

## What We Know About Non-Degree Credentials: A Literature Scan

*A project of the Non-Degree Credentials Research Network at the George Washington Institute of Public Policy, The George Washington University<sup>1</sup>*

### Preface

Non-degree credentials are of growing importance to the system of credentialing in the United States, with growing numbers of workers seeking credentials that are often shorter, cheaper, and more versatile than traditional postsecondary degree programs. Yet, we know little about them, and research on college degrees still dwarfs efforts to understand non-degree credentials. Indeed, to date there has been no systematic effort survey the literature to see how adequate existing research is for answering questions critical to understanding this phenomenon. This is an initial effort to scan the literature to identify the strengths and limitations of existing research on non-degree credentials, and to identify gaps that scholars may be able to fill.

This effort to understand non-degree credentials comes at a time when important initiatives are improving our understanding of non-degree credentials through data collection efforts such as the Interagency Working Group on Expanded Measures of Enrollment and Attainment (GEMEnA) and Credential Engine. These efforts complement a growing body of scholarly research. Meanwhile, newfound attention to the potential for credentials awarded on the basis of work-based learning such as those awarded through apprenticeships and bootcamps to benefit workers who might not otherwise obtain an occupational credential is reflected in public policies that facilitate the expansion of these programs. Attention to the effects of occupational regulation through licensure is also increasing, with scholars contributing to major reports to policymakers on the potential effects of licensure on workers in the United States and abroad (Council of Economic Advisors 2015; Koumenta et. al. 2014). The Non-Degree Credentials Research Network (NCRN) was created to fill the gaps in our knowledge of non-degree credentials, and, as a starting point in this effort, this literature scan attempts to identify what we know about some of the most pressing public policy questions regarding non-degree credentials.

### Definitions

Ultimately, the five types of credentials that we have chosen to focus our attention on in the early stages of the NCRN and in this scan are certificates, certifications, licenses, apprenticeships, and bootcamps. These credentials exist at all levels of formal educational attainment and can be found in both educational and workforce training contexts. Other credential formats undoubtedly exist; however, we feel that these five can be differentiated from each other to a sufficient degree that distinct

---

<sup>1</sup> Corresponding author: Kyle Albert, [kalbert@gwu.edu](mailto:kalbert@gwu.edu). The support and feedback of the following members of the NCRN on prior drafts of this document is gratefully acknowledged: Evelyn Ganzglass, Michelle Van Noy, Heather McKay, Peter Blair, Burt Barnow and Steve Crawford.

definitions can be offered. Below we offer preliminary definitions of these credentials, while acknowledging that these definitions are not set in stone and some credentials may effectively blend multiple aspects of these definitions.

- A certificate is a credential issued in recognition of a postsecondary course of study, which can be either for-credit or noncredit. Many certificates are issued by postsecondary institutions, though professional/trade associations or other non-accredited entities can and often do develop certificate programs. Certificates cannot be revoked, as they are awarded on the basis of activities completed by the individual who earns the certificate. By the same token, certificates do not necessarily represent the competencies of an individual. In general, certificates are earned by completing individual courses which may have their own associated examinations, but there is not a cumulative final exam that must be passed before the certificate is issued.
- A certification is a voluntary, competency-based credential issued on the basis of demonstrating competency in a given subject matter through some form of assessment, often a standardized test. Certifications often require renewal on a periodic basis through the completion of activities that, in theory, demonstrate continuing competence. Certifications tend to be offered by trade and professional associations, though some corporations offer certifications related to the products and services they offer.
- Licenses are normally defined as competency-based, time-limited credentials that, unlike certifications, are required by the state in order to perform a designated set of occupational tasks for pay. Moreover, licensing often require additional training, require passing a test, and, in some cases, may exclude ex-offenders from having a license. Certification can be a prerequisite to licensure.
- Apprenticeships are formal programs of study that blend work experience with a structured program of coursework. In countries with well-developed apprenticeship systems like the United States and Germany, apprenticeships are normally regulated by the state. The term “apprenticeship” is sometimes applied to informal training programs that are not formally registered, however such programs tend not to result in the issuance of a formal credential and are therefore not a focus of this project.
- Bootcamps are a variant of certificate programs that are particularly popular in technology-related fields, offering immersive instruction and project-based learning over a period of up to a few months. They normally offer a certificate in recognition of program completion, but tend to lack formal accreditation. A strong argument can be made for analyzing bootcamps as a subset of traditional certificate programs, however the bootcamp experience for students differs substantially enough from a typical certificate program that we have decided to treat bootcamps as a separate phenomenon for the purposes of this document.

