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Occupational entry regulations and their effects on productivity in services: Firm-level evidence

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ABSTRACT /RESUME

Occupational entry regulations and their effects on productivity in services: firm-level evidence

This paper assesses the link between occupational entry regulations (OER) and labour productivity. It combines international firm-level productivity data with the new composite indicator measuring the stringency of OER in terms of administrative burdens, qualifications requirements, and mobility restrictions estimated in von Rueden and Bambalaite (2020). The analysis is performed for 11 EU countries, for three professional and eight personal services. The evidence suggests that bold reforms easing OER, especially those concerning qualification requirements, could help increase the contribution of personal and professional services to aggregate productivity growth via two channels: the improvement in firm-level productivity growth, where the average firms in regulated sectors could gain around 1.5 percentage points on impact; and a higher contribution of labour reallocation to firms' employment growth, which could increase by up to 10 percent for the most productive firms. Given the scope for reform highlighted by cross-country differences in regulatory approaches and the potential positive effects on productivity of such reforms, our results are supportive of the need to (i) review regulations in the light of changing public interests, technological developments and international experience, (ii) shift the focus of regulations from inputs to outputs wherever possible, and (iii) check the implications of regulations for competition and explore new ways to deliver better information to consumers.

JEL classification codes: J44 ;O43; L5; O57; L16; C21.

Keywords: occupational licensing; productivity; regulations; catch-up; reallocation

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Les effets de la certification professionnelle sur la productivité des services: Résultats au niveau d'entreprise

Cette étude évalue les liens potentiels entre les critères de certification professionnelle et la productivité du travail. L'étude s'appuie à la fois sur des données internationales de productivité au niveau d'entreprise et sur un nouvel indicateur (proposé par von Rueden et Bambalaite, 2020) comparant à travers plusieurs pays la sévérité des critères administratifs, de qualification et de mobilité. L'analyse concerne onze pays européens, trois services professionnels et huit services à la personne. Nos résultats suggèrent que réformer ces critères, spécialement le niveau de qualifications requis, pour faciliter l'accès au marché des prestateurs de ces services pourrait renforcer leur contribution à la croissance de la productivité agrégée de deux façons: cela pourrait accélérer la vitesse à laquelle les entreprises s'approchent des meilleures pratiques internationales, un canal interne aux entreprises à travers lequel leur croissance augmenterait en moyenne d'environ 1,5 points en pourcentage selon nos estimations; et cela pourrait aussi conduire à une plus forte croissance de l'emploi dans les entreprises les plus productives, un canal de réallocation à travers lequel ces entreprises pourraient augmenter leur avantage d'embauche vis à vis des entreprises moins productives de dix pour cent selon nos estimations. Étant donné le potentiel de réforme avéré par notre indicateur et l'entité estimée des effets positifs de cette réforme sur la productivité, nos résultats appuient des réformes qui viseraient à (i) réexaminer les critères existants à la lumière des changements dans les objectifs d'intérêt public, les technologies et l'expérience internationale; (ii) recentrer les critères sur la qualité des services plutôt que sur la sévérité des critères d'accès au marché là où cela est faisable; et (iii) vérifier la cohérence des critères (existants ou proposés) avec la normative sur la concurrence ainsi qu'etudier les manières de fournir une meilleure informations aux consommateurs des services concernés.

Classification JEL : J44 ; O43; L5; O57; L16; C21.

Mots-clés : critères de certification professionnelle, productivité, régulations, rattrapage, réallocation.

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Occupational entry regulations and their effects on productivity in services: firm-level evidence

By Indre Bambalaite, Giuseppe Nicoletti and Christina von Rueden[1]

1. Introduction[2]

1. The economics of occupational entry regulations are capturing increasing attention among academics, policymakers and the media. These regulations set the administrative, qualification and (cross-jurisdictional) mobility requirements for being allowed to provide services in certain areas, and their stringency varies from licensing to certification (compulsory or voluntary). In advanced economies, where services are the bulk of economic activity, the share of occupations and workers covered by such regulations is large and, where historical data are available, this share has been shown to rise over time (Kleiner and Krueger, 2010). For instance, regulated workers are estimated to account for between 15 and 35% of the workforce across both EU countries and states of the US, where the overall share has gone up fivefold (from 5 to 22%) over the past few decades (Kleiner, 2017; Koumenta and Pagliero, 2017).

2. There are good reasons for regulating entry in occupations where the specific competency of providers is key to the satisfaction, health and safety of customers, and asymmetries of information concerning these competencies and the corresponding quality of services are large between providers and customers (Law and Kim, 2005). But there are also reasons to worry that, by creating barriers to entry,

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2 The OER database, all graphs and further background material can be found on the dedicated webpage to this project: https://bit.ly/2w4MR2X

such regulations may unduly protect incumbents and stifle business dynamism, weighing down on aggregate productivity in economies that are increasingly driven by entrepreneurial initiative and innovation. This concern arises especially as new business models based on digital platforms that reduce transaction costs and information asymmetries spread out rapidly, potentially reducing the need for regulating service provision (Larsen et al., 2019).

3. Most of the research in the area of occupational entry regulations has dealt either with their presumed positive effects on quality of service and creation of skills (Kleiner, 2017) or with their possible negative effects via reduction of supply and rent generation, with the implied higher prices and wages and lower employment in regulated occupations (Koumenta and Pagliero, 2017). While most empirical studies find little effects on quality and skills, there is abundant evidence of an upward effect on wages and prices and some evidence of downward effects on employment and hours worked. There is also evidence, often based on the US, that occupational regulations stifle geographical mobility of workers between federal States (Hermansen, 2019; Ghani, 2019).

4. The focus of this study is on the possible dynamic effects of occupational entry regulations on firm-level productivity, an area that has been vastly under-researched to date. Specifically, we look at two ways in which the contribution of both personal and professional services to productivity growth could be lowered by excessively stringent regulations: via reduced firm capabilities and incentives that slow down their rate of adoption of best practices and via lesser job reallocation from low to high productivity firms. By raising the cost and complications of entry in markets for services, occupational regulations may make it difficult for entrepreneurs to access professions and compete, thereby reducing incumbents' incentives to update their practices and innovate. At the same time, occupational entry regulations imposing stringent skill requirements and stifling job markets, both along tasks and geographically, may make it difficult for workers to participate in the labour market and, once in, move across firms that need their skills. This, in turn, might hinder successful firms from finding the workers they need to grow.

5. To our knowledge, this is the first cross-country study looking at the link between occupational entry regulations and productivity growth at the firm level in a range of personal and professional services.[3] We are also the first to study how such regulations can influence the ability of successful businesses to grow in these regulated sectors.

6. The analysis builds on firm-level data from the ORBIS database and a new cross-country proxy for the stringency of occupational entry regulations, based on von Rueden and Bambalaite (2020). This indicator provides a snapshot of regulatory stringency for 11 EU countries (hereafter referred to as "EU11"), all US states and Canadian provinces, Iceland, Israel and a representative Indian state[4] for five professional services and nine personal (private or public) services as well as nurses. It is constructed along three dimensions – (i) administrative burdens, (ii) qualification requirements, and (iii) mobility restrictions – the influence of which on productivity and job reallocation is also separately assessed by the empirical analysis.

7. While our analysis is the first of its kind, it suffers from a number of limitations. First, due to a lack of harmonised historical data for occupational entry regulations across countries, the effects of these regulations are identified via their variability across countries and sectors only. Second, while the regulation data covers 2018 or 2019 (depending on the country), the most recent firm-level data covers the 2014-16 period, which requires to assume that regulation has not changed significantly over the recent past and

[3] Some studies have focused on the regulation of services at large and on its economic effects on downstream sectors (Arnold et al., 2011; Arnold et al., 2015; Barone and Cingano, 2011; Bourlès et al., 2013),

[4] The European sample includes Belgium, Finland, France, Germany, Hungary, Italy, Portugal, Slovenia, Spain, Sweden, and the UK. Concerning India, the indicator for Delhi is assumed to be representative as the regulations assessed by this study were almost identical in Haryana and Uttar Pradesh.

that reverse causality is not an issue.[5] Third, while the regulation data covers both EU and non-EU countries and a wide range of occupations, the empirical analysis could only be based on a subset of 11 EU countries and 11 (three professional and eight personal) services with sufficiently representative and reliable cross-country firm-level data, which further restricted the variability available for identification.

8. We exploit the variance in regulations from this subset of countries and occupations to gauge their potential effects on firm-level labour productivity growth and on the extent of efficient labour reallocation within each occupation. Results based on a standard model of productivity catch-up suggest that stringent regulations are associated with lower productivity growth of the average firm in the regulated sectors, but particularly so for small firms and firms close to the productivity frontier. According to our estimates, the average firm in regulated sectors would experience a 1.5 percentage point higher productivity growth on impact, if all dimensions of occupational entry regulations were to be significantly eased. The higher productivity associated with lower administrative burdens and mobility restrictions together is estimated roughly as large as for lower qualification requirements. This is consistent with research finding that curbing competitive pressures – in this case via high occupational entry barriers – lowers managerial incentives to continue to improve efficiency and innovate. Indeed, once the qualifications are acquired and markets have been entered, insiders can lead a quiet life benefiting from the protection that occupational entry regulations ensure.

9. We also find that occupational entry regulations tend to be associated with lower employment growth of the most productive firms in each regulated service, pointing to a significant reduction in the efficiency of labour reallocation across firms in countries with the most stringent regulations. Our estimates imply that easier regulations, especially those concerning qualification requirements, could be associated with a 10% higher contribution of reallocation from low to high productivity firms to employment growth. This could reflect a number of factors: a wider availability of labour, due to less stringent requirements for service providers; easier entry for innovative businesses, due to lower administrative and other barriers; and easier mobility of individuals across firms, due to a combination of easier requirements and lower barriers, including territorial mobility.

10. Our findings have potentially relevant policy implications in several areas. First, the new indicator of occupational entry regulations provides useful information to policy-makers concerning areas where home regulations deviate from those observed in other countries. This is particularly useful for countries that share the same level of development and similar institutional structures as the existence of comparatively looser entry regulations that achieve the same public policy objectives abroad (or in other federal states) could stimulate reflection on the need to reform regulations at home. Second, while productivity concerns were rarely at the core of policy decision-making in this field, our analysis suggests that there could be sizable unintended side effects of occupational entry regulations on aggregate productivity. Therefore, given the significant share of GDP accounted for by services, implementing reforms in the area of occupational entry regulations could help sustain productivity growth in the current period of slowdown.

11. Against this background, two principles emerge: (i) the need for reviewing regulations in the light of their adequacy for meeting the stated public interest targets, technological developments and international experience, and (ii) the need to lighten requirements and shift the focus of regulations from inputs to outputs, whereby the focus of regulations becomes ensuring certain quality standards for goods and services provided rather than reserving activities or setting standards for the professionals providing them. Other important areas for action are: replacing where possible licensing systems with less distortionary certification schemes; promoting the development of consumer information systems (e.g.

[5] Available regulatory information for the most recent period (see Table 5) and limited causality testing (see Annex A) suggest that these assumptions may not be overly restrictive, though additional analysis is needed in these areas.

service quality comparison platforms), in order to reduce informational asymmetries where they persist; and paying special attention to the potential anti-competitive consequences of new regulations.

12. The plan of the paper is as follows. The next section provides motivation for looking at occupational entry regulations and their effects on productivity, briefly surveying and drawing on existing research. Section 3 first describes the data used in the empirical analysis, including differences in regulatory approaches across EU11 and non-EU countries based on a novel indicator of occupational entry regulations covering both personal and professional services. It then looks at the link between those differences and two determinants of aggregate productivity growth: within-firm efficiency improvements and the ability of productive firms to grow. Section 4 discusses policy implications and recent reform efforts in some of the countries covered by the indicator of occupational entry regulations. Section 5 concludes.

2. Occupational entry regulations – a primer

13. Occupational regulations have been defined in a multitude of ways.[6] In this paper, we focus on entry regulations and define them as "legal barriers governing access into occupations", for instance through minimum qualification requirements (Koumenta and Pagliero, 2017). In most cases, this situation requires workers to obtain an "occupational license", i.e. an authorisation from a national authority or competent body, before they are legally permitted to use the protected title and carry out the activities reserved by a specific occupation. Regulations can also refer to "certification schemes", whereby individuals voluntarily choose to be certified by a third party so as to use a protected title, e.g. to call themselves "architect". Hereafter, we will subsume under the term occupational entry regulations both legal requirements (such as qualifications or licensing) and certification schemes.

2.1. Occupational regulations affect a significant share of the workforce

14. Occupational licensing – i.e. the practice of regulating who can do a job – has been one of the fastest growing labour market institutions over the past decades (Johnson and Kleiner, 2017; Blair and Chung, 2018). Today, almost one out of four workers report having an occupational license in the US, compared with one in 20 workers in the 1950's (Kleiner and Krueger, 2010). However, not all US-states are equally affected by this trend. As illustrated by Figure 1, (Panel A), only 12% of the workforce are licensed in South Carolina (SC), for instance, while 33% of workers are subject to such regulations in Iowa (IA). European statistics (which unfortunately lack the historical dimension) draw a similar picture for the most recent period, with an average of 22 % of the EU labour force being licensed (Figure1, Panel B), although again, licensing requirements are very diverse across jurisdictions, with estimates ranging from 14% in Denmark to 33% in Germany. While these figures naturally reflect other cross-country differences, such as the industrial structure, the legal system[7] or the role of the state[8], they also indicate countries' propensity to revert to occupational licensing as a mechanism to regulate entry into occupations.

[6] Several papers notably also include registration, i.e. the legal requirement for professionals to register their name and address with a relevant regulatory body, and accreditation schemes, which resemble certification schemes but are exclusively dealt with by professional associations, as separate categories (see for instance Koumenta et al., 2014)

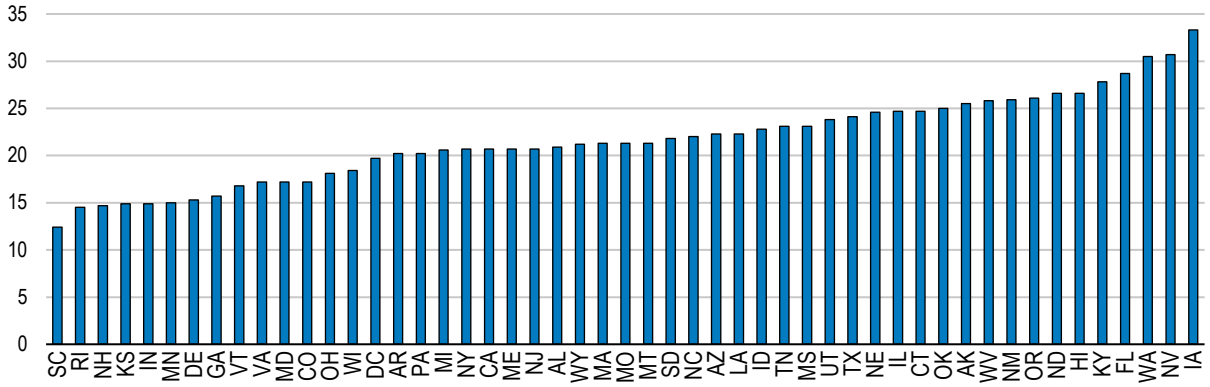
[7] Some legal systems might rely on insurance rather than ex-ante checks on who provides the service. Pagliero (2019) relates the prevalence of occupational regulations to legal origins.

[8] To name one example, the need for regulation of engineers could be deemed lower if the State guaranteed public building inspections that make sure buildings are safe.

