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Occupational closure and wages in Norway

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Abstract

Recent literature has pointed to occupational closure in order to explain wage inequality between occupations. The basic argument of occupational closure is that average occupational wages are higher in closed occupations because these occupations are better able to establish and maintain institutional barriers to access. In this study we analyse occupational closure and its wage effects in Norway by matching newly gathered occupational data on four different closure institutions (licensure, certifications, unionization, and educational credentials) to register data. The results show strong wage effects of licensure and unionization, net of occupational skill requirements. Our analyses furthermore show substantial differences in the returns to occupational closure across social classes: licensure is especially beneficial for higher classes, whereas unionization generates rents for lower classes, implying that occupational closure affects social inequality in Norway.

Keywords

Occupations, Norway, wage inequality, social closure, licences, certifications

Introduction

Occupations are argued to be 'microclasses' that are at the heart of the system of social stratification in the labour market (Grusky and Sørensen, 1998; Grusky and Weeden, 2001). To understand why occupations are so important, several recent sociological studies point to occupational closure: institutional barriers that affect occupational wage returns directly (Bol and Weeden, 2015; Kleiner, 2006; Weeden, 2002). The central argument of this theory is that barriers to occupations put artificial restrictions on the supply of labour, thereby increasing the average occupational wages. These barriers can limit access to the occupation directly (e.g. occupational licensing), or indirectly by restricting access to skill

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acquisition required to perform the labour (e.g. educational credentialing). Although most studies find empirical evidence for the link between occupational closure institutions and wages, so far this relation has only been studied in three countries: the United States (Kleiner, 2006; Weeden, 2002); Germany (Bol, 2014; Giesecke and Verwiebe, 2009; Haupt, 2012); and the United Kingdom (Bol and Weeden, 2015; Humphris et al., 2010; Kleiner and Krueger, 2010).

In this article, we look at four forms of occupational closure (licensure, educational credentialing, unionization, and certification) in a country with a highly different institutional context than the countries studied so far: Norway. Even though wage differentials are comparatively small in the social-democratic welfare state of Norway (Hægeland and Kirkebøen, 2007; OECD, 2011), there is some evidence that a substantial share of the total wage inequality takes place between occupations (Petersen et al., 1997). This means that wage differentials between Norwegians are for a significant part differences between average occupational wages. In this article we try to explain between-occupation wage inequality by looking at occupational closure in Norway.

With our study we make two contributions. First, we empirically test the viability of the occupational closure theory in the Norwegian context. Since no study so far has examined the wage returns to closure in a social-democratic welfare state, we are able to evolve the comparative literature on occupational closure (Bol and Weeden, 2015), which tries to explain cross-national variation in between-occupation wage inequality by looking at the broader institutional contexts of countries. A central feature of the Norwegian model is the tripartite system that coordinates collective wage bargaining with an aim to maintain a compressed wage structure and small income differences (Barth et al., 2003). At this moment, we do not know if the effects of occupational closure on wages that are found in different types of western countries also exist in Norway, as they might be mitigated by the country's strong and corporative wage policy.

Second, in this article we investigate the consequences of occupational closure for aggregate inequality. Who benefits most from closure, and how might this affect existing inequalities? More specifically, we analyse how the effects of the four forms of occupational closure vary across six 'big' social classes (Erikson and Goldthorpe, 1992). If closure institutions are unequally distributed across social groups, or if returns are unequally distributed across social groups, occupational closure might affect social inequality.

Using multilevel models, in which we nest individuals in occupations, we analyse administrative microdata from Norway, combined with occupational data that are gathered for this paper or derived from existing surveys (e.g. Survey on Income and Living Conditions (SILC)). The main benefit of the administrative records is that they contain the full working population, and that we are therefore able to include even relatively small occupations.

To foreshadow our results, we find that occupational closure increases the average occupational wage, with strong effects for licensure and unionization. We find no evidence for wage effects of voluntary certification and only limited evidence for wage effects of educational credentialing. Finally, the effects of the four closure institutions are heterogeneous across six big social classes, with strong effects for licensure for the higher classes and strong effects for unionization for lower social classes. This indicates that licensure increases social inequality in Norway, whereas unionization decreases it.

Occupational closure

In the past two decades, studies have increasingly pointed to occupations as the unit of analysis by which individuals' outcomes and opportunities are divided. This microclass literature argues that social classes manifest at the disaggregated occupational level (Grusky and Weeden, 2001), instead of in big social classes (Erikson and Goldthorpe, 1992). In the microclass perspective, occupational closure is one of the most important mechanisms by which wage differentials across occupations (or microclasses) can be explained. The argument put forward in closure theory is that social and legal barriers to access increase the wages of all occupational incumbents, predominantly by putting artificial restrictions on the supply

of labour or by signalling the quality of a particular service. This wage effect of occupational closure can be understood as a monopoly rent (Sørensen, 2000): a premium on top of the wage that would be obtained in a (hypothetical) fully competitive market. To the extent that the rents that are associated with occupational closure are unevenly obtained across the labour market, occupational closure forms an important source of wage inequality (Weeden and Grusky, 2014). In this study we distinguish between four occupational closure institutions: licensure, certification, unionization, and educational credentialing.

Licensure

Access to occupations can be restricted by occupational licences, where performing licensed occupational labour is regulated by law, making unauthorized practice illegal. Although licensure is most common in the professional occupations, it is widespread across the occupational structure (e.g. Alecu and Drange, 2016b; Humphris et al., 2010). When access to occupational labour is restricted by a licence, individuals cannot respond to changes in the demand for that labour, and thus licensure creates a monopoly rent for the occupational incumbents. At the same time, an occupational licence might signal a higher quality of service, meaning that consumers are willing to pay a higher price if a product is created by, or a service provided by, a licensed worker. In Norway, licensure is primarily found within occupations related to health and social care, law and accounting, teaching, transportation, security, and electrical instalment. Some licences, especially in the professional and associate professional occupations, require completion of a specific education and training programme and document certificate of good conduct.

Certification

Voluntary certifications have the same rationale as licences: protecting clients and consumers from the misconduct of practitioners. However, in contrast to licences, certificates are not legally required to access the occupation. This voluntary nature of a certification makes them a much weaker form of closure (Humphris et al., 2010; Weeden, 2002), as they are only able to signal the quality of service and channel demand to the occupation. Although certifications are no legal barrier to access an occupation, they can still have a barricading function insofar as gatekeepers consider it to be important. In some instances, insurance companies can refuse to pay damage claims if work was done by uncertified practitioners.

The requirements for a voluntary certificate can vary widely, from simply being a member of an occupational group, to testifying completion of training for a particular skill or documenting the completion of an educational programme (Kleiner, 2011). The certificates issued by Norwegian certifying bodies mostly require some form of training and examination. Certificates in Norway are different from those in the US in that they are almost exclusively issued by educational institutions instead of certification providers in the private sector.

There are several mechanisms that predict wage effects of certificates. First, certifications are often developed by occupational organizations in response to new skill demands, and can thereby enhance the certificate holders' productivity. Second, certificates can be seen as formal evidence of skills and can be used for negotiating higher wages from both employers and consumers.

Unionization

It is thoroughly documented that unions raise the average wage of workers covered by a union (Askildsen and Nilsen, 2002; Barth et al., 2000). When unions are organized at the occupational level they are likely to affect the mean occupational wage. Occupations with a high level of union coverage will be more able to impose collective wage demands on employers, securing rents for occupational workers.

Unions can also more generally try to improve the position of the occupations they represent. In Norway, the case of the lift-installers provides an interesting example. After the legal monopoly of lift-installers was repealed by the government, the union managed to re-establish the requirement that all work on personnel lifts needs to be carried out by trained lift-installers (Magdahl, 2005).

