strasse 104, 90478 Nuremberg, Germany, E-Mail: Michael.Stops@iab.de.

*** Prof. Dr. Martin Abraham, Friedrich-Alexander University Erlangen-Nürnberg, Chair of Sociology and Empirical Research Methods, Findelgasse 7/9, 90402 Nuremberg, Germany, E-Mail: martin.abraham@fau.de.

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Berufe als Arbeitsmarktinstitutionen

Berufliche Regulierung und ihre Auswirkungen auf das Job-Matching und die berufliche Schließung

Zusammenfassung: Wir definieren Berufe als Institutionen, die das Bildungssystem mit dem Arbeitsmarkt koppeln und argumentieren, dass Berufe idealtypische Anforderungsprofile von Stellenangeboten darstellen. Auf dieser theoretischen Grundlage erarbeiten wir unterschiedliche Mechanismen, wie berufliche Institutionen und deren Regulierung berufliche Qualifikationen definieren und den Zugang zu Berufen und gleichzeitig Mobilität zwischen Berufen strukturieren. Das Ausmaß der beruflichen Regulierung variiert erheblich zwischen den Berufen. Darauf aufbauend analysieren wir die Auswirkungen der beruflichen Regulierung. Wir zeigen, dass die Regulierung zweiteilige Effekte hat. Erstens erhöht die berufliche Regulierung den Informationsstand sowohl für Arbeitgeber als auch für Arbeitssuchende und verringert somit die Unsicherheit im Matching-Prozess. Zweitens produziert berufliche Regulierung "closed shops", indem der Zugang zu Berufen eingeschränkt wird. Studien, die sowohl die positiven als auch die negativen Auswirkungen beruflicher Regulierungen berücksichtigen, sind bisher selten. Wir schließen diese Lücke, indem wir zwei zentrale Arbeitsmarktprozesse untersuchen: Job Matching und berufliche Schließung. Um berufliche Regulierung empirisch abzubilden, verwenden wir einen innovativen Indikator und testen unsere Hypothesen mit deutschen Daten. Die Ergebnisse zeigen, dass je stärker die berufliche Regulierung bei sonst gleichen Bedingungen ist, desto weniger aufwändig gestaltet sich der Matching-Prozess für die Vertragspartner. Im Gegensatz dazu wird der Wechsel in eine neue Beschäftigung umso unwahrscheinlicher, je stärker ein Beruf reguliert ist.

Stichworte: Berufliche Regulierung, Matching, Berufliche Mobilität, Berufliche Schließung

1 Introduction

Occupations are important determinants of labour market processes. Blossfeld (1987), for example, demonstrates that the choice of the first occupation is crucial for the remainder of the employment career. Buchmann et al. (2010) shows that the sex composition of an occupation influences the labour supply of women. Regarding inequality, the finding that wages differ between occupations, ceteris paribus, is especially noteworthy (e.g., Bol/Weeden 2015; Damelang et al. 2018; Kleiner/Krueger 2010; Marinescu/Wolthoff 2016). Accordingly, occupational credentials govern workers´ access to labour market positions (Solga/Konietzka 1999). Findings like these underline the decisive roles that occupations play on the labour market, not only in association with individual's occupational positions but also with the institutional characteristics of occupations that go beyond individuals.

However, the institutional mechanisms of how occupations influence labour market processes have rarely been spelled out in detail. So far, it has been difficult to frame occupations as an important part of the theoretical explanation of labour market processes despite the fact that differences in occupational regulation and the resulting occupation-specific patterns of labour exchange are considerably important for the understanding of labour markets (Dostal et al. 1998: 447).

In this paper, we describe occupations as institutions that link the education system with the labour market. We contribute to research on occupations and inequality in three ways. First, we provide a theoretical outline that can be integrated into the existing theoretical discussion that describes occupations as labour market institutions (for earlier institutional views on occupations cf., e.g., Beck et al. 1980; Blien/Phan thi Hong 2010; Witte/Kalleberg 1995). On this theoretical basis, we elaborate distinct mechanisms how occupational institutions and their regulation define occupational qualifications and determine both access to occupations and mobility between occupations. We argue that the extent of occupational regulation varies considerably between occupations.

Second, we analyse the labour market effects induced by occupational regulation. We argue that regulatory effects are twofold. On the one hand, occupational regulation enhances information for both employers and job seekers and thus reduces uncertainty in the matching process. On the other hand, occupational regulation creates 'closed shops' by restricting access to occupations as literature on social closure in labour markets emphasises (cf., Haupt 2012).

Regarding the job matching process, the regulation of occupations reduces employers' uncertainty regarding the motivation and abilities of job seekers. Institutional regulations such as occupational credentials can reduce uncertainty because they allow employers to develop expectations about supplied knowledge and skills (Arkes 1999). Especially in occupational labour markets, young people invest in occupation-specific skills and knowledge and gain occupational credentials upon completing education and training. These occupational credentials correspond with occupation-specific job requirements that result in specific search and recruitment behaviours by employers. Accordingly, employers organise work around defined occupational groups (Marsden 2000) and attempt to find adequate workers by naming occupations in job advertisements. Consequently, the regulation of occupations can reduce uncertainties in the job matching process. To analyse the uncertainty-reducing effect of occupational regulation, we examine vacancy durations and argue that they are shorter in more regulated occupations because recruitment processes should be more efficient.

Closely related to occupational regulation is the concept of occupational closure that emerges if employers only recruit workers with corresponding credentials for an occupation and deny access for others. Two modes of occupational regulation and employers' recruiting behaviour are present. Regarding the first mode, occupa-

tional regulations as a form of licensure define the qualifications that job seekers need to be allowed to pursue an occupation for compensation (Kleiner 2006; Redbird 2017). Looking at the second mode, employers only recruit job seekers with an occupation-specific credential even if the law does not enforce the access restriction (Haupt 2015). As an indicator of closure, we examine occupational mobility of employees and argue that access in more regulated occupations is more difficult, especially for workers who lack corresponding qualifications.