We chose not to define badges as a specific credential category as they vary widely in requirements and often are simply tools for communicating the completion of a credential such as a certification rather

than a credential in and of themselves, though we do acknowledge that some stakeholder organizations may view badges as a distinct class of credentials (Everhart 2016). Similarly, while internships are sometimes used as a signal of expertise by job seekers, they are also often well embedded in other credentials and not clearly recognized as standalone credentials in and of themselves. Moreover, very little empirical research exists on both badges and internships at the moment. While the lines between these credential types are often blurry, we nonetheless use them as a starting point for our scan of the literature and encourage the NCRN to explore whether additional credential formats fit within its mandate.

This literature scan is oriented around several overarching questions that many scholars are attempting to address in their research. Specifically, we ask the following questions:

- How prevalent are non-degree credentials in the US workforce?
- Who benefits from non-degree credentials in terms of labor market outcomes, and to what extent?
- Why have non-degree credentials proliferated in recent years?
- How do employers perceive and use non-degree credentials?
- What motivates individuals to pursue non-degree credentials?

These are not the only questions of importance and relevance by any means, but they do speak to some of the most pressing public policy challenges in relation to non-degree credentials. By exploring the contexts in which these questions have (and have not) been answered, we can identify areas in which researchers could focus future efforts to examine non-degree credentials with the ultimate goal of helping students, workers, employers, and the providers of education and training.

## **Methodology**

This scan is limited to documents that describe original research; opinion pieces are excluded, though we cite a few works that attempt to analyze the published research of others. As stakeholders in the world of non-degree credentials differ in their approaches to research and standards of evidence, we have tried to err on the side of being inclusive without altering our view of the literature with case studies and industry benchmarking reports that are unlikely to be generalizable. In general, we sought to focus our scan on books and works published in scholarly journals, though we also draw upon reports self-published by credible institutions such as Mathematica Policy Research, which has a track record for doing rigorous analyses of educational outcomes. We attempted to locate literature that addresses each of our research questions for each type of credential we consider, though for certain credential types we came up with less material than others. We identified literature both by conducting targeted searches for information on our specific research questions and by searching for work by specific researchers known to be active on the topic of non-degree credentials through the process of identifying nominees for the NCRN. Literature published within the past ten years was given greatest priority in our research, though we attempt to include influential studies from earlier times where appropriate. This scan is not

limited to research conducted inside or about the United States, though the literature we were able to locate is exclusively in English and the vast majority is conducted by US-based researchers. Studies of non-US credentials (such as British and German apprenticeship programs) were only included to the extent that they might inform policy or practice in the US. It is inevitable in this sort of project that we may have overlooked certain subjects of research that may be relevant, and we welcome feedback on literature that we may have overlooked.

### **Research Question 1. How prevalent are non-degree credentials in the US workforce?**

It is important to document the prevalence of non-degree credential in the US to gain an accurate measure of the scope of their impact on the US workforce both in the past and at present. Historical data on the prevalence of non-degree credentials is difficult to find, in part because no large-scale surveys of the US labor market have inquired about the prevalence of non-degree credentials on a regular basis. One of the first efforts was a nationally-representative survey conducted by Gallup that attempted to estimate the prevalence of licensure (Kleiner and Krueger 2010). From this research came a string of credential-related items on government surveys coordinated by the Interagency Working Group on Expanded Measures of Enrollment and Attainment (GEMEnA), starting with a module on the Survey of Income and Program Participation and continuing with items on surveys such as the Current Population Survey and the Education Longitudinal Study. Still, though, data is spotty relative to college degrees – especially when it comes to establishing long-term trends. While the 2016 Adult Training and Education Survey (ATES) provides cross-sectional data on the prevalence of certain credentials, it will not be repeated until 2019, with microdata available to researchers in 2020 or 2021. ATES provides detail on who earns different types of credentials and answers basic questions on the characteristics of credential-holders, though it does not enable us to identify outcomes associated with specific credentials. No state maintains comprehensive data on the attainment of non-degree credentials; the most tracked non-degree credential format, for-credit certificates, are only tracked for all students in 25 states (Leventoff 2018). Below we describe what is known about different types of non-degree credentials, starting with certification.