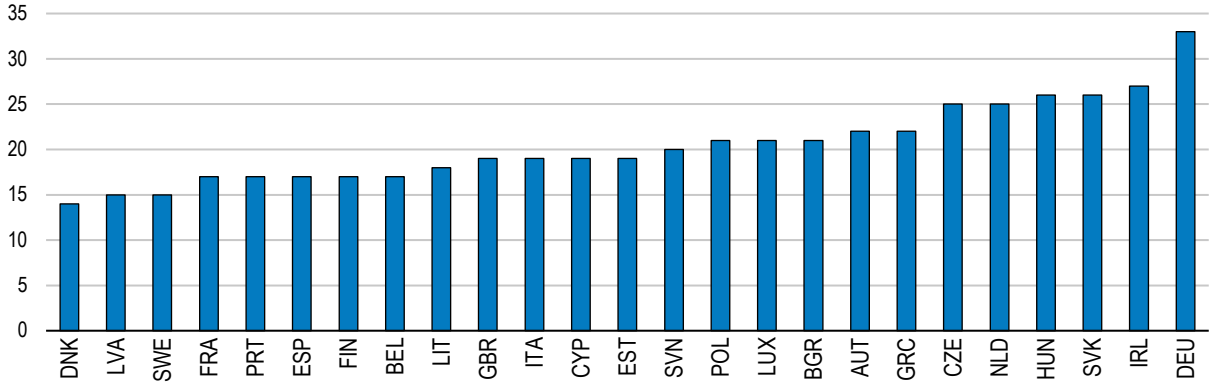
Figure 1. The share of the workforce holding an occupational license varies widely across jurisdictions

Percentage of licensed workers (%)

Panel A: the United States (2013)



Panel B: The European Union (2015)

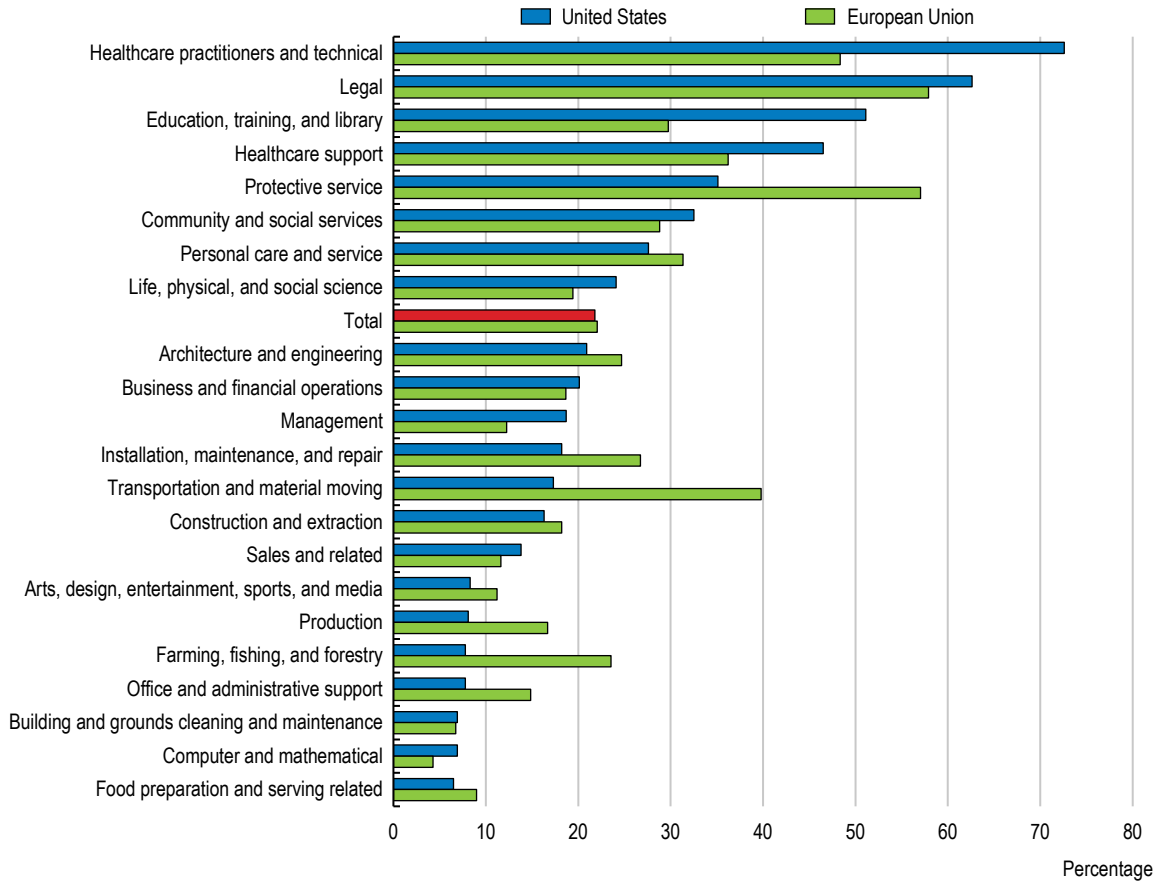


Note: Panel A: Compilation based on an analysis of data from a Harris poll of 9,850 individuals conducted in the first half of 2013 and Kleiner and Vorotnikov (2013); Panel B: Based on information retrieved from the EU Survey of Regulated Occupations.
Source: Panel A: Kleiner (2017) based on analysis of data from a Harris poll and Kleiner and Vorotnikov (2017). Panel B: Koumenta and Pagliero (2017). To download this graph, please visit https://bit.ly/2w4MR2X

15. Figure 2 suggests that occupations restricted by entry barriers can be found in all sectors. Unsurprisingly, their use is particularly common in health and education, where protecting the public from incompetent providers of services is particularly important given the specific vulnerability of the targeted population of consumers (sick and young people). However, licensed occupations are widespread also in other sectors, such as legal services, financial and business services, or construction and transport, implying that regulators seek to insure customers (individuals and businesses) not only from health and safety hazards (which can be relevant also in some of these sectors) but also from economic losses.

Figure 2. Education and health services are subject to most licensing requirements

Percentage of employees with an occupational license by industry, 2015(EU) and 2018(USA)



Source: Calculations produced by Maria Koumenta (Queen Mary University of London) based on EU Survey of Regulated Occupations and US Bureau of Labour Statistics Current Population Survey. To download this graph, please visit https://bit.ly/2w4MR2X

2.2. The pros and cons of occupational regulations

16. A common justification for occupational regulations in general, and licensing in particular, is the existence of information asymmetries (Law and Kim, 2005). Indeed, a lack of expert knowledge and the intangible nature of services, make it difficult for consumers to accurately assess the quality of services they buy, especially in areas where repeated interactions between customers and providers are difficult (such as when issues of health, safety or irreversible damage can arise) and reputational mechanisms are disarmed. This is particularly the case for so-called “credence goods”, whose quality can hardly be established, even after consumption (Darby and Korni, 1973). This, in turn, could incentivize sellers to pass low-quality goods and services for high-quality ones.

17. Occupational regulations attempt to address these information asymmetry concerns by truncating the bottom of the professional quality distribution through minimum human capital requirements (Leland, 1979) as well as by establishing sanctioning mechanisms for foul behaviour of sellers. Low-quality providers, who are not able to meet the required skill standards, would then be forced to exit the market while consumers receive a more homogenous and, on average, higher quality good. At the same time, employers would benefit from the signalling function of occupational regulations, insofar as they allow them to better assess applicants’ productivity and quality (Spence, 1973).

18. Despite the theoretical gains from occupational regulation, most of the research in this area failed to demonstrate quality improvements resulting from stricter regulatory entry barriers, or a reduction in the quality of goods and services following an easing of such barriers (Caroll and Gaston, 1981; Koumenta et al., 2019; Kleiner, 2017; Kleiner and Kudrle, 2000, Powell and Vorotnikov, 2015). At the same time, information asymmetries may have been losing importance over time, especially as digital technologies (notably the surge of digital platforms) significantly contributed to reducing transaction costs and make information about the quality of services more easily accessible (Larsen et al., 2019; OECD, 2016). In the light of this, OECD (2018) suggested shifting the regulatory focus from inputs to outputs. After all, the stated goal of occupational regulations is to ensure that consumers receive the desired quality of services, not to limit the number of providers.

19. Opponents of occupational regulations have argued for long that occupational restrictions mainly serve to protect incumbents' vested interests. Friedman (1962), for instance, observed that licensing systems were usually guarded by incumbents, whose quests for stricter entry regulations were merely a sign of rent-seeking behaviour rather than a sign of concern about the quality of the proposed services. To some extent, his hypothesis was supported by the introduction of 'grandfathering rights', whereby incumbents were allowed to bypass the new requirements posed by regulations, at the time they were introduced. These claims are also supported by a host of empirical evidence finding higher market power, notably leading to higher prices, in strictly regulated professions (see below).[9]

20. If restrictions on the number of available providers lead to excessive price increases, consumers might also be looking for lower quality substitutes outside the regular market, opt for 'do-it-yourself' services, or even decide not to consume the service at all, with potentially health or safety threatening consequences (Friedman, 1962; Kleiner, 2006). For example, research commissioned by the Legal Services Board in the UK (LSB, 2016), found that 28% of those who had a legal problem over the period 2012-15 but did not revert to legal support, took this decision based on financial grounds. Because such considerations are likely most relevant for low-income groups, as well as Small and Medium Sized Enterprises (SMEs), benefits arising from occupational regulations could thus mostly apply to upper-income groups or large firms (Shapiro, 1986).

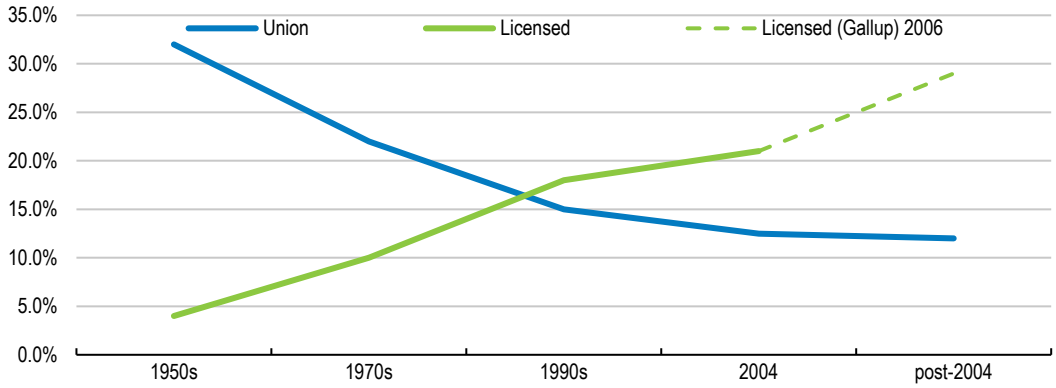
21. Interestingly, Kleiner and Krueger (2010) find that the share of workers covered by occupational regulations in the US has surged at a time when unions – another key labour market institution – registered important membership losses (Figure 3).[10] Both institutions support workers, inter alia by raising average wages. However, unions also play a key role in reducing wage inequality by pushing up wages at the bottom of the wage distribution and restraining them at the top, while there is no such effect for occupational licensing (Gittleman et al., 2015). A similar surge in the number of occupations covered by entry regulations has been observed in Canada, Italy and Israel, where it was coupled by increasing restrictiveness as well (Mocetti et al., 2019; Zhang, 2017; von Rueden and Bambalaite, 2020).

[9] In cases where professional associations represented by incumbents are also responsible for dealing with complaints from clients, Friedman (1962) further asserted that such power could also be used to ensure weak discipline in response to professional misbehaviour.

[10] Whether the same phenomenon can be observed outside of the US and to what extent these trends are interlinked, remains an open question.

Figure 3. Comparisons in the time-trends of two labour market institutions: licensing and unionisation

Percentage of workers affected by either institution (United States)



Note: Information on the share of licensed workers are sourced from Kleiner (2006) until 2004. For the post-2004 period the authors rely on the Gallup Survey 2006.
Source: Kleiner and Krueger (2010). To download this graph, please visit https://bit.ly/2w4MR2X

2.3. Occupational regulations and productivity

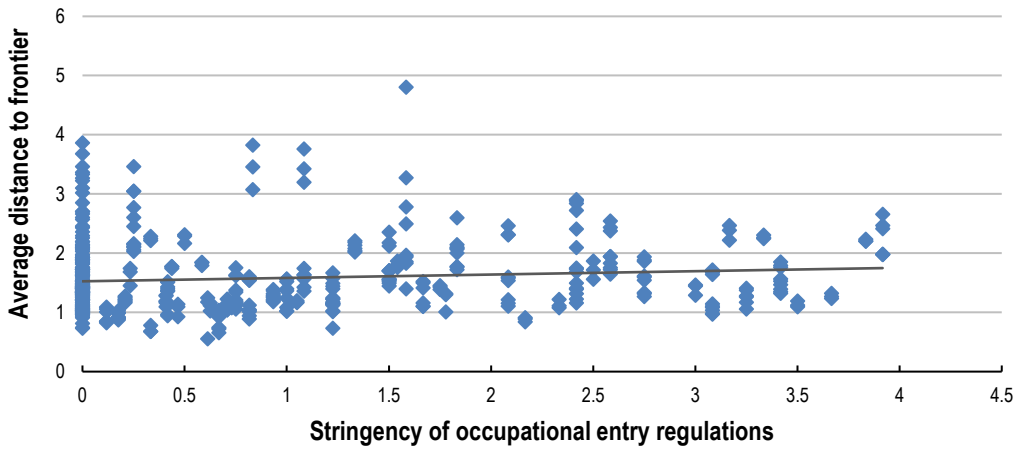
22. As illustrated by a large and growing body of empirical research (see Annex C for a comprehensive literature overview), occupational regulations have wide-ranging consequences for economic outcomes (e.g. employment, mobility, skills, wages and prices), including a range of potential drivers of productivity. Existing evidence also suggests that services liberalisation at large can improve the productivity performance of firms and sectors using the regulated services as inputs (Arnold et al., 2011; Arnold et al., 2015; Barone and Cingano, 2011; Bourlès et al., 2013, Corugedo and Ruiz, 2014; van der Marel et al., 2016). Bound by data limitations, however, the productivity implications of occupational entry regulations on the regulated sector itself remains an under-researched area. This paper attempts to fill this gap by exploring two channels through which occupational regulations could affect productivity outcomes in sectors that are directly affected by the regulation: a within-firm channel and a between-firm channel.

2.3.1. The channels explored: within-firm effects

23. The *within-firm channel* mainly operates via the influence that occupational entry regulations may have on the ability and incentives of firms to adopt production techniques developed at the global productivity frontier, and in turn, raise firm-level productivity growth. Whether this influence is positive or negative is an empirical question. On the one hand, regulations might weigh on firm's catch-up process by limiting their capabilities due to restrictions on the supply of skilled professionals, or by curbing their incentives to innovate due to the lower competitive pressures implied by high entry regulations. On the other hand, high entry barriers posed by occupational regulations might also have a positive bearing on productivity outcomes provided they trigger selection effects. With only high-skilled (high-productive) professionals (firms) entering the market, the average level of productivity could be raised relative to a situation where entry is easier. Preliminary evidence from simple correlation analysis, however, shows that, on average, firms in country-sectors where occupational regulations are stringent display a lower average level of productivity (i.e. are further away from the global productivity frontier) than firms in countries where regulations are loose (Figure 4), implying that selection effects, if present, are likely weak.

Figure 4. Firms in highly regulated environments tend to be further away from the frontier

Correlation between the average distance to the frontier by country-sector cells and the full indicator, EU11, 2014-16



Note: Each dot represents one country-sector cell, where sectors correspond to one of the occupations covered by the OER indicator (e.g. architectural activities in Spain). Productivity is defined as log labour productivity, while the distance to the frontier is measured as the difference between average log labour productivity at firm-level and the average productivity at the global frontier (computed by sector) over the period 2014-16. The set of countries used includes Belgium, Finland, France, Germany, Hungary, Italy, Portugal, Slovenia, Spain, Sweden, and the UK.

Source: Authors' calculation based on ORBIS data and the occupational regulation indicator. To download this graph, please visit https://bit.ly/2w4MR2X

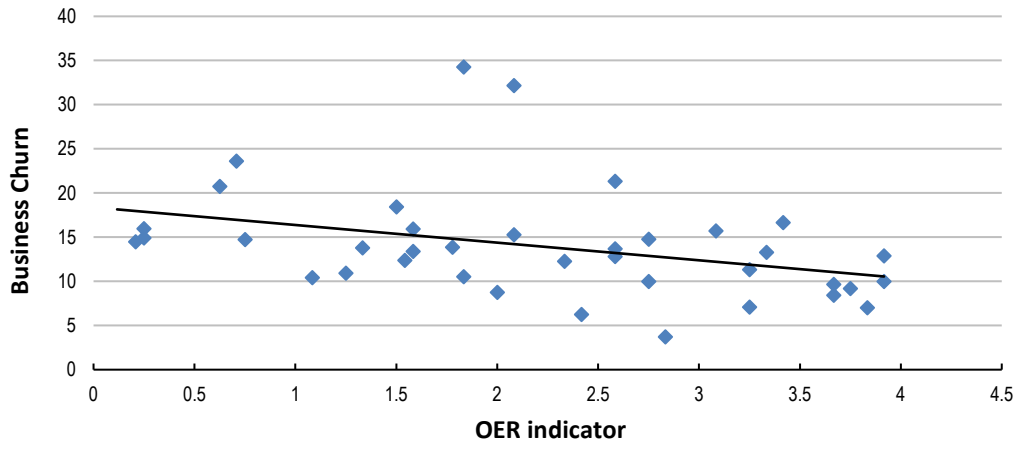
24. While previous research has not yet explored the within-firm channel explicitly, it already addressed two important drivers of firm-level productivity growth in this context: business dynamism and the availability of labour. Business dynamism is a vital condition for productivity, as pressures from new entrants foster the adoption of best practices in firms (e.g. in terms of management styles) and stimulate innovation activities. Stronger competitive pressures also imply higher churn rates, since low productive firms are more easily forced out of the market, in turn, making room for new, possibly more productive, entrants. Rostam-Afschar (2015), for instance, shows that the complete exemption from educational entry requirements granted by the 2004 Reform of German craftsmanship doubled the number of entrants within four years in occupations affected by the reform. Similarly, Canton, Ciriaci and Solera (2014) find that an easing of professional services regulations increases sectoral churn rates, suggesting that lower burdens are associated with enhanced business dynamism.