The extent to which unions raise occupational wages depends on the structure of the union. A vertical organization will tend to compress wages across occupations belonging to the same union, while a horizontal organization does not aim to equalize wages between low-skilled and high-skilled workers (Checchi et al., 2010). Unions in Norway are heavily segmented by occupation and predominantly organized horizontally. There is one peak association for professionals ('Akademikerne'), associate professionals ('Unio'), vocational occupations ('YS') and one all-encompassing union ('LO'), although the latter is dominated by manual workers. To give an example: if TEKNA, the union for engineers with a graduate degree, negotiates higher wages for their members, this also raises the wages of other engineers.

Educational credentialing

A final closure institution that we consider is educational credentialing (Bol and Van de Werfhorst, 2011; Collins, 1979). Nowadays for many occupations employers are only willing to hire workers when they fulfil specific educational requirements, often set by the level of schooling, but also by the field of study. When there are bottlenecks in education, students are not able to respond to a changing demand of labour, thereby generating a rent for those with that educational degree. As has been noted before, rents can be generated both because a credential restricts individuals' access an occupation, but also because a credential restricts individuals from obtaining the skills required to perform occupational labour (Bol and Weeden, 2015; Weeden and Grusky, 2014). As long as the access to obtaining skills is restricted, rents will accrue to those with that credential. Both explanations expect credentials to raise occupational wages more when there is a tight education–occupation link (DiPrete et al., 2016). In such a scenario, a large proportion of individuals in an occupation have the same, specific, educational qualification.[1]

In Norway education, including tertiary education, is in principle free and open to all. At the secondary level, students choose between academic and vocational tracks, both of which can lead to tertiary degrees. The vocational programmes typically combine two years of schooling with two to three years of in-firm apprenticeships. At the tertiary level, admittance to professional programmes is based on grades, and the number of available spots is adjusted to prospective labour demand. Since 2003, grades also regulate access to disciplinary degrees. The absence of any significant bottlenecks in the Norwegian educational system thus predicts comparatively small or even absent effects of educational credentialing.

Occupational closure and social inequality

We expect the four closure institutions (licensure, voluntary certification, unionization, and educational credentialing) to increase the average occupational wages, both because they lay restrictions on the supply of occupational labour and because the institutions signal the quality of the work that is done. While this hypothesis is straightforward, it will tell us relatively little about the impact of occupational closure on aggregate inequality in Norway. Bol and Weeden argue that 'the impact of closure on aggregate inequality depends on [. . .] the distribution of closure across occupations, and [. . .] the magnitude of closure-based rents across occupations' (2015: 367). To be able to say more about inequality, we will investigate how the prevalence of, and returns to, closure are distributed across the system of social stratification in Norway. More specifically, we will look at how the effects of the four closure institutions vary across the big social classes in which these occupations can be found (Erikson and Goldthorpe, 1992).

If occupational closure increases aggregate inequality, we would expect to see higher prevalence and/or higher returns for occupations that belong to higher social classes. A common way to define these

'big' social classes is by dividing occupations according to the employment relation and the level of authority that workers have. Erikson and Goldthorpe argue that, for example, service workers often 'exercise delegated authority' (1992: 42), meaning that they have more autonomy over the service that they deliver than workers who produce a product rather than a service.

There are several explanations for why we might expect the returns to occupational closure to be larger for higher social classes. First, occupations that belong to higher social classes have more autonomy over the product or service that they sell, and therefore have a more powerful position in the labour market. A licensed lawyer is likely to obtain more profit from his or her licence than a licensed dental technician. The more autonomous lawyer will be able to obtain larger rents from the production of his service than the dental technician (with comparatively less autonomy) will be able to gain from his or her product.

A second reason is that occupations in higher social classes will more often be in high-profit industries where there is more rent to be distributed in the first place. Put differently, it is not so much a direct effect of social class that explains heterogeneous returns to occupational closure by class, but instead the compositional differences between the markets in which we find (closed) occupations from high and low social classes.

Irrespective of the mechanism that might drive variation in returns to closure, from an inequality perspective the interesting puzzle is whether prevalence of and returns to occupational closure are similar across the social structure. Although we investigate how a 'microclass' mechanism (occupational closure) differs across big social classes, we do not believe that our results will provide evidence for either a big class perspective (e.g. Erikson and Goldthorpe, 1992) or microclass perspective (Grusky and Sørensen, 1998). Our study will not show whether big classes or microclasses are relatively more important (see Erikson et al., 2012; Goldthorpe, 2002; Grusky and Weeden, 2001). Instead, what we hypothesize here is an interaction between occupations and big classes. Occupational closure explains why some occupations have higher wage returns than others, but the extent to which it does so differs across big classes: groups of occupations that differ by employment relations and the level of authority they have over what they produce.

Data and variables

Register data

The individual-level information is derived from several public registers with micro data on work and employment, education, income, and demography. The information covers the entire population born between 1955 and 1990, and everyone born prior to 1955 who has graduated from higher education. We have excluded individuals who did not have employment as their main activity in 2007. Furthermore, we have excluded employees in the military service and legislators.

Occupational classification

The occupations are classified according to the Norwegian standard for occupational classification (STYRK). STYRK is identical to the European International Standard Classification of Occupations (ISCO-88) at the third-digit level and adapted to Norwegian conditions at the four-digit level. The classification is structured according to (a) skill level and (b) skill specialization. Skill level distinguishes between four levels of education depending on whether the occupation normally requires a postgraduate degree, graduate degree, secondary education, or primary education. Skill specialization is based on the field of knowledge required in the occupation, the tools and machinery used, the goods or services produced, and the materials one is working with (SSB-NOS, 1998).

By 2007 all employees, except state employees, were classified with STYRK-codes in the register data (Villund, 2014). The state sector instead reported occupational titles derived from collective wage

agreements. These codes were translated into the STRYK manually by exact matching on occupational title and matching by education, occupational code, and industry. The use of generic titles such as consultant and advisors in public administration (for example in municipals, ministries, and directorates) prevented matching. For that reason, employees in public administration are excluded from the analyses. This group constituted 4% of the gross sample.

Individual-level variables

Our dependent variable is the logarithm of gross yearly wages. Yearly wages include any bonuses, fees, or benefits in kind that are liable to tax. The upper limit for tax-free earnings was NOK1000 per employer.

The relevant control variables on the individual level are sex, geographical workplace location (defined in accordance with a centrality index of Norwegian municipalities), industry (16 major categories defined in accordance with NACE rev.1), work hours, number of days employed, years since graduation, and years since graduation squared.

Social class is operationalized using a variant of the EGP scheme which is built on ISCO codes and is therefore easily adapted to the data at hand. We have made two minor changes. First, our classification excludes the self-employed as these are not in our sample. Second, we do not classify individuals according to supervisory jobs because this information lacks in the register data. It would also complicate the multilevel modelling as social classes would be cross-classified within occupations. We use the aggregate Erikson, Goldthorpe, Portocarero (EGP) scheme that was revised for Norway.[2] The EGP classes are higher controllers, lower controllers, routine non-manual workers, skilled manual workers, semi–unskilled manual workers, and farm labour. Descriptive statistics for all individual-level variables can be found in Table 1.

Occupational closure indicators

Data on occupational licensure and certificates were gathered specifically for this study (see Alecu and Drange, 2016a). An occupation is classified as licensed if the right to practise is regulated by the authorities by law or by the regulations of the law. The inclusion criterion for the coding is that the licences are granted to actual persons and not juridical persons, such as companies (which was the case for example for real estate brokering until 2007).

Similar to previous studies (Carter, 2005; Weeden, 2002), the data on certification were coded based on extensive searches.[3] The inclusion criteria are that the certificate was (a) issued by an association, union, or private or public educational institution situated in Norway, (b) awarded to an individual practitioner, not a company, (c) not related to a specific method, product, or work safety, and (d) not limited to a specific company.

For union membership we use data from the Norwegian SILC in the years 2000, 2003, 2006, and 2009. In that survey, respondents are asked about their union member status. Our measure of the level of unionization of an occupation is an aggregation of union membership to the occupation level and therefore constitutes a proportion (i.e. the proportion of workers in an occupation that responded to be union members). These data were then merged with the register data at the occupational level.