Third, we use an innovative indicator in our empirical analyses that allows us to measure occupational regulation very precisely. Based on comprehensive information on occupations from a German database, the BERUFENET, Vicari (2014) observed for each single occupation whether such regulations exist. She aggregates this information to the 3-digit occupational code and derives an indicator for occupational regulation. This indicator varies considerably between the different occupations and, therefore, allows the theoretical and empirical exploration of the effects of occupational regulation. We focus on the German labour market, which is a typical example for an occupational labour market, where we expect particularly strong effects of occupational regulation on both outcomes.

The remainder of the paper is organised as follows. In the next section, we describe occupations as labour market institutions and discuss occupational regulation mechanisms. Building on that, we derive hypotheses about how occupational regulation foster the employee-employer match and restrict occupational mobility. Afterwards, we introduce the data, i.e. the German Job Vacancy Survey, the Sample of Integrated Employment Biographies, and BERUFENET and provide information on the empirical strategy, which comprises random-intercept linear regression and logistic regression models. The subsequent section presents the estimation results. Finally, we discuss our results and conclude.

2 Occupations as labour market institutions

In line with previous studies, we define institutions as a set of rules that demand a binding validity in a certain population, usually containing incentives for human action in a society (e.g., Nee 2005). Generally, institutions aim to solve problems of coordination, of cooperation and of distribution in specific social or economic situations (Coleman 1994).

Our institutional theory of occupations starts with the role of labour markets as "arenas for the matching of persons to jobs" (Sørensen/Kalleberg 1981: 52). In the education system, future workers gain knowledge and skills through education and training. When they enter the labour market and seek jobs, they meet vacancies that employers ideally try to fill with the most suitable candidates at the lowest cost.

We argue that occupations represent ideal-typical requirement profiles of these vacancies that link the acquisition of knowledge and skills with labour market

demand. Figure 1 illustrates this view, according to which the "occupational institution" comprises formal and informal rules that link the knowledge and skills of job seekers acquired in the education and training system with typical bundles of tasks in the labour market. Occupational institutions provide a framework under which job seekers and employers meet.

Figure 1: Occupations as rules linking the education and training system with the labour market

The left-hand panel of Figure 1 covers the entire education and training system in which qualifications that are relevant on the labour market are conveyed. In the different components of the education and training system, from general-education schools through firms providing specialised training, the actors acquire general and specific knowledge and skills. These knowledge and skills can be regarded as decisions to invest in one's own human capital (Becker 1993). A problem arising here is that actors must develop expectations about what qualifications employers demand in the future as sketched on the right-hand panel of Figure 1.

The problem outlined above can be solved in different ways (cf., Allmendinger 1989; Thelen 2004). One possibility is to integrate key elements of training into the firms, which then provide the set of qualifications relevant for them. A major disadvantage of this "training on the job" strategy is that it becomes difficult for an employee to switch to another employer due to the lack of uniform standards for the sets of qualifications. Against this background, occupations constitute another possible solution by creating institutionalised rules that harmonise and coordinate the qualifications acquired with the job requirements. These institutionalised rules control the contents and scope of occupational knowledge and skills. They shape the expectations of which qualifications applicants need as well as the expectations of both employers and applicants on the workplace and on the salary.

Thus, institutions such as training regulations define the bundle of tasks that workers have to perform in different occupations. Consequently, institutional regulations differentiate occupations from one another and determine the qualifications needed to gain access to different occupations. We summarise the occupation-speci-

fic qualifications and the corresponding conditions for the acquisition and exercise of these as the concept of an 'occupational institution'.

There are two main advantages of occupational institutions. First, if these rules can claim a binding nature, uncertainty is reduced for the actors involved, and investment in human capital is encouraged (Thelen 2004). Second, these rules facilitate a more efficient and more cost-effective matching process than would be possible without this information. Kalleberg/Sørensen (1979: 361) define occupations "as groups of individuals who perform similar activities, have similar skills and competencies […]". Building on that, in our sense an occupation is more than simply a job with certain tasks; it is supported by general rules and expectations about the way tasks are combined in an economy based on the division of labour.

3 Occupational regulation mechanisms

In this section, we describe how occupational institutions and their regulation mechanisms structure the matching of supplied and demanded labour. Ideal-typically, the two dimensions of standardization and credentialism determine occupational regulation. Following Sengenberger (1987: 126ff), an occupation consists of a standardised and intercompany qualification, with the acquisition of this qualification being accompanied by a credential. Because occupational regulation refers to links between the education system and the labour market, they can be located on both sides. In the following, we discuss the occupational regulation mechanisms.

The degree of standardization indicates whether and to what extent knowledge and skills acquired in the education system are comparable over time and space (Allmendinger 1989). Thus, the degree of standardization signals whether the imparted knowledge and skills for an occupation are similar or whether they vary from graduate to graduate. In other words, are different holders of the same credential able to perform the same bundle of tasks? In Germany, the standardization of occupations is closely linked to the system of vocational training. On average, a particularly high degree of standardization of training characterises the German vocational training system. Each of the 327 apprenticeship occupations has its own professional code and training regulations (GOVET 2016).

In contrast, university education is in most cases poorly standardised. Training contents vary more or less between different subjects, due to individual priorities within study programs and between different study sites. Nevertheless, university education can also be standardised to some extent in two ways. First, some subjects have a large body of canonical knowledge, as is the case in physics, biology or theology. Second, in some subjects, several years of practical training follow university education, which is the case for doctors, teachers, and lawyers.