25. Reduced business dynamism would also be reflected in measures of market power. The positive wage premium associated with occupational regulations, estimated at 6%-15%, could thus be an indication of low competitive pressures due to weak dynamism (Blair and Chung, 2018a). In line with this, there is also ample evidence of a decline in wages and prices associated with easing of occupational entry regulations (Athanassiou et al. 2015; Larsen et al., 2019; Kleiner et al, 2016 Kleiner, 2017). Interestingly, the wage premia from occupational regulations are shared unequally among workers across the wage distribution. While the top third of earners is estimated to enjoy a wage boost between 10%-24%, the bottom third only sees a 4%-5% increase in wages (Kleiner and Vorotnikov, 2017). [11] Aggregate evidence for the EU11 professional services tends to support the idea that stricter regulations are associated with lower market competition, as proxied by churn rates (Figure 5).

[11] Further inequality concerns could arise as the exclusion of workers from regulated professions might lead to an excess supply of workers in unregulated professions, thus dampening the wage level in these occupations.

Figure 5. Higher occupational regulation is associated with lower churn rates

Correlation between the churn rates and the full indicator, professional services, EU11, 2014-16



Note: Each dot represents one country-sector cell, where sectors correspond to one of the occupations covered by the OER indicator (e.g. architectural activities in Spain). Business churn is defined as the sum of enterprise births and enterprise deaths divided by the number of active enterprises. The set of countries used includes Belgium, Finland, France, Germany, Hungary, Italy, Portugal, Slovenia, Spain, Sweden, and the UK.

Source: Authors' calculation based on Eurostat Business Demography statistics by legal form, and OER indicator. To download this graph, please visit https://bit.ly/2w4MR2X

26. Existing research further suggests that occupational entry regulations curb the supply of labour that firms need to realise their full innovative potential. In particular, Blair and Chung (2018a) estimate that licensing reduces the equilibrium labour supply by an average of 17%-27%. Consistent with this, Cahuc and Kramarz (2004), find that after deregulating the road transport sector in France, employment growth in the sector increased from 1.2% in 1986 to 5.2% in 1990. Lastly, Kleiner et al. (2016) also show that prescription restrictions for nurses in the United States reduce the number of hours worked by 3%.

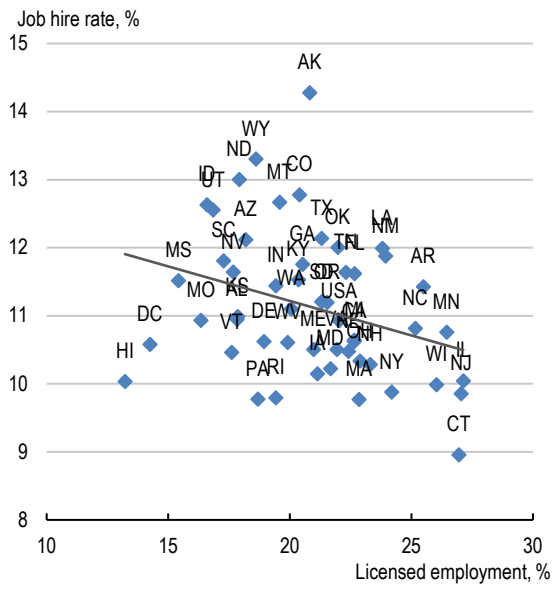
2.3.2. The channels explored: between-firm effects

27. The *between-firm channel* operates through the ability of highly productive firms to attract more skilled professionals than low productive ones. While this is normally the case in well-functioning market economies (Foster et al., 2016; Decker et al., 2016), occupational entry requirements could introduce rigidities in the mobility (including across professions) of skilled professionals, potentially reducing the propensity of labour to move to its most productive uses. By limiting the growth of successful firms, occupational entry regulations might thus trim high productive firms' contribution to aggregate productivity growth.

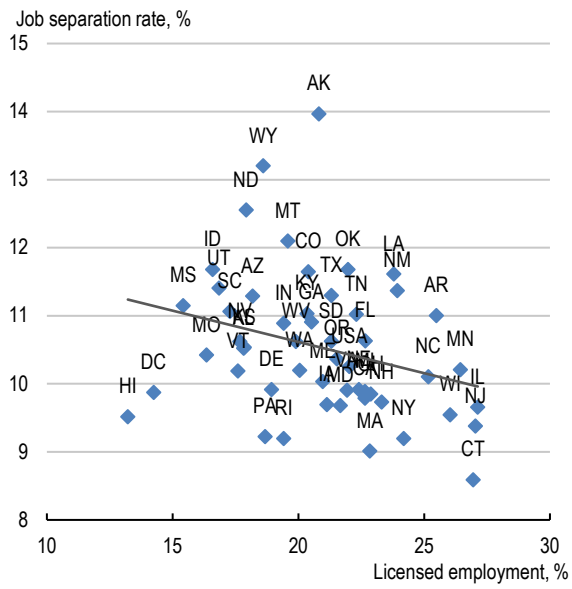
28. Evidence concerning the effects of occupational entry regulations on mobility across jurisdictions, and especially across professions, is still scarce. Still, several studies find that US interstate migration rates for individuals in occupations with state-specific licensing requirements are lower than for members of other occupations (Johnson and Kleiner, 2017; Kleiner et al., 1982; Pashigian, 1979). Moreover, recent evidence for the US (Hermansen, 2019) suggests that separation and hiring rates (two measures of the intensity of labour market reallocation) tend to be lower in states where the share of licensed employment is higher (Figure 6).

Figure 6. Labour market fluidity tends to be lower in states with more licensed employment

A. Total job hire rate, average 2012-2018



B. Total job separation rate, average 2012-2018



Note: Licensed employment by state is computed by mapping licensing information to occupational employment statistics and aggregating within states.
Source: Hermansen, 2019 based on data from CareerOneStop.org and Occupational Employment Statistics, BLS; Job-to-job Flows database, Census Bureau. To download this graph, please visit https://bit.ly/2w4MR2X

3. Data and empirical analysis

3.1. A comprehensive measure of occupational regulations for OECD countries

29. To analyse the link between occupational entry regulations (henceforth called OER) and productivity this paper uses a novel cross-country composite indicator of the stringency of occupational entry regulations introduced by von Rueden and Bambalaite (2020). Specifically the indicator covers a set of five professional services, nine personal services and nurses for a total of 18 OECD countries, India and South Africa, a subset of which are used in the empirical analysis (see Table 1). Canada and the United States are covered at the province-level and state-level, respectively, where each province (state) is regarded as a separate jurisdiction. Information to construct the new OER indicator were primarily drawn from the EC Regulatory Professions Database and the OECD Product Market Regulation Indicator. However, for several countries, they were collected by country experts.[12] For professional services, the OER indicator mostly relies on the information contained in the OECD PMR database.[13]

[12] Jason Hicks, Morris M. Kleiner and Wenchen Wang (all University of Minnesota) for the United States; Tingting Zhang (Merrimack College) for Canada; Davud Rostam-Afschar (University of Hohenheim) for Austria; Ulrike Unterhofer (ETH Zurich) for Switzerland; Lukasz Dabros (Warsaw School of Economics) for Poland; Thulisile Radebe (Resbank South Africa) for South Africa; Diksha Gupta (who was an intern at the OECD Economics Department at the time the paper was written) and Yair Osheroff (The Hebrew University of Jerusalem) for India and Israel, respectively.

[13] Von Rueden and Bambalaite (2020) provide a detailed comparison between the OER, PMR and other similar indicators.

30. Importantly, the indicator only measures legal restrictions to entry into occupations, i.e. regulations restricting the number of service providers (either self-employed or employees) through legal provisions. Put differently, the indicator only records legal requirements governing the rights to exercise protected activities and hold a legally protected title (i.e. a license), or to holding a protected title only (i.e. a certificate). The latter case would occur, for instance, if a country only allowed certified architects to use the professional title, i.e. call themselves "architects", even though it is possible to carry out the activities usually associated with this profession without holding a title. We differ from previous studies in that we exclude certification schemes that are not related to the right of holding a title, and therefore carry no legal implications.[14] Given our focus on restrictions to entry into occupations, we further opt to neglect legal requirements associated with business conduct and business permits, including hygiene or fire safety regulations.

Table 1. Countries and occupations covered by the indicator

Countries*			Occupations		
European		Non-European	Personal		Professional
Austria	Poland	Canada** (province-level)	**Aesthetician**	**Hairdresser**	Accountant
Belgium	**Portugal**	India (Delhi)*	**Baker**	**Painter-decorator**	**Architect**
Finland	**Slovenia**	Israel	**Butcher**	**Plumber**	**Civil Engineer**
France	**Spain**	United States (state-level)	Taxi driver	Nurses***	**Lawyer**
Germany	**Sweden**	South Africa	**Driving instructor**		Real-estate agent
Hungary	Switzerland* (Basel)		**Electrician**		
Iceland	**United Kingdom**				
Italy					

Note: Countries and professions in bold were used for the empirical analysis.
(*) For Switzerland (India), the indicator focuses on the occupational entry regulations imposed by the representative Canton of Bern (State of Delhi), but regulations were found to be almost identical in Basel and Bern (Uttar Pradesh and Haryana).
(**) Data for Canada could not be validated by Canadian authorities.
(***) The indicator further covers general care nurses, which, however, neither fall under the personal nor the professional service category.

31. As displayed in Figure 7, the construction of the indicator is carried out in three steps. First, information about specific regulatory barriers is collected along three regulatory areas: (I) administrative burdens, capturing limitations and procedural hurdles set on obtaining the legal authorisation to practice; (II) qualification requirements recording the educational attainment required from professionals prior to entering the occupation; and (III) mobility restrictions accounting for labour mobility across jurisdictions (countries or subnational levels of government). A 0-6 score increasing in restrictions is assigned to each element collected. The scores attributed to each individual element are then summed-up by sub-indicator, before all sub-indicators are themselves weighted and summed-up to one aggregate value. Lastly, for each occupation the indicator is discounted depending on the type of occupational regulations, where we differentiate between (A) licensing (no discount), (B) a situation in which only the manager/supervisor requires a license (30% discount), and (C) certification (50% discount). Each type of regulation is

[14] Although where market expectations and public acceptance play an important role, holding a protected title might be a necessary feature for some activities.

characterised by a specific set of legal requirements (or the absence thereof) which determine their regulatory intensity, as described in more detail in von Rueden and Bambalaite (2020). Taken together, the final indicator is scaled to take values between 0 (no regulation) and 6 (fully regulated).

32. It should be noted upfront that the OER indicator was designed with the aim of covering regulations affecting the access of (dependent or independent) providers to a broad set of personal and professional services in a wide range of countries.[15] As a result, several simplifications to limit potential biases in cross-country (or cross-state) comparison, which also limited its scope and depth, had to be embraced. In particular, the indicator fails to reflect differences in the number of reserved activities associated with each occupation across countries, which may impinge on the actual stringency of entry requirements.[16] Moreover, it overlooks relevant aspects of occupational regulations for which comparative data were lacking (e.g. prices of licenses, grandfathering rights, regulatory powers of professional associations, etc.) as well as regulatory dimensions unrelated to market access (e.g. hygiene checks or conduct regulations). Lastly, due to a lack of adequate data, the indicator also fails to account for changes in occupational regulations over time, and for regulatory differences within countries or subnational levels of government.

33. As described in Table 2, the occupational entry requirements measured by the OER indicator can vary significantly across countries. More detailed analysis in von Rueden and Bambalaite (2020) shows that for personal services, several Nordic countries usually impose few or no entry regulations, while Germany typically often impose more restrictive occupational entry regulations. Similarly, several Nordic countries restrict entry to professional services the least, while Italy imposes the highest barriers. Overall, however, patterns across countries are similar insofar as personal services are usually subject to lower entry requirements than professional services. Interestingly, occupational entry requirements even vary widely for the same profession within closely integrated economic areas (Figure 8). This observation is surprising, both because the US and Canada are known to be highly integrated markets and because of the European Commission's persistent efforts towards the creation of a Single Market for services. In the empirical analysis, we use the cross-country and cross-occupations variability of the OER on a subset of EU countries to identify the link between these regulations and some of the drivers of productivity.

[15] Indeed, the regulatory aspects covered by the OER indicator are specifically chosen to fit a broad set of services, and only rely on information that tends to be publicly available, so as to allow for simple extensions to additional countries and professions. Both aspects are key to understanding the difference between the proposed OER and the existing PMR indicator. The two should thus be treated as complements, not as substitutes (see Von Rueden and Bambalaite, 2020).

[16] The presumed reserved activities by occupation are listed in Von Rueden and Bambalaite (2020).

Figure 7. Structure of the new OECD Occupational Entry Regulations (OER) indicator

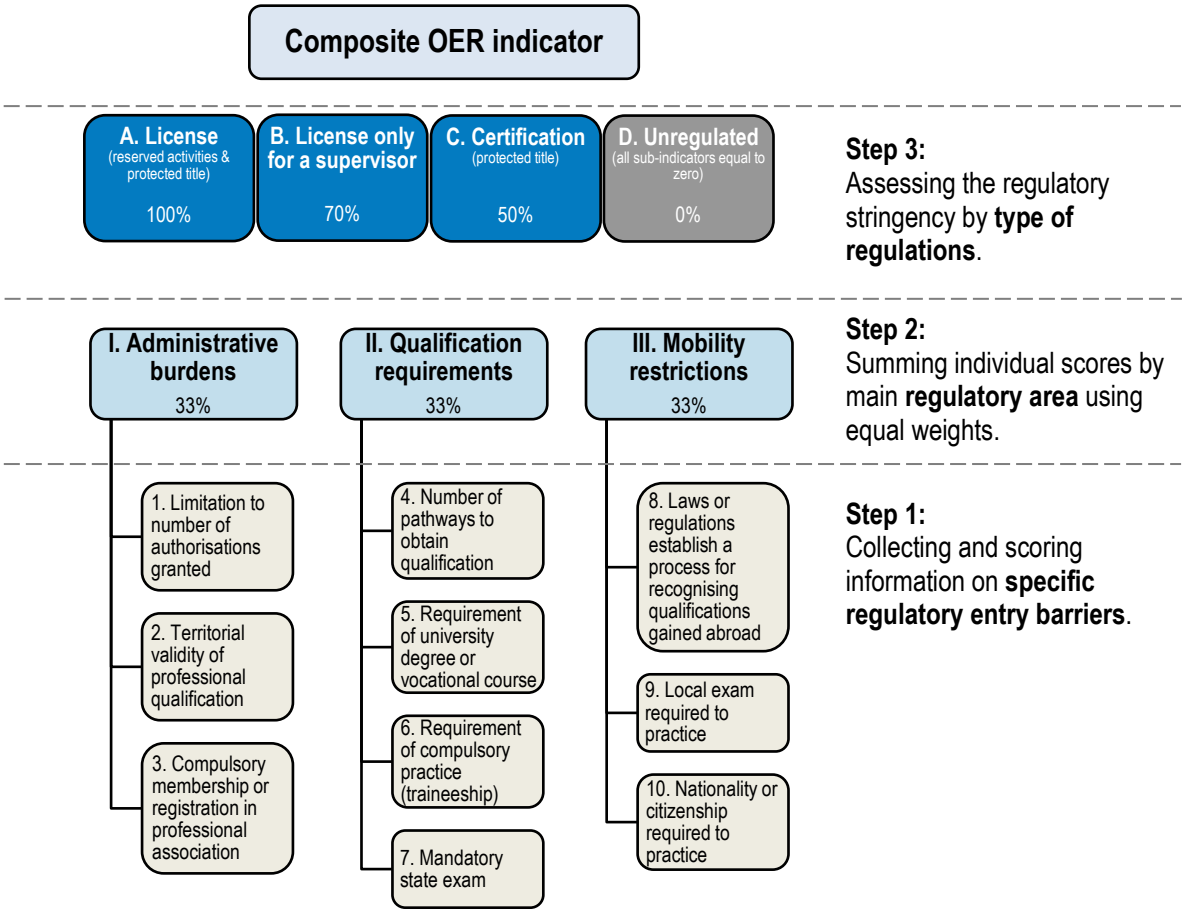


Table 2. Summary statistics OER indicator by profession

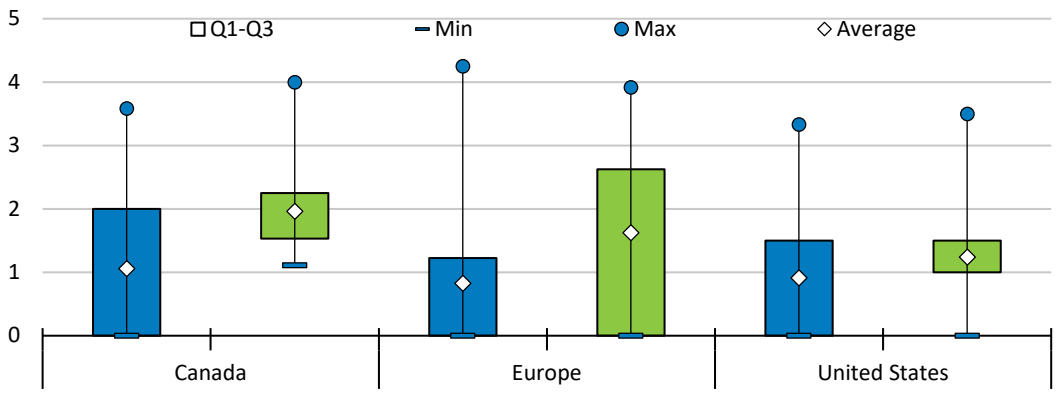
	Aesthetician	Baker	Butcher	Driving Instructor	Electrician	Hairdresser	Painter-decorator	Plumber	Taxi driver
Sample average	0.3799	0.3158	0.2929	1.4283	0.9236	0.4457	0.3429	0.5946	2.5468
Average of 5 highest countries	1.1695	1.1933	1.0883	2.215	1.7694	1.2694	0.1567	1.5633	3.6
Average 5 lowest countries	0	0	0	0.8333	0.0850	0	0	0	1.6105
Variance	0.2567	0.3132	0.2605	0.3066	0.4480	0.2855	0.2797	0.4537	0.6355

