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Why does education pay off? Relations between institutional context and the mechanisms by which education pays off in the labor market

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Chapter 5

Occupational Closure and Wage Inequality in Germany and the United Kingdom

Abstract
Closure-based approaches to labor market inequality argue that artificial restrictions on the supply of labor to an occupation or other labor market position drive up its wages, thereby contributing to between-occupation inequality. To date, the closure argument has been neither elaborated nor tested in a comparative context. In this chapter, we develop a theoretical argument to account for differences in the prevalence and wage effects of closure practices across countries and assess its predictions in the United Kingdom, a liberal market economy (LME), and Germany, a coordinated market economy (CME). Using newly collected occupation-level data on licensure, educational credentialing, unionization, and apprenticeships that are linked to individual-level wage data, we show that closure increases mean occupation wages in both countries. However, the prevalence and payoff of closure practices varies systematically across the two countries, with vocational credentialing and unionization having particularly strong effects in Germany relative to other sources of closure, and tertiary credentialing and licensure having particularly strong effects in the UK. The labor markets of both countries, then, are entirely polluted by rents that affect between-occupation wage inequality.

This chapter is co-authored by Kim A. Weeden and is available as Bol, Thijs, and Kim A. Weeden. nd. "Occupational Closure and Wage Inequality in Germany and the United Kingdom." *Working paper, AMCIS, University of Amsterdam*, and is currently under review.

5.1 INTRODUCTION

In the wake of the recent take-off in wage inequality in many advanced industrialized societies, an extensive literature has emerged to identify the sources of inequality, explain why it has risen so dramatically, and account for cross-national differences in the level and pattern of inequality. Within this literature, institutional approaches that focus on "non-market" or post-market income-setting processes are often pitted against "market" approaches that focus on supply and demand factors. More recently, scholars have sought to understand how contemporary institutions affect the labor supply, thereby paving the way for reconciliation between the institutional and supply-and-demand approaches. In particular, there has been a resurgence of interest in institutionalized sources of social closure (Weber 1978 [1922], see also Parkin 1974; Tilly 1998; Weeden 2002; Grusky and Weeden 2011; Tomaskovic-Devey and Lin 2011) that restrict the supply of labor in "closed" positions below the level of demand, thereby generating wage returns in excess of those that would be observed in a competitive market ("rents").[1]

To date, the closure argument has primarily been applied to understand economic inequality in liberal market economies (see, e.g., Weeden 2002; Avent-Holt and Tomaskovic-Devey 2010; Grusky and Weeden 2011; Tomaskovic-Devey and Lin 2011), leaving its implications for comparative inequality research underdeveloped. As there are only a few studies who focus on occupational closure in coordinated market economies (see Giesecke and Verwiebe 2009; Haupt 2012), we simply do not yet know whether the wage premia associated with closure are a more widespread feature of advanced industrialized societies. This chapter redresses this gap by, first, elaborating the closure argument to better identify and understand cross-national differences in patterns of closure and its wage effects, and second, systematically assessing the predictions of the closure-based approach using data from two European countries. Our argument emphasizes closure around occupations (see Grusky and Sørensen 1998; Weeden and Grusky 2005a, 2005b, 2012a).

The backdrop for our analysis is the well-known variation across countries in levels of economic inequality: inequality is relatively high in liberal market economies (LMEs), where economic exchange occurs in competitive markets and through arms-length contracting, and relatively low in coordinated market economies (CMEs), where economic exchange is facilitated by "strategic interaction" between employers, trade unions, the state, the educational system, and other institutional actors (Hall and Soskice 2001). The conventional explanation for this pattern focuses on the institutions in CMEs that compress inequality by raising wages for workers at the bottom of the wage distribution (e.g., trade unions) and by redistributing income from top-end workers to bottom-end workers through taxation and welfare benefits. The implicit assumption is that the relatively high levels of inequality in LMEs are due to the *absence* of such inequality-suppressing institutions. Institution-poor LMEs thus serve primarily as a foil for institution-rich CMEs.

1. More formally, rents are the returns above that which would be necessary to keep an asset in production in a competitive market (e.g., Tullock 1967). Or, more simply, rents are "the surplus of pure profit obtained from owning the resource [...] independently of the efforts of whoever owns [that] resource" (Sørensen 1996: 1337-1338; see also Morgan and Cha 2007, Morgan and Tang 2007). We are concerned in this chapter with rents accruing from owning a labor market asset or skill (Sørensen 1996, 2000).

This near-exclusive emphasis on the inequality-suppressing institutions in CMEs has, in our view, led to an impoverished understanding of cross-national similarities and differences in the sources of wage inequality. Specifically, we argue that the characteristically high level of market-based inequality in LMEs is generated not only by the near absence of institutions that secure rents for those at the bottom of the wage distribution, but also by the presence of institutions that generate rents at the top of the wage distribution. The characteristically low levels of inequality in CMEs stem not only from the inequality-suppressing effects of institutions that protect low-wage workers, but also from comparatively weak (but not altogether absent) closure at the top of the wage distribution. Thus, labor markets in both types of economies are entirely polluted by rents, but the distribution and magnitude of rents vary in systematic ways across systems of economic exchange.

We will develop and assess these ideas through a comparison of two European countries: Germany and the United Kingdom. In the comparative inequality literature, Germany serves as the prototypical CME, while the UK serves as the prototypical (European) LME. By identifying differences across these two countries in the prevalence of closure practices and their impact on observed wages, we offer important new insights into comparative wage inequality. Granted, we cannot make general claims about all CMEs based solely on the German case, nor can we make claims about all LMEs based solely on the UK case. Nevertheless, if any systematic differences in the distribution and payoff to closure strategies across the economic types highlighted in the comparative inequality literature are to be found, one would expect them to be revealed in a comparison of these two countries.

In assessing the wage effects of occupational closure, we feature new and extensive data on closure at the detailed occupation level in our two countries. We focus on four closure practices: licensure, credentialing in the formal educational system, unionization, and apprenticeships. We link our country-specific data on occupational closure to (1) country-specific occupation-level data on skill requirements, and (2) individual-level microdata from 2006-2007 (UK) and 2006 (Germany), which allows us to apply multilevel models that take full advantage of the data's nested structure. To foreshadow our results, we find a strong positive relationship between occupational closure and wages in both countries, but also substantively important differences across the two countries in both the prevalence of each institutionalized source of occupational closure and their wage effects.

The rest of the chapter proceeds as follows. We first review the occupational closure argument, paying particular attention to the institutionalized sources of closure in contemporary industrialized societies and the mechanisms by which closure affects occupational wages. Whereas this section borrows from the extant literature, the subsequent section represents a new elaboration of the closure argument for the comparative context. After a necessarily detailed discussion of the data that we collected for this project, we then describe the basic contours of occupational closure in Germany and the UK and present results from our multilevel models estimating the country-specific wage returns to the various closure practices. We conclude by drawing out the implications of our results for comparative inequality research.

5.2 OCCUPATIONAL CLOSURE

Occupational closure occurs wherever legal and normative barriers restrict the supply of labor in an occupation and protect its incumbents from external competition. It drives up occupation wages through two proximate mechanisms. First, closure may restrict access to opportunities to receive the occupation-specific training or skills. Potential recruits who lack skills that are in high demand cannot respond to market signals and secure the training they would need to obtain these skills. Second, barriers may restrict the supply of labor that can legally practice the tasks that are under the occupation's jurisdiction (Sørensen 2000; see also Weeden 2002; Abbott 1988; Larson 1977). In this case, it is not so much that access to opportunities to acquire skills or the markers of skill is restricted, but that access to positions requiring those skills is restricted. Both mechanisms drive up mean occupation wages, but the underlying source of rents differs.

In this chapter, we consider four institutionalized sources of closure ("closure practices") that restrict access to skill acquisition or to skill application: educational credentialing, licensure, unionization, and apprenticeships. These sources of closure do not exhaust the institutions in contemporary labor markets that may generate occupation rents. We contend, however, that these are four of the most prominent and deeply institutionalized sources of occupational closure. If closure has any measurable impact on the wage distribution, as the closure argument predicts, it should be evident in a positive association between these institutionalized sources of closure and mean occupation wages.

Educational credentials refer to the degrees and certifications earned in the formal educational system. These credentials may serve primarily as a filtering device for children of privileged class positions (Collins 1979: 21; Berg 1970), signify successful training in job-relevant skills, or act as a signal of underlying traits (e.g., ambition, persistence) that are valued by employers. If opportunities to obtain credentials are unrestricted, workers will presumably invest in education up to the point where the anticipated wage returns are equal to the costs of obtaining the credential (e.g., Sørensen 2000). The supply of credentialed labor would respond to demand for it, and there would be no market rents. Instead, modern educational systems are characterized by rationing of adequate training for college and of slots in the post-secondary programs whose graduates are sought by employers (see Grusky and Weeden 2011; Weeden and Grusky 2012b), generating excess wage returns for those who obtain the training or credentials (Sørensen 2000: 1554).