Standardisation is closely related to credentialism. Employers use occupational credentials as signals to infer job seekers' knowledge and skills (Bills 2003). The

value of educational signals – "how clearly employers can determine, ex-ante, the suitability of a job seeker for the job they are offering" (Breen 2005: 126) – is stronger the more pronounced standardisation is. Nevertheless, graduates of low standardised qualifications can also acquire credentials. In this case, the signal is not as strong as it is for standardised qualifications. For example, in Germany, the training of bakers is more standardised compared to that of non-doctoral practitioners (cf., BERUFENET 2018). The training canon of the bakery trade is much more regulated, so that every baker has a basic stock of uniform knowledge and skills. Employers know this and can assess the knowledge and skills of graduates very precisely. In contrast, the training of non-doctoral practitioners is much more heterogeneous. Consequently, one does not know at first glance what knowledge and skills the respective actors actually have.

The two dimensions of education regulation – standardization and credentialism – correlate with two dimensions that include rules of access to occupational positions in the labour market. The rules of access correspond strongly with mobility between occupations. The dimension of substitutability raises the question of whether employers consider only a particular type of education and training for occupational positions, or whether graduates with different qualifications can compete for the same positions.

For example, the occupation of occupational therapy assistants is linked to exactly one corresponding vocational training, so that there is an occupation-specific monopoly on these jobs. In contrast, graduates of different apprenticeship occupations compete for commercial positions. Nevertheless, these graduates have at least some similarity (e.g., retail salesperson, logistics manager etc.). In contrast, for recycling specialist there are virtually no formal or informal rules that link access to certain training programmes (cf., BERUFENET 2018).

In the following, we refer to an occupation as closed if the access to employment in this occupation is linked to an occupation-specific credential. The main drivers of occupational closure are formal and informal recruitment arrangements. We distinguish between two modes of regulation of recruitment (Haupt 2015). First, in licensed occupations, the regulation of recruitment has a legal basis. Only with the required licence is one allowed to pursue this occupation for compensation. Second, occupational closure can also emerge without licensing and persists if employers only recruit job seekers with an occupation-specific credential. This mode of recruitment is linked to the vocational specificity of a training curriculum (Vogtenhuber 2014). The higher the vocational specificity of a qualification is, the more likely it is that employers will recruit only workers with the respective credential. An important basis for this form of closure is the protection of occupational titles, which is linked to standardised education. Job seekers without such education are not allowed to hold such a title. Having an occupational title, however, is one of the key signals in the recruitment process.

To summarise, occupational institutions include rules that link human capital acquisition to the labour market. These rules are the basis for the delineation of occupations and thus the regulation of access to them. However, the extent of the link between education and labour market differs in Germany (DiPrete et al. 2017). Some occupations are strongly linked with the education system and rely exclusively on specific qualifications, while other occupations largely waive any qualification standards.

For example, pharmacists require state permission to perform their work. They only receive this permission if they have successfully completed extensive exams. Pharmacists are a typical example of a licensed occupation or profession. Electronic engineers, as another example, do not require state permission to practice their occupation. Nevertheless, the occupational title "electronic engineer" is protected and may only be obtained after passing a final exam. In contrast, estate agents do not require state permission in Germany, their occupational title is not protected and there is no nationwide recognised final exam. Thus, the extent of regulation differs between occupations (cf., BERUFENET 2018).

4 The effects of occupational regulation mechanisms on the labour market – hypotheses

As has been shown, occupations – or, more precisely, occupational institutions – link the education and training system with the labour market. The strength of the link varies, depending on how strong the institutional regulation is. We now break down this basic idea of the (differently pronounced) regulating effect of occupations into two facets of the labour market and analyse them empirically.

First, we analyse to what extent occupational institutions influence the creation of employment relationships. We argue that occupations bundle understandable and calculable information for both job seekers and employers regarding the knowledge and skills required and offered that should lead to an efficient matching process. Second, we examine the occupational mobility of employees and argue that occupational institutions can reduce occupational mobility by restricting access to occupational positions.

Regarding employer-employee matching, occupational institutions should lead to higher efficiency and cost-effectivity. From an employer's point of view, the match between employees' knowledge and skills and the job requirements determine the expected productivity and the quality of employees' expected work performance. Within the matching process, employers and job seekers face incomplete information (Stigler 1961). While employers must assess job seekers' capabilities, which is ex ante largely unknown (Jovanovich 1979), job seekers do not have complete information about the workplace and the tasks demanded. In general, scholars describe the costs incurred here as transaction costs of economic exchange (Williamson et al. 1985; Miller 1992: 27ff). To reduce the information problem and the

incurred transaction costs for both sides, prior to the labour exchange, a process is required to clarify, to agree upon and to monitor an exchange of performance.

Occupations and occupational credentials can reduce the transaction costs of the matching process in the labour market. Occupational credentials correspond to occupational qualifications and signal the existence of a typical set of knowledge and skills. By looking at the credential, employers can easily assess applicants' expected productivity and training costs. Consequently, occupational credentials reduce the information problem. The extent to which occupational credentials reduce this information problem depends on the confidence in the quality of the signal (Breen 2005). This confidence is usually generated by binding, long-term stable rules – such as the content and standardization of final exams – that ensure that a graduate has the appropriate knowledge and skills. In Germany, the vocational education and training system largely generates this confidence. In addition, other institutional arrangements contribute to that confidence, such as occupational licensing.

The empirical significance of occupational credentials provides a first indication. In Germany, between 70% and 90% of all employees perform their apprenticeship occupation when starting their careers (Konietzka 1999). According to Saar et al. (2014), employers always use educational credentials as a selection criterion to limit the pool of applicants. Employers use credentials either as a signal of productivity or of applicants' general trainability (Di Stasio/van de Werfhorst 2016).

Theoretically, the more pronounced the regulation of an occupation is the less effort the contracting parties should have to make in the matching process. Information problems are best overcome as education and training becomes more standardised, followed by a familiar signal that unambiguously informs about the acquired knowledge and skills. In this case, the knowledge and skills offered and required are transparent for both employers and job seekers, which minimises the uncertainty due to incomplete information. Thus, the institutionalization of occupations reduces the transaction costs of the matching process. Empirically, the level of regulation of an occupation increases the matching efficiency (Dengler et al. 2016). Conversely, we expect stronger matching problems in less institutionalised occupations. For example, a high level of uncertainty about the skills and knowledge of university graduates makes a much more detailed screening inevitable.