Anecdotal observations point toward a major surge in the number of certification programs and the number of occupations in which certification is available in the 1980s and 90s (Albert 2017; Gallagher 2016), but no official, comprehensive records exist. The federal government does not require certification bodies to register with any agency (though some effort is made to track certification programs that may be of interest to job seekers through the Career OneStop Certification Finder database), and states tend to make minimal effort to track the attainment of credentials other than degrees and licenses. Complicating matters further, researchers charting the entire population of certification programs in the United States have used different definitions of what constitutes a bonafide certification program and different methodologies for ensuring the comprehensiveness of their count. Weeden (1999; 2002) found evidence for the existence of 1,908 certification programs, supplementing records in the annual *Encyclopedia of Associations* and *Professional and Trade Associations of the United States* directories with her own data collection. Carter (2005) identified a far smaller number of certifications a few years later, though she may have targeted more established certification programs in her count.

Weeden's dissertation also represented the only effort to estimate the percentage of the workforce holding at least one certification across all occupations (6.8%) prior to the introduction of certification items on federal surveys over the past decade, an effort that began in earnest with Topical Module 13 of the 2008 panel of the Survey of Income and Program Participation (SIPP). Since then, data from the 2015 and subsequent waves of the Current Population Survey (CPS) and ATES provide new estimates of the prevalence of certifications and licenses across the entire population, with the caveat that CPS data is structured in such a way that one cannot reliably differentiate between certifications and licenses due to ambiguity in the wording of the question in which respondents are asked to identify the credential issuer. Recent federal surveys are also limited insofar as they tend to ask about one's "most important credential," which could be either a certification or license – leaving us in the dark about whether a license is held concurrently with certification. Using the 2008 SIPP, Ewert and Kominiski (2014) estimate that 21% of the US adult population has either a certification or a license; Cronen et al (2017) use 2016 ATES data to estimate that 21% of the adult population has a license and 7% has a certification, with some overlap between those populations.

In contrast to certification, national estimates of the percentage of the workforce covered by licensure have fallen somewhat as coverage on national surveys has improved over time. Weeden (1999) estimated that 33% of the US workforce was licensed by estimating the proportion of the workforce in occupations where licensure was known to exist. Kleiner and Krueger (2010), using a nationally-representative Gallup poll, estimated that 29% of the US working population in 2008 held an occupational license, significantly exceeding the 21% estimated by Cronen et al. (2017) using nationally representative survey data from the ATES.

Numerous attempts have also been made to chart the prevalence of postsecondary certificates. In high-demand fields, such as computer science and related fields, the number of certificates surged from the late 90s onward with certificates issued by nonprofit institutions growing much faster than those issued by for-profits (Kuehn and Jones 2018). Ewert and Kominiski (2014) estimated that 8.9% of the adult population holds a certificate, which falls between the 12% of the adult population with a certificate estimated by Carnevale, Rose, and Hansen (2013) and 8% estimated by Cronen et al. (2017). Both Ewert and Kominiski and Cronen et al. found that certifications are most likely to be held by individuals who already hold a postsecondary degree, with 30% of the adult population holding an associate's degree also holding a certification or license and over half of master's, doctoral, and professional degree holders also holding such a credential.

Certificates are targeted toward different types of learners; some, particularly those issued by community colleges, are designed for individuals with no postsecondary credential, while others (especially non-credit certificates) are designed to complement existing credentials. Survey data shows that certificates are particularly likely to be held by those with some exposure to college education but no bachelor's degree (Cronen et al. 2017). A 2018 tabulation of data from the Integrated Post-Secondary Education Data System confirmed the concentration of certificates at the sub-baccalaureate level: 66,997 unique certificate programs were found to exist the United States, of which 56,128 are targeted toward the sub-baccalaureate population (Credential Engine 2018). It is unclear how well existing studies capture data on non-credit certificate programs, such as certificate programs managed by

university extension schools that award continuing education units rather than transferrable credits.<sup>2</sup> Noncredit college instruction is particularly difficult to measure; it was estimated that 10% of all college courses (and 20% of all community college courses) were noncredit (Voorhees and Milam 2005), but most evidence on the nature of noncredit instruction – including the availability of credentials such as postsecondary certificates associated with noncredit courses – tends to consist of case studies (see, e.g., Van Noy 2008). Noncredit courses in an intensive in-person “bootcamp” format rapidly grew in popularity in recent years; as of 2017, 1,387 programs were believed to exist worldwide in technology-related fields of study. The vast majority, 1,010, of those programs were located in the United States, mostly in large cities and mostly offering coursework in web development (Arbeit et al. 2019).