All previous measures are operationalized in similar ways in earlier studies, but educational credentialing is measured differently. Whereas Weeden (2002) uses the proportion of respondents in each occupation with a tertiary degree, we do not think that this is the best measure for credentialing in the Norwegian context. The main argument of credentialing theory is that (a) the occupation should be restricted by a degree or (b) access to education should be restricted. Since there are no bottlenecks in tertiary education in Norway, we do not believe that more individuals with a tertiary degree indicates that there is more credential closure. This does not, of course, mean that access to occupations in Norway is not restricted by educational degrees. Both formally (by law) and informally (perception of

Table 1. Descriptive statistics, individual-level variables ($N = 1{,}592{,}673$).

	Mean	SD	Min	Max
Logarithm of yearly wage	12.60	0.80	4.76	17.30
Work hours	32.30	9.10	4.00	98.08
Experience in years	14.00	10.40	0.00	37.00
Days of employment	337.20	72.40	1	365
Female	0.49		0	1
Family status				
Married, no children	0.06		0	1
Married with children	0.43		0	1
Single	0.37		0	1
Single with children	0.02		0	1
Other	0.11		0	1
Education level				
No education	0.00		0	1
Primary education	0.00		0	1
Lower secondary, basic education	0.20		0	1
Upper secondary education, basic year	0.06		0	1
Upper secondary education, final year	0.31		0	1
Post-secondary non-tertiary education	0.03		0	1
Tertiary education, undergraduate	0.30		0	1
Tertiary education, graduate level	0.08		0	1
Second stage of tertiary education (PhD)	0.01		0	1
Field of education				
General subjects	0.29		0	1
Humanities and arts	0.05		0	1
Teacher training and pedagogy	0.08		0	1
Social sciences and law	0.03		0	1
Business and administration	0.13		0	1
Natural sciences, voc., and tech. subjects	0.23		0	1
Health, welfare, and sports	0.14		0	1
Primary industries	0.01		0	1
Transport, communications, safety, security	0.03		0	1
Unspecified field of study	0.01		0	1
Level of centrality				
Least central municipalities	0.08		0	1
Less central municipalities	0.06		0	1
Quite central municipalities	0.16		0	1
Central municipalities	0.53		0	1
Oslo (Capital city)	0.18		0	1
Industry				
Primary industry	0.12		0	1
Mining and quarrying	0.01		0	1
Manufacturing	0.01		0	1
Electricity, gas, and water supply	0.01		0	1
Construction	0.07		0	1
Wholesale, retail trade, and repairs	0.16		0	1
Hotels and restaurants	0.03		0	1
Financial intermediation	0.07		0	1
Transport, storage, and communication	0.02		0	1
Real estate, renting, and business activities	0.12		0	1

(continued)

Table 1. (continued)

	Mean	SD	Min	Max
Public adm., defence, compulsory soc. security	0.05		0	1
Education	0.10		0	1
Health and social work	0.21		0	1
Other community, social, and personal service	0.04		0	1
Social class				
Higher controllers	0.16		0	1
Lower controllers	0.19		0	1
Routine non-manual	0.32		0	1
Skilled manual	0.11		0	1
Semi–unskilled manual	0.21		0	1
Farm workers	0.01		0	1
Immigration status				
No immigrant background	0.94		0	1
1st gen. immigrants, western countries	0.02		0	1
1st gen. immigrants, non-western countries	0.04		0	1
2nd gen. immigrants, western countries	0.00		0	1
2nd gen. immigrants, non-western countries	0.00		0	1

employers), some occupations will require a specific educational credential. For this reason, we argue that credential closure in Norway is more likely when a high proportion of individuals in a given occupation have the *same* educational qualification. This would indicate that a strong link between educational qualifications and occupation is established because the qualification is (formally or informally) required by the employer.

We operationalize this idea of educational credentialing by using a segregation method proposed by DiPrete and colleagues (DiPrete et al., 2016). They measure the link between an educational credential and an occupation by using both the level of the degree and the field of the degree. When many individuals with the same educational credential end up in the same occupation, there is a strong link (e.g. law, medicine). When individuals with the same educational degree end up in a wide diversity of occupations, the link is weak (e.g. social science, general secondary school degree). We use the local segregation to measure educational credentialing.[4]

We prefer this measure over earlier measures, since there is no reason to assume that occupational closure by educational credentials only takes place in occupations where people have a tertiary degree. While we believe that our indicator of credentialing is a better indicator of occupational closure by educational credentials than the proportion of individuals with a tertiary degree, we have redone our analyses with the proportional measure as well. These results are discussed extensively in the Online Supplement, and show that we find a substantial effect of credentialing when we use the proportion of tertiary educated, although the effect loses significance once we adjust for occupational skills.

Occupational skills

Although previous studies have found that occupational closure affects wages, there are many alternative explanations for cross-occupational wage differences. We add two different explanations as control variables: occupational tasks and gender composition.

The register data do not contain information on job tasks. These variables are aggregated from the pooled data of working conditions that were part of the Norwegian SILC (again for 2000, 2003, 2006, and 2009). Similar to the unionization data, we merged these data with the register data at the

Table 2. Occupational data descriptive statistics.

	$Mean_{ij}$	SD_{ij}	$Mean_j$	SD_j
Occupational closure				
Licensure	0.24	0.40	0.16	0.34
Certification	0.12	0.27	0.10	0.26
Union density	0.56	0.24	0.59	0.27
Credentialing	–0.09	0.71	0.11	0.67
Occupational control variables				
Proportion of females	0.49	0.31	0.37	0.28
Physical skill demands	0.98	0.49	1.00	0.55
Cognitive skill demands	2.12	0.26	2.17	0.28
Emotional skill demands	2.83	0.88	2.37	0.82
Number of observations	$N = 1{,}592{,}673$		$N = 294$	

Source: 2007 data from Norwegian registers.
Note: ij: individual; j: occupation.

occupational level. We include three occupational skill measures: emotional tasks, physical tasks, and cognitive tasks.

The variables on emotional skills are a mean score of two variables measuring the extent to which employees of a given occupation must (a) relate to strong emotions such as grief, anger, etc. and (b) have face-to-face contact with clients or customers. The answers are given on a scale from (0) 'not at all' to (4) 'to a great extent'. The variables on physical demands are a mean score of nine items: (a) sit crouched; (b) lift in uncomfortable positions; (c) work standing up; (d) work with arms lifted overhead; (e) work with body leaned forward; (f) do repeated arm movements; (g) breathe heavily; (h) work with head leaned forward; and (i) lift more than 10 kg daily. The answers are given on a scale from (0) 'never' to (5) 'all the time'. Finally, the scale for cognitive skills consists of two items asking how often one is required to (a) develop occupational skills and (b) learn new skills. The answers range from (0) 'almost never' to (4) 'to a very great extent'. A final control variable at the occupational level is the proportion of females, as this has been shown to affect average occupational wages. Descriptive statistics for all occupational variables can be found in Table 2.

Analytical strategy

Closure institutions only create 'true' monopoly rents to the extent that these effects do not pick up skills differentials at the level of the individual or the occupation. In our models we control for a large series of individual-level and occupational-level covariates, for which an important assumption is that we are adequately covering the alternative explanations that might increase occupational wages. At the same time we believe that the estimate we will get by controlling for all these factors might lead to lower-bound estimates of the true effects of closure. For example, by controlling for the skill requirements of occupations, we are giving away part of the closure effect to these covariates, since closure institutions might partly function by restricting access to skill requirement (see Bol and Weeden, 2015). For this reason, we will estimate models with and without control variables, as well as models fitting only one closure institution at a time. We use the following basic equation:

$$Y_{ij} = \alpha + b'X_{ij} + c'W_j + u_j + e_{ij} \quad (1)$$

Where Y_{ij} is the natural logarithm of yearly wages of individual i in occupation j; α is the grand mean intercept; b' is a vector of individual characteristics X_{ij}; c' is a vector of occupational characteristics W_j; and u_j and ε_{ij} are random terms at the occupational and individual level. By changing the covariates in c',

Table 3. Correlation matrix.