If the educational system is a rent-generating institution, is it also a source of *occupational* closure and rents? We argue that wherever entry into an occupation requires (a) an educational credential that can only be obtained in the formal educational system (the credentialist view); or (b) occupation-specific training and skills that can only be acquired through the formal educational system (the training view), educational closure produces occupational closure. As we discuss below, the strength of the correspondence between educational closure and occupational closure differs across countries. Here we wish only to make the general point that if educational credentials are in short supply, the supply of workers in occupations that require such credentials will likewise be constrained and rents will accrue to those who have obtained the credentials.

Apprenticeships serve much the same function for the skilled trades as educational credentialing does for the professions (Parkin 1974: 13; see also Weber [1922] 1978: 344). In the classic apprenticeship system, job-relevant training takes place on the job itself, with employers taking primary responsibility for training workers and administering the apprenticeships (Ryan 2001). In most contemporary apprenticeships, on-the-job training under the supervision of a master is combined with vocational training in the formal educational system. These "dual apprenticeship systems" govern access to the skills of the trade and to the "credential" of journeyman (Shavit and Müller 1998). And, as with educational credentials, rationing of slots in apprenticeship systems will limit the supply of labor in the apprenticed trade by restricting access to credential or skill acquisition. The returns to degrees earned by individual workers are a combination of compensation for the costs of training and economic rents (see, e.g., Sørensen 2000; Weeden and Grusky 2012b).

Whereas educational credentialing and apprenticeships primarily operate by restricting access to opportunities to obtain occupational credentials and training, licensure secures rents by restricting access to opportunities to practice a set of skills or lay claim to an occupational title. These licenses require that the person in the licensed occupation demonstrate a minimum level of competence, pay a fee, and meet other non-task-relevant requirements such as residency, citizenship, or "moral turpitude."[2] Competence may be evaluated by the licensing agency or by organizations representing the occupation, in either case typically using standards set by occupational agents. Many licenses also require the applicant to hold a specific educational credential and complete continuing education credits, but the credential is itself not sufficient for licensure.

Licensure protects occupation members' exclusive right to sell a particular set of services and, often, to claim a specific title; as such, it serves as a "patent on a practice" (Larson 1977; see also Weber [1922] 1978: 342). Like patents on technology or intellectual property, licenses embed rights to the asset in the state, which has the power to enforce the rights of the "patent holders" by prosecuting those who practice without a license. This legal backing makes licensure one of the stronger sources of closure (Friedman 1962). The restrictions it places on the supply of labor that can legally lay claim to an occupational title are especially pronounced where occupational agents have direct control over the number of new entrants or proportion of applicants that meet the licensure requirements (e.g., passing bar exams), but even where licenses are administered by the state, they represent barriers to entry that require time, energy, and resources for potential occupational practitioners to clear.

Finally, unions have long been understood as institutions that generate rents for union members, and for non-union workers in heavily unionized industries through wage spillover effects (e.g., Freeman and Medoff 1984; see also Western and Rosenfeld 2011). These rents can stem from exclusionary practices and closed-shop agreements that directly protect union members from outside competition (e.g.,Wright 2009: 106) or from union control over access to the acquisition of particular skills (e.g., Bills

2. We differentiate licensure from mandatory registration, whereby the state–typically without the input of occupational representatives–requires new practitioners to register their names with the relevant bureaucracy, perhaps paying a small fee or showing proof of insurance. Mandatory registration is a very weak barrier to entry, and hence there is little reason to anticipate that it will have an appreciable effect on occupation wages.

2005: 78). Unions may also raise wages by helping workers capture a larger share of firm profits, or what Morgan and Tang (2007) call "negotiated rents." The key to union-generated rents lies in the unions' state-granted right to bargain collectively, with the threat of the withdrawal of labor as a key weapon in the effort to secure rents through restrictions on skill acquisition and skill application.

The relationship between unionization and occupational closure depends on the type of union (see also Weeden 2002: 64). Unions that represent entire industries or social classes will affect occupation-level wages to the extent that occupations are unevenly distributed across the represented industries (e.g., line repairers are concentrated in telecommunications). The efficacy of unionization as a source of occupational wage premia thus depends not only on ability of unions to restrict access to training and negotiate favourable agreements, but also whether unions in a given country are predominantly organized around occupations, industries, or even broader aggregations of positions.

To date, empirical assessments of the hypothesized link between these closure practices and wage inequality have focussed primarily on one institution in isolation. For example, a substantial body of research examines the positive relationship between unions and wage inequality, both over time and across countries (e.g., Western and Rosenfeld 2011; Western 1999). A smaller body of research, primarily in economics, shows a positive effect of licensure on wages (e.g., Kleiner 2006, Kleiner and Krueger 2010; Humphris, Kleiner, and Koumenta 2011), albeit without parsing out the effects of other occupational closure practices with which licensure is correlated. In one of the few exceptions, Weeden (2002) shows that in the United States, closed occupations have higher mean wages than is predicted by individual-level attributes and occupation-level measures of skills and gender composition. The wage returns to licensure and educational credentialing were especially strong, the wages effects of voluntary certification and unionization relatively modest, and the wage effect of representation by occupational associations non-existent, a pattern of findings she attributes to the relative effectiveness of closure practices that impose restrictions on the supply of labor.

The closure argument shows considerable promise as a generalized account of occupational wage inequality. So far, however, this promise is based on an empirical record that is charitably described as sparse. Our empirical goal is to extend this record by evaluating the wage effects of closure outside of the United States. Our theoretical goal, to which we first turn, is to elaborate the closure argument for the comparative context, and in particular identify how closure practices and their wage returns vary across the broad systems of economic coordination in which closure practices are embedded.

5.3 Occupational closure in comparative context

The extant literature on the relationship between closure and wage inequality has ignored the broader institutional context in which closure practices are embedded in favour of more general arguments about the ubiquity of rents in advanced industrialized nations (see Weeden 2002; also Grusky and Weeden 2012b). At the same time, the closure argument offers no theoretical justification for assuming that either the

favoured sources of closure or their wage returns will be identical across countries. In this section, we identify sources of cross-national differences in the prevalence of different closure practices, and discuss how differences in institutional context affect the anticipated payoff to these practices.

We take as our starting point the oft-noted distinction between CMEs, where economic exchange is coordinated and negotiated among various actors (trade groups, unions, the state), and LMEs, where economic exchange between economic actors is coordinated through competitive markets and ostensibly arms-length contracting (Hall and Soskice 2001: 8). We argue that in CMEs, the reliance on extra-market relationships and emphasis on long-range planning provide fertile ground for closure practices that restrict access to both the acquisition and application of occupation-specific skills. In LMEs, by contrast, the reliance on spot-market contracting and the absence of centralized planning reduces the prevalence and effectiveness of closure practices that restrict access to occupation specific training, at least relative to CMEs, but increases the prevalence of restrictions on skill application (e.g., through licensure). We develop these arguments below in the context of the UK and Germany, as exemplars of LMEs and CMEs, respectively.

5.3.1 Occupational Closure in the UK

The formal institutions of closure in the UK reflect its status as a liberal market economy. In such systems, the output of the educational system is neither highly differentiated nor coordinated in any meaningful way by external actors (e.g., trade unions, the state, employers) to meet long-term economic goals.[3] Indeed, educational institutions in LMEs, even those that are publicly funded, guard their independence jealously, and are more likely to adopt educational goals that emphasize intellectual exploration, critical thinking, and personal development rather than narrow vocational training. Some occupation-specific training can be found, most notably the professional schools (e.g,, law school, business school, etc) and, arguably, post-secondary training programs where the content of and standards for instruction are developed in consultation with occupational representatives (e.g., engineering schools).

More often, though, educational closure in LMEs takes the form of bottlenecks in preparatory training for university or of restrictions on the number of slots in post-secondary institutions available to secondary school graduates. In 2011, 70% of UK applicants to tertiary education were accepted to at least one tertiary institution, meaning that nearly 1/3 were unable to enter university immediately despite showing enough interest to apply (University and College Admissions Services 2011). We do not know, of course, whether these applicants were denied admission because of insufficient preparatory training or because of insufficient slots in universities, but for our purposes it does not matter much: in the UK, as in other LMEs, the educational system does not necessarily expand to fit employer demand for college-educated labor, generating rising returns to a college degree that partially reflect wage premia associated with restricted supply (Goldin and Katz 2008; Weeden and Grusky 2012b).