	Accountant	Architect	Civil Engineer	Lawyer	Real-estate agent
Sample average	1.4580	1.8862	1.3275	2.8025	1.2063
Average of 5 highest countries	3.3	3.1667	2.783	3.75	2.7167
Average 5 lowest countries	0	0.3583	0	1.6624	0
Variance	2.0354	1.2026	1.1639	0.6646	1.2291

Note: For the US and Canada, unweighted averages are used. An indicator value of 0 indicates the absence of regulations, 6 reflects a fully regulated market.
Source: OECD OER database

Figure 8. The dispersion of regulatory approaches within economic areas suggests incomplete economic integration

OECD OER Indicator (0 – absence of regulations, 6 – fully regulated occupation)



Note: Blue bar refers to personal services (include aestheticians, bakers, butchers, driving instructors, electricians, hairdressers, painters, plumbers and taxi drivers); green bar refers to professional services (accountants, architects, civil engineers, lawyers and real-estate agents). The stringency of occupational entry regulations is measured by the OECD OER Indicator, where a value of 0 indicates the absence of regulations and 6 reflects a fully regulated market (von Rueden and Bambalaite, 2020). Regulations for Canada and US are measured at province/state level. The European sample includes Austria, Belgium, Finland, France, Germany, Hungary, Iceland, Italy, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.
Source: OECD OER database. To download this graph, please visit https://bit.ly/2w4MR2X

3.2. Firm-level productivity data

34. The productivity and other firm-level variables come from Orbis, a comprehensive source of harmonized cross-country longitudinal data commercialised by Bureau van Dijk. The Orbis data cover publicly listed and privately owned firms, which are classified at a fine enough sectoral aggregation to identify firms in the personal and professional services occupations covered by our analysis (i.e. at the 4-digit NACE level). Thus the occupational regulation indicator can generally be matched with firms in corresponding sectors, except when occupations are not accurately reflected in any of the available 4-digit sectors or when Orbis coverage in these sectors is too poor.[17] Of course, some professions, such as electricians, could still be present in other sectors (such as when they provide their services as employees of manufacturing or service firms, but reflecting such cases would require (currently non-available) cross-country information about workers' tasks (and backgrounds) at the firm level.

35. Prior to the analysis we implement a number of data manipulations, building on the data construction steps described in Gal (2013) and Kalemli-Özcan et al. (2015). These notably involve: (i) ensuring comparability of nominal variables across countries and over time (industry-level PPP conversion and deflation); (ii) deriving new variables that are used in the analysis, such as productivity; and (iii) filtering and cleaning the database, i.e. eliminating outliers and keeping only company accounts that fit the purposes of our analysis.[18] To maximise coverage and bypass the numerous challenges related to measuring multi-factor productivity in services (Sorbe et al., 2018), we focus on labour productivity, calculated as the ratio of (deflated) value added to employment.

36. Our combined dataset contains about 300.000 observations, spanning 11 EU countries and 11 occupations, which were selected based on the number of available observations in the sectors of interest.[19] As expected, the set of services considered by the analysis is characterised by a high share of self-employment. Because the concept of labour productivity is ambiguous for the self-employed, firms with one employee are excluded from the analysis of the within-firm channel. However, in the analysis of the between-firm channel, which is concerned with measuring to what extent more productive firms are able to attract (human) resources, we also retain self-employed firms whose workforce grows over the sample period as a robustness check (see Table A.7). Annex A Table A.1-A.4 provide a detailed set of summary statistics.

3.3. Empirical approach

37. As mentioned above, we focus the empirical analysis on the link between occupational entry regulations (as proxied by the OER indicator) and labour productivity. The pervasive and widening presence of such regulations in services and the rising share of services in advanced economies suggest that their side effects on aggregate productivity could be large. Leveraging firm-level data in the regulated sectors, we explore two channels through which regulations could affect aggregate productivity outcomes: a within-firm channel and a between-firm channel.

3.3.1. The within-firm channel

38. We explore the within-firm channel using a neo-Schumpeterian specification of productivity growth (Aghion and Howitt, 1997), where firm-level productivity growth is a function of growth at the productivity

[17] This was the case for instance for real-estate agents (sector "6800 – Real estate activities") and accountants (sector "6920 – Accounting, bookkeeping, and auditing services; tax consultancy").

[18] For instance, we use unconsolidated accounts only, so as to ensure that the covered economic activity refers to the local, domestic market, and does not reflect the activity of multinationals.

[19] Over the period 2014-16, each country covers at least 2000 firms for the sectors of interest.

frontier and the distance of the firm productivity level to this frontier. We expect faster frontier growth to lift growth of firms below the frontier, and the "catch-up" effect to be stronger for firms that are further away from the frontier, reflecting their larger potential to benefit from the adoption of frontier best practices and technologies. In keeping with past research (e.g. Arnold et al., 2011; Gal et al., 2019) we augment the model with our OER indicator to test whether occupational entry regulations affect the catch-up process.

39. Accordingly, the baseline specification takes the following form:

$$\Delta Productivity_{f,s,c,t} = \alpha_1 + \alpha_2 \Delta Frontier_{st} + \alpha_3 Gap_{f,s,c,t-1,} + \beta Regulation_{s,c} + \gamma X_{f,s,c,t} + \delta_{ct} + \delta_s + \varepsilon_{f,s,c,} \quad (1)$$

where $\Delta Productivity_{f,s,c,t}$ reflects the change in the logarithm of labour productivity, i.e. labour productivity growth, of firm f in sector s and country c at time t; $\Delta Frontier_{cs}$ measures the growth of the top 5% globally most productive firms in sector s and year t[20]; $Gap_{f,s,c,t-1,}$ stands for the lagged distance of firm f to the productivity frontier; and $X_{f,s,c,t}$, denotes firm-level control variables such as the firm's size (captured by the logarithm of firm-level employment) and age. Baseline regressions also include country-time and sector fixed effects (δ_{ct}, δ_s)[21] and are clustered at the country-sector level. The main coefficient of interest, β, is expected to be negative, assuming that higher regulatory barriers rein in productivity growth by limiting both firm capability and incentives to improve efficiency. The results are robust to a variant that would include sector-year fixed effects but drop the (sector-year) global frontier growth to avoid collinearity (see Annex A, Table A.5).

40. In an attempt to further account for the large heterogeneity among firms we also test whether the effects of occupational regulations on productivity growth vary according to productivity levels. We first interact the indicator with the lagged gap (model III) and then interact the indicator with a categorical variable splitting the sample into four productivity classes (model IV). Finally, we perform the same analysis replacing productivity quartiles with different size classes (model V). All regressions are implemented using the full indicator as well as its three sub-components (administrative burdens, qualification requirements and mobility restrictions).

41. The analysis is subject to three major caveats. First, since the OER only provides a snapshot of occupational regulations in 2018-19 (depending on the country), the source of identification for the regulation effects is only variability across sectors and countries. Second, as the most recent available firm-level data is for 2016, there is a time mismatch between our regulation and productivity variables. We tackle this by limiting the time-series coverage of our productivity growth variable to the 2014-16 period, which requires assuming that no major reforms in the area of occupational regulation occurred over the very recent past, an assumption supported by anecdotal information about recent reforms (see Table 6 below). Third, partly due to these limitations in the data, we cannot control for potential reverse causality issues that could arise if productivity growth of firms in a specific country-sector cell would influence the current stance of occupational regulations. For instance, this could be the case if occupations suffering from low productivity growth seek to shield their occupation from competition by lobbying regulators for higher entry barriers. To check the possibility that causality runs from productivity to regulation, and in the absence of suitable instruments, we regress the indicator on lagged values of productivity at the sector level, but find no statistically significant effects (see Table A.8). Our fixed effects structure aims at covering

[20] As in past studies (e.g. Gal et al., 2019) the frontier is defined as the comparatively more consistent global industry frontier, across all countries contained in the full, cleaned sample of the Orbis database (i.e. 26 OECD and 4 key partner economies) as opposed to the national frontier. However, results are also robust to using the national frontier (see Annex A, Table A.6).

[21] To control for time invariant sector specific technological characteristics and economy-wide factors that are omitted from the regressions. Identification of the effect of OER hinges on the assumption that no other firm and time invariant country-sector factor affects productivity growth of the average firm in the sample.

other endogeneity issues related to omitted confounding factors that could affect both regulation and productivity.[22]

3.3.2. The between-firm channel

42. To study this channel we adopt a canonical model of firm dynamics (Foster et al., 2016; Decker et al., 2016), which predicts that firms with higher productivity should attract more labour and grow faster if the market environment allows for an efficient allocation of resources.[23] Following the approach of Adalet McGowan et al. (2017), we test whether occupational entry regulations slow down this reallocation mechanism by interacting past productivity levels with our OER indicator:

$$\Delta EMPL_{f,s,c,t} = \alpha_1 + \alpha_2 Productivity_{f,s,c,t-1} + \alpha_3 Productivity_{f,s,c,t-1} * Regulation_{s,c} + \gamma X_{f,s,c,t} + \delta_{cst} + \varepsilon_{f,s,c,t} \quad (2)$$

where $\Delta EMPL_{f,s,c,t}$ denotes employment growth of firm *f* in sector *s*, country *c* and at time *t*; $Productivity_{f,s,c,t-1}$ stands for the lagged labour productivity level of the same firm; and $X_{f,s,c,t}$ controls for firm-specific age and size effects (measured as the log of employment). The regressions further include country-sector-time fixed-effects, to account for unobservable characteristics across these dimensions (e.g. changes in other country-sector-specific regulations) and are clustered at the country-sector-year level.

3.4. Results: Stringent OER are associated with weaker productivity growth

43. Table 3 shows OLS estimates of the productivity growth model. Estimates of the baseline specification (Col I) are in line with priors and similar in magnitude to the results found by recent research (Gal et al., 2019): each year, 20% of frontier growth is passed onto other firms and, all things equal, roughly 30% of the gap to the frontier is closed through "catch-up" effects.

44. Turning to our main variable of interest, we find that on average higher occupational entry barriers are associated with lower productivity growth (Col II, Table 2). A one unit reduction in the full indicator (which would correspond to a significant reform, given that the average level of the indicator is 0.7) is associated with an increase in labour productivity by 1.6 percentage points of the average firm – a very significant increase considering that average productivity growth in this sample stands at 0.3% (Table A.2)

45. Since the link between occupational regulations and productivity growth might vary across the productivity distribution, we estimate three further specifications. First, we test a non-linear model in which the estimated average coefficient varies with distance to frontier (Col III, Table 2). Second, we estimate coefficients for each productivity quartile (from low productive quartile 1 to high productive quartile 4) (Col IV, Table 2). Third, we estimate coefficients for every size quartiles (from small size quartile 1 to large size quartile 4). While we fail to find any significant continuous non-linearity interacting the gap with the regulatory indicator, results for the productivity quartiles suggest that regulations are increasingly associated with lower productivity growth moving up the productivity distribution, with the negative association being almost double the average for firms in the highest productive quartile. This is consistent with the neo-Schumpeterian view that a lack of competition is more damaging for firms that are close to

[22] To control for omitted sector-specific country characteristics that might bias the effect of OER on productivity growth, we further augment specification (1) with the share of self-employed workers by sector based on the number of self-employed contained in the ORBIS dataset. Results remain broadly unchanged (see Table A.9) .

[23] Via this market mechanism, high productive firms would ultimately enjoy higher market shares, while low productive firms would seek to downsize or exit the market – a concept labelled as "allocative efficiency" (Arnold et al., 2013; Andrews and Cingano, 2014). When policies hinder this process, valuable resources are trapped in low productive firms.

the global frontier and that compete neck-and-neck with their global rivals. In a similar vein, results for the size quartiles suggest that the negative association between occupational regulation and productivity growth is strongest for the relatively smaller firms perhaps reflecting the lesser ability of these firms to meet the related costs in order to enter the market or expand to scale (Col V, Table 2).

46. Figure 9 illustrates the economic magnitudes implied. Averaging out the indicator across occupations, the simulations are cast in terms of moving from the most regulated country (Germany) to the least regulated country (Sweden), a change that corresponds to a one unit decrease in the full indicator (effects that are not statistically significant are reported as nil). The change in productivity associated with such an easing of regulation varies substantially across productivity cohorts ranging from a 1.2 percentage point increase in the second quartile to 2.5 percentage point for the most productive firms. Looking at size cohorts, while very small firms (1-10 employees) experience an almost 2 percentage point boost following the simulated change in regulation, there is no significant association between changes in regulations and growth for larger firms.

47. Next, we perform the same analysis using the three elements of our OER indicator - administrative burdens, qualification requirements and mobility restrictions. The negative association between occupational regulations and productivity growth persists on average for administrative burdens and mobility restrictions, albeit at lower significance levels (Table 4). As before, the negative association becomes stronger as firms become more productive as found in regressions that differentiate firms by productivity cohorts using categorical variables (model IV). Similarly, results distinguishing by firm size broadly replicate findings for the full indicator (model V). While qualification requirements are not significantly associated with productivity growth in the average firm, the negative link is significant for high productivity firms. Thus, in all cases lower regulatory burdens are associated with higher productivity growth in firms that are smaller or at the higher end of the productivity distribution. Conversely, the extent to which the link between qualification requirements and productivity varies with firm size is less clear.

48. Simulating a change in regulation that reduces the indicator from its highest to its lowest country average in this sample, shows that while all changes of regulation are associated with productivity growth, the association is largest for barriers to entry due to qualification requirements (Figure 10), largely reflecting the wider cross-country variability of this dimension of the OER. If such regulations were eased from German to Swedish levels, for instance, high-productivity firms could benefit from an instantaneous 4 percentage point increase in productivity growth.