To operationalise the effort of matching, we use vacancy duration. Vacancy duration consists of search and screening durations (Oyer/Schaefer 2011). Both search and screening duration should be shorter as employers and job seekers are better informed about supplied and demanded labour.[1]

1 In addition to occupational regulation mechanism, the duration of a vacancy may depend on factors beyond the matching process. For example, employers may have an interest in not filling vacancies immediately, because, e.g., they need the new employee at a later point in time according to their production plans (cf., Heckmann et al. 2013). However, we do not aim to

From these theoretical mechanisms, we derive the following hypothesis (H1): Vacancy times of jobs are shorter the more distinct an occupation's access regulation is.

The second key mechanism by which occupational institutions can have an impact on the labour market is the closure of occupations. While the institutionalization of occupations facilitates matching, it may also result in reduced labour market flexibility. This reduced flexibility originates from mobility hurdles that can be associated with occupational closure. Institutionalised occupations should therefore reduce mobility between occupations.

If education and training is highly regulated, its graduates will be channelled heavily to the designated jobs. Alternative applicants will then have no real chance to be recruited for these jobs, even if the law does not enforce the access restriction (Haupt 2015; Matheson 2001). This recruitment behaviour reduces mobility between occupations in the German labour market (Damelang et al. 2015).

Both formal and informal modes of recruitment regulation may reduce competition within occupations, which can result in economic benefits. Empirical studies show that employees who work in occupations with a strong access restriction typically receive higher wages (e.g., Bol/Weeden 2015; Damelang et al. 2018). The stronger occupational closure is and the more effective the occupational monopoly is, the easier it is to cut back products or services (Weeden 2002). This allows the monopolists to achieve higher returns compared to a situation without artificial monopoly (Sørensen 1996).

Occupational regulation thus has a twofold role: on the one hand, standardised credentials serve as a competence signal and simplify the matching process. On the other hand, the same credentials determine one's career opportunities, and non-existent credentials can pose a nearly insurmountable barrier, despite the possible existence of knowledge and skills. Particularly in Germany, the labour market is occupationally distinct, and the allocation of labour is controlled by formal qualifications. Accordingly, the German labour market is characterised as a particularly strong 'credentialist mobility regime' (König/Müller 1986). As a result, it is difficult, if not impossible, to find access to specific occupations without the appropriate occupational credential. Occupational regulation and, in particular, occupational credentials play a key role in the closure process.

To operationalise occupational closure, we use the occupational mobility of employees. We assume that the access to an occupation is more restricted the more distinct its regulation is, in particular for workers from other occupations.

analyse the reasons for job vacancies. Moreover, these factors should not affect our results because we have no reason to assume that they correlate systematically with occupations.

From these theoretical mechanisms, we derive the following hypothesis (H2): Switches between occupations are less likely the more distinct the occupations' access regulations are.

5 Data and empirical strategy

In this section, we first present the German Job Vacancy Survey of the Institute for Employment Research (IAB). These data contain information about vacancy duration. Second, we describe the Sample of Integrated Labour Market Biographies. These data are particularly suited to analyse occupational mobility. Third, we introduce BERUFENET, which is a data source that contains information about the regulation of the access to jobs. Based on the occupational code, we link information from BERUFENET with the other two data sources. The linkage with the German Job Vacancy Survey is suited to test the uncertainty-reducing effect of occupational regulation (H1) and the linkage with the Sample of Integrated Labour Market Biographies allows testing the closure effect of occupational regulation (H2).

5.1 The German Job Vacancy Survey of the IAB – analysing vacancy duration

To analyse vacancy durations, we use the German Job Vacancy Survey of the IAB (IAB JVS) (Kubis et al. 2017). The IAB JVS is a cross-sectional study that is carried out annually. The sample is randomly drawn from all establishments in Germany with at least one employee subject to social security contributions. Employees subject to social security contributions account for approximately 70% of the total labour force. The IAB JVS queries information on the entire unfilled labour demand, on future labour demand, and on employers' perceptions of recent labour market policy developments. The IAB JVS provides the most comprehensive representative data on matching processes in Germany. For example, each establishment in the survey answers detailed questions on the last hiring.

From these questions, we get information about the occupational title of the last hiring. Moreover, we can calculate the vacancy duration of the last hiring by combining question 45 ("When did you start looking for staff for this job?") with question 46 ("When did you choose this applicant?"). Thus, we have for each establishment information about the occupational title and the vacancy duration of the last hiring. Taken together, we have several observations of the vacancy duration for an occupation based on information from different establishments.

With this information, we create a dataset on establishment level that includes the vacancy duration and the occupational title of the last hiring, the year of data collection and further information about the establishments. In particular, we include seven establishment size classes, 23 industries based on the German Classifi-

cation of Industries 2008, and region (East and West Germany) because these are the stratifying variables for the sampling of the IAB JVS.

The IAB JVS reports the occupational titles according to the three-digit number of the German Classification of Occupations 2010 (KldB 2010) (Paulus/Matthes 2013). In total, the three-digit number of the KldB 2010 consists of 144 occupational groups. Empirically, we observe 140 occupational groups due to small numbers in the remaining four groups. Because the occupational coding is only reliable since 2012 and the data are right-censored in 2014, we use the three waves 2012, 2013, and 2014 of the IAB JVS for our analysis.

In total, the data consists of 23,852 establishments, of which 72% report a new hire. Thus, we observe 17,251 hires for 140 occupations. The vacancy duration ranges from 1 to 365 days;[2] the average is 60 days and the median is 45 days.