It bears emphasizing that even though access to tertiary education in the UK is restricted, and thereby rent-generating, access to lower level educational credentials is

3. Educational institutions in Northern Ireland, Scotland and Wales offer slightly different degrees than England. In 2005, the member states in the UK tried to harmonize their qualification systems through the National Qualification Framework (NQF), which assigns a level to every state-specific qualification.

nearly universal. The vast majority of intermediate degrees (e.g., "A levels") are obtained through the secondary educational system, which is accessible to all. Although nearly a third of upper secondary students in the UK are enrolled in a vocational program, vocational credentialing in the UK is relatively weak, again reflecting the absence of coordination between the state, employers, unions, and the educational system. Standards for training for these degrees are set with relatively minimal input from employers or unions, and vocational degrees are neither a necessary nor a sufficient condition for entry into the occupations for which vocational students are ostensibly trained. Although employers may prefer to hire workers who are vocationally trained, they are under no legal obligation to do so; the restrictions on the supply of labor thus rely on employers' beliefs about the utility of the vocational credentials. As we describe below, our UK data do not allow us to differentiate intermediate degrees obtained in a non-vocational program from those obtained in a vocational training program. Theoretically, though, we do not anticipate a large wage return to either, the former because of nearly universal access to secondary training and the latter because of the absence of coordination between vocational education and major economic actors.

We similarly anticipate relatively small wage returns to apprenticeships. Although there are approximately 190 apprenticeships currently offered in the UK, they are a heterogeneous array of programs, with—in typical LME fashion—no explicit coordination with employers (Thelen 2004), no agreed-upon meaning of the "apprenticeship" label, and no centralized oversight of programs that adopt the "apprenticeship" label (Ryan 2001; Ryan and Unwin 2001).[4] Apprenticeships are rarely required to practice an occupation, although they may be incorporated as part of a National Vocational Qualification (NVQ) or professional qualification. This high level of decentralization of apprenticeships, coupled with their voluntary status, leads us to anticipate relatively small wage returns to this form of closure in the UK compared to its returns in Germany.

The apprenticeship system in the UK is closely tied to union activities (Steedman 2001). To the extent that unions rely on their control over apprenticeships to protect their members from competition, we should therefore anticipate low wage returns to unionization in LMEs. However, unions may also attempt to secure rents for members more directly, by using the threat of the withdrawal of labor to negotiate a greater share of firm profits; these negotiated rents require not only high levels of unionization within an occupation (generating few alternatives), but also centralized collective bargaining. As is well known, unions in the UK, as in other LMEs, are under siege, with the percentage of workers covered by collective bargaining declining rapidly from about 70% in 1980 to 30% in 2000 (OECD 2004: 145). Moreover, union-based collective bargaining is highly decentralized, typically occurring at the company or plant level; unions in the UK lack the major role in economic coordination that they enjoy in CMEs (Ebbinghaus and Visser 2000). We therefore anticipate that the occupational wage returns to unionization to be relatively modest in the UK, compared to other forms of closure and compared to the union wage premium in Germany.

With the notable exception of tertiary credentialing, then, we expect relatively modest wage returns to closure practices that restrict access to training and skills,

4. The Adult Learning Inspectorate (since 2007 known as Ofsted) was set up in 2001 to inspect the quality of apprenticeship programs, but has few "teeth" relative to the national regulation of the German apprenticeship system (Ryan and Unwin 2001).

and similarly modest wage returns to unionization, which in theory generates rents through both the skill acquisition and skill application mechanism. Perhaps ironically, licensure—a closure practice that directly restricts access to positions where skills can be applied—is prevalent in the UK, although not as common as in the United States. This curious state of affairs is, we think, a result of the widespread belief—promulgated, in many cases, by occupational representatives—that licensure overcomes conditions of imperfect information that prevent "the market" from weeding out incompetence or malfeasance (see, e.g., Council of State Governments 1952).[5] At least according to its proponents, licensure greases the wheels of economic exchange and makes markets more efficient. It therefore serves as something of a substitute to vocational or occupation-specific credentialing in which the competency filter is embedded in the training itself, through an educational system that is carefully watched by employers, unions, and the state. As we argued above, because licensure embeds occupational closure in the legal apparatus of the state, we anticipate that it is not only prevalent in the UK relative to Germany, but will have large wage effects compared to other closure practices.

5.3.2 Occupational Closure in Germany

Closure in Germany takes on a notably different cast than closure in the UK, reflecting Germany's far greater economic coordination and emphasis on long-range planning. This plays out, in part, in the German educational system, which is justly famous for its vocational orientation and emphasis on occupation-specific skills (Brauns, Scherer, and Gangl 2001; Busemeyer 2009; Hansen 2011). This system is highly differentiated, with a relatively large number of educational qualifications that can be obtained given similar years of training: in Germany, it is the content of the credential, and not just its level, that drives future job placements and limits occupational mobility (Solga and Konietzka 1999: 28; Grunow and Mayer 2007). Tertiary education, for example, is provided through two types of institutions: state universities, which offer general degrees (similar to most universities in LMEs); and the *Fachhochschule* (University of Applied Sciences), which offers occupation-specific degrees. Moreover, limitations on the number of slots to obtain specific disciplinary degrees in universities and *Fachhochschulen* (Mayer, Müller, and Pollak 2007: 251) restricts the pool of workers who have access to occupation-specific training and credentials.

These barriers to access to training are further reinforced by state mandates that specify the educational credential required to enter an occupation. To become a self-employed baker in Germany, for example, one must obtain a "master craftsman" diploma in baking or the equivalent qualification.[6] However, licensure of the sort observed in the UK and other LMEs, wherein the state mandates criteria above and beyond required educational credentials, is relatively rare. Several occupations require professional registration, which is often voluntary (OECD 2006b), and a handful of health care occupations require licenses similar to those in the UK. These restrictions are likely to generate wage returns for the licensed occupations in Germany, in much

5. Some occupations in the UK have "voluntary licensure." This is analogous to a certification obtained from a non-governmental occupational association (see Weeden 2002).

6. See the *Handwerksordnung*, nr. 30 (bundesrecht.juris.de/hwo/anlage_a_195.html, last accessed July 12, 2011).

the same way that they do in the UK. [7] In effect, though, in the German system, with its highly coordinated economic exchanges and tighter coupling between the educational system and major economic actors, closure is more likely to occur through restrictions on opportunities to obtain training and skills. In particular, we expect high wage returns to vocational credentialing in Germany, on par with the wage returns to tertiary credentialing.

Vocational training in Germany is, of course, closely linked to the German apprenticeship system, which has been described as the heart of the "German skills machine" (Culpepper and Finegold 1999). According to the Federal Ministry of Education and Research (BMBF), two-thirds of German secondary school students learned a "*recognised* occupation requiring formal training" (BMBF 2003:1; emphasis added). Although less than a third of recognized occupations (41 out of 153) require an apprenticeship, another third are connected to a voluntary apprenticeship program. In marked contrast to the UK, all German apprenticeships are regulated by regional governmental agencies (i.e., the Chambers of Industry and Commerce and the Crafts Chambers), which set the curriculum and requirements for apprenticeships and advise and monitor the employers who offer apprenticeships.[8] Occupational groups are also deeply involved in setting up apprenticeship systems, and thereby exert indirect control over the number and training of new entrants into the occupation (see, e.g., Thelen 2004; Busemeyer 2009). This should, in theory, generate higher average wages for occupations in which apprenticeships are mandatory for entry, but with one important caveat: because most apprenticeships are part of a dual system, some of the wage-enhancing effects of apprenticeships may be "absorbed by" measures of vocational credentialing.

In Germany, as in other CMEs, unions take a central role in negotiations over wages, negotiations that often culminate in legally binding and enforceable collective labor agreements (CLAs). Although trade union membership rates are lower in Germany (22.6%) than in the UK (29.3%, see Visser 2006), CLA coverage in Germany is relatively high at 68% of all employees (OECD 2004: 145). Most of these CLAs govern wages at the industry or company level, meaning that their effect on occupational wages is indirect. German unions are, however, central in the development and implementation of occupations-specific apprenticeships, defining requirements for entry for nearly 300 occupations (Busemeyer 2009: 394). Although the trade union effect on occupational closure *per se* may thus be indirect, we expect the relatively strong bargaining power of trade unions and their involvement in the apprenticeship system to translate into a larger wage premium in unionized occupations in Germany compared to the UK.

As the preceding discussion implies, all four institutionalized closure practices can be found in the UK and Germany. The countries differ, however in the prevalence of each closure practice, the extent to which it restricts the supply of labor, and, consequently, the magnitude of its anticipated wage returns. To summarize, we anticipate positive wage returns to all four closure strategies, but greater payoffs to vocational credentialing,

7. Article §132a of the *Strafgesetzbuch*, which can be visited at dejure.org/gesetze/StGB/132a.html, last accessed April 22, 2011.

8. Almost a quarter of all companies and more than 93% of companies with more than 500 employees offer apprenticeships (BMBF 2003: 7).

unionization, and apprenticeships in Germany compared to the UK, with the caveat that the apprenticeship effect may be mediated by vocational credentialing (because of the dual system) and unionization. We also anticipate positive wage returns to tertiary credentialing and licensure in Germany, even though licensure, at least, is much less prevalent in Germany. Conversely, we anticipate high wage returns to licensure and tertiary credentialing in the UK compared to the other closure strategies, and modest wage returns to vocational credentialing, unionization, and apprenticeships in the UK compared to Germany.