	1	2	3	4	5	6	7	8
1. Licensure	1.00							
2. Certification	–0.09	1.00						
3. Unionization	0.30	0.00	1.00					
4. Credentialing	0.40	–0.01	0.36	1.00				
5. Cognitive skills	0.09	0.08	0.06	0.43	1.00			
6. Emotional skills	0.39	–0.07	0.06	0.08	0.18	1.00		
7. Physical skills	–0.06	0.07	–0.11	–0.11	–0.45	–0.34	1.00	
8. Proportion female	0.12	–0.18	0.08	0.11	0.00	0.58	–0.33	1.00

Source: Own calculations using the Norwegian Register Data for 2007. *N* [occupations] = 294.

we estimate a series of nested models that estimate the gross and net (skill-adjusted) association between occupational closure and log wages.

In the second part of the analyses we will investigate whether the returns to occupational closure are the same across different big classes. To estimate this, we interact each of the four closure institutions with the six big classes.

$$Y_{ij} = \alpha + b'(X_{ij}) + c'W_j + m'H_j + d'W_j * H_j + u_j + e_{ij} \quad (2)$$

Equation 2 fits the same covariates as equation 1, with the exception that we now estimate the interactions d' between the occupational characteristics W_j with the big classes H_j.

Results

Descriptive results

Before we turn to the analyses, we will take a look at the descriptive statistics of the occupation level variables in Table 2. The columns indexed $_{ij}$ are calculated on the basis of individual-level data, while the columns indexed $_j$ are calculated for occupations. This means that 24% of Norwegian employees are in occupations that require a licence, but only 16% of the 294 occupations we analyse are licensed. We find a lower percentage of workers in occupations that require a certificate (12%), whereas 56% of the working population are in a union. The measure of educational credentialing has no absolute interpretation, as it is a relative measure of the strength of the link between an educational credential and an occupation.

Next, we investigate correlations between the occupational level variables in Table 3. These correlations are calculated for the unweighted sample, that is, each occupation has equal weight (instead of being weighted by the number of workers in the occupation).

If we look at our closure indicators, we find positive correlations between licensure and unionization (0.30) and licensure and credentialing (0.40). The correlation between educational credentialing and licensure makes sense: most occupations that require a licence will also require a specific educational degree, thereby making that educational degree (for example in health) strongly linked to an occupation (DiPrete et al., 2016). The finding that licensure is correlated to unionization is in line with results from the US (Kleiner and Krueger, 2010). Certification is not correlated to any of the other closure institutions, indicating that certified occupations and licensed occupations are not associated. Occupations with a high level of unionization also tend to be those occupations that are more strongly linked to a specific educational degree (0.36), indicating that unions might be especially strong in those occupations that also have educational credentialing.

There are interesting correlations between the other occupational factors and the four closure institutions as well. First, we see that occupations that require a licence more often demand emotional job tasks (0.39), indicating that licensed occupations often involve personal contact. With respect to the skill requirements, we find that cognitive skills are more important in occupations that score high on educational credentialing (0.43). The other correlations between the occupational skill requirements and the closure indicators are close to zero. Finally, female-dominated occupations tend to require few physical skills (–0.33) but relatively often require emotional skills (0.58).

Wage effects of occupational closure

In Table 4 we present selected regression coefficients from our multilevel models. We estimate several models: an empty model (Model 1), a series of models that fit each closure institution separately (Models 2–4), a model with the effects of occupational closure unadjusted for the occupational control variables (Model 5), and the skill-adjusted effects of occupational closure (Model 6). We only show the occupational level effects; the individual-level effects can be found in Appendix A. For clarity we present the main results from these analyses (the marginal effects of the four closure indicators) graphically in Figure 1.

The null model in Table 4 makes clear that a substantial portion of wage inequality takes place between occupations. About 31% of the variance in log yearly wages takes place between occupations.[5] This does not of course mean that 31% of wage inequality in Norway can be explained by looking at occupational characteristics: to a large extent these cross-occupational wage differences are driven by compositional differences across occupations (e.g. educational composition). The main goal of this study is, however, to explain (part of) the between-occupation wage variance by looking at occupational factors.

Figure 1 shows the predicted effects of the four forms of institutionalized closure separately (light grey bars), simultaneously without skill controls (dark grey bars), and simultaneously with all occupational controls (black bars). For licensure we find a consistent positive effect. When controlling for all four closure institutions (Model 6), we predict that licensed occupations obtain a wage benefit of 12.3% ($e^{0.116}$) compared to occupations that do not require an occupational licence. The magnitude of this effect is comparable to the predicted effects of licensure for the United Kingdom (13%, Humphris et al., 2010), Germany (11%, Bol and Weeden, 2015), and the United States (15%, Kleiner and Krueger, 2010 and 9%, Weeden, 2002). By adding the occupational level control variables (Model 7), we see that the effect of licensure even slightly increases to 13.7%. Our results thus provide convincing evidence for the wage returns to licensure in Norway.

In contrast to licensure, we find no effect of certification. Even in the model where we only add certification, we find a very weak effect of 1.9% ($e^{0.019}$). In all specifications the effect of certification is not significant, and more importantly, very small. In line with earlier studies (Weeden, 2002), we find that certification is not positively associated with average occupational wages.

Our analyses do provide evidence for a (well-known) positive relation between the unionization of an occupation and the average wage returns in the occupation. Our results show that a large part of the strong 'gross' unionization effect (Model 4) can be attributed to the other closure institutions. In a model where we only add unionization we find a unionization effect of 17.2% ($e^{0.159}$). After controlling for the other three closure institutions (Model 6), we predict that a fully unionized occupation receives a 9.0% ($e^{0.086}$) wage premium compared to an occupation where no one is a member of a union. Given the distribution of the unionization variable in our data (see Table 2), the standardized effect is slightly smaller than the effect of licensure. Nevertheless, the effect of unionization is substantial, and robust to adding the other occupational factors in Model 7.

The final set of bars in Figure 1 present the predicted effects of educational credentialing. This indicator measures the strength of the connection between educational degrees and occupations. In Model 5 we see a significant and positive 'gross' effect of educational credentialing. An increase of 1 standard deviation on the educational credentialing indicator (SD = 0.71) is associated with a 5.1%

Table 4. Multilevel regression results (selected coefficients).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
Individual controls	no		yes		yes		yes		yes		yes		yes	
Proportion female			–0.114**	(0.035)	–0.087*	(0.037)	–0.103**	(0.035)	–0.109**	(0.035)	–0.119***	(0.035)	–0.177***	(0.034)
Licensure			0.162***	(0.029)							0.116***	(0.031)	0.128***	(0.026)
Certification					0.019	(0.038)					0.028	(0.036)	0.009	(0.027)
Union density							0.159***	(0.036)			0.086*	(0.038)	0.102***	(0.029)
Educational credentialing									0.070***	(0.014)	0.035*	(0.016)	–0.027	(0.014)
Physical skills													–0.108***	(0.016)
Cognitive skills													0.281***	(0.033)
Emotional skills													0.000	(0.013)
Constant	12.697***	(0.023)	10.400***	(0.023)	10.414***	(0.024)	10.327***	(0.031)	10.416***	(0.023)	10.351***	(0.031)	9.870***	(0.088)
σ_u	0.167***	(0.007)	0.029***	(0.001)	0.031***	(0.001)	0.030***	(0.001)	0.029***	(0.001)	0.027***	(0.001)	0.015***	(0.001)
σ_e	0.371***	(0.000)	0.197***	(0.000)	0.197***	(0.000)	0.197***	(0.000)	0.197***	(0.000)	0.197***	(0.000)	0.197***	(0.000)
ICC	0.311		0.127		0.138		0.131		0.129		0.122		0.071	
–2LL	–1,472,146		–966,372		–966,387		–966,378		–966,375		–966,365		–966,275	

Source: 2007 data from Norwegian registers. *N* [occupations] = 294; *N* [individuals] = 1,592,673.