Table 3. Catch-up model – baseline results

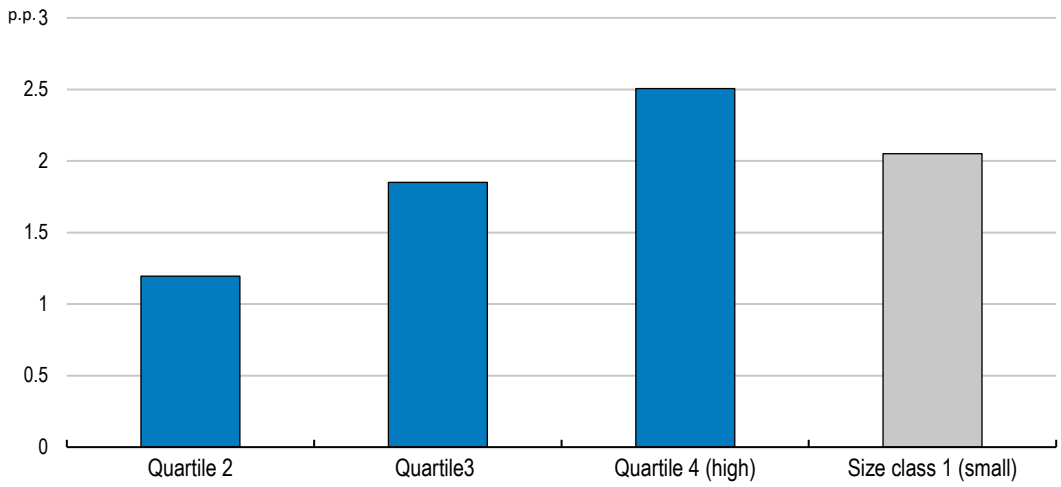
Dependent variable: labour productivity growth

Indicator	Full indicator				
Model	I	II	III	IV	V
Frontier growth	0.239***	0.238***	0.241***	0.154***	0.237***
	(0.0576)	(0.0576)	(0.0580)	(0.0564)	(0.0573)
Gap to frontier (lag)	0.326***	0.327***	0.337***		0.323***
	(0.0122)	(0.0121)	(0.0148)		(0.0120)
Employees (log)	0.0375***	0.0371***	0.0372***	0.0296***	
	(0.00285)	(0.00294)	(0.00297)	(0.00234)	
Age	4.91e-05	5.05e-05	7.45e-05	-0.000105	0.000261
	(0.000235)	(0.000235)	(0.000242)	(0.000193)	(0.000236)
Indicator		-0.0166**	-0.0162**		
		(0.00823)	(0.00814)		
Indicator x lagged gap to frontier			-0.0111		
			(0.00882)		
Productivity quartile 1 (lowest)				0.452***	
				(0.0167)	
Productivity quartile 2				0.195***	
				(0.00849)	
Productivity quartile 3				0.109***	
				(0.00516)	
Indicator x productivity quartile 1				-0.0130	
				(0.0113)	
Indicator x productivity quartile 2				-0.0115*	
				(0.00655)	
Indicator x productivity quartile 3				-0.0178***	
				(0.00607)	
Indicator x productivity quartile 4				-0.0241***	
				(0.00859)	
Size dummy 1 (1-10 employees)					-0.0708***
					(0.0208)
Size dummy2 (11-50 employees)					-0.0220
					(0.0198)
Size dummy 3 (51-250 employees)					-0.00352
					(0.0161)
Indicator x size dummy 1					-0.0197**
					(0.00854)
Indicator x size dummy 2					-0.00765
					(0.00788)
Indicator x size dummy 3					-0.000621
					(0.0115)
Indicator x size dummy 4					0.00464
					(0.0198)
Observations	254,380	254,380	254,380	254,380	254,380
R-squared	0.181	0.182	0.182	0.180	0.119

Note: This table shows the results of equation (1) where firm-level labour productivity growth is regressed on growth of the top 5 per cent of firms in each sector-year cell, the lagged level of productivity, age and size (measured by employees) with various alterations. In particular, model III further includes the interaction between the indicator and the gap; model IV differentiates the effect of regulation by size class; and model V differentiates by productivity quartile. All regressions include sector and country-year fixed effects and are clustered at country-sector level. Firms at the sector-year frontier are excluded from the regressions. The gap variable is demeaned. Regressions are based on firms with more than one employee, from 11 EU countries for 11 personal and professional services over the period 2014-16. ***, **, and * represent p<0.001, p<0.05 and p<0.1 respectively. Robust standard errors are reported in parenthesis.
Source: OECD calculations based on ORBIS and OER Indicator.

Figure 9. Easing regulations would benefit most small and high productive firms

Productivity gains from reducing regulation from most (GER) to least (SWE) regulated country



Note: This figure shows the ceteris paribus impact of a reduction in the average stringency (across occupations) of occupational entry requirements by country, measured by the composite indicator introduced in this paper, from German to Swedish levels, which corresponds to a one unit decrease. Calculations are based on estimates from Table 2, model IV and V.
Source: OECD calculations based on ORBIS and OER Indicator. To download this graph, please visit https://bit.ly/2w4MR2X

Table 4. Catch-up model – results by sub-indicator (Part 1)

Dependent variable: labour productivity growth

Indicator	Administrative burdens	Administrative burdens	Qualification requirements	Qualification requirements	Mobility restrictions	Mobility restrictions
Model	II	III	II	III	II	III
Frontier growth	0.238***	0.241***	0.239***	0.242***	0.239***	0.241***
	(0.0576)	(0.0580)	(0.0577)	(0.0580)	(0.0575)	(0.0577)
Gap to frontier (lag)	0.327***	0.337***	0.327***	0.336***	0.327***	0.331***
	(0.0121)	(0.0148)	(0.0122)	(0.0156)	(0.0120)	(0.0126)
Employees (log)	0.0371***	0.0372***	0.0373***	0.0374***	0.0372***	0.0373***
	(0.00294)	(0.00297)	(0.00289)	(0.00291)	(0.00288)	(0.00291)
Age	5.05e-05	7.45e-05	4.99e-05	7.05e-05	6.63e-05	7.90e-05
	(0.000235)	(0.000242)	(0.000236)	(0.000240)	(0.000232)	(0.000236)
Indicator	-0.0166**	-0.0162**	-0.0160	-0.0149	-0.0414*	-0.0378**
	(0.00823)	(0.00814)	(0.0152)	(0.0152)	(0.0212)	(0.0188)
Indicator x lagged gap to frontier		-0.0111		-0.0168		-0.0311
		(0.00882)		(0.0159)		(0.0251)
Observations	254,380	254,380	254,380	254,380	254,380	254,380
R-squared	0.182	0.182	0.181	0.181	0.182	0.182

Table 4. Catch-up model – results by sub-indicator (Part 2)

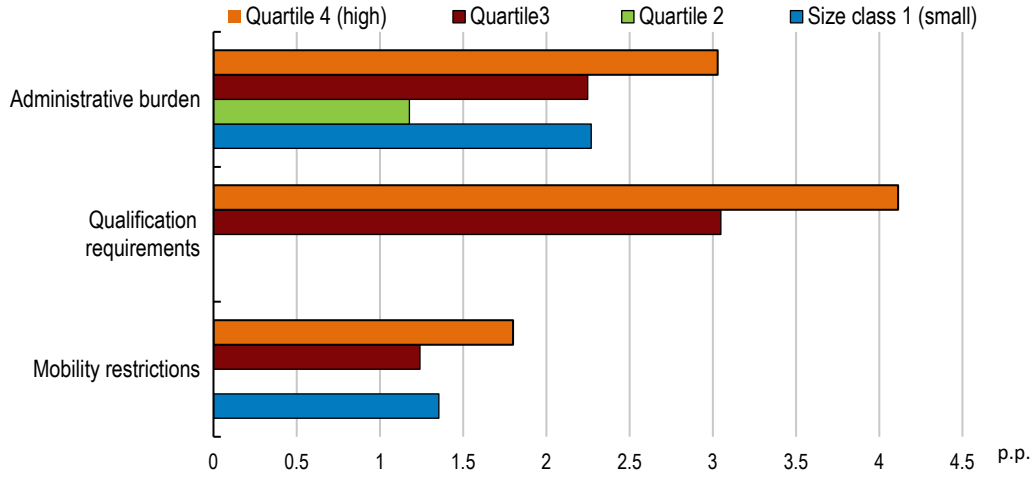
Indicator	Administrative burdens	Administrative burdens	Qualification requirements	Qualification requirements	Mobility restrictions	Mobility restrictions
Model	IV	V	IV	V	IV	V
Frontier growth	0.154***	0.237***	0.155***	0.237***	0.154***	0.238***
	(0.0564)	(0.0573)	(0.0564)	(0.0575)	(0.0564)	(0.0573)
Gap to frontier (lag)		0.323***		0.322***		0.323***
		(0.0120)		(0.0122)		(0.0120)
Employees (log)	0.0296***		0.0297***		0.0297***	
	(0.00234)		(0.00229)		(0.00231)	
Age	-0.000105	0.000261	-0.000107	0.000259	-8.45e-05	0.000276
	(0.000193)	(0.000236)	(0.000192)	(0.000236)	(0.000192)	(0.000233)
Productivity quartile 1 (lowest)	0.452***		0.447***		0.458***	
	(0.0167)		(0.0168)		(0.0152)	
Productivity quartile 2	0.195***		0.194***		0.199***	
	(0.00849)		(0.00880)		(0.00773)	
Productivity quartile 3	0.109***		0.109***		0.111***	
	(0.00516)		(0.00540)		(0.00449)	
Indicator x productivity quartile 1	-0.0130		-0.00950		-0.0375	
	(0.0113)		(0.0167)		(0.0335)	
Indicator x productivity quartile 2	-0.0115*		-0.0130		-0.0166	
	(0.00655)		(0.0127)		(0.0140)	
Indicator x productivity quartile 3	-0.0178***		-0.0263**		-0.0317*	
	(0.00607)		(0.0118)		(0.0167)	
Indicator x productivity quartile 4	-0.0241***		-0.0357**		-0.0555*	
	(0.00859)		(0.0157)		(0.0301)	
Size dummy 1 (0-10 employees)		-0.0708***		-0.0523***		-0.0863***
		(0.0208)		(0.0186)		(0.0129)
Size dummy 2 (11-50 employees)		-0.0220		-0.00577		-0.0327***
		(0.0198)		(0.0178)		(0.0120)
Size dummy 3 (51-250 employees)		-0.00352		0.00606		-0.00851
		(0.0161)		(0.0157)		(0.0111)
Indicator x size 1		-0.0197**		-0.0218		-0.0486**
		(0.00854)		(0.0156)		(0.0224)
Indicator x size 2		-0.00765		0.00289		-0.0166
		(0.00788)		(0.0160)		(0.0153)
Indicator x size 3		-0.000621		0.0310		-0.00178
		(0.0115)		(0.0226)		(0.0262)
Indicator x size 4		0.00464		0.0572*		0.00989
		(0.0198)		(0.0312)		(0.0593)
Observations	254,380	254,380	254,380	254,380	254,380	254,380
R-squared	0.119	0.180	0.119	0.179	0.119	0.180

Note: This table shows the results of equation (1) where firm-level labour productivity growth is regressed on growth of the top 5 per cent of firms in each sector-year cell, lagged productivity levels, age and size (measured by employees), distance to frontier and regulations, with various alterations. In particular, model III further includes the interaction between the sub-indicators and the gap; model IV differentiates the

effect of regulation by productivity quartile; and model V differentiates by size class. All regressions include sector and country-year fixed effects and are clustered at country-sector level. Firms at the sector-year frontier are excluded from the regressions. The gap variable is demeaned. Regressions are based on firms with more than one employee, from 11 EU countries for 11 personal and professional services over the period 2014-16. ***, **, and * represent p<0.001, p<0.05 and p<0.1 respectively. Robust standard errors are reported in parenthesis.
Source: OECD Calculations based on ORBIS and OER Indicator. To download this graph, please visit https://bit.ly/2w4MR2X

Figure 10. The largest effects of reform emerge from qualification requirements

Productivity gains from reducing regulation from most to least regulated country



Note: This figure shows the ceteris paribus impact of a reduction in the average stringency of occupational entry requirements, measured by three sub-indicators introduced in this paper, from the sample maximum to sample minimum (always Sweden). For administrative burdens, the most restrictive burdens are recorded for Portugal, for qualification requirements it is Germany, and for mobility restrictions it is Hungary. Calculations are based on estimates from Table 3, models IV and V, on results that are statistically significant only.
Source: OECD calculations based on ORBIS and the OER Indicator. To download this graph, please visit https://bit.ly/2w4MR2X

3.5. Results: Stringent OER hinder reallocation

49. We next test the hypothesis that occupational entry requirements introduce rigidities in the supply and mobility of skilled professionals that can impair the efficient reallocation of labour. In line with priors, higher productivity is generally associated with stronger firm-level employment growth in professional and personal service occupations (Table 5, Col I). However, the negative and statistically significant coefficient estimates of the interaction between lagged labour productivity and the OER indicator of occupational regulations (Col II) or its sub-components (Col III-V) suggest that occupational regulations raising entry barriers may slow down the movement towards allocative efficiency.

Table 5. Reallocation model

Dependent variable: employment growth

	Baseline	Full Indicator	Administrative burdens	Qualification requirements	Mobility restrictions
Labour productivity (lagged)	0.0823***	0.0862***	0.0862***	0.0872***	0.0843***
	(0.00342)	(0.00465)	(0.00465)	(0.00492)	(0.00381)
Labour productivity (lagged) x Indicator		-0.00455**	-0.00455**	-0.00902**	-0.0145***
		(0.00207)	(0.00207)	(0.00407)	(0.00522)
Employees (log)	0.0270***	0.0269***	0.0269***	0.0269***	0.0270***
	(0.00213)	(0.00214)	(0.00214)	(0.00214)	(0.00214)
Age	-0.0050***	-0.00501***	-0.00501***	-0.00501***	-0.00501***
	(0.000199)	(0.000199)	(0.000199)	(0.000199)	(0.000199)
Observations	275,933	275,933	275,933	275,933	275,933
R-squared	0.061	0.061	0.061	0.061	0.061

Note: This table reports the results of the reallocation model (equation 2) where employment growth is regressed on lagged values of firm-level labour productivity, the interaction between lagged productivity (demeaned when interacted) and the various forms of the indicator, a measure of the firms' size (employees) and its age. All regressions include country-sector-time fixed effects and are clustered in the same dimension. The underlying sample includes firms with more than one employee from 11 EU countries for 11 personal and professional services over the period 2014-16. ***, **, and * represent p<0.001, p<0.05 and p<0.1 respectively. Robust standard errors are reported in parenthesis.
Source: OECD calculations based on ORBIS and OER Indicator.

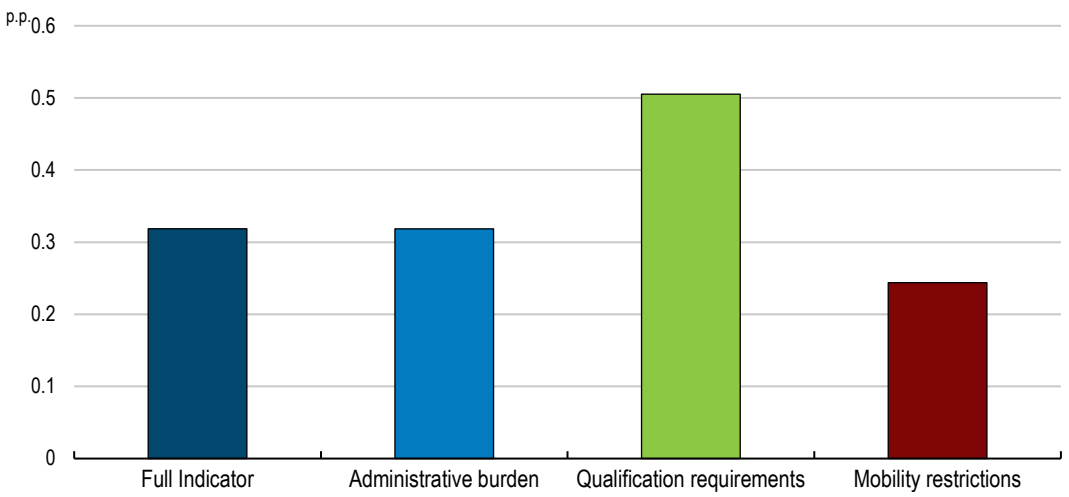
50. Based on the coefficient estimates in Table 5, Figure 11 simulates the gains to productivity-enhancing reallocation of reducing the level of occupational entry requirements from their highest in-sample value (Germany, or Hungary for mobility requirements) to their lowest value (Sweden). Importantly, all simulations refer to the difference in employment growth between the fourth (highest) and first (lowest) productivity quartiles. Panel A shows that under this reform scenario the difference in employment growth between high and low productive firms would be 0.3 percentage points higher than in the baseline. Similar gains could be obtained, if administrative burdens and mobility restrictions were lowered to the sample minimum. These results are economically significant since they represent a roughly 10% increase in the contribution of reallocation to the average firm-level employment growth in the sample.[24] Panel B shows that the benefits from reform would vary substantially across countries, depending on their initial level of regulation. The largest gains would be obtained by easing qualification requirements, again reflecting the wider variability across countries.