5.4 Methods and data

Our analytic task is to estimate the wage returns to occupational closure (rents) in excess of the wages that would accrue in the absence of artificial restrictions on supply. The challenge, which faces all rent-based analyses, is that competitive market wages are unobserved (see, e.g., Sørensen 2000; also Morgan and Tang 2007). Weeden (2002) addresses this problem by estimating the returns to closure after adjusting for individual-level measures of human capital and occupation-level measures of skills. This strategy "gives away" some of the wage returns to restrictions on access to generalized tertiary education, for example, or to the training necessary to enter high-skilled occupations, some portion of which are properly understood as rents (see also Weeden and Grusky 2012b). Our skill-adjusted models in this sense offer lower-bound estimates of the returns to closure. Although we think that the case for closure is strengthened if we observe a significant closure effect in the presence of such controls, we also estimate the unadjusted wage returns to closure.

We estimate the association between occupational closure and wages with multilevel random intercept models in which individuals (*i*) are nested in occupations (*j*). The general multilevel model is given by the following equation:

$$Y_{ij} = \alpha + b'(X_{ij} - \overline{X}..) + c'W_{ij} + u_j + \varepsilon_{ij} \qquad \textbf{(4.1)}$$

In this equation, Y is the logged earnings; *b'* is a vector for the fixed effects of individual level characteristics X_{ij}, which are all centered around their grand mean; *c'* is a vector for the effects of all occupational level characteristics W_j; and u_j and e_{ij} are random terms at respectively the occupational and individual level. By changing the covariates in *c'*, we construct a series of nested models that allow us to identify gross and net closure wage effects. We apply these nested models to data for Germany and the UK separately, because data limitations (see below) make more formal tests of differences in the estimated coefficients indefensible.

5.4.1 Individual-level data and measures

Individual-level data for our analyses were obtained from nationally representative household surveys conducted in 2006 (Germany) and 2006 and 2007 (UK). The German microdata are extracted from the public use file of the German Microcensus (German Federal Statistics Office 2011) and the UK micro-data from the Quarterly

Labor Force Survey (QLFS; Office of National Statistics 2011). In the QLFS, data are collected quarterly, and each sampled household participates in five waves. To obtain unique observations we limit our analytic sample to respondents from the first and fifth wave for each quarter of the 2006 survey and the first wave of data collected in 2007. We restrict our analyses to respondents who are currently employed, who are between the ages of 18 and 65, and, in the German data, those who indicated that their reported income is predominantly from wages and salaries.[9] The final analytic sample consists of 134,376 individuals nested in 330 occupations in the German data, and 75,681 individuals nested in 344 occupations in the UK data.

TABLE 5.1: DESCRIPTIVE STATISTICS OF INDIVIDUAL LEVEL VARIABLES FOR THE UK

Variable	Mean	SD	Min.	Max.
Female	0.53	0.50	0	1
Married	0.71	0.45	0	1
Kids in home	0.38	0.48	0	1
Ethnic minority	0.10	0.29	0	1
Country of residence:				
England	0.83	0.37	0	1
Scotland	0.09	0.29	0	1
Wales	0.05	0.21	0	1
Northern Ireland	0.03	0.16	0	1
Highest educational qualification:				
No qualifications	0.09	0.29	0	1
Other qualifications	0.07	0.26	0	1
Below NVQ Level 2	0.14	0.35	0	1
NVQ Level 2	0.16	0.36	0	1
Trade Apprenticeships	0.05	0.22	0	1
NVQ Level 3	0.15	0.35	0	1
NVQ Level 4 and above	0.34	0.47	0	1
Years of education	13.83	2.83	1	35
Experience	23.39	12.55	0	53
Experience squared	704.47	612.84	0	2,809
Normal hours in workweek	34.23	10.59	1	97
Parttime	0.24	0.43	0	1
ln Monthly earnings	6.82	0.66	3.73	10.49
Net monthly earnings	1,119.54	815.55	40.00	36,000

SOURCE. – Author's calculations using the Quarterly Labor Force Survey, all quarters of 2006 and 2007.

In all models, the dependent variable is the natural logarithm of monthly earnings. In the QLFS, earnings are measured as a continuous variable and no transformation is necessary. In the German Microcensus, earnings are coded into 24 categories, so to

9. The UK survey collects wage and salary data, whereas the German Microcensus collects information on monthly net income. By excluding German respondents who report that their primary income is from sources other than wages or salaries, we bring the two samples into closer alignment.

approximate a continuous measure we assigned each category its midpoint value. We also fit models to the UK data in which we discretize earnings into an ordinal variable comparable to the German measure, and obtained very similar results.

Our models estimate coefficients for the same set of individual level covariates in each country, to the extent possible given each nation's labor force survey (see Table 5.1 for the UK, Table 5.2 for Germany). The demographic covariates include binary indicators for gender (female = 1), marital status (married = 1), ethnicity[10] (ethnic minority = 1), and the presence of dependent children in the home (yes = 1). We also control for geographic region: in the German models, we fit a binary indicator of residence in former Eastern Germany; and in the UK models, we add a series of dummy variables corresponding to the member states (Scotland, Wales, and Northern Ireland, with England as the omitted category).

Table 5.2: Descriptive statistics of individual level variables for Germany

Variable	Mean	SD	Min.	Max.
Female	0.43	0.49	0	1
Married	0.60	0.49	0	1
Kids in home	0.52	0.50	0	1
Ethnic minority	0.02	0.14	0	1
Former Eastern Germany	0.23	0.42	0	1
Highest qualification				
CASMIN 1abc	0.27	0.45	0	1
CASMIN 2ab	0.39	0.49	0	1
CASMIN 2c	0.13	0.33	0	1
CASMIN 3a	0.07	0.26	0	1
CASMIN 3b	0.14	0.35	0	1
Years of education	16.44	4.98	9	35
Experience	19.60	11.41	0	50
Experience squared	514.30	480.05	0	2,500
Normal hours in workweek	37.98	10.41	1	90
Parttime	0.18	0.39	0	1
ln Monthly earnings	7.32	0.60	4.32	9.99
Net monthly earnings	1,821.30	1,452.06	75.00	22,000

SOURCE. – Author's calculations using the German Microcensus, wave 2006.

Our individual-level models include measures of labor force participation and human capital: number of hours normally worked in a week, a binary indicator for full-time or part-time employment (part-time = 1), work experience, work experience squared, years of education, and highest degree earned. We approximate work experience, which is not asked directly in either survey, with the difference between the date of the last degree earned and the date of the interview. We measure highest degree completed

10. The German Microcensus asks respondents to indicate if they belong to an ethnic minority. The best available analog in the UK data is a flag for whether respondents were born in non-Western countries.

with categories tailored to each countries' educational systems.[11] In the German data, the highest degree earned can be one of five CASMIN categories (Brauns, Scherer, and Steinman 2003): elementary education or less ("CASMIN 1abc" and the reference category in our tables); vocational secondary education from *Realschule* (2ab); full vocational maturity degrees of *Abitur,* or *Fachhochschulreife* (2c); *Fachhochschul* degree (3a); and university degrees (3b). In the UK microdata, educational degrees are given in seven levels of National Vocational Qualifications: no qualifications (the reference category); other qualifications; below NVQ Level 2; NVQ Level 2; trade apprenticeships; NVQ Level 3; and NVQ Level 4 and above. We fit degrees as dummy variables, avoiding assumptions of hierarchy or equidistant spacing of the categories.

5.4.2 Occupational-level data

To retain as much detail as possible, we rely on the occupational classification schemes in which the data were originally collected. The German data are coded into the 369 categories of the 1992 *Klassifizierung der Berufe* (KldB-1992), and the UK data into the 353-category version of the 2000 Standard Occupational Classification scheme (SOC-2000). We exclude 11 categories in the KldB-1992 that are reserved for respondents who are still at school or cannot be coded into an occupation. Due to missing individual- and the occupational-level data, we lose 27 additional categories in the German data and 9 in the UK data, either because the occupations are too small to be represented in the survey (e.g., saddlers, craft shoe makers, musical instrument makers) or, less commonly, because they are residual categories (e.g., "metal workers not elsewhere classified") for which we could not obtain reliable information on occupation skills or closure.

Neither Germany nor the UK systematically collects official occupation-level data on skills or closure practices at a sufficient level of detail or comprehensiveness for our goals.[12] We constructed our own occupation-level data set from a variety of country level sources, reconciling the occupation codes of the source data with the KldB-1992 or SOC-2000 as necessary. We first describe the occupation-level "controls" that we fit in some models, then our measures of closure practices.

Occupational skills and demographic controls

Much prior research shows a net effect of the gender composition of occupations on wages, and some also shows a net effect of racial composition (see, e.g., Kilbourne et al. 1994; Tomaskovic-Devey 1993; Huffman and Cohen 2004; also Weeden 2002). In keeping with this prior research, we constructed measures of the percentage of women and the percentage of ethnic minorities in each occupation. These measures are aggregated from the German Microcensus and UK QLFS.