Note: The dependent variable is the natural logarithm of yearly wages. Standard errors are listed in parentheses. All models also fit individual-level covariates; see Appendix A.

*$p < 0.05$; **$p < 0.01$; ***$p < .001$, two-tailed tests.

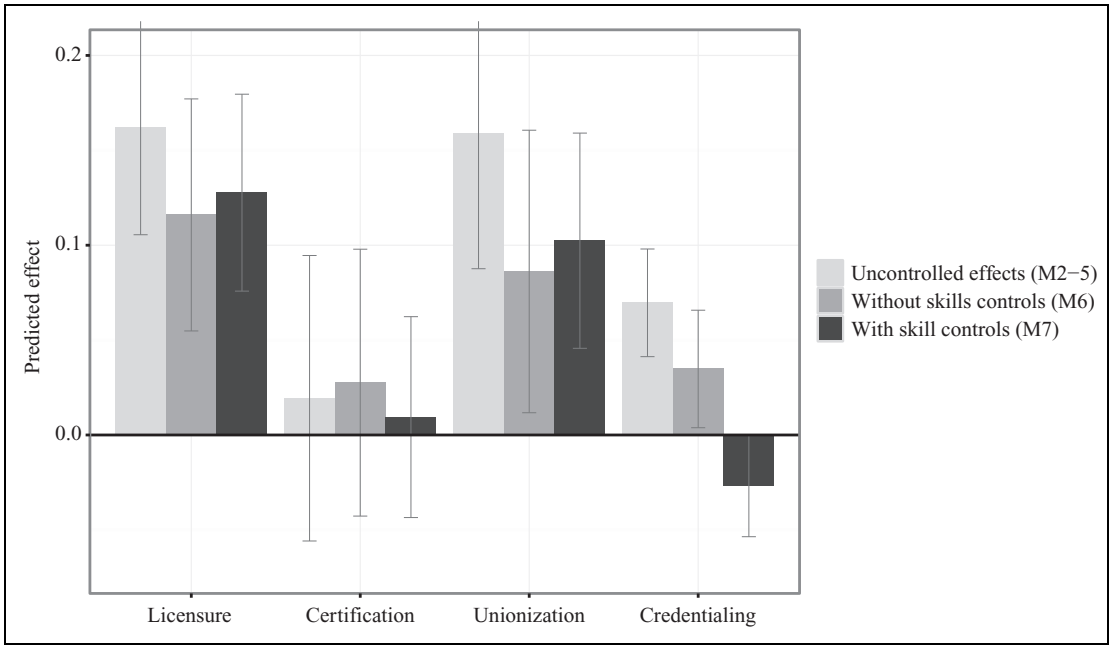

Figure 1. Selected effects from main regression models.
Note: The predicted effects are obtained from Table 3. Whiskers depict a 95% confidence interval.

($e^{(0.070*0.71)}$) increase in yearly wages. When we add the other closure variables we see that the effect halves, showing that part of what we attribute to the credentialing effect is actually explained by the other closure institutions (given the high correlations, most likely licensure or unionization). In the final model the effect of educational credentialing disappears. We believe that this shows that the only reason why we find a small effect of credentialing is because of the link between what skills are acquired in education and what skills are demanded by the occupation. It is important to articulate that this does not mean that educational credentialing does not yield any wage returns; in fact, it is likely that the credentialing effect works completely through (barriers to) skill acquisition.

Overall, we find convincing support for occupational closure. Whereas the 'strongest' form of closure (licensure) has a positive effect on wages, we do not find any effect for voluntary certificates that we would not expect to generate large rents anyway. The effect of educational credentialing is small and disappears in a fully controlled model, indicating that in the relatively open educational system of Norway educational credentialing is an ineffective method of closure. In line with earlier studies, we find that unionization is positively associated with wages.

Occupational closure across big social classes

If we want to learn more about how occupational closure affects overall inequality in Norway, these average effects tell us relatively little. For this reason, we investigate heterogeneity of closure returns across six big social classes: high controllers; low controllers; routine non-manual; skilled manual; unskilled manual; and farm labour. In order to study the heterogeneity in closure effects, we estimated a model in which we interacted the six big classes with the four closure institutions. Since an alternative hypothesis is that the wage returns to occupational skill requirements vary across the occupational structure, we have included interactions with these variables. The effects in this model become very hard to interpret, as there are many different main and interaction effects that need to be considered simultaneously to tease out the closure effects for the different big classes. For this reason, we only

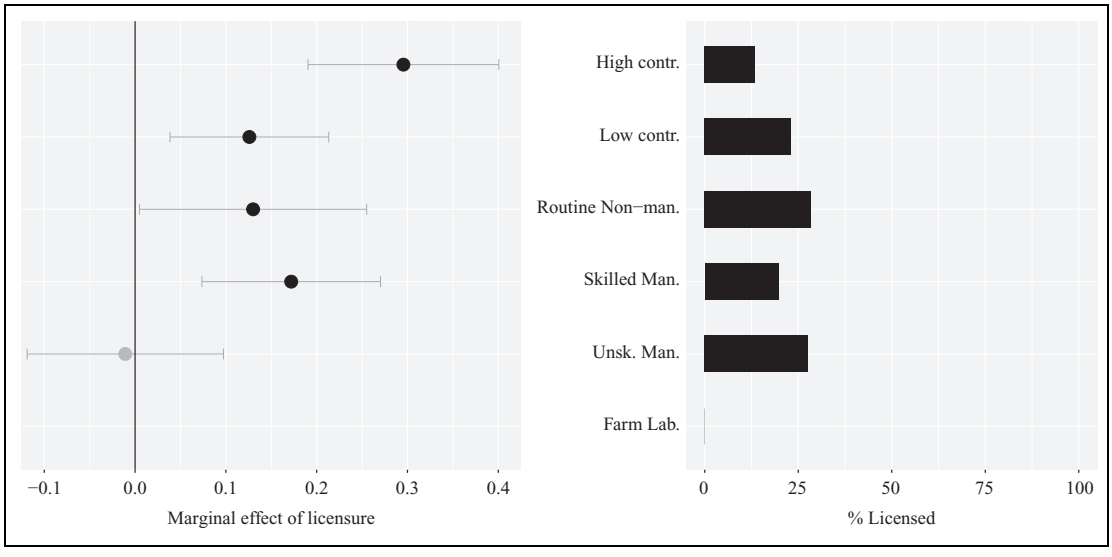

Figure 2. The effects of licensure across big classes.
Note: Point estimates are average marginal effects that we have obtained from an interaction model that can be found in Appendix B. Whiskers depict 95% confidence interval.

report the marginal effects in four figures (2–5): one for each closure institution. The full interaction model can be found in Appendix B.

In Figure 2 the effects of occupational licensure are summarized. In the left panel of the graph we report the predicted marginal effects for each of the six big social classes; in the right panel we report the average score for each big social class. For licensure, the average score refers to the proportion of workers in a big social class that work in a licensed occupation. When we look at these descriptive statistics, it becomes clear that licensure is found quite evenly across the different class groups. Besides farmers, where licensure is completely absent, we find the lowest percentage in the high controllers (13.4%) and highest percentage for occupations classified as routine non-manual (28.5%). When we then turn to the left panel, we see that there is quite some variation in the licensure effect. Licensed workers in the higher controller group obtain a predicted 34.4% ($e^{0.296}$) wage premium, whereas this figure is 13.4% for lower controllers, 18.8% for skilled manual workers, and 13.9% for employees in routine non-manual occupations. Surprisingly, the effect of licensure is absent for the class group where it is most common: unskilled manual workers. The strong effects for the higher classes and the small (or absent) effects for the lower classes indicate that licensure is likely to increase social inequality in Norway, as lower class occupations benefit less.