5.2 The Sample of Integrated Labour Market Biographies – analysing occupational mobility

For the observation of individual mobility patterns in Germany, we use the Sample of Integrated Labour Market Biographies provided by the IAB (SIAB) (Ganzer et al. 2017). This data set is a representative 2% sample of the German working population whose data are collected by the Integrated Employment Biographies (IEB). The IEB comprises all individuals who are employees subject to social security, who are in marginal part-time employment, or who are recipients of unemployment benefits. The statuses are depicted exact to the day, and they are recorded with a rich set of information referring to the individuals or to the different employment statuses, respectively.

These data allow us to construct a panel data set with which we compare the employment statuses of an individual from month to month. Since we are interested in individual mobility patterns, we particularly observe for each month whether an individual is employed in an occupation, again at the three-digit number level of the KldB 2010, which is different to the occupation that the individual was assigned to the month before. Based on this information, we construct a mobility dummy variable that is coded with "1" if the occupation is different and "0" otherwise. Since our measure relies on the information about an initial employment episode with an assigned occupation, we use the information from an individual's first employment episode, but we set the dummy variable that belongs to this initial episode as missing and, thus, this episode is not further considered in our analysis. In the case that the individual was employed in the previous month, we simply take the assigned occupation from the data. In the case that the individual was unem-

2 Vacancy duration is right-censored. We dropped 113 observations that report a duration of more than 365 days. This is a very small share of 0.65%.

ployed in the previous month, we take the assigned occupation from the most recent employment episode before the unemployment episode.[3]

Accordingly, the monthly average of our mobility dummy variable over the sample depicts the probability that an individual will change his or her occupation in a certain month. This measure enables us to analyse how occupational regulation determines this probability at the individual level.[4]

The observation period ranges from October 2012 to December 2014. We choose this period for two reasons. First, valid employment information that refers to the most recent and significantly improved occupational classification scheme, 2010 (KldB 2010), is available from 2011.[5] However, due to the transition from the old to the new occupational classification scheme, the employment measures from the Statistics of the Federal Employment Agency are only available from October 2012. Second, we right-censor our analyses to December 2014 to harmonise the observation period with the period from the IAB JVS.

With these data at hand, we observe 12,689,353 monthly employment statuses of 633,771 individuals. We observe that 579,745 individuals did not change their occupation in the observation period, 46,968 individuals changed their occupation once, and 7,058 individuals changed their occupation two or more times. In total, we observe 62,217 occupation changes. These numbers confirm findings that compared with other countries occupational mobility is a rather rare phenomenon in the German labour market (Longhi/Brynin 2010).

5.3 Empirical measure of occupational regulation

In this part, we introduce an indicator that measures occupational regulation empirically. This indicator contains information on standardisation and credentialism and describes both formal and informal modes of regulation of recruitment. In par-

3 Consequently, we consider both direct and indirect mobility and abstract from approaches that distinguish mobility patterns with and without unemployment episodes between job changes. For our research question such a distinction does not matter because we are interested in the relationship between the regulation of an occupation and probability to transition into this occupation from other occupations, abstracting from different mobility patterns like upward or downward mobility that could be related to the distinction of direct and indirect mobility patterns.

4 Here, we must emphasise that we do not aim to analyse the reasons for occupational switches. The reasons for changing one's occupation are manifold and lie, beside others, in the current occupation as well as in the new occupation (e.g., Damelang et. al 2015; Fitzenberger et al. 2015; Reichelt/Abraham 2017). From our understanding, institutional regulation influences into which occupations individuals change after they make the decision to change their job.

5 The improvement refers directly to potential measurement issues regarding mobility: the KldB 2010 explicitly re-considered that occupations that are very similar regarding job contents and requirements should be assigned to the same occupational orders and segments, respectively, whereas occupations that reveal significant differences should be assigned to different occupational orders and segments.

ticular, the indicator shows whether access to an occupation is linked to a standardised training credential and on whether legal entry regulations apply for an occupation. Vicari (2014) developed this indicator, which is free to download from the website of the IAB.[6]

An occupation has legal entry regulations if legal and administrative regulations define access to and practice of the occupational activity, as well as holding of the job title. Licensing is intended to ensure that only competent and ethical individuals practice an occupation. This applies to occupations in which practicing must meet quality standards to protect the public, such as medical doctors, lawyers and teachers, among others.

Standardised training credentials apply if federal or state laws determine the acquisition of the credential. This is effective for all apprenticeship occupations that are organised in the German Vocational Training Act ('Berufsbildungsgesetz'). Moreover, this indicator also includes vocational school training programmes, e.g., early childhood educators or geriatric nurses, and further education, such as technicians and master craftsmen.

Information on occupational characteristics is available at BERUFENET, an online career information portal provided by the German Federal Employment Agency (https://berufenet.arbeitsagentur.de/). These data contain information on, among others, qualification requirements and legal access regulations for approximately 3,900 distinct occupations – similar to the O*NET database in the U.S. For empirical reasons, Vicari (2014) aggregated this very detailed information at the level of occupational groups, which refers to the 3-digit level of the German Classification of Occupations 2010 (KldB 2010). For aggregation at the 3-digit level, she weights each single occupation by the share of all employees at this level divided by the number of employees at the 3-digit level (for a detailed and comprehensive description, see Vicari 2014). Accordingly, the indicator for occupational regulation ranges from 0 to 1.

The mean value of the indicator is 0.70, and its median is 0.78. Occupations with the lowest scores are, among others, "occupations in warehousing and logistics, in postal and other delivery services, and in cargo handling" (KldB 2010: 513) and "occupations in cleaning services" (KldB 2010: 541). Higher scores have, for example, "occupations in education and social work, and pedagogic specialists in social care work" (KldB 2010: 831), "occupations in metalworking" (KldB 2010: 242) and "occupations in business organisation and strategy" (KldB 2010: 713). Typical representatives for occupations with very high scores are "office clerks and secretaries" (KldB 2010: 714) and "sales occupations in retail trade (without product specialisation)" (KldB 2010: 621). Heavily regulated occupations, which have

6 www.iab.de/389/section.aspx/Publikation/k140512304.

scores close to 1, are, for example, "occupations in pharmacy" (KldB 2010: 818) and "technical occupations in energy technologies" (KldB 2010: 262).