We construct indicators of occupational skills from the BIBB/BAuA Employment Survey of 2006 (Germany) and the British Skill Survey (BSS) of 2001 and 2006 (pooled) for the UK.[13] Both surveys are based on representative samples of the employed

11. Some respondents reported 35 or more years of education. We assume these are errors or outliers, and exclude these respondents from the analysis.

12. The EurOccupations data (Tijdens et al. 2009), for example, excludes about half of the occupations in the labor force surveys and is plagued by missing values on many of the key variables we would need for this project.

13. More information on the BIBB/BAuA Employment Survey can be found at: www.bibb.de/

workforce, ask detailed questions about occupational skills, and contain sufficient cases (20,000 in the BIBB/BAuA, 12,257 in the pooled BSS) to generate measures of skills for each occupation in the KldB-1992 and SOC-2000 schemes.

Our measures of occupational skills include scales of physical abilities, technical skills, complex mental processing, mathematical skills, interaction skills, and presentation skills. Each scale combines information from multiple questions in country-specific surveys. For each skill scale, we chose component items based on the items used to construct similar scales in O*NET, an occupation database in the U.S.[14] We constructed our scales using factor analysis, saving the factor scores with a mean of zero and a standard deviation of one. We then mapped the factor scores onto the categories in our occupation coding schemes. A detailed description of all skill variables, a list of items constituting each scale, and the results of the factor analysis are available in Appendix H.

Occupational closure

The featured measures in our analyses are indicators of the four institutionalized sources of occupational closure. We measure the extent of occupation-specific educational credentialing with two indicators: the required level of education, and an indicator of whether the occupation is regulated by the European Qualifications Network. In the German data, the level of education required in each occupation is measured with two variables: the percentage of BIBB/BAuA respondents who answer "vocational training or *Meister/Techniker* degree" in response to the question, "What qualification is normally required to do the job you have now?"; and the percentage of respondents who respond that a tertiary degree is required. Likewise, for the UK we aggregate responses to a similar question, "if they were applying today, what qualifications, if any, would someone need to get the type of job you have now?" The two occupation-specific measures of required qualifications in the UK indicate the percentages of respondents who responded with "low or intermediate degree" (e.g., GCSEs, NVQ 1-3) and "tertiary degree."

Our measures of educational credentialing also include a dummy variable that indicates if an occupation is regulated by the European Qualifications Network (EQN). In 2005, the EU passed a directive that requires all member states to generate a list of occupations that, according to national law, require a particular educational degree to enter. We assign a value of unity to occupations that are listed in the directive, and a null value to unlisted occupations.

The source of our data on licensure also differs across the two countries. For the German data, we identify all occupations that are covered by licensure laws using Article §132a of the criminal law supplemented with information on legal job protection from the German government's database of occupations.[15] In recognition that the

dokumente/pdf/BIBB_BAuA_2006_Data_Manual_neu.pdf, last accessed at November 12, 2011. Additional information on the British Skill Surveys can be found at: www.esds.ac.uk/findingData/snDescription.asp?sn=4972 and www.esds.ac.uk/findingData/snDescription.asp?sn=6004, both last accessed at November 12, 2012.

14. For more information, see www.onetonline.org, accessed at March 7, 2012.

15. This database can be found at berufenet.arbeitsagentur.de, last accessed May 14, 2011. Our measure of licensure is more restricted than the measure used by Haupt (2012). This difference in operationalization is mainly due to the strong intertwinement of educational credentials and occupational licenses: many occupational licenses are obtained within formal educational tracks (e.g., Hansen 2011), and differentiating

occupations specified in licensure laws and the occupations used in administrative classification schemes do not overlap perfectly, we eschewed a simple dummy variable and instead estimated the percentage of occupational incumbents who are licensed (see also Weeden 2002). Similarly, for the UK data, we identified the percentage of workers in an occupation who hold mandatory licenses or the Chartered designation, meaning that the title is legally protected. We collected information on occupational licensure in the UK through using legal codes, annual reports and websites of professional associations, websites with job profiles, e-mail contacts and telephone calls; additional details on these sources are available from the first author.

Our measures of unionization are aggregated from individual-level survey questions on trade union membership (0 = no, 1 = yes).[16] For Germany, we use the four waves of the European Social Survey (ESS; European Social Survey 2011) collected from 2002 to 2008.[17] We constructed a measure of union density in each of the three-digit ISCO codes collected in the ESS, then matched ISCO codes to the KldB-1992 scheme. Measures of occupation-level union participation for the UK could be aggregated from the QLFS, although only from the fourth quarters of the 2006 and 2007 surveys.

Closure through apprenticeship is likewise measured with a continuous variable indicating the percentage of workers in an occupation who have completed an apprenticeship. For our German data set, we calculated this measure from the German Microcensus, which asks respondents whether they have a vocational degree or any other apprenticeship; as noted above, vocational degrees are core to the dual system of apprenticeship. For our UK data, our measure is aggregated from individual responses to a QLFS question that asks respondents if they have completed a recognised apprenticeship.

5.5 Results

As the preceding discussion implies, we have tried to construct comparable measures of closure across our two countries. However, because the institutions themselves differ across the countries (e.g., the two educational systems offer different degrees) and because of idiosyncratic measures in each country's labor force survey, we were not always entirely successful. We think it is more defensible to fit separate models to data that are tailored to the individual country, thereby remaining true to the underlying institutions, than to force comparability in order to formally test cross-national variations in estimated coefficients. To this end, we first examine the prevalence of the closure practices in the UK and Germany, and then the estimated wage returns to closure in each country.

between licenses and credentials is often hard. Our results are, however, not influenced by the use of our measure of licensure: we replicated our analyses with the measure of Haupt (2012) and found roughly the same results. The only noteworthy difference is that the effect sizes of educational credentialing in Germany slightly decrease, as one would expect.

16. The QLFS includes data on collective labour agreement coverage, but there is no comparable measure for Germany. We therefore use the more comparable measure of trade union density for both countries.

17. The ESS data contain a random sample of the German population with a pooled sample size of 11,413. Because of the modest size of this sample, we anticipate some noise in the occupation-level estimates of union density, which will tend to lead to a downward bias in the estimated union effect.

5.5.1 How prevalent is occupational closure in the UK and Germany?

Table 5.3 provides weighted (by occupation size) and unweighted descriptive statistics for our occupation-level covariates.[18] It shows, firstly, that educational credentialing is a pervasive closure strategy in both countries: 69% of workers in the UK and 84% of workers in Germany are in occupations that require a degree, and 25% of workers in both countries are in occupations listed in the EQN directive. Vocational credentialing is especially pronounced in Germany, where 61% of workers are in occupations that require a vocational degree, compared to 40% in the UK. Apprenticeships, too, are more prevalent in Germany, covering 52% of workers and a similar percentage of occupations compared to 11% of workers and 15% of occupations in the UK. These descriptive results are consistent with the well-known vocationalism of the German system.

Table 5.3: Descriptive statistics of all occupational variables

Variable	United Kingdom				Germany			
	$Mean_{ij}$	SD_{ij}	$Mean_j$	SD_j	$Mean_{ij}$	SD_{ij}	$Mean_j$	SD_j
No educational requirements	0.31	0.29	0.33	0.31	0.16	0.20	0.22	0.25
Intermediate (UK)/ vocational (Germany) degree required	0.40	0.20	0.37	0.23	0.61	0.31	0.60	0.32
Tertiary degree required	0.29	0.26	0.30	0.27	0.23	0.33	0.18	0.31
EU regulated	0.25	0.43	0.24	0.43	0.25	0.43	0.22	0.41
Licensure	0.13	0.32	0.18	0.36	0.05	0.22	0.05	0.21
% Unionized	0.29	0.23	0.28	0.22	0.14	0.08	0.15	0.09
% Apprenticeship	0.11	0.15	0.15	0.16	0.52	0.22	0.53	0.21
Physical abilities	-0.05	0.56	0.05	0.61	0.03	0.61	0.20	0.61
Technical skills	-0.05	0.43	0.10	0.52	0.05	0.56	0.28	0.58
Complex processing skills	-0.01	0.47	0.04	0.48	-0.01	0.44	-0.10	0.48
Interaction skills	0.04	0.45	-0.05	0.52	-0.04	0.51	-0.18	0.53
Presentation skills	0.04	0.55	-0.03	0.57	-0.03	0.33	-0.14	0.35
Mathematical skills	0.00	0.49	-0.04	0.49	0.52	0.17	0.50	0.20
% Ethnic minority	0.10	0.06	0.09	0.06	0.03	0.03	0.04	0.04
% Female	0.51	0.32	0.38	0.30	0.44	0.32	0.34	0.29

SOURCE. – Author's calculations using the Quarterly Labor Force Survey, all quarters of 2006 and 2007 and the Microcensus of 2006.

NOTE. – The *i* refers to individuals and the *j* to occupations. Consequently, the $mean_{ij}$ and sd_{ij} are the weighted mean and standard deviation, while the $mean_j$ and sd_j show the unweighted mean and standard deviation.