Figure 3 summarizes similar findings for certification. The proportion of certified workers is relatively high in the skilled manual class (29.1%) and the lower controllers (20.9%), and small or absent in all other classes. As in the main analyses, we find virtually no significant effects of certification on wages. Furthermore, the point estimates are small and very close to zero. The only exception is among unskilled manual workers, where we find a positive effect of certification. This predicted wage gain of 13.2% ($e^{0.124}$) that is associated with certification seems to be fully driven by workers on Norwegian oil platforms that require a certificate. For them the certificate might function as a barrier that generates rents. However, given the absence of effects for virtually all of those who are in a certified occupation, it seems unlikely that certification has any influence on aggregate inequality in Norway.

The results for unionization are displayed in Figure 4. Union membership is quite common across all big classes except the farmers. Even among the high controllers, 56% are members of a union, whereas

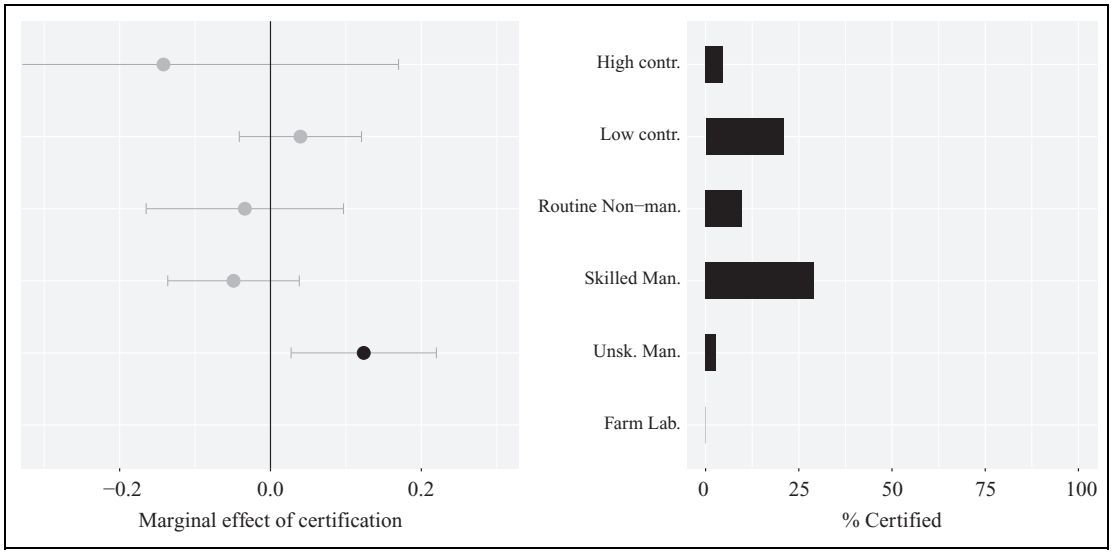

Figure 3. The effects of certification across big classes.
Note: Point estimates are average marginal effects that we have obtained from an interaction model that can be found in Appendix B. Whiskers depict 95% confidence interval.

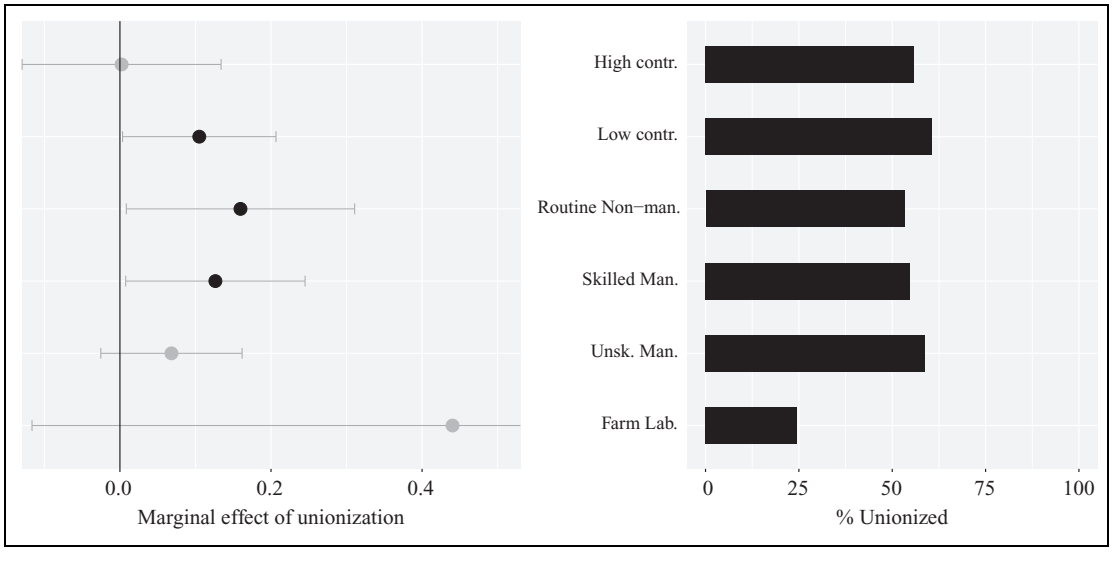

Figure 4. The effects of unionization across big classes.
Note: Point estimates are average marginal effects that we have obtained from an interaction model that can be found in Appendix B. Whiskers depict 95% confidence interval.

the highest percentages are found among the low controllers (61%) and the unskilled manual class (59%). All of the predicted effects are positive and half of them reach significance, with predicted effects between 0.10 and 0.20. While union membership is quite evenly distributed across the classes, the effects are not. We find a very small and non-significant effect for higher controllers, but we find positive effects for the 'middle' groups (low controllers, routine non-manual, skilled manual). Although the predicted

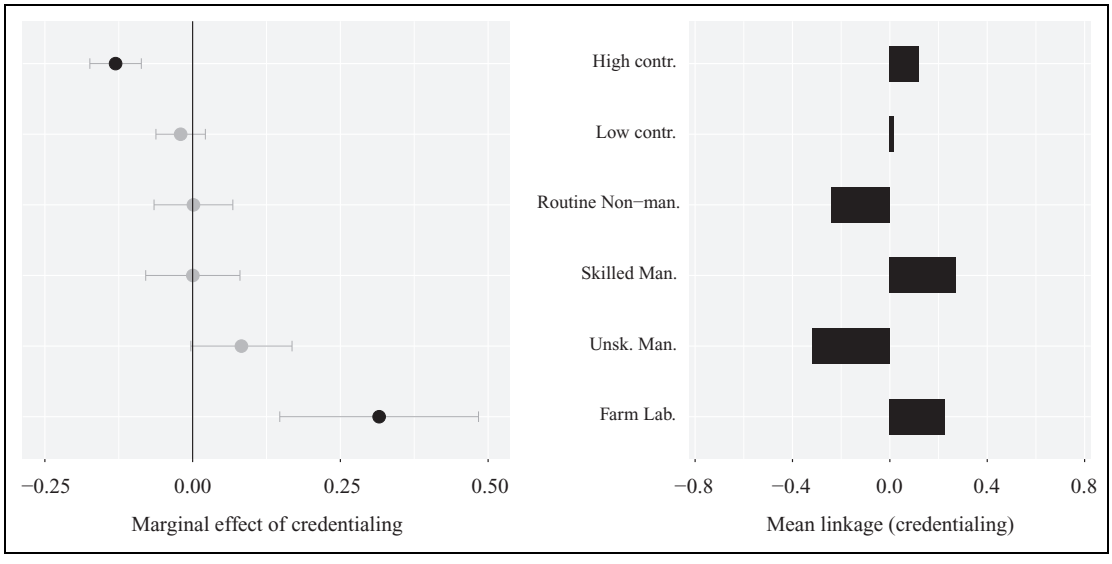

Figure 5. The effects of credentialing across big classes.
Note: Point estimates are average marginal effects that we have obtained from an interaction model that can be found in Appendix B. Whiskers depict 95% confidence interval.

effect for unskilled manual does not reach significance, our general conclusion is that – as expected – unionization seems to mitigate existing inequalities, having lower payoffs for the higher classes.