[24] The average firm-level employment growth recorded in the sample is 8.9 percent of which 3.9 percent can be ascribed to the reallocation of labour.

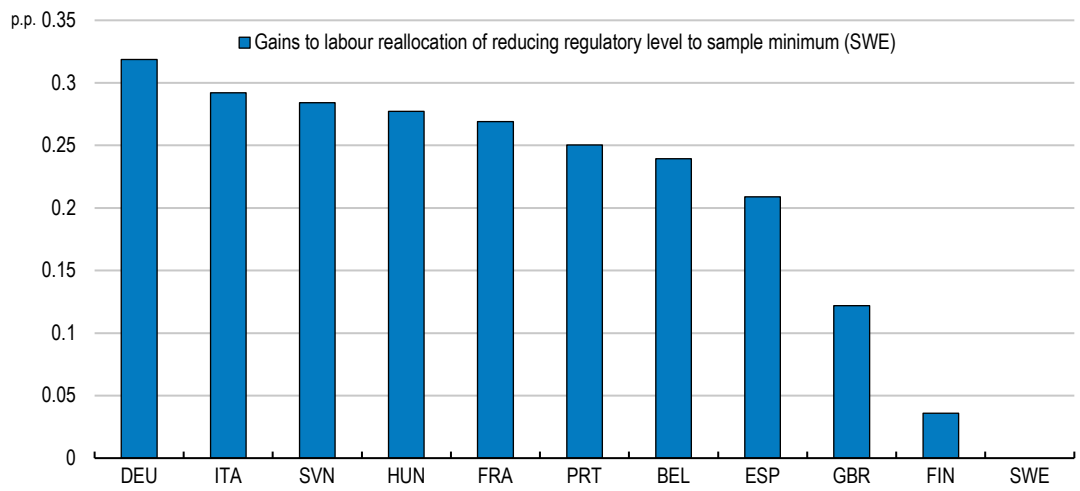
Figure 11. Impact of regulatory reform on labour reallocation

Change in employment growth between the average firm at the 4th and 1st productivity quartiles

Panel A



Panel B



Note: Panel A shows the counterfactual gains to the efficiency of labour allocation (i.e. the differenc2 in employment growth between firms at the 75th percentile of the productivity distribution and firms at the 75th percentile of the distribution) from reducing the stringency of occupational entry requirements from sample maximum to minimum. Panel B displays the gains of reducing the level of regulation (full indicator) to sample minimum (SWE) by country. Calculations are based on estimates from Table 7.
Source: OECD calculations based on ORBIS and OER indicator. To download this graph, please visit https://bit.ly/2w4MR2X

4. Policy implications and reform efforts

51. Occupational entry regulations have been predicated on their presumed benefits for customers of personal and professional services, though past research has had a hard time detecting these benefits. Productivity concerns are not among the primary objectives of policy decision-making in this field, but our analysis suggests that the unintended side effects of occupational entry regulations on aggregate productivity can be significant. While the public interest objectives these regulations aim to achieve remain legitimate and relevant, there is likely a mismatch between policy means and goals in the area of

occupational entry. Moreover, this mismatch may become increasingly detrimental as the asymmetries and other market failures that these policies are meant to address fade away due to the spreading out of digitally-operated services platforms. Therefore, appropriate strategies for reforming occupational regulations that preserve their objectives while avoiding their undesired side effects are warranted.

52. OECD countries have implemented a number of reforms of occupational entry requirements over the past two decades, most of them in European countries (Table 6). The EU has been instrumental in encouraging member countries to review their regulations according to the principle of proportionality and in the light of mutual evaluation of regulatory regimes. By means, among others, of EC Directives 2005/36/EC and 2013/55/EU, it has also promoted the facilitation of entry into personal and professional occupations for foreign service providers within the single market. Yet for most occupations fungibility across the Single Market remains a distant target, as illustrated by the remaining cross-EU variability of the OER indicator.

Table 6. Selected occupational entry reforms

Panel A: the European Union

Country	Year	Reform
Germany	2004	Amendment of the Crafts code reduced the number of licensed occupations from 94 to 41
United Kingdom	2007	Legal Service Board reform – separation of regulatory and representative powers
Spain	2009	Reduction of barriers for individuals from other regulated occupations to exercise reserved activities, reduction of tariffs and restrictions on advertising
Poland	2009; 2013	Modification of the rules of entry to the profession of advocate and legal advisors
Greece	2011	Abolishment of unjustified redundant regulations related to regulated professions
Italy	2012	Relaxation of multiple restrictions including both access and conduct regulations (loosened terms for traineeships, abolition of tariffs, advertising and legal form restrictions)
Portugal	2013	Relaxation of entry requirements for occupations that were not regulated by professional bodies
Slovenia	2013	Reduction of number of craftsmen occupations required to obtain a license
Belgium	2019	Deregulation of craftsmen occupations in the Flemish region

Panel B: the United States

State	Year	Reform
Florida	2011	Reduction/exemption of licensing fees for military veterans and low-income
Michigan	2013-2014	Out of 87 occupations reviewed, 6 became unlicensed
Arizona	2016	Out of 102 occupations reviewed, 5 became unlicensed
	2019	First US State to recognize all out-of-state licensures (HB 2569)
Nebraska	2016	Exception of license for natural hair braiders
Utah	2017	Reduction of entry regulations for electricians, plumbers and contractors
Wisconsin	2017	Reduction of entry regulations for barbers, cosmetologists, aestheticians, electrologists, and manicurists

Panel C: Canada

Province	Year	Reform
All	2009	Amendment of the 1995 Agreement on Internal Trade (AIT) to remove labour mobility barriers for certified workers so they will be able to move freely to work where opportunities exist.
All	2009	Assessment and Recognition of Foreign Qualification- A Pan Canadian Framework for the Assessment and Recognition of Foreign Qualifications, was established which represents a joint commitment by federal, provincial and territorial governments to work together to improve the foreign qualification assessment and recognition systems in Canad
Alberta, British Columbia, and	2010	New West Partnership Trade Agreement (2010), whereby "any worker certified for an occupation by a regulatory authority of a Party shall be recognized as qualified to practice

Saskatchewan		that occupation by the other Party."
All	2014	Action Plan for Better Foreign Qualification Recognition (2014)
All	2015	Apprentice Mobility Protocol
All	2016	Atlantic Apprenticeship Harmonization Project (AAHP) (2016) harmonize the requirements and standards for 10 skilled trades, including electricians and plumbers, in New Brunswick, Nova Scotia, Newfoundland, and Prince Edward Island
All	2017	Canadian Free Trade Agreement – reaffirming labour mobility provisions established under the 2009 version of the Agreement on International Trade.

Source: Von Rueden and Bambalaite (2020) based on Canton, Ciriaci and Solera (2014), Kilmer (2019), Kleiner (2019), Koumenta et al. (2019), Zhang (2017) and OECD Reform Tracker.

53. Strikingly, the variability of occupational entry regulations across the EU countries covered in this study is often comparable to the variability still observed across Canada and the US, where one would expect a higher degree of market integration. Various broad policy initiatives were indeed also implemented in Canada (Table 5, Panel C), but the remaining regulatory differences across provinces suggest the need for further integration efforts. As for the US, there have been fewer attempts to reform these regulations at the federal or state level, with on the contrary a well-documented trend for such regulations to cover an increasing share of occupations (Figure 3). Limited reforms, rarely involving delicensing of some occupations (e.g. Michigan and Arizona) more often just changing the licensing system or establishing the need for reviewing existing regulations (e.g. Utah, Wisconsin, Florida, Nebraska), have been implemented in 11 states (Kilmer, 2019). Nevertheless, the need for and the economic benefits of occupational licensing are increasingly being questioned in both academic and policy circles.

54. Outside the EU, the US and Canada, the available evidence for Israel, Iceland and India suggests that, while some voice concern, little policy action has been taken in the area of occupational entry regulations. If anything, there was a tendency towards increasing restrictions, especially in Israel and India (see von Rueden and Bambalaite, 2020).

55. In sum, two principles emerge from the policy debate and existing research on occupational entry requirements: (i) the need for reviewing regulations in the light of their adequacy for meeting the stated public interest targets, technological developments and international experience; and (ii) the need to lighten requirements and shift the focus of regulations from inputs to outputs, whereby the focus of regulations becomes ensuring certain quality standards for goods and services provided rather than reserving activities or setting standards for the professionals providing them. Indeed, recent OECD recommendations (e.g. OECD, 2018) highlight that limiting occupational entry by reserving activities or setting exceedingly restrictive qualification requirements can be inefficient if the purpose of regulation is to ensure that the outcome (e.g. a building standard) is of the desired quality.

56. Other important areas for action are replacing where possible licensing systems with less distortionary certification schemes; promoting the development of consumer information systems (e.g. service quality comparison platforms), in order to reduce informational asymmetries where they persist; and paying special attention to the potential anti-competitive consequences of new regulations.

5. Concluding remarks

57. This paper contributes to the understanding of occupational entry policies and their implications for the economy, but further data collection and research are needed to provide increasingly sound policy advice in this key, but complicated area. As for data collection, coverage of more OECD countries, more occupations and historical developments in occupational entry regulations would be highly desirable. Our survey only includes a small sample of the regulated occupations in a subset of OECD countries in a single year. Yet evidence for the US suggests that over 1000 professions and personal services are regulated

(mostly via licensing) and that the share of services covered has gone up sharply over time. These phenomena could be shared by other OECD countries as well. Moreover, aside from US states and Canadian provinces, our data are missing within-country variability in regulations, which could arise also in other federal countries and possibly even in unitary ones if occupational rules are set at the local level.

58. Extending the data to cover more countries, more occupations, more periods and within-country variation would not only give better guidance to policy but also allow much better identification of the effects of occupational entry regulations on economic performance. For instance, more plausibly causal effects on firm-level productivity could be captured by using the time or the cross-jurisdiction dimensions. Further, within-country variability in regulations could be linked with job flows across regions, provinces or states to check whether it constitutes a barrier to worker mobility, with potentially important implications for aggregate productivity.

59. Finally, an area that remains relatively unexplored is the effect of occupational entry regulations (or reforms therein) on inclusiveness. Easier access, stronger competitive pressures and efficiency improvements set off by the liberalisation of entry requirements may have conflicting influences. They are likely to reduce incomes of incumbent professionals that previously benefited from rents, but might also increase wages of professionals in new and faster-growing firms; they can also facilitate access to occupations for those with lower levels of education and, by attracting more labour into the deregulated occupations, this could also have positive effects on relative wages in other sectors of the economy; finally, the likely reduction in prices from productivity improvements and rent reduction could benefit low-income consumers of professional and occupational services, which may have been discriminated in the past. Investigating the net effect of these influences on labour market access and inequality would help win resistance to reform and guide policy.

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Annex A. Robustness checks and additional statistics

Table A.1. Firms by size class and occupation

	NACE 2	1 employee	2-10 employees	11-50 employees	51-250 employees	250+ employees	TOTAL
Electrician	4321	25424	67615	20644	1814	106	115603
Plumber	4322	20684	56555	17656	1115	54	96064
Painter	4334	7945	19929	5522	426	22	33844
Butcher	4722	3997	13572	2155	120	3	19847
Baker	4724	2309	8534	1743	138	12	12736
Lawyer	6910	11929	16031	2136	693	113	30902
Architect	7111	12944	14074	1906	222	15	29161
Engineer	7112	46743	52865	15001	2242	241	117092
Engineer	7120	5180	10247	3345	560	66	19398
Driving Instructor	8553	2697	8662	889	20	1	12269
Aesthetician/Hairdresser	9602	17197	37785	3073	164	9	58228
TOTAL		157049	305869	74070	7514	642	545144
Percentage of total		**28.8%**	**56.1%**	**13.6%**	**1.4%**	**0.1%**	**100.0%**

Note: All statistics refer to the years 2014-16 and are based on the country sample used for the empirical analysis (i.e. for which productivity estimates are available). The occupation of engineer corresponds to two possible 4-digit sectors, hence both are included. Aestheticians and hairdressers fall under the same 4-digit sector.
Source: Author's calculation based on ORBIS data.

Table A.2. Summary statistics: balance sheet data, by sector

Sample excluding self-employed, 2014-16

		LP		LP growth (%)		Employees		Employment growth (%)		Wages		K/L ratio	
Occupation	Nace Rev 2	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Electrician	4321	10.3	0.6	0.8	42.5	10.2	28.6	6.0	33.9	10.2	0.6	30.5	373.0
Plumber	4322	10.3	0.6	0.7	40.5	9.5	16.9	5.4	30.7	10.1	0.6	21.2	94.5
Painter	4334	10.2	0.6	0.0	39.9	9.6	24.2	5.5	32.3	10.1	0.6	15.5	49.1
Butcher	4722	10.2	0.8	2.5	42.3	6.8	11.3	5.1	29.9	10.0	0.6	30.8	62.8
Baker	4724	10.1	0.8	2.3	41.6	8.7	23.8	6.1	34.1	10.0	0.6	31.9	108.5
Lawyer	6910	11.1	0.8	-2.9	40.9	12.3	42.2	5.0	28.4	10.7	0.6	118.3	3248.2
Architect	7111	10.6	0.9	-1.6	51.2	7.2	18.0	9.4	34.7	10.4	0.7	87.1	1339.1
Engineer	7112	10.8	0.8	-1.5	45.5	12.2	40.6	8.5	33.2	10.5	0.7	214.3	6866.9
Engineer	7120	10.7	0.7	0.7	39.4	13.8	37.0	7.8	30.5	10.4	0.6	52.5	261.4
Driving Instructor	8553	9.9	0.8	0.7	42.1	5.5	7.3	4.6	29.5	9.8	0.6	25.0	86.2
Aesthetician/Hairdresser	9602	9.7	0.8	2.2	43.1	5.3	11.2	5.3	31.6	9.8	0.6	18.6	83.6
	Total	10.37	0.8	0.3	43	9.7	27.8	6.3	32.2	10.2	0.7	67.1	3028.5

Note: All statistics refer to the years 2014-16 and exclude self-employed. Labour productivity and real wages are measured in logs; the capital-labour ratio is denoted in thousands of 2010 USD. The occupation of engineers corresponds to two possible 4-digit sectors, hence both are included. Aestheticians and hairdressers fall under the same 4-digit sector.
Source: Author's calculation based on ORBIS data.

Table A.3. Summary statistics: OER indicator, by sector

		Full indicator		Administrative burdens		Qualification requirements		Mobility restrictions	
		mean	sd	mean	sd	mean	sd	mean	sd
Electrician	4321	0.4915	0.63	0.4915	0.633	0.41133	0.4841	0	0
Plumber	4322	0.2786	0.45	0.2786	0.449	0.23246	0.401	0	0
Painter	4334	0.3633	0.47	0.3633	0.471	0.27992	0.3981	0	0
Butcher	4722	0.1849	0.33	0.1849	0.329	0.18493	0.329	0	0
Baker	4724	0.0617	0.21	0.0617	0.214	0.06173	0.2138	0	0
Lawyer	6910	3.07	1.03	3.07	1.028	1.56547	0.4817	0.83283	0.5021
Architect	7111	1.828	0.92	1.828	0.924	1.1496	0.5801	0.12278	0.2584
Engineer	7112	0.9611	0.95	0.9611	0.946	0.64047	0.5333	0.13582	0.3586
Engineer	7120	1.7782	1.31	1.7782	1.306	0.93391	0.5262	0.49727	0.6232
Driving Instructor	8553	1.2772	0.38	1.2772	0.377	1.22144	0.3272	0.05333	0.1809
Aesthetician/Hairdresser	9602	0.2433	0.29	0.2433	0.285	0.20249	0.2227	0	0
Total		0.7264	0.98	0.7264	0.981	0.49597	0.5748	0.09039	0.3047

Note: All statistics refer to the years 2014-16 and exclude self-employed firms. Labour productivity and real wages are measured in logs; the capital-labour ratio is denoted in thousands of 2010 USD. The profession of engineers corresponds to two possible 4-digit sectors, hence both are included. Aestheticians and hairdressers fall under the same 4-digit sector.
Source: Author's calculation based on ORBIS data.