In the UK, by contrast, closure is more likely to take the form of generalized educational credentialing and licensure. Nearly 30% of workers in the UK are found in occupations that require a tertiary (university) degree, compared to 23% in Germany. Similarly, 13% of UK workers are in licensed occupations (see also Humphris et al. 2011), compared to 5% of German workers. Consistent with prior research (e.g., Visser

18. We will devote little space to the occupation-level controls. It is worth noting, though, that UK occupations contain higher percentages of both women and ethnic minorities than German occupations, where the former is in part due to the more expansive definition of ethnic minorities used in the UK micro-data. We cannot usefully compare skill levels across the two countries, given our occupation-level measures of skills are standardized with mean 0 within each country.

TABLE 5.4: BIVARIATE CORRELATIONS OF ALL OCCUPATIONAL VARIABLES

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
United Kingdom															
1 No degree req.	1.00														
2 Intermediate degree req.	-0.53	1.00													
3 Tertiary degree req.	-0.70	-0.24	1.00												
4 EU regulated	-0.38	*-0.04*	0.47	1.00											
5 Licensure	-0.25	*-0.03*	0.31	0.51	1.00										
6 % Unionized	-0.16	*0.10*	*0.10*	0.18	0.33	1.00									
7 % Apprenticeship	*-0.05*	0.14	*-0.06*	*-0.09*	-0.08	*-0.06*	1.00								
8 Physical abilities	0.49	-0.11	-0.47	-0.22	*-0.13*	*0.04*	0.31	1.00							
9 Technical skills	0.23	*0.03*	-0.29	*-0.10*	*-0.04*	*-0.02*	0.49	0.66	1.00						
10 Complex processing skills	-0.65	0.19	0.58	0.30	0.23	0.11	0.15	-0.27	*-0.02*	1.00					
11 Interaction skills	-0.51	0.23	0.39	0.24	0.21	0.26	-0.24	-0.35	-0.39	0.62	1.00				
12 Presentation skills	-0.70	0.20	0.64	0.37	0.29	0.26	-0.24	-0.59	-0.52	0.68	0.76	1.00			
13 Mathematical skills	-0.47	0.19	0.37	0.26	*0.06*	-0.19	0.12	-0.35	-0.11	0.51	0.35	0.40	1.00		
14 % Ethnic minority	*0.05*	-0.25	0.15	*0.07*	*0.08*	-0.13	-0.30	-0.13	*-0.07*	*-0.02*	*0.03*	*0.03*	*0.05*	1.00	
15 % Female	-0.17	0.17	*0.05*	*0.06*	*0.00*	*0.01*	-0.58	-0.37	-0.38	-0.12	0.24	0.19	*-0.08*	0.16	1.00
Germany															
1 No degree req.	1.00														
2 Vocational degree req.	-0.43	1.00													
3 Tertiary degree req.	-0.36	-0.68	1.00												
4 EU regulated	-0.24	*0.04*	0.16	1.00											
5 Licensure	*-0.09*	-0.26	0.34	0.19	1.00										
6 % Unionized	*-0.10*	0.14	*-0.07*	*-0.07*	*0.00*	1.00									
7 % Apprenticeship	0.21	0.69	-0.88	-0.18	-0.29	0.14	1.00								
8 Physical abilities	0.17	0.37	-0.52	0.20	-0.16	*0.05*	0.45	1.00							
9 Technical skills	-0.20	0.47	-0.32	*0.07*	-0.10	0.29	0.35	0.55	1.00						
10 Complex processing skills	-0.65	*0.01*	0.52	0.20	0.15	*0.08*	-0.49	-0.24	*0.00*	1.00					
11 Interaction skills	-0.46	-0.18	0.56	0.34	0.14	*-0.05*	-0.56	-0.25	-0.29	0.72	1.00				
12 Presentation skills	-0.43	-0.37	0.73	0.14	0.16	*-0.10*	-0.70	-0.55	-0.44	0.69	0.78	1.00			
13 Mathematical skills	-0.61	0.26	0.23	*0.07*	-0.02	*0.09*	-0.16	*-0.07*	0.35	0.47	0.25	0.26	1.00		
14 % Ethnic minority	0.50	*-0.10*	-0.30	-0.15	*-0.11*	*-0.03*	0.21	0.32	0.11	-0.55	-0.50	-0.49	-0.37	1.00	
15 % Female	*0.10*	-0.19	0.11	*0.02*	*-0.01*	-0.38	-0.20	-0.37	-0.67	*-0.04*	0.21	0.24	-0.28	-0.12	1.00

SOURCE. – Author's calculations using the Quarterly Labor Force Survey, all quarters of 2006 and 2007 and the German Microcensus, wave 2006.
NOTE. – The correlations are unweighted, all occupations have equal weight. All correlations that are shown in italics are not significant for $p<0.05$.

2006), we find that unionization rates are greater in the UK than in Germany, with 29% of UK workers found in unionized jobs compared to 14% of German workers. The potential for institutionalized rent is thus nearly as great in our exemplar LME as in our exemplar CME, even if the practices through which closure is secured differ.

Table 5.4 presents the bivariate correlations between closure practices and skills, each measured at the occupation level. In both countries, licensure and tertiary educational credentialing are positively correlated, although at modest levels (0.31 in the UK, 0.34 in Germany), as are licensure and EQN regulation. Vocational credentialing and apprenticeships are strongly correlated in Germany (0.69) but much less so in the UK (0.14), which is consistent with Germany's reliance on the dual system and the virtual absence of this system in the UK. In Germany, unionization is weakly correlated with vocational credentialing (0.14) and apprenticeship (0.14), but uncorrelated with licensure; in the UK, by contrast, unionization is uncorrelated with intermediate degree credentialing or with apprenticeship, but strongly correlated with licensure (0.33). In the UK, licensure and unionization are complementary closure strategies for elite craft occupations, whereas in Germany these occupations are far more likely to secure closure through the vocational education and dual system of apprenticeships.

Is closure the sole provenance of high-skilled occupations? Not surprisingly, Table 5.4 shows that tertiary credentialing has a strong, positive correlation with complex processing, interaction, presentation, and mathematical skills in both countries. Licensure is also positively correlated with these non-technical skills, but the correlations are more modest in size, ranging from 0.21 to 0.29 in the UK and from 0.14 to 0.16 in Germany. Vocational credentialing, apprenticeships, and unionization are most likely in occupations that require high levels of technical skills in Germany, whereas in the UK only apprenticeships have a significant positive correlation with technical skills (0.49).[19] In general, then, we find that closure is dispersed across occupations requiring different types of skills, but the institution through which closure is secured varies, with tertiary credentialing, licensure, and unionization more likely in occupations requiring interactional or cognitive skills and vocational credentialing and apprenticeships more likely in those that require physical or technical skills.

In the UK, occupational closure is more likely to take the form of occupational licensure or tertiary degree requirements, whereas in Germany it is more often secured through vocational educational credentialing and apprenticeships; unionization rates are relatively compatible in both countries, although as noted this masks differences in the level of union organization (i.e., firms or industries). These are consistent with our claim that, firstly, institutionalized closure practices can be observed in LMEs and CMEs alike, and secondly, that closure practices that directly and explicitly reduce competition (e.g., licensure) are, ironically, more prevalent in LMEs than in CMEs.

5.5.2 Closure and occupation wages in the UK

We next turn to the core task of estimating the impact of these closure practices on

19. We find it interesting, albeit tangential to our main focus, that the negative correlation between apprenticeship coverage and the women's occupational representation is stronger in the UK (-0.58) than in Germany (-0.20). This likely reflects the diffusion of apprenticeships throughout the occupational structure in Germany, compared to its concentration in the male-dominated occupations in the craft sector in the UK.

occupational wages in each country. For ease of presentation, we first discuss the results for the UK, and then compare the results for Germany against them. The tables in the main text present only the coefficients for the occupation-level covariates; all individual level estimates are available in Appendix I.