The final figure shows the effects of credentialing. The descriptive statistics in the right panel of Figure 5 do not refer to a proportion, but indicate the average credentialing score in that social class. The strongest link between educational degrees and occupations can be found in the higher controllers, skilled farmers, and skilled manual workers. For routine non-manual and unskilled manual workers, the link between a specific educational qualification and an occupation is weak, indicating that in those classes individuals with a widely different educational background work in the same occupations. Similar to the main results in Table 3 and Figure 2, we find that most effects of credentialing are close to zero and not significant. There are two exceptions. For higher controllers, being strongly linked is negatively related to wages. This could indicate that that managers (weakly linked) earn higher wages than professionals (strongly linked). We find a positive effect for the farmers, most likely driven by forestry workers, who have relatively high wages in this group and whose occupation is strongly linked to an educational credential. The graph does not make clear what the inequality-effects of credentialing are, but if anything it will decrease inequality, given the negative effect for the high controllers.

Conclusion

In this article we have examined the wage returns to occupational closure, focusing on four different forms: licensure, certification, unionization, and educational credentialing. Using a newly gathered occupational database, we estimated how much closure there is in Norway, how occupational closure affects wages, and how this differs across social classes. Our general proposition was that occupational closure affects wages positively, as it can be used to lay artificial restrictions on the supply of employees, thereby creating monopoly rents for workers in 'closed' occupations. We have three main findings.

Our first finding is descriptive, but nevertheless new and important: occupational closure is widespread in Norway. Licensure, certification, union membership, and educational credentialing are visible

across the whole occupational structure and are institutions that need to be taken into account when we want to understand how inequality is generated in labour markets. Our overall estimate is that 24% of the Norwegian workforce is employed in a licensed occupation, which is not very different from the findings of other studies in Germany, the United Kingdom, or the United States. It therefore seems that, although different forms of occupational closure are prevalent across countries (cf. Bol and Weeden, 2015), occupational closure itself is a phenomenon that is observed relatively independent of broader national contexts. These results signal the importance of occupational institutions in contemporary labour markets.

The key question of our article is how occupational closure affects wages. Overall, we find a positive association between occupational closure and wages, although there are important differences between the four closure institutions that we have studied. Our models predict substantial wage gains from being in a licensed occupation, resulting in a 12.3% wage premium compared to workers in occupations that lack a licence. Given the complete absence of wage effects from certification, we believe that our results show that occupational closure primarily generates economic rents by restricting access to an occupation. A licence and a certificate are in a way quite similar: they can be used as a signal of quality, or can be exploited to increase the overall status of an occupation. The major difference between the two, however, is that in licensed occupations the licence is a requirement to get access, whereas this is not the case for a certificate. Licences are therefore much more efficient in creating a monopoly, and obtaining rents from that monopoly (Weeden, 2002). In line with earlier studies, we have included unionization in our analyses as well, although the mechanism at play is likely to be different from the mechanism that drives the licensure effect. The ways by which unions increase occupational wages are not so much by 'closing' access to an occupation, but instead by hoarding opportunities for occupational incumbents, for example by negotiating higher wages. In our study we only find limited evidence for educational credentialing. This could be explained by the absence of bottlenecks in the Norwegian educational system or by the improved operationalization of educational credentialing we have used in this study. The low returns to education are also in line with previous research that shows that returns to education are comparatively small in Norway (Barth et al., 2003).

Finally, we find that occupational closure has a differential payoff across big social classes. Licensure, for example, does not yield equal returns across the social structure, and has the strongest effects for occupations that are classified as belonging to the higher social class. This indicates that licensure might increase existing social cleavages by increasing the wages of those who are already better off. For unionization we find a reverse pattern, where the highest effects are observed for the lower classes, showing that unions mitigate social inequality in Norway. Although the question of how these forms of occupational closure affect wage inequality reaches beyond the goal of this article, we believe that our findings indicate that these questions are important to ask in future research.

With this article we have extended the study of occupational closure in the Norwegian context. In the introduction, we questioned whether the effects of occupational closure might be mitigated by the egalitarian wage policy in Norway. In centralized wage systems, supply restrictions are not expected to raise average wage levels because monopoly is not a legitimate principle in collective wage setting. Decentralized systems such as those in the US and the UK are more likely to yield monopoly rents (Barth et al., 2003: 32–33). Our results, however, show that the relative returns to licensure and unionization in Norway are comparable to the results from the US and the UK. Although Norway has a highly compressed wage structure, the effects of occupational closure are similar to those found in liberal and less coordinated economies, with the caveat for educational credentialing.

In line with earlier studies on occupations and wage inequality, we find that occupations matter for structuring wage inequality. Given the wide spread of occupational institutions such as licensure, certification, and credentialing across contemporary labour markets, we believe that it is crucial to learn more about their effects on wages. In this study we have showed that in the Norwegian case occupational closure directly affects the wages of workers. Moreover, we have shown that occupational institutions affect social inequality, indicating that using occupational closure to explain (rising) wage inequality forms an important research agenda for sociologists interested in social stratification and inequality.

Notes

1. See 'Data and variables' for a more detailed explanation of our operationalization of educational credentialing, which is different from earlier studies.
2. The EGP code is based on the classification made by Ganzeboom and Treiman (1996) and revised by Johannes Hjellbrekke (UiB) for Norway. The correlation with the Ganzeboom and Treiman standard is 0.93.
3. We searched the internet for the combination of the occupational title and the key word certific* (Norwegian: sertifi*) for each occupational title in the ISCO-standard. Two researchers worked independently of each other according to defined inclusion criteria and the inter-coder reliability was 85–95%. If the search provided a match, the source of the certificate was checked to evaluate its credibility (see Alecu and Drange, 2016a).
4. Following DiPrete et al. (2016), we take the natural logarithm of the segregation measure.
5. This proportion of the variance is reduced to 14% of the variance after adjusting for the control variables.

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Supplemental material

The online [appendices/data supplements/etc.] are available at http://journals.sagepub.com/doi/suppl/10.1177/0001699316659768.

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Appendix A. Individual-level coefficients from multilevel regression models (selected models)