6 Results: the twofold role of occupational regulation

We assume that occupational regulation has a twofold role. First, we argue that occupational regulation enhances information for both job seekers and employers and thus reduces uncertainty in the matching process, which results in short vacancy durations (H1). Second, occupational regulation creates 'closed shops' by restricting access to occupations and thus reduces occupational mobility (H2).

To test hypothesis H1, we use the logarithm of the vacancy duration as the dependent variable because vacancy duration is right-skewed. We run a random-intercept linear regression model with the measure of occupational regulation and the abovementioned stratifying variables as controls (East vs. West Germany, firm size, and industry). Controls on establishment level adjust for different resources and job search strategies, which affects the duration of vacancies. For example, large firms are likely to attract more applicants than small firms. Moreover, we control for the respective year of data collection. Additionally, we include a control for occupation specific unemployment rates. Occupation-specific unemployment rates approximate labour supply and demand in an occupation. For example, a high labour demand should be accompanied by shorter vacancy duration, ceteris paribus, because the pool of applicants is likely to be bigger. The data for occupation-specific unemployment rates stems from the Statistics of the Federal Employment Agency and is available for October 2012 to December 2014 (see bisds.iab.de). For this analysis, we calculated the average unemployment rate in the fourth quartile for each year and each occupation because the IAB JVS is conducted in this period.

For the exploration of hypothesis H2, we use a logistic model with the individual's probability in a month to be employed in a different occupation compared with the previous month as variable to be explained. We are primarily interested in the effect of the indicator for occupational regulation. We complement the model with further control variables for sex, age, the monthly occupation-specific unemployment rate of the previous occupation and monthly time dummies.

In Table 1, we present results for both H1 and H2. The results in column (1) refer to the analysis of the impact of occupational regulation on vacancy duration. In column (2), we present the results for the impact of occupational regulation on occupational mobility.

Table 1: The twofold role of occupational regulation; coefficients are obtained from a random-intercept model (column 1) and from a logistic regression model (column 2)

	(1)	(2)
	H1: Vacancy duration	H2: Occupational mobility
	Data: IAB JVS	Data: SIAB
Occupational regulation	-0.171 ***	-0.510 ***
	(0.077)	(0.019)
Constant	3.596 ***	-3.345 ***
	(0.098)	(0.031)
Controls	yes	yes
Var (cons)	0.019	--
	(0.005)	--
Var (residual)	1.430	--
	(0.015)	--
Log likelihood	-27,611.942	--
Pseudo R-squared	--	0.034
N hires	17,251	--
N occupations	140	--
N observations	--	12,689,353
N individuals	--	633,771

Remarks: Standard errors in parentheses. ***p<0.001; **p<0.01; *p<0.05.
Coefficients of model "H1: Vacancy duration" were obtained from a random-intercept model. Dependent variable: logarithm of vacancy duration. Controls: establishment size, industries, region (East and West Germany), year of survey, occupation-specific unemployment rates.
Coefficients of model: "H2: Occupational mobility" were obtained from a logistic regression model. Dependent variable: odds of an occupational change. Controls: age, sex, occupation-specific unemployment rate in the previous occupation, month dummies. Standard errors are clustered at the individual level.

Turning to H1, occupational regulation has a clear negative impact on vacancy durations. Consequently, we can confirm H1: the more distinct occupational regulation is, the shorter vacancy durations are. With respect to H2, we find a significant negative effect of occupational regulation on the probability of an occupational change. This result suggests that transitioning into a new occupation is less likely the more distinct the regulation of this occupation is. We can confirm H2.

Concerning both hypotheses, Table 1 shows a clear pattern: Occupational regulation reduces uncertainty in the process of job search and recruitment, and it creates distinct occupational labour markets with nearly insurmountable barriers.

As a robustness check for the analysis of vacancy durations, we excluded all occupations with fewer than 20 observations. With this specification, 98 occupations remain. The multivariate analysis reveals that the impact of occupational regulation on vacancy duration is essentially the same. With regard to both analyses, we run

different specifications, each with a different set of control variables. Throughout all specifications, the results remain robust.

7 Discussion and conclusion

From a theoretic perspective, we argue that the regulation of occupations contributes to a reduction of uncertainty in the job or worker search processes regarding the motivation, the abilities, or the requirements of the actors. Occupational credentials reduce uncertainty because they allow transparency for employers and employees on supplied and demanded knowledge and skills. This transparency makes the matching process more efficient. However, a direct observation of information asymmetries is not possible, although one implication of the uncertainty effect is that successful recruitment processes in more regulated occupations should be more efficient and, therefore, take relatively shorter times. Consequently, the duration of a firm's search for workers in a certain occupation should negatively depend on how strictly the access to these occupations is regulated.

Furthermore, the literature widely discusses that incumbent workers or groups of workers can create benefits by controlling and closing access to the labour market segments to which they are assigned. We argue that this behaviour is reflected in the observation that the access in regulated occupations, particularly for workers from other occupations, is more restricted. Consequently, switches between occupations should be less often observed the more distinct the occupations' access regulations are.

In our empirical analyses, we focus on Germany because the German labour market reveals a strong and well-defined occupational structure and is framed by regulations that are directly related to this structure. We consider two modes of regulation. First, in some occupations, explicit legal entry regulations restrict access to employment, similar to occupational licensing in the USA or the UK. Second, for some occupations, access to employment is linked to an occupational credential but without legally binding rules.

We validate the first hypothesis with data from the IAB Job Vacancy Survey, which is a survey among firms on their recruitment strategies and outcomes. We find a robust negative relation between firms' worker search durations and the extent of the regulation indicator. This is in line with our first hypothesis and rather corroborates the uncertainty reducing effect of occupational regulation.

We validate the second hypothesis with the Sample of Labour Market Biographies (SIAB), a representative employment sample from register data. We find a robust negative relation between the probability of transitioning into an occupation and the extent of the regulation indicator. This finding is in line with our second hypothesis.