Table A.4. Summary statistics: balance sheet data (extended sample), by sector

Sample including firms that exit self-employment over the period 2014-16

		Productivity		Productivity growth		Employees		Employment growth		Wages (log)		K/L ratio (in 1000)	
Profession	Nace Rev 2	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Electrician	4321	10.328	0.68	1.7	44.9	8.6	26.2	3.4	33.8	10.1	0.7	36.5	406.4
Plumber	4322	10.317	0.67	1.6	42.9	8.1	15.7	3.1	30.8	10.1	0.6	26.1	189.8
Painter	4334	10.197	0.67	0.9	42.7	8.0	22.2	2.7	32.6	10.0	0.6	20.1	132.2
Butcher	4722	10.197	0.8	3.5	43.7	5.9	10.6	2.8	30.1	10.0	0.7	35.8	106.8
Baker	4724	10.149	0.79	3.2	42.8	7.7	22.3	3.6	34.9	10.0	0.6	35.0	108.7
Lawyer	6910	11.089	0.86	-2.0	45.3	8.5	34.7	1.4	26.8	10.7	0.6	138.4	2680.0
Architect	7111	10.566	0.92	1.4	56.3	4.8	14.4	3.3	31.7	10.3	0.8	106.4	1084.7
Engineer	7112	10.753	0.84	0.3	50.1	8.3	33.3	3.8	30.3	10.4	0.9	198.6	5795.4
Engineer	7120	10.698	0.74	1.9	42.4	11.1	33.3	5.0	29.7	10.4	0.8	80.7	2062.4
Driving Instructor	8553	9.908	0.78	1.6	44.2	4.7	6.8	2.3	29.5	9.8	0.7	28.2	89.1
Aesthetician/Hairdresser	9602	9.7557	0.82	3.6	44.4	4.3	10.0	2.1	31.0	9.8	0.6	21.1	90.5
	Total	10.38	0.83	1.5	45.8	7.6	24.6	3.2	31.4	10.2	0.7	77.0	2787.0

Note: All statistics refer to the years 2014-16 and are based on firms with more than employee and self-employed firms whose workforce grows over the sample period. Labour productivity and real wages re measured in logs; the capital-labour ratio is denoted in thousands of 2010 USD. The profession of engineers corresponds to two possible 4-digit sectors, hence both are included. Aestheticians and hairdressers fall under the same 4-digit sector.
Source: Author's calculation based on ORBIS data.

Table A.5. Catch-up model with sector-time FE

Dependent variable: labour productivity growth

Indicator			Full indicator		
Model	I	II	III	IV	V
Frontier growth			Omitted		
Gap to frontier (lag)	0.327***	0.328***	0.338***		0.323***
	(0.0123)	(0.0121)	(0.0148)		(0.0121)
Employees (log)	0.0375***	0.0372***	0.0373***	0.0297***	
	(0.00284)	(0.00293)	(0.00296)	(0.00234)	
Age	5.41e-05	5.49e-05	7.95e-05	-9.69e-05	0.000267
	(0.000236)	(0.000236)	(0.000243)	(0.000193)	(0.000236)
Indicator		-0.0164**	-0.0159*		
		(0.00825)	(0.00816)		
Indicator x lagged gap to frontier			-0.0115		
			(0.00881)		
Productivity quartile 1 (lowest)				0.454***	
				(0.0167)	
Productivity quartile 2				0.196***	
				(0.00843)	
Productivity quartile 3				0.110***	
				(0.00511)	
Indicator x productivity quartile 1				-0.0130	
				(0.0113)	
Indicator x productivity quartile 2				-0.0113*	
				(0.00656)	
Indicator x productivity quartile 3				-0.0175***	
				(0.00608)	
Indicator x productivity quartile 4				-0.0237***	
				(0.00861)	
Size dummy 1 (0-10 employees)					-0.0722***
					(0.0211)
Size dummy2 (11-50 employees)					-0.0232
					(0.0202)
Size dummy 3 (51-250 employees)					-0.00464
					(0.0163)
Indicator x size dummy 1					-0.0195**
					(0.00855)
Indicator x size dummy 2					-0.00724
					(0.00791)
Indicator x size dummy 3					-0.000506
					(0.0115)
Indicator x size dummy 4					0.00248
					(0.0209)
Observations					
R-squared					

Note: This table shows the results of equation (1) where firm-level labour productivity growth is regressed on growth of the top 5 per cent of firms in each sector-year cell, lagged productivity (demeaned when interacted), age and size (measured by employees) with various alterations. In particular, model III further includes the interaction between the indicator and the gap; model IV differentiates the effect of regulation by size class; and model V differentiates by productivity quartile. All regressions include sector-time and country-year fixed effects and are clustered at country-sector level. Firms at the sector-year frontier are excluded from the regressions. Regressions are based on firms with more than one employee, from 11 EU countries for 11 personal and professional services over the period 2014-16. ***, **, and * represent p<0.001, p<0.05 and p<0.1 respectively. Robust standard errors are reported in parenthesis.

Table A.6. Catch-up model: national frontier

Dependent variable: labour productivity growth

Indicator	Full indicator				
Model	I	II	III	IV	V
National frontier growth	2.908***	2.755***	1.186***	1.104***	2.738***
	(0.407)	(0.406)	(0.289)	(0.314)	(0.400)
Gap to national frontier (lag)	0.366***	0.366***	0.0145		0.362***
	(0.0117)	(0.0116)	(0.0170)		(0.0116)
Employees (log)	0.0443***	0.0440***	0.0136***	0.0354***	
	(0.00335)	(0.00345)	(0.00390)	(0.00257)	
Age	0.000359	0.000361	-0.000463*	4.71e-05	0.000582**
	(0.000229)	(0.000230)	(0.000270)	(0.000211)	(0.000228)
Indicator		-0.0145***	-0.00941***		
		(0.00492)	(0.00249)		
Indicator x lagged gap to frontier			0.151***		
			(0.0239)		
Productivity quartile 1 (lowest)				0.504***	
				(0.0190)	
Productivity quartile 2				0.238***	
				(0.0113)	
Productivity quartile 3				0.146***	
				(0.00841)	
Indicator x productivity quartile 1				-0.0120	
				(0.0120)	
Indicator x productivity quartile 2				-0.0107	
				(0.00753)	
Indicator x productivity quartile 3				-0.0179**	
				(0.00685)	
Indicator x productivity quartile 4				-0.0262**	
				(0.0108)	
Size dummy 1 (1-10 employees)					-0.0330***
					(0.00634)
Size dummy2 (11-50 employees)					0.0322***
					(0.00506)
Size dummy 3 (51-250 employees)					0.0692***
					(0.0142)
Indicator x size dummy 1					0.0732**
					(0.0290)
Indicator x size dummy 2					-0.0157***
					(0.00501)
Indicator x size dummy 3					-0.00953
					(0.00575)
Indicator x size dummy 4					-0.0206
					(0.0157)
Observations					-0.0345
R-squared					(0.0228)

Note: This table shows the results of equation (1) where firm-level labour productivity growth is regressed on growth of the top 5 per cent of firms in each country-sector-year cell, lagged productivity (demeaned when interacted), age and size (measured by employees) with various alterations. In particular, model III further includes the interaction between the indicator and the gap; model IV differentiates the effect of regulation by size class; and model V differentiates by productivity quartile. All regressions include sector-time and country-year fixed effects and are clustered at country-sector level. Firms at the sector-year frontier are excluded from the regressions. Regressions are based on firms with more than one employee, from 11 EU countries for 11 personal and professional services over the period 2014-16. ***, **, and * represent p<0.001, p<0.05 and p<0.1 respectively. Robust standard errors are reported in parenthesis.
Source: OECD calculations based on ORBIS and OER Indicator.

Table A.7. Reallocation model using extended sample

Dependent variable: employment growth

	Baseline	Full Indicator	Administrative burdens	Qualification requirements	Mobility restrictions
Labour productivity (lagged)	0.0615***	0.0655***	0.0655***	0.0665***	0.0635***
	(0.00269)	(0.00383)	(0.00383)	(0.00414)	(0.00307)
Labour productivity (lagged) x Indicator		-0.00437**	-0.00437**	-0.00844**	-0.0130***
		(0.00172)	(0.00172)	(0.00351)	(0.00397)
Employees (log)	0.0571***	0.0571***	0.0571***	0.0570***	0.0571***
	(0.00257)	(0.00256)	(0.00256)	(0.00256)	(0.00256)
Age	-0.00458***	-0.00459***	-0.00459***	-0.00458***	-0.00458***
	(0.000202)	(0.000203)	(0.000203)	(0.000203)	(0.000203)
Observations	340,464	340,464	340,464	340,464	340,464
R-squared	0.068	0.068	0.068	0.068	0.068

Note: This table reports the results of the reallocation model (equation II) where employment growth is regressed on lagged values of firm-level labour productivity, the interaction between lagged productivity (demeaned when interacted) and the various forms of the indicator, a measure of the firms' size (employees) and its age. All regressions include country-sector-time fixed effects and clustered in the same dimension. The underlying sample contains firms with more than one employee, as well as self-employed firms whose workforce grows over the sample period, from 11 EU countries for 11 personal and professional services over the period 2014-16. ***, **, and * represent p<0.001, p<0.05 and p<0.1 respectively. Robust standard errors are reported in parenthesis.
Source: OECD calculations based on ORBIS and OER Indicator.

Table A.8. A simple reverse causality check

Dependent variable: OER indicator

	Full Indicator
Labour productivity t-2 (2016)	0.166
	(0.234)
Labour productivity t-3 (2015)	-1.266
	(0.864)
Labour productivity t-4 (2014)	1.381*
	(0.763)
Observations	165
R-squared	0.718

Note: The F-test of joint significance is rejected at Prob > F = 0.2478. Labour productivity reflects the average level across firms at the country-sector level on a yearly basis.
Source: OECD calculations based on ORBIS and OER Indicator.

Table A.9. Controlling for the share of self-employed by sector

Dependent variable: labour productivity growth

Indicator	Full indicator				
Model	I	II	III	IV	V
National frontier growth	0.245***	0.244***	0.247***	0.159***	0.243***
	(0.0575)	(0.0574)	(0.0578)	(0.0561)	(0.0571)
Gap to national frontier (lag)	0.327***	0.327***	0.337***		0.323***
	(0.0122)	(0.0121)	(0.0148)		(0.0120)
Employees (log)	0.0374***	0.0371***	0.0372***	0.0296***	
	(0.00285)	(0.00294)	(0.00297)	(0.00234)	
Age	4.98e-05	5.12e-05	7.52e-05	-0.000104	0.000262
	(0.000235)	(0.000235)	(0.000242)	-0.000193	(0.000236)
Share of SE	**0.419****	**0.395****	**0.400****	**0.343***	**0.403****
	(0.193)	(0.196)	(0.198)	(0.203)	(0.195)
Indicator		-0.0165**	-0.0161**		
		(0.00822)	(0.00813)		
Indicator x lagged gap to frontier			-0.0112		
			(0.00882)		
Productivity quartile 1 (lowest)				0.452***	
				(0.0167)	
Productivity quartile 2				0.196***	
				(0.00848)	
Productivity quartile 3				0.109***	
				(0.00515)	
Indicator x productivity quartile 1				-0.0129	
				(0.0113)	
Indicator x productivity quartile 2				-0.0114*	
				(0.00655)	
Indicator x productivity quartile 3				-0.0177***	
				(0.00606)	
Indicator x productivity quartile 4				-0.0240***	
				(0.00857)	
Size dummy 1 (1-10 employees)					-0.0710***
					(0.0207)
Size dummy2 (11-50 employees)					-0.0221
					(0.0198)
Size dummy 3 (51-250 employees)					-0.00378
					(0.0161)
Indicator x size dummy 1					-0.0196**
					(0.00853)
Indicator x size dummy 2					-0.00754
					(0.00789)
Indicator x size dummy 3					-0.000483
					(0.0116)
Indicator x size dummy 4					0.00477
					(0.0198)
Observations	254,380	254,380	254,380	254,380	254,380
R-squared	0.181	0.182	0.182	0.119	0.180

Note: This table shows the results of equation (1) where firm-level labour productivity growth is regressed on growth of the top 5 per cent of firms in each country-sector-year cell, lagged productivity (demeaned when interacted), age and size (measured by employees), the sector's share of self-employed over total employment varying by year, with various alterations. In particular, model III further includes the interaction between the indicator and the gap; model IV differentiates the effect of regulation by size class; and model V differentiates by productivity quartile. All regressions include sector-time and country-year fixed effects and are clustered at country-sector level. Firms at the sector-year frontier are excluded from the regressions. Regressions are based on firms with more than one employee, from 11 EU countries for 11 personal and professional services over the period 2014-16. ***, **, and * represent p<0.001, p<0.05 and p<0.1 respectively. Robust standard errors are reported in parenthesis.

Source: OECD calculations based on ORBIS and OER Indicator.

Annex B. Abbreviations of countries and states

Table B.1. Abbreviations of countries

Country	Abbreviation	Country	Abbreviation
Austria	AUT	Italy	ITA
Belgium	BEL	Poland	POL
Canada	CAN	Portugal	PRT
Finland	FIN	Slovenia	SVN
France	FRA	South Africa	ZAF
Germany	DEU	Spain	ESP
Hungary	HUN	Sweden	SWE
Iceland	ISL	Switzerland	CHE
India	IND	United Kingdom	GBR
Israel	ISR	United States	USA/US

Table B.2. Abbreviations of US states

State	Abbreviation	State	Abbreviation
Alabama	AL	Missouri	MO
Alaska	AK	Montana	MT
Arizona	AZ	Nebraska	NE
Arkansas	AR	Nevada	NV
California	CA	New Hampshire	NH
Colorado	CO	New Jersey	NJ
Connecticut	CT	New Mexico	NM
Delaware	DE	New York	NY
District of Columbia	DC	North Carolina	NC
Florida	FL	North Dakota	ND
Georgia	GA	Ohio	OH
Hawaii	HI	Oklahoma	OK
Idaho	ID	Oregon	OR
Illinois	IL	Pennsylvania	PA
Indiana	IN	Rhode Island	RI
Iowa	IA	South Carolina	SC
Kansas	KS	South Dakota	SD
Kentucky	KY	Tennessee	TN
Louisiana	LA	Texas	TX
Maine	ME	Utah	UT
Maryland	MD	Vermont	VT
Massachusetts	MA	Virginia	VA
Michigan	MI	Washington	WA
Minnesota	MN	West Virginia	WV
Mississippi	MS	Wisconsin	WI
		Wyoming	WY

Annex C. Literature review

Table C.1. Literature review

Author and year	Title	Country	Occupations	Source of regulation	Economic variable	Main finding
Anderson at al. (2016)	The effect of occupational licensing on consumer welfare: Early midwifery laws and maternal mortality	United States	Midwives	U.S. Census Bureau	Safety, quality, maternal mortality	The authors find that requiring midwives to be licensed reduced maternal mortality by 6 to 7 percent. In addition, they find that requiring midwives to be licensed may have had led to modest reductions in non-white infant mortality and mortality among children under the age of 2 from diarrhoea.
Arnold, Javoric,and Mattoo (2011)	The Productivity Effects of Services Liberalization: Evidence from the Czech Republic	Czech Republic	Professional Services	PMR	Productivity	The results, based on firm-level data from the Czech Republic for the period 1998-2003, show a positive relationship between services sector reform and the performance of domestic firms in downstream manufacturing sectors.
Arnold et al. (2015)	Services Reform and Manufacturing Performance: Evidence from India	India	Professional Services; Networks	PMR	Growth	Banking, telecommunications, insurance and transport reforms all had significant positive effects on the productivity of manufacturing firms.
Athanassiou et al. (2015)	The effects of liberalisation of professional requirements in Greece	Greece	Lawyers, notaries, auditors, accountants, dentists, physiotherapists, taxi drivers, shipping agents, tourist guides, chartered valuers, real-estate agents	Greek Labour Force Survey (LFS) conducted by the Hellenic Statistical Authority (ELSTAT)	Employment, prices	The reform in Greece lead to significantly lower prices for consumers of services of real estate agents, and, to a lesser extent, of legal professions, accountants, tax consultants and physiotherapists. The number of start-ups for notaries, auditors, tourist guides and chartered valuers more than doubled in 2014 compared with the yearly average before the liberalisation.
Barone and Cingano. (2011)	Services Regulation and Growth: Evidence from OECD Countries	OECD	Professional Services; Networks	PMR	Value added, productivity, export growth	Lower service regulation increases value added, productivity and export growth in downstream service-intensive industries.
Blair and Chung (2018a)	How much barrier to entry is occupational licensing?	United States	32 2-digit major occupation groups	Survey of Income and Program	Occupational choice	Licensing reduces equilibrium labour supply by an average of 17.5%-27%

				Participation (SIPP); Current Population Survey (CPS) and dataset created by Blair and Chung; CareerOneStop.org		
Blair and Chung (2018b)	Job Market Signalling through Occupational Licensing	United States	N.A.	Wave 13 to Wave 16 of the SIPP 2008 Panel.	Wage, minorities	The authors show that an occupational license serves as a job market signal, similar to educational qualifications. In the presence of occupational licensing, they find evidence that firms rely less on observable characteristics such as race and gender in determining employee wages. As a result, licensed minorities and women experience smaller wage gaps than their unlicensed peers.
Bourlès et al. (2013)	Do Product Market Regulations in Upstream Sectors Curb Productivity Growth? Panel Data Evidence for OECD Countries	OECD	Professional Services; Networks	PMR	MFP	Anticompetitive upstream regulations have curbed MFP growth over the past 15 years, more strongly so for observations that are close to the productivity frontier.
Canton,Ciriaci and Solera (2014)	The Economic Impact of Professional Services Liberalisation	EU	Professional services	PMR	Allocative efficiency and Profits through birth and death rates	The study shows that all the professions under investigation are characterized by negative values of allocative efficiency in almost all EU countries, but the UK. A reduction of the professional services regulation indicator (PMR) by 1 point increases the churn rate on average by 1.75 p.p. This leads to an increase of the AE index by 5.7 p.p. (namely 1.75 times 3.26) and to a decrease of the profit rates by 5.36 p.p. (1.75 times 3.063).
Caroll and Gaston (1981)	Occupational Restrictions and the Quality of Service Received: Some Evidence	United States	Electricians, Dentists, Plumbers,		Wages, entry, graduates	State licensing laws requiring that electricians pass an oral examination or meet experience requirements were associated with fewer per capita electricians.
Carpenter et al (2018)	The Continuing Burden of Occupational Licensing in the United States	United States	Low- and moderate-income occupations	Laws	N.A.	The descriptive analysis of the data indicates striking disparities in requirements within and between occupations and within and between states.
Chai and Kleiner (2016)	The Labor Market Consequences of Regulating Similar Occupations: The Licensing of Occupational and Physical Therapists	United States	Therapists	American Community Survey (ACS	Wages, employment	The study shows the influence of occupational licensing on two occupations that provide similar services: occupational therapists and physical therapists. Authors' results show that occupational licensing can raise the wages of members of both occupations, but the duration of state occupational licensing statutes is the dominant influence on wage determination. Occupational licensing is also associated with a reduction in annual hours worked and in the relative numbers of members in each of the professions.