	Model 2		Model 6		Model 7	
	ln wage		*ln wage*		*ln wage*	
Individual-level independent variables						
Gender (women = 1)	–0.095***	(0.003)	–0.095***	(0.003)	–0.095***	(0.003)
Family status (ref: married, no children)						
Married with children	0.046***	(0.002)	0.046***	(0.002)	0.046***	(0.002)
Single	–0.104***	(0.002)	–0.104***	(0.002)	–0.104***	(0.002)
Single with children	–0.005	(0.004)	–0.005	(0.004)	–0.005	(0.004)
Other	–0.003	(0.003)	–0.003	(0.003)	–0.003	(0.003)
Gender * family status, (ref: married, no children)						
Woman * married with children	–0.038***	(0.003)	–0.038***	(0.003)	–0.038***	(0.003)
Woman * single	0.048***	(0.003)	0.048***	(0.003)	0.048***	(0.003)
Woman * single with children	0.008	(0.006)	0.008	(0.006)	0.008	(0.006)
Woman * other	0.004	(0.004)	0.004	(0.004)	0.004	(0.004)
Education level (ref: no education/unspecified)						
Primary education	–0.043*	(0.020)	–0.043*	(0.020)	–0.043*	(0.020)
Lower secondary education	–0.050**	(0.016)	–0.050**	(0.016)	–0.050**	(0.016)
Upper secondary education, basic education	–0.033*	(0.016)	–0.033*	(0.016)	–0.033*	(0.016)
Upper secondary education, final year	0.099***	(0.016)	0.099***	(0.016)	0.099***	(0.016)
Post-secondary non-tertiary education	0.110***	(0.016)	0.110***	(0.016)	0.110***	(0.016)
First stage of tertiary education, undergraduate level	0.167***	(0.016)	0.167***	(0.016)	0.167***	(0.016)
First stage of tertiary education, graduate level	0.321***	(0.016)	0.321***	(0.016)	0.320***	(0.016)
Second stage of tertiary education (PhD)	0.477***	(0.016)	0.477***	(0.016)	0.476***	(0.016)
Field of education (ref: general subjects)						
Humanities and arts	–0.005*	(0.002)	–0.005*	(0.002)	–0.005*	(0.002)
Teacher training and pedagogy	0.059***	(0.002)	0.059***	(0.002)	0.059***	(0.002)
Social sciences and law	0.024***	(0.003)	0.024***	(0.003)	0.024***	(0.003)
Business and administration	0.100***	(0.002)	0.100***	(0.002)	0.100***	(0.002)
Natural sciences, vocational, and technical subjects	0.113***	(0.002)	0.113***	(0.002)	0.113***	(0.002)
Health, welfare, and sports	0.128***	(0.002)	0.128***	(0.002)	0.128***	(0.002)
Primary industries	0.033***	(0.004)	0.033***	(0.004)	0.033***	(0.004)
Transport and communications, safety, and security	0.121***	(0.003)	0.121***	(0.003)	0.121***	(0.003)
Unspecified field of study	0.011*	(0.006)	0.011*	(0.006)	0.012*	(0.006)
Immigration status (ref: no immigration background)						
First generation immigrants, western countries	–0.011***	(0.003)	–0.011***	(0.003)	–0.011***	(0.003)
First generation immigrants, non-western countries	0.004*	(0.002)	0.004*	(0.002)	0.004*	(0.002)
Second generation immigrants, western countries	–0.022*	(0.011)	–0.022*	(0.011)	–0.022*	(0.011)
Second generation immigrants, non-western countries	–0.114***	(0.005)	–0.114***	(0.005)	–0.114***	(0.005)
Level of centrality (ref: least central municipals)						
Less central municipalities	0.017***	(0.002)	0.017***	(0.002)	0.017***	(0.002)
Quite central municipalities	0.016***	(0.002)	0.016***	(0.002)	0.016***	(0.002)
Central municipalities	0.030***	(0.001)	0.030***	(0.001)	0.030***	(0.001)
Oslo (Capital city)	0.095***	(0.002)	0.095***	(0.002)	0.095***	(0.002)
Experience in years	0.034***	(0.000)	0.034***	(0.000)	0.034***	(0.000)
Experience in years squared	–0.001***	(0.000)	–0.001***	(0.000)	–0.001***	(0.000)

(continued)

(continued)

	Model 2		Model 6		Model 7	
	ln wage		*ln wage*		*ln wage*	
Industry (ref: agriculture, hunting, forestry, and fishing)						
Mining and quarrying	–0.143***	(0.006)	–0.143***	(0.006)	–0.143***	(0.006)
Manufacturing	0.240***	(0.004)	0.240***	(0.004)	0.240***	(0.004)
Electricity, gas, and water supply	–0.034***	(0.005)	–0.034***	(0.005)	–0.035***	(0.005)
Construction	–0.053***	(0.002)	–0.053***	(0.002)	–0.053***	(0.002)
Wholesale, retail trade, and repairs	–0.068***	(0.002)	–0.068***	(0.002)	–0.068***	(0.002)
Hotels and restaurants	–0.160***	(0.003)	–0.160***	(0.003)	–0.160***	(0.003)
Financial intermediation	0.031***	(0.002)	0.031***	(0.002)	0.031***	(0.002)
Transport, storage, and communication	0.083***	(0.004)	0.083***	(0.004)	0.082***	(0.004)
Real estate, renting, and business activities	–0.107***	(0.002)	–0.107***	(0.002)	–0.108***	(0.002)
Public adm. and defence, compulsory social security	–0.198***	(0.003)	–0.198***	(0.003)	–0.198***	(0.003)
Education	–0.178***	(0.003)	–0.178***	(0.003)	–0.178***	(0.003)
Health and social work	–0.210***	(0.002)	–0.210***	(0.002)	–0.211***	(0.002)
Other community, social, and personal service activities	–0.162***	(0.003)	–0.162***	(0.003)	–0.162***	(0.003)
Extra-territorial organizations and bodies	–0.254***	(0.041)	–0.254***	(0.041)	–0.254***	(0.041)
Working hours	0.030***	(0.000)	0.030***	(0.000)	0.030***	(0.000)
Days of employment	0.003***	(0.000)	0.003***	(0.000)	0.003***	(0.000)

Source: 2007 data from Norwegian registers. *N* [occupations] = 294; *N* [individuals] = 1,592,673.
Note: The dependent variable is the natural logarithm of yearly wages. Standard errors are listed in parentheses.
*$p < 0.05$; **$p < 0.01$; ***$p < .001$, two-tailed tests.

Appendix B. Multilevel regression models with big class interactions (selected coefficients)

	Model 1	
	ln wage	
Individual controls	yes	
Occupational level independent variables		
Average share of women	–0.169***	(0.032)
Closure variables		
Licensure	0.296***	(0.054)
Certification	–0.142	(0.159)
Union density	0.002	(0.067)
Credentialing (log linkage)	–0.130***	(0.022)
Occupational controls		
Physical skill demands	–0.115	(0.075)
Cognitive skill demands	0.130	(0.101)
Emotional skill demands	–0.046	(0.025)

(continued)

(continued)

	Model 1	
	ln wage	
Controls		
EGP social class (higher controllers)		
Lower controllers	–0.384	(0.332)
Routine non-manual	–0.863*	(0.355)
Skilled manual	–0.390	(0.327)
Semi–unskilled manual	–0.408	(0.297)
Farm workers	–1.657	(1.091)
EGP * licensure		
Lower controllers * licensure	–0.170*	(0.070)
Routine non-manual * licensure	–0.166*	(0.083)
Skilled manual * licensure	–0.124	(0.073)
Semi–unskilled manual * licensure	–0.306***	(0.077)
Farm workers * licensure		
EGP * certification		
Lower controllers * certification	0.182	(0.164)
Routine non-manual * certification	0.108	(0.172)
Skilled manual * certification	0.093	(0.165)
Semi–unskilled manual * certification	0.266	(0.166)
Farm workers * certification		
EGP * unionization		
Lower controllers * unionization	0.103	(0.085)
Routine non-manual * unionization	0.157	(0.102)
Skilled manual * unionization	0.124	(0.091)
Semi–unskilled manual * unionization	0.066	(0.082)
Farm workers * unionization	0.438	(0.292)
EGP * credentialization		
Lower controllers * credentialization	0.110***	(0.031)
Routine non-manual * credentialization	0.132**	(0.040)
Skilled manual * credentialization	0.131**	(0.046)
Semi–unskilled manual * credentialization	0.213***	(0.049)
Farm workers * credentialization	0.446***	(0.089)
EGP * physical skills		
Lower controllers * physical skills	0.011	(0.091)
Routine non-manual * physical skills	0.188*	(0.092)
Skilled manual * physical skills	0.084	(0.085)
Semi–unskilled manual * physical skills	0.111	(0.083)
Farm workers * physical skills	0.018	(0.214)
EGP * cognitive skills		
Lower controllers * cognitive skills	0.043	(0.124)
Routine non-manual * cognitive skills	0.211	(0.137)
Skilled manual * cognitive skills	–0.001	(0.134)
Semi–unskilled manual * cognitive skills	–0.070	(0.118)
Farm workers * cognitive skills	0.440	(0.378)
EGP * emotional skills		
Lower controllers * emotional skills	0.048	(0.033)
Routine non-manual * emotional skills	0.023	(0.041)
Skilled manual * emotional skills	0.017	(0.036)

(continued)

(continued)

	Model 1	
	ln wage	
Semi–unskilled manual * emotional skills	0.099**	(0.032)
Farm workers * emotional skills	0.206	(0.118)
Constant	10.490***	(0.266)
σ_u	0.010***	(0.000)
σ_e	0.197***	(0.000)
ICC	0.04777	
–2LL	–966210.682	

Source: 2007 data from Norwegian registers. *N* [occupations] = 294; *N* [individuals] = 1,592,673.
Note: The dependent variable is the natural logarithm of yearly wages. Standard errors are listed in parentheses.
*$p < 0.05$; **$p < 0.01$; ***$p < .001$, two-tailed tests.