Our novel results complement the state of knowledge on the economic and social implications of occupational regulation and lead to some notable implications. On the one side, the uncertainty-reducing effect caused by occupational regulation can avoid productivity losses due to skill mismatch or to unfilled vacancies. The question is whether this could compensate or, at least, dampen the expected output losses due to potential higher wages that are predicted in strongly regulated occupations. For employees, occupational regulation minimises the risk of skill mismatches, which reduces wage inequalities.

On the other side, the closure effect produces barriers for occupational mobility. A change to a closed occupation is difficult or only possible with the appropriate credential. As a result, employees who want to change jobs have only a limited range of possible target occupations (Struck/Dütsch 2012). Thus, the regulation of occupations can reduce flexibility in the labour market. This can slow down necessary adjustments to the occupational structure, for example due to technological changes, and favour wage inequality or unemployment (e.g., Acemoglu/Autor 2011; Liu/Grusky 2013). Additionally, low occupational flexibility makes it more difficult to reduce skill shortages (see, for example, Koppel 2010).

The analytical concept of occupations as labour market institutions proposed here allows integrating occupations in a theoretical framework, both in sociological labour market research and in inequality research. Within this framework, we are able to explain the structuring effect of occupations on individual employment biographies. Occupational regulation mechanisms reduce uncertainty in the job matching process. Nevertheless, it also creates nearly insurmountable barriers for those with different occupational qualifications.

References

Acemoglu, D. and Autor, D. H. (2011). Skills, tasks and technologies: implications for employment and earnings, in: D. Card and O. Ashenfelter (Eds.): *Handbook of Labor Economics*, Volume 4, Part B, Amsterdam, London: North Holland, 1043-1171.

Allmendinger, J (1989). Educational systems and labor market outcomes. *European Sociological Review* 5: 231-250.

Arkes, J (1999). What do educational credentials signal and why do employers value credentials. *Economics of Education Review* 18: 133-141.

Beck, U., Brater, M. and Daheim, H.-J. (1980). *Soziologie der Arbeit und der Berufe. Grundlagen, Problemfelder, Forschungsergebnisse*. Reinbek: Rowohlt.

Becker, G.S. (1993). H*uman capital. A theoretical and empirical analysis with special reference to education*. Chicago/London: University of Chicago Press.

BERUFENET (2018). *Die Datenbank für Ausbildungs- und Tätigkeitsbeschreibungen der Bundesagentur für Arbeit*. https://berufenet.arbeitsagentur.de/.

Blien, U. and Phan thi Hong, V. (2010). Berufliche Lohnunterschiede, 263-280, in: Euler D., Walwei, U. and Weiß, R. (Eds.). *Berufsforschung für eine moderne Berufsbildung. Stand und Perspektiven*. Stuttgart: Steiner.

Blossfeld, H.P. (1987). Labor-market entry and the sexual segregation of careers in the Federal Republic of Germany. *American Journal of Sociology* 93: 89-118.

Bills, D.B. (2003). Credentials, signals, and screens: Explaining the relationship between schooling and job assignment. *Review of Educational Research* 73: 441-469.

Bol, T. and Weeden, K.A. (2015). Occupational closure and wage inequality in Germany and the United Kingdom. *European Sociological Review* 31: 354-369.

Breen, R. (2005). Explaining Cross-National Variation in Youth Unemployment: Market and Institutional Factors. *European Sociological Review* 21: 125-134.

Buchmann, M., Kriesi, I. and Sacchi, S. (2010). Labour market structures and women's employment levels. *Work, Employment and Society* 24, 279-299.

Coleman, J.S. (1994): *Foundations of Social Theory*. Cambridge, Mass.: Harvard University Press.

Damelang, A., Schulz, F., and Vicari, B. (2015). Institutionelle Eigenschaften von Berufen und ihr Einfluss auf berufliche Mobilität in Deutschland. *Schmollers Jahrbuch* 135: 307-334.

Damelang, A., Haupt, A., and Abraham, M. (2018). Economic consequences of occupational deregulation: Natural experiment in the German crafts. *Acta Sociologica* 61: 34-49.

Dengler, K., Stops, M., and Vicari, B. (2016). Occupation-specific matching efficiency. *IAB Discussion Paper* 16/2016.

DiPrete, T., Eller, C.C., Bol, T., and van de Werfhorst, H.G. (2017). School-to-work linkages in the United States, Germany, and France. *American Journal of Sociology* 122: 1869-1938.

Di Stasio, V. and van de Werfhorst, H. (2016). Why does education matter to employers in different institutional contexts? A vignette study in England and the Netherlands. *Social Forces* 95: 77-116.

Dostal, W., Stooß, F., and Troll, L. (1998). Beruf. Auflösungstendenzen und erneute Konsolidierung. *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung* 31: 438-460.

Fitzenberger, B., Lickleder, S., and Zwiener, H. (2015). Mobility across firms and occupations among graduates from apprenticeship. *Labour Economics* 34: 138-151.

Ganzer, A., Schmucker, A., vom Berge, P., and Wurdack, A. (2017). Sample of integrated labour market biographies – regional file 1975-2014. *FDZ-Datenreport* 01/2017.

GOVET (2016). *Vocational Education and Training in Germany*. Bonn: German Office for International Cooperation in Vocational Education and Training. www.bibb.de/dokumente/pdf/GOVET_Praesentation_Maerz_2016_EN.pdf

Haupt, A. (2012). (Un)Gleichheit durch soziale Schließung. Effekte offener und geschlossener Teilarbeitsmärkte auf die Lohnverteilung in Deutschland. *Kölner Zeitschrift für Soziologie und Sozialpsychologie* 64: 729-753.

Haupt, A. (2015). *Zugang zu Berufen und Lohnungleichheit in Deutschland*. Berlin, New York: Springer (Springer Research).