Chi, Kleiner and Qian (2017)	Do Occupational Regulations Increase Earnings? Evidence from China	China	N.A.	Chinese General Social Survey (CGSS), a national household survey	Wage	Authors find that licensing is associated with an average of 15 percent higher wages and certification with a 13–14 percent higher wage. A part of the positive effect of certification on wages is due to self-selection. In addition, the characteristics of a certificate or license, such as the type and quantity, further influence wage determination in China.
Chini et al. (2016)	Effects of Liberalisation in Austria using the Example of Liberal Professions	Austria	Professional services: Architects, Engineering Consultants, Accountants/Tax Advisers and Lawyers	(Ö)NACE 5-digit-level time series data from Income Tax Statistics (2003-2012), Wage Tax Statistics (2004-2014) and Structural Business Statistics (2003-2013)	Self-employed people, employed people, wages and number of companies.	The authors arrive at mixed conclusions and hint at the difficulty of disentangling the effects of a rather specific reform on employment, entry rates, wages, etc. from other developments, which also influence the behaviour of the professions under review.
DePasquale and Stange (2014)	State Regulation and the Mobility of Nurses: An Examination of the Nurse Licensure Compact	United States	Nurses	1990 and 2000 U.S. Census and the 2006 to 2012 American Community Survey (ACS).	Migration	Eliminating cross-state licensure restrictions expands the geographic scope of the nurse labour market. It does not appear that cross-state licensing restrictions affect the aggregate labour supply of nurses.
Larsen et al. (2019)	Consumer protection in an online world: When does occupational licensing matter.	United States	Interior designer	Online platforms	Occupational Licensing Signals on Consumer Choice	The results show that more stringent licensing regulations lead to less competition and higher prices, but do not improve customer satisfaction. They found that consumers care about online reviews and prices more than about occupational licensing signals available on the platform. They found that licensing stringency is associated with fewer quotes and higher transaction prices but not better service, at least as measured through online reviews and propensity to use the platform again.
Corugedo and Ruiz (2014)	The EU Services Directive: Gains from Further Liberalization	France	Services sector	Unclear	Productivity	Through input output analysis, this paper finds important multiplier effects of greater efficiency services to the rest of the economy.
Forth et al. (2011)	A review of occupational regulation and its impact	United Kingdom	82 licensed jobs; 19 certified jobs; 20 jobs with registration requirements.	Forth et al., 2011, couples with Quarterly Labour Force Survey.	Qualification levels, training and wages	Licensing associated with higher wages; qualification levels and job related training for SOC Major Group 2 (Professional occupations) and 3 (Associate Professional and Technical Occupations). However, this was not the case for other groups.
Gittleman, Klee and Kleiner (2015)	Analyzing the Labor Market Outcomes of Occupational Licensing.	United States	N.A.	Survey of Income and Program Participation	Wages	Workers with a license earn around 8.4 percent higher wages on average controlling for detailed occupation characteristics.

Gittlemann and Kleiner (2016)	Wage Effects of Unionization and Occupational Licensing Coverage in the United States	United States	N.A.	CareerOneStop	Wages	The economic returns to union coverage are greater than those for licensing requirements. Moving to a licensed occupation from an unlicensed occupation conferred no wage gain.
Han and Kleiner (2016)	Analyzing the Influence of Occupational Licensing Duration and Grandfathering on Labor Market Outcomes	United states	3 major universally licensed occupations	Council of State Governments (1952) report	Labour Market outcomes	The authors found that duration years of occupational licensure are positively associated with wages for continuing and grandfathered workers. The estimates show a positive relationship of duration with hours worked, but find moderately negative results for participation in the labor market. Consequently, unlike some other labor market public policies, such as minimum wages or direct unemployment insurance benefits, occupational licensing would likely influence labor market outcomes when measured over a longer period of time.
Holen (1965)	Effects of Professional Licensing Arrangements on Interstate Labor Mobility and Resource Allocation	United States	Dentists, lawyers, physicians and surgeons	Survey of Current Business (January, 1950)	Migration and resources allocation	Empirical evidence is consistent with the hypothesis that professional licensing arrangements and practices in dentistry and law restrict interstate mobility among dentists and lawyers and distort the allocation of professional personnel in these fields.
Johnson and Kleiner (2017)	Is Occupational Licensing a Barrier to Interstate Migration?	United States	22 professions	IPUMS-USA Survey	Migration	Between-state migration rate for individuals in occupations with state-specific licensing exam requirements is 36 percent lower relative to members of other occupations.
Klee (2013)	How Do Professional Licensing Regulations Affect Practitioners? New Evidence.	United States	Accountants, attorneys, cosmetologists, teachers	Kleiner (2006)	Vocational training	More stringent licensing regulations are not associated with higher vocational class enrolment, although increased stringency among some regulations is positively related to whether respondents have acquired training since the current job began.
Kleiner, Gay and Greene (1982)	Barriers to Labour Migration: the case of Occupational Licensing	United States	3digit 14 universally licensed occupations	Public Use Sample (PUS) of the 1970 Census	Migration	Using a model of migration estimated for 14 occupations, the authors show that more restrictive state licensing statutes reduced immigration and were significantly related to increases in the earnings of the persons in these occupations.
Kleiner and Krueger (2010)	The Prevalence and Effects of Occupational Licensing	United States	Professional/Technical/Managers/Other/All	Gallup survey	Wages	Licensing has about the same quantitative impact on wages as do unions -- that is about 15 percent, but unlike unions which reduce variance in wages, licensing does not significantly reduce wage dispersion for individuals in licensed jobs.
Kleiner and Park (2014)	Life, Limbs and Licensing: Occupational Regulation, Wages, and Workplace Safety of Electricians	United States	Electricians	Department of Labour	Wages; workplace safety	Local licensing of electricians is associated with approximately a 12-percent wage premium beyond that afforded by state regulations and that certain aspects of occupational requirements of state licensing, such as age and education, as well as exam requirements, raise the wages of electricians by about 6 percent to 8 percent. No systematic influence of occupational licensing on the injury rates, severity of injuries, or death rates of electricians was found.
Kleiner et al. (2016)	Relaxing Occupational Licensing Requirements: Analysing Wages and Prices for a Medical Service	United States	Nurse Practitioners	Nurse, Practitioner's annual legislative	Wages, hours worked, transaction prices	When nurse practitioners have more independence in their scope of practice, their wages are higher but physicians' wages are lower, which suggests some substitution between the occupations. The analysis of

				updates for 1999–2010		insurance claims data shows that more rigid regulations increase the price of a well-child visit by 3–16 percent. However, they find no evidence that the changes in regulatory policy are reflected in outcomes that might be connected to the quality and safety of health services.
Kleiner (2016)	Labour Markets with Occupational Licensing: Their Economic Effects Battling Over Jobs: Occupational Licensing in Health Care	United States	Dentists and dental hygienists	American Community Survey	Wages; employment growth	States that allow hygienists to be self-employed have about 10 percent higher earnings, and that dentists in those states have lower earnings and slower employment growth.
Kleiner and Vorotnikov (2017)	Analysing occupational licensing among the states	United States	N.A.	Workforce survey conducted by Harris Poll Interactive, a subsidiary of the Nielsen Company.	Wages	The national estimates suggest that occupational licensing raises wages by about 11% after controlling for human capital and other observable characteristics. The analysis shows the influence of occupational regulation on wage inequality across the income distribution.
Kleiner and Soltas (2018)	A Welfare Analysis of Occupational Licensing in U.S. State	United States	N.A.	N.A.	Wages	Licensing raises wages and hours per worker but reduces employment in licensed occupations. For marginal occupations, the welfare costs of licensing thus significantly exceed the benefits.
Koumenta and Humphris (2015)	The Effects of Occupational Licensing on Employment, Skills and Quality : A Case Study of Two Occupations in the UK	UK	Nursery school workers and for security guards.	Labour Force Survey (LFS) is pooled together between 2000 and 2013	Employment, wages, skill levels	For nursery school workers, licensing has a negative effect on employment and wages but a positive effect on skill levels. For security workers, wages increase, but there is no effect on employment or skills. In both occupations a positive impact on quality was observed.
Koumenta and Pagliero (2017)	Measuring prevalence and labour market impacts of occupational regulation in the EU	EU	10 ISCO 1-digit professional groups	EU Survey of Occupational Regulation	Wages; employment; mobility; skills	Licensing is associated with higher wages; distorts relative wages; disproportionately benefits those at the higher end of the income distribution. Inconclusive results on employment.
Koumenta and Pagliero (2018)	Occupational Licensing in the European Union; Coverage and Wage Effects	EU	10 ISCO 1-digit professional groups	EU Survey of Occupational Regulation	Wages	Licensing is associated with 4% higher wages (one third attributed to rents; two-thirds attributed to signalling). Occupational licensing increases wage inequality; wage gains differ by occupation and level of education attainment.
Law and Kim (2005)	Specialization and Regulation: The Rise of Professionals and the Emergence of Occupational Licensing Regulation	United States	N.A.	N.A.	Wages, malpractice, mortality rates, entry rates	The evidence is consistent with the asymmetric information hypothesis, whereby occupational licensing was historically introduced to reduce information asymmetry.
Morikawa (2017)	Occupational licenses and labor market outcomes	Japan	N.A.	Survey of Life and Consumption under the Changing Economic	Wages; characteristics of license holders; labor market attachment	Nearly 40% of the working population use occupational licenses in their current jobs. Occupational licenses have a significant association with the labor market outcomes, and its association with the labor participation and wages are remarkable among females and elderly people. Estimated wage premiums are far greater for monopolistic licenses than for

				Structure and Policies		certifications, suggesting the existence of monopoly rents.
Pashigian (1979)	Occupational licensing and the interstate mobility of professions	United States	34 professions with a focus on legal professions	N.A.	Migration	The comparatively low interstate mobility rate of lawyers may be due to state licensing and restrictions on reciprocity or to the investments made by lawyers to develop local reputations or to the investments made by lawyers in state specific law.
Powell and Vorotnikov (2015)	Real Estate Continuing Education: Rent Seeking or Improvement in Service Quality?	United States	Real estate agents	The Massachusetts Division of Professional Licensure	Quality of service; number of entries	The analysis fails to find any improvement in the quality of service as measured by complaints to the real estate licensing board. We do find that the adoption of continuing education reduced the number of licensed active agents by 39 to 58 percent and increased the income of those who remained by 11 to 17 percent.
Redbird (2017)	The New Closed Shop? The Economic and Structural Effects of Occupational Licensure	United States	300 census-identified occupations	Current Population Survey (CPS)	Wage, hours, participation	Author argues that licensure, instead of increasing wages, creates a set of institutional mechanisms that enhance entry into the occupation, particularly for historically disadvantaged groups, while simultaneously stagnating quality.
Rojek and Masior (2016)	The Effects of Reforms liberalising Professional Requirements in Poland	Poland	22 regulated professions	Labour Force Survey	Wages, prices	The authors found that after deregulation of the professions of real estate agents and real estate managers, net creation of business in the sector was positive. The reform of the professions of city tourist guide, land tourist guide and tour leaders also coincided with an increase in the number employed in the sector.
Rostam-Afschar (2014)	Entry regulation and entrepreneurship: a natural experiment in German craftsmanship	Germany	craftsmen	German microcensus and German Confederation of Skilled Crafts	Entry/exit/stock of businesses	The results show that the complete exemption from the educational entry requirement has fostered self-employment significantly by substantially increasing the entry probabilities, while there is no evidence that exit rates have been affected.
Rostam-Afschar (2015)	Regulatory Effects of the Amendment to the HwO in 2004 in German Craftsmanship	Germany	Craftsmen	Census of Crafts, German microcensus, Establishment Panel of the Institute for Employment Research	Employment, revenues and wages	As a result of 2004 German Craftsmanship reform, the number of new entrants into these professions doubled between 2002 and 2008. Five years after the reform there were still more start-ups than companies going out of business. One of the direct consequences of reducing the qualification requirement for setting up a business is that fewer of the self-employed hold a degree. Evidence presented shows that training activities have not been significantly reduced due to the reform. The number of people starting an apprenticeship had already declined in both groups of occupations (deregulated and not deregulated) before the reform.
Rostam-Afschar, Pagliero and Koumenta (2019)	Effects of regulation on service quality	EU	Seven professions: Lawyers in Poland, Architects and Engineers in Germany,	1. Service satisfaction surveys (lawyers), 2. peer ratings and census data	Quality	Main findings of licensing effects on quality: 1. Advocates and legal advisors – small; 2. Architects and civil engineers – negative; 3. Pharmacists – positive;

			Pharmacists in Italy, Tourist Guides in Greece, Driving instructors in the UK, Ride-Hailing Drivers in Dublin and London	(architects and engineers), 3. confidential administrative data (pharmacists), 4. labour force survey data and online booking website (tourist guides), 5. administrative data (driving instructors) and 6. Uber data (ride-hailing drivers)		4. Tourist guides – mixed ; 5. Driving instructors – mixed; 6. Ride hailing drivers – no effects.
The White House (2015)	Occupational Licensing - A Framework for Policymakers	United States	N.A.	N.A.	N.A.	Study defines the best practices in licensing (i.e. limiting licensing requirements, applying the results of comprehensive cost-benefit-analysis, harmonizing regulatory requirements, allowing practitioners to offer services to their full potential) can allow States, working together or individually, to safeguard the well-being of consumers while maintaining a modernized regulatory system that meets the needs of workers and businesses.
Timmons and Thornton (2010)	The Licensing of Barbers in the USA	United States	Barbers	N.A.	Wages	Certain licensing provisions may have increased barber earnings by between 11 and 22 per cent. The magnitude of our estimates is somewhat higher than those found in studies examining the effects of licensing in similar professions.
van der Marel (2017)	Reforming Services: What Policies Warrant Attention?	EU	Professional Services	PMR	Growth	Reducing regulatory barriers create sustained dynamism in services by allowing firms to expand and grow, reaping further productivity gains that will eventually lead to higher economic growth.
van der Marel, Kren and Iootty (2016)	Services in the European Union: What Kinds of Regulatory Policies Enhance Productivity	EU	Professional services	Product Market Regulation	Productivity	Lowering overall service restrictions to an average feasible level of the three most deregulated EU economies would increase the productivity performance (in levels) of firms operating in both services and manufacturing industries by a maximum of 5.34 percent.
Zapletal (2017)	The Effects of Occupational Licensing Evidence from Detailed Business-Level Data	United States	Cosmetologists	Own compilations	Entry and exit patterns	No evidence that more intense occupational licensing regulation affects the equilibrium number of practitioners or leads to higher prices for consumers. However, such regulation substantially reduces practitioner entry and exit rates.