Table 5.5 shows the results of the multilevel models applied to the UK data. We begin with a null model that fits no occupation or individual-level covariates, which shows that nearly 40% of the variation in logged earnings takes place between occupations.[20] This percentage decreases by roughly 1/3, to 28%, in a model (not shown) that fits individual-level effects but no occupation-level covariates, thereby adjusting the between-occupation variance for compositional differences between occupations in the individual-level attributes of their incumbents. In Model 1, which fits the occupational demography measures, the residual between-occupation variance component is further reduced to 27%. In Model 2, which adds the closure measures, the unexplained occupation-level variance declines to 12%. From this, we conclude that occupations are an important source of heterogeneity in wages in the UK, and moreover closure practices can account for much (but not all) of the occupation-level variation that remains after compositional effects are purged out.[21]

Our primary interest is in the estimated closure effects from Model 2. This model fits all individual-level covariates and controls for occupational demography, but does not fit our measures of occupational skills. In so doing, it allows the measures of closure to capture some of the effects of restrictions on skill acquisition.[22] The estimated coefficients from this model show that three of the four closure strategies have the anticipated positive wage returns at the occupation level: educational credentialing, licensure, and unionization. The impact of tertiary educational requirements is substantial, generating a wage premium of 81% (exp[0.591]=1.81) relative to those with no requirements; the impact of intermediate qualifications is, with 30% (exp[0.261]=1.30), also substantial. Fully licensed occupations have an additional wage premium of more than 10% (exp[0.094]=1.10), compared to unlicensed occupations, while fully unionized occupations offer an anticipated earnings premium of 20% (exp[0.178]=1.20).[23] Apprenticeships, by contrast, have a negative effect on wages in the UK context, a finding that we will unpack below, while our measure of EU regulation through the EQN shows no additional effect on wages above and beyond that captured by credentialing and licensure. The apprenticeship results notwithstanding, these results are broadly consistent with the argument that occupational closure generates wage returns to occupation members above and beyond that which we would anticipate based on the individual-level human capital

20. The share of between-occupation heterogeneity is affected by the specificity of the occupational classification schemes (see also Weeden 2002). Although we use the most detailed schemes possible, these classifications are still aggregations of occupational boundaries, meaning that a more detailed scheme would likely show a greater proportion of the variance occurring between occupations.

21. In a model (not shown) that includes the composition controls, all individual covariates and the measures occupational skills, the residual occupation-level variance shrinks to 13%.

22. In the UK, as in the US, ethnic composition had no net association with earnings whereas gender composition was negatively associated with earnings (see also Weeden 2002).

23. An alternative measure of union closure that indexes the percentage of occupation members who are covered by a collective labor agreement (CLA) shows a smaller, but still significant, wage premium of 9 percent. We report models using the measure of union membership to maximize comparability with the German data, which lack a measure of CLA coverage.

Table 5.5: Multilevel random intercept models to estimate the wage effects of occupational closure in the UK.

	Model 0	Model 1	Model 2	Model 3
Composition controls				
% Ethnic minority		0.287	0.142	0.100
		(0.210)	(0.144)	(0.130)
% Female		-0.156***	-0.260***	-0.232***
		(0.040)	(0.033)	(0.032)
Occupational closure variables				
No educational requirements			ref.	ref.
Intermediate educational degree required			0.261***	0.045
			(0.039)	(0.043)
Tertiary educational degree required			0.591***	0.291***
			(0.034)	(0.048)
EU regulated			-0.034	-0.036
			(0.022)	(0.020)
Licensure			0.094***	0.093***
			(0.026)	(0.023)
% Unionized			0.178***	0.202***
			(0.038)	(0.038)
% Apprenticeship			-0.170*	-0.069
			(0.073)	(0.065)
Occupational skill variables				
Physical abilities				-0.082***
				(0.019)
Technical skills				0.020
				(0.023)
Complex processing skills				0.099***
				(0.029)
Interaction skills				0.040
				(0.024)
Presentation skills				0.022
				(0.030)
Mathematical skills				0.029
				(0.019)
Constant	6.917***	6.882***	6.769***	6.867***
	(0.021)	(0.037)	(0.041)	(0.043)
σ^2u (occupations)	0.150***	0.047***	0.018***	0.014***
	(0.006)	(0.002)	(0.001)	(0.001)
σ^2e	0.227***	0.127***	0.127***	0.127***
	(0.001)	(0.000)	(0.000)	(0.000)
ICC (occupations)	0.398	0.272	0.123	0.097
-2LL	104,586	59,833	59,526	59,447
N (occupations)	344	344	344	344
N (individuals)	75,982	75,982	75,982	75,982

SOURCE. – Author's calculations using the Quarterly Labor Force Survey, all quarters of 2006 and 2007.

NOTE. – Dependent variable is the natural logarithm of monthly earnings. Standard errors are listed in brackets under coefficients. All coefficients in Model 1, 2, and 3 are controlled for all individual level variables. These individual level estimates are not shown but can be found in Appendix I.

* p<0.10, ** p<0.05, *** p<0.01

and related attributes of occupation members.

Model 3 adds our measures of occupational skills to the occupation-level equation. As we argued above, this model likely underestimates the "true" effects of closure, because the wage returns to skills include some unobservable portion that is due to barriers to the acquisition of skills. The estimates from Model 3 are nonetheless useful in addressing the alternative interpretation of the closure effects in Model 2, namely that our closure measures are *only* picking up productivity returns to skills that are, unfortunately, unobserved at the individual level. Indeed, Model 3 shows that the skill-adjusted closure effects are greatly reduced, but not altogether eliminated.[24] The most striking change, relative to Model 2, is the absence of positive effects of intermediate credentials and negative effects of apprenticeship. In the UK, intermediate credentials evidently generate rents only insofar as occupations that require a mid-level degree are also those that require cognitive and interpersonal skills; similarly, the negative association between apprenticeship and wages in the unadjusted model is evidently due to the concentration of apprenticeships in occupations that require modest technical and physical skills (see also Table 5.4). Notably, however, the effect of tertiary credentialing is attenuated in Model 3, but still sizeable with an expected wage premium of 34% (exp[0.291]=1.34). The positive net wage effect of licensure persists, and indeed is unaffected by controlling for occupational skills. These results lead us to conclude that in the UK, a deregulated labor market with an educational system that emphasizes general learning, tertiary credentialing and licenses are the principal means through which occupations generate rents.

5.5.3 Closure and occupation wages in Germany

Do the same patterns obtain in Germany, our representative CME? For the most part, we are more struck by the similarities than by the differences, but with several important caveats. First, turning to the results of a decomposition exercise, we find that 26% of the total variance in wages in Germany takes place between occupations. Although this is lower than the analogous percentage estimated from the UK data (40%), we hesitate to make too much of this disparity given cross-survey differences in the measurement of earnings (see Data section). The reduction in variance attributable to our occupation-level measures, however, shows a similar pattern in Germany as in the UK, with residual occupation-level variance declining by nearly three quarters (to 7%) in models that estimate occupational demography and closure effects (see Model 2, Table 5.6). In Germany, just as in the UK, occupational closure practices generate much of the occupation-level heterogeneity in earnings.

The estimated effects of the closure-wage relationships also show a similar, although not identical, pattern in Germany as in the UK.[25] Model 2, which does

24. The coefficients pertaining to skills show effects comparable to other analyses: complex processing skills and presentation skills are positively associated with earnings, and physical complexity is negatively associated with earnings. Given these results are by now well established, we will not devote further space to them.

25. In the German data, both measures of occupational demography are negatively correlated with wages, although the wage penalty associated with high percentages of ethnic minorities in an occupation disappears when adjusting for skills. Gender segregation, however, not only contributes to wage inequality in Germany (as in the UK), but its effects cannot be attributed to solely to the skills associated with "women's work" or to association between closure and gender composition (see, e.g., Tomaskovic-Devey 1993).

Table 5.6: Multilevel random intercept models to estimate the wage effects of occupational closure in Germany

	Model 0	Model 1	Model 2	Model 3
Composition controls				
% Ethnic minority		-1.976***	-0.714***	-0.076
		(0.242)	(0.214)	(0.218)
% Female		-0.101**	-0.050*	-0.132***
		(0.031)	(0.025)	(0.031)
Occupational closure variables				
No educational requirements			ref.	ref.
Vocational degree required			0.136***	0.083*
			(0.034)	(0.041)
Tertiary educational degree required			0.423***	0.234***
			(0.054)	(0.055)
EU regulated			-0.020	0.031
			(0.017)	(0.017)
Licensure			0.082*	0.090**
			(0.034)	(0.031)
% Unionized			0.406***	0.381***
			(0.078)	(0.072)
% Apprenticeship			-0.021	0.040
			(0.071)	(0.069)
Occupational skill variables				
Physical abilities				-0.075***
				(0.016)
Technical skills				-0.039*
				(0.019)
Complex processing skills				0.049*
				(0.021)
Interaction skills				-0.027
				(0.023)
Presentation skills				0.099*
				(0.042)
Mathematical skills				0.077
				(0.043)
Constant	7.306***	7.388***	7.110***	7.137***
	(0.017)	(0.022)	(0.058)	(0.057)
σ^2u (occupations)	0.089***	0.025***	0.013***	0.010***
	(0.004)	(0.001)	(0.001)	(0.000)
σ^2e	0.251***	0.163***	0.163***	0.163***
	(0.000)	(0.000)	(0.000)	(0.000)
ICC (occupations)	0.262	0.132	0.072	0.057
-2LL	197,017	138,537	138,340	138,271
N (occupations)	330	330	330	330
N (individuals)	134,376	134,376	134,376	134,376

SOURCE. – Author's calculations using the German Microcensus, wave 2006.

NOTE. – The dependent variable is the natural logarithm of monthly earnings. Standard errors are listed in brackets under coefficients. All coefficients in Model 1, 2, and 3 are controlled for all individual level covariates. These individual level estimates are not shown but can be found in Appendix I.