Heckmann, M., Noll, S., and Rebien, M. (2013): Stellenbesetzungen mit Hindernissen. Bestimmungsfaktoren für den Suchverlauf. *Wirtschafts- und Sozialstatistisches Archiv* 6: 105-131.

Jovanovich, B. (1979). Job matching and the theory of turnover. *Journal of Political Economy* 87: 972-990.

Kleiner, M. (2006). *Licensing occupations: Ensuring quality or restricting competition?* Michigan: W.E. Upjohn Institute.

Kleiner, M.M. and Krueger, A.B. (2010). The prevalence and effects of occupational licensing. *British Journal of Industrial Relations* 48: 676-687.

Kalleberg, A.L. and Sørensen, A.B. (1979). The sociology of labor markets. *Annual Review of Sociology* 5: 351-379.

Konietzka, D. (1999). Die Verberuflichung von Marktchancen. Die Bedeutung des Ausbildungsberufs für die Plazierung im Arbeitsmarkt. *Zeitschrift für Soziologie* 28: 379-400.

Koppel, O. (2010). *Ingenieurarbeitsmarkt 2009/10 – Berufs- und Branchenflexibilität, demografischer Ersatzbedarf und Fachkräftelücke*. Institut der deutschen Wirtschaft Köln.

Kubis, A., Moczall, A., and Rebien, M. (2017). The IAB job vacancy survey. Establishment survey on job vacancies and recruitment processes. Waves 2000 to 2014 and subsequent quarters since 2006. *FDZ-Datenreport* 04/2017.

König, W. and Müller, W. (1986). Educational systems and labour markets as determinants of worklife mobility in France and West Germany: A comparison of men´s career mobility 1965-1970. *European Sociological Review* 2: 73-96.

Liu, Y. and Grusky, D. B. (2013). The payoff to skill in the third industrial revolution. *American Journal of Sociology* 118: 1330-1374.

Longhi, S. and Brynin, M. (2010). Occupational change in Britain and Germany. *Labour Economics* 17: 655-666.

Marinescu, I. E. and Wolthoff, R. (2016). Opening the black box of the matching function: The power of words. *NBER Working Paper* No. 22508. National Bureau of Economic Research.

Marsden, D. (2000). A theory of job regulation, the employment relationship, and the organization of labour institutions. *Industrielle Beziehungen* 7: 320-347.

Matheson, C. (2001). Staff selection in the Australian public service: A history of social closure. *Australian Journal of Public Administration* 60: 43-58.

Miller, G. (1992). *Managerial dilemmas*. Cambridge, UK: Cambridge University Press.

Nee, V. (2005). The new Institutionalism in economics and sociology, 49-74. In: Smelser, N.J. and Swedberg, R. (Eds.) *The Handbook of Economic Sociology*. Second Edition, Princeton: Princeton University Press.

Oyer, P. and Schaefer, S. (2011). Personnel economics: Hiring and incentives, ch. 20. In: Ashenfelter, O. and Card, D. (Eds.) *Handbook of Labor Economics*. Vol. 4B, 1 ed. Elsevier.

Paulus, W. and Matthes, B. (2013). The German classification of occupations 2010. Structure, coding and conversion table. *FDZ-Methodenreport* 08/2013.

Redbird, B. (2017). The new closed shop? The economic and structural effects of occupational licensure. *American Sociological Review* 82: 600-624.

Reichelt, M. and Abraham, M. (2017). Occupational and regional mobility as substitutes: a new approach to understanding job changes and wage inequality. *Social Forces* 95:1399-1426.

Saar, E., Unt, M., Helemäe, J., Oras, K., and Täht, K. (2014). What is the role of education in the recruitment process? Employers' practices and experiences of graduates from tertiary educational institutions in Estonia. *Journal of Education and Work* 27: 475-495.

Sengenberger, W. (1987). *Struktur und Funktionsweise von Arbeitsmärkten. Die Bundesrepublik Deutschland im internationalen Vergleich.* Arbeiten aus dem Institut für Sozialwissenschaftliche Forschung e.V., Frankfurt am Main: Campus.

Solga, H. and Konietzka, D. (1999). Occupational matching and social stratification. Theoretical insights and empirical observations Taken from a German-German comparison. *European Sociological Review* 15: 25-47.

Sørensen, A.B. (1996). The structural basis of social inequality. *American Journal of Sociology* 5: 1333-1365.

Sørensen, A.B. and Kalleberg, A.L. (1981). An outline of a theory of the matching of persons to jobs, 49-74. In: Berg I (Ed.) *Sociological Perspectives on Labor Markets*. New York: Academic Press.

Stigler, G.J. (1961). The Economics of information. *The Journal of Political Economy* 69: 213-225.

Struck, O. and Dütsch, M. (2012). Gesicherte Mobilität am Arbeitsmarkt: Zur Bedeutung berufsfachlicher Qualifikationen in geschlossenen und offenen Beschäftigungssystemen. *Industrielle Beziehungen* 19: 154-186.

Thelen, K. (2004). *How institutions evolve: The political economy of skills in Germany, Britain, the United States, and Japan*. Cambridge: Cambridge University Press.

Vicari, B. (2014). Degree of standardised certification of occupations. An indicator for measuring institutional characteristics of occupations. *FDZ-Methodenreport* 04/2014.

Vogtenhuber, S. (2014). The impact of within country heterogeneity in vocational specificity on initial job matches and job status. *Journal of Vocational Behavior* 85: 374-384.

Weeden, K. (2002). Why Do Some Occupations Pay More than Others? Social Closure and Earnings Inequality in the United States. *American Journal of Sociology* 108: 55-101.

Williamson, O. E., Wachter, M. L., and Harris, J. E. (1975). Understanding the employment relation: The analysis of idiosyncratic exchange. *Bell Journal of Economics* 6: 250-278.

Witte, J.C. and Kalleberg, A.L. (1995). Matching training and jobs: The fit between vocational education and employment in the German labour market. *European Sociological Review* 11, 293-317.