* p<0.10, ** p<0.05, *** p<0.01

not fit occupational skills, show that educational credentialing is an important source of occupational wages in Germany, much as it was in the UK. German workers in occupations that require either a vocational or a general university degree receive higher wages than one would anticipate based on composition effects. Licensure also positively affects occupational wages in Germany, with fully licensed occupations receive a wage premium of 9% (exp[0.082]=1.09) relative to unlicensed occupations. Unionization, too, has a substantial positive effect on occupational wages in Germany, and indeed is one of the most beneficial in terms of occupational wage returns: a hypothetical occupation in which all workers are unionized, occupational earnings would exceed those in a nonunionized occupation by 50% (exp[0.406]=1.50).

This general pattern of results for Germany persists in the model that adjusts for occupational skills (see Model 3 in Table 5.6). The wage premiums for vocational and tertiary credentialing remain statistically significant in Model 3, although the magnitude of the effects diminish to just over half of the unadjusted effects, or 9% (exp[0.083]=1.09) and 26% (exp[0.234]=1.26) wage premiums, respectively. Notably, in Germany the effects of vocational credentialing are large and robust to the inclusion of occupational skill controls, whereas in the UK the wage premium of intermediate (vocational) credentials is modest and disappears in the skill-adjusted models. This disparity likely reflects the highly stratified German educational system, with its well-deserved reputation for vocationalism and the limitations this system places on the supply of trained labor for occupations at the end of the vocational track. The intermediate qualifications secured through the UK educational system, by contrast, only generate wage premia to occupational incumbents by virtue of the association between educational closure and occupational skills. This finding is in line with our earlier cross-national study of sheepskin effects (Chapter 3), where we found that vocational degrees generate larger labor market returns when labor markets are more coordinated. In the highly coordinated labor market of Germany, vocational credentials are more effective in generating economic rents than comparable degrees in countries where markets are more liberal, such as the UK.

Model 3 also shows that the positive wage effects of licensure and unionization in Germany are robust to the introduction of occupational skills. The coefficients for EU regulation and apprenticeship in the adjusted model are positive, although none reach statistical significance. The estimated wage effects of credentialing, unionization, and licensure in Germany thus largely conform to the predictions of the closure argument. We did not, however, anticipate the absence of positive wage returns to apprenticeships. In understanding this result, two points are worth noting. First, in the German dual system, apprenticeships typically require a vocational credential obtained in schools. It could be that apprenticeships secure rents, but only by virtue of the restrictions places on access to the vocational degrees with which they are associated. Second, a supplementary analysis shows that closure through apprenticeships raises wages of manual occupations relative to other manual occupations that do not embed training in the apprenticeship system, but not relative to wages in the average occupation (see also Parkin 1974).

As much as comparative inequality research emphasizes cross-national differences in the institutions that affect levels of aggregate wage inequality, we find evidence of substantial similarity, at least at the broad brush-stroke level, in the patterns of closure-based rents in Germany and the UK. Educational credentialing, licensure, and

unionization have positive effects on wages in both countries, whereas apprenticeship does not. At the same time, we observe at least two key differences in the pattern of closure. First, German vocationalism gives rise to a stronger and more robust effect of vocational credentialing on occupational wages and, in the manual sector, a stronger effect of apprenticeships on wages. Second, although the estimated wage returns to licensure are comparable in magnitude across the two countries, licensure is much less prevalent in Germany than in the UK (see Table 5.4). As such, licensure in Germany generates wage premiums for a handful of occupations, but its effect on aggregate levels of wage inequality may be relatively modest. In the UK, by contrast, the rents accruing to licensure are enjoyed by a far larger percentage of workers, which one might anticipate would lead to a more substantial overall effect on wage inequality. We take up a discussion of closure's effects on aggregate wage inequality in the next section. Here, we merely note that these disparities are explicable in terms of differences across the two countries in the broader systems of economic coordination and the closure practices most compatible with these systems.

5.6 Discussion and conclusion

In this chapter, we analyzed four key, institutionalized occupational closure practices and their relationship to wages in Germany and in the UK. At the most basic level, we offer what we believe to be the first systematic comparison of occupational closure and its effect on wages in these, or indeed any, European countries. This analysis serves as an extension and replication of extant efforts to assess the inequality-generating effects of closure in the United States. If closure theory is to serve as a general account of wage inequality in advanced industrialized societies, it is surely necessary to make the case that it receives empirical support beyond the home turf of its major proponents. Our results offer this support.

Our theoretical contribution is to elaborate the closure approach to the comparative context, and link this work to the much broader comparative inequality literature on labor market regimes, we think to the benefit of both. Just as the occupational closure framework has developed largely without reference to the broader system of institutions that coordinate economic exchange, so too has the comparative inequality literature developed largely without reference to institutionalized forms of occupational closure and their effects on labor prices within systems of economic exchange. While in the VoC-literature rent-generating institutions at the bottom of the income distribution are fully acknowledged for their role in mitigating wage inequality, almost no attention is given to rent-generating institutions at the top of the income distribution. This chapter takes a critical step toward addressing these gaps in the inequality literature.

Our analysis supports three important conclusions. First, occupational closure is as pervasive in the UK, the prototypical European LME, as in Germany, the prototypical CME. The two countries differ in the form that closure takes: educational credentialing in general, and vocational credentialing in particular, is more prevalent in Germany, as are apprenticeships, while licensure and unionization cover more of the labor force in the UK. These distributional patterns also suggest that the two countries differ in the most prevalent mechanism through which closure generates rent. In Germany, where the emphasis is on long-range planning and negotiation of

economic exchange through non-market relationships, restrictions on access to skill acquisition predominates, whereas in the UK, more direct interventions (in the form of licensure) to the supply of labor that is legally allowed to apply occupation-specific skills are more prevalent.

Second, we have shown that occupational closure generates wage returns in excess of those anticipated based on individual-level demographic and human capital attributes, and moreover that these positive returns are observed in both Germany and the UK. This finding provides positive evidence for the relatively simple hypothesis at the heart of the closure approach: closed occupations earn higher wages than open occupations, net of individual-level compositional effects. Third, however, the magnitudes of the wage effects differ across the two countries. Vocational educational credentials, unionization, and apprenticeships yield greater returns in Germany than in the UK, although the latter returns are significant only where the comparison occupation is in the manual sector. Conversely, although licensure yields positive wage returns in both countries, it is a substantially more prevalent strategy in the UK. Taken together, these closure practices account for a substantial portion of the between-occupation variance in earnings, which is itself nontrivial.

We have framed these findings in terms of their implications for understanding differences across countries in patterns of wage inequality between occupations. Are they also relevant for understanding differences across countries in the level of aggregate wage inequality? We think so. Logically, the impact of occupational closure on aggregate levels of inequality depends on (1) the closure effect on mean occupational wages, (2) the closure effect on within-occupation wage inequality, (3) the distribution of closure practices across occupations, and (4) the relative size of the closure effect across different kinds of occupations. If closure is primarily found in, or generates the greatest wage premia in, high-skilled occupations that even in the absence of closure would fall near the top of the occupational wage distribution, closure will have an exacerbating effect on aggregate levels of wage inequality. Conversely, if closure is primarily found in, or has the greatest benefits for, occupations that would in the counterfactual closure-free world fall at the bottom of the wage distribution, closure will suppress aggregate levels of inequality.

Our results suggest that cross-national variations in the prevalence and payoff of closure practices can shed some light on oft-noted differences in levels of wage inequality. Our data show that in Germany, closure practices are spread relatively evenly throughout the division of labor, and the wage returns of closure practices traditionally favored by the manual sector (e.g., unionization) are at least on par with licensure and general tertiary credentialing, closure practices that are more commonly found in the professions and other elite nonmanual occupations. Trade unionization and vocational credentialing generate strong positive wage returns, and apprenticeships elevated wages in the manual sector but not elsewhere. To be sure, "top-end" rents are not altogether absent in Germany, as evidenced by the heretofore undocumented wage returns to licensure and net wage returns to tertiary credentialing. However, due to the relatively modest levels of licensure in Germany, the net result is that closure in Germany likely compresses overall levels of wage inequality, even as it exacerbates wage inequality between manual occupations and between the licensed and unlicensed professions. In the UK, by contrast, closure that generate rents for members of unskilled occupations is less prevalent (e.g., apprenticeships, intermediate

credentials), and their wage effects weak relative to the wage premiums generated by the closure practices (e.g., licensure, tertiary credentials) favored by elite nonmanual occupations.

More generally, our analysis serves as a useful corrective to the comparative inequality literature, which overemphasizes the institutions "at the bottom" of the wage distribution that compress inequality in CMEs, in particular, and largely ignores the institutions that generate rents in LMEs. If we want to understand why LMEs have so much more inequality than CMEs, we need to understand not only how the institutions in CMEs compress wage inequality, but also how the institutions in ostensibly liberal market economies exacerbate it.