Researchers have also attempted to gauge the extent of work-based learning credentials such as apprenticeships. Registered apprenticeships reach 410,000 workers in the United States as of 2016, though it has been argued that many more occupations are suitable for the introduction of apprenticeship programs (Fuller and Sigelman 2017). However, apprenticeships also exist as unregistered programs that lack the formal legal structure and protections of a registered apprenticeship and may in fact have more in common with internships. Variation in the types of apprenticeships available to American workers is likely to grow as the Department of Labor launches a new program for recognizing apprenticeships, the Industry-Recognized Apprenticeship Program, in the near future.

The above data points point to a picture of the extent of non-degree credentials and their role in the overall system of training and credentialing in the United States that is still incomplete but improving over time. Complicating efforts to understand the overall size and distribution of non-degree credentials is that certain credentials are often embedded in other credentials; for example, certificates and bootcamps can be completed as part of college degrees, as can certifications (Zanville, Porter, and Ganzglass 2017; McCarthy and Prebil 2018). High schools have also embedded certifications within their curricula to varying degrees of success, allowing one to obtain an IT certification while completing one’s diploma (Haimson and Van Noy 2004). Newer surveys are moving toward more nuanced definitions of credentials and questions that reflect the extent to which non-degree credentials tend to be stacked atop or embedded within one another and traditional college degrees, which may lead to the refinement of some of the estimates of prevalence in the current literature. In the meantime, we can say with confidence that non-degree credentials are a labor market phenomenon that reach a substantial portion of the US population and have grown in popularity over time.

## **Research Question 2. Who benefits from non-degree credentials in terms of labor market outcomes, and how much?**

---

<sup>2</sup> Continuing education units (CEUs) are offered by some higher education institutions to recognize student progress toward certificates. CEUs are often difficult to define in relation to credit hours; for the purposes of this review, we note that CEUs can be awarded for coursework that would not normally merit academic credit, whereas activities for credit would normally meet the standard for CEUs. Official guidance from the US Department of Education recognizes the uncertainty and lack of uniformity in non-credit education, warning international counterparts that CEUs are “awarded for a variety of experiences in different settings whose only common criterion is that they be measurable, supervised educational or training experiences with defined starting and ending points” (US Network for Education Information 2008).

Research attempting to establish a wage premium associated with any type of credential not mandated by the state, be it a degree or a non-degree credential such as a certification, faces the challenge of controlling for the possibility that more motivated or competent individuals may simultaneously be more likely to certify and likely to enjoy higher wages even in the absence of a certification or other credential. The phenomenon of more capable and competent individuals self-selecting into certification is not simply hypothetical: research on individuals who sit for HR certifications confirms that certification earners indeed tend to be more motivated and report higher confidence in their competency than those who do not attempt to certify (Fertig 2010). Researchers must also contend with substantial variation in the value of credentials across different fields of study. Nonetheless, researchers have attempted to isolate the extent to which the value of non-degree credentials can be attributed to the value added by a credential itself – whether due to its signaling value or the enhancement of human capital – relative to the effect of self-selection.

Weeden (1999; 2002) was among the first scholars to demonstrate the potential value of non-degree credentials, finding that average occupation-level wages tended to be higher where certification density was higher and workers were more likely to be subject to licensure. Bol and Weeden (2015) find evidence of similar macro-level benefits to occupations that compel a large proportion of their members to hold non-degree credentials in an analysis of the UK and German labor markets. Recent research on certification has shifted from the examination of occupation-level benefits to the individual worker as the unit of analysis. Renski (2018) argues that all manufacturing workers get some sort of wage premium from certification and licensure that cannot be accounted for on the basis of “endowments,” such as educational and demographic characteristics; subsequent research suggests that such returns may be highest for those who lack a bachelor’s degree (Baird, Bozick, and Zaber 2019). Similarly, Albert (2016) finds evidence of a certification earnings premium in a cohort of young workers even when controlling for individual characteristics that might predict self-selection into certification, such as high school test scores. Research of a descriptive nature comparing median wages for certified and non-certified workers also finds that certified workers tend to earn more than their peers (Ewert and Kominiski 2014; Cronen et al. 2017). However, the certification premium may disproportionately accrue to male workers, whose return on investment may be amplified by the likelihood that they received employer support to pay for their certification (Tesfai, Dancy, and McCarthy 2018). This male certification premium is especially strong for workers without an associate’s or higher degree (Kim and Chatterji 2018).

Credit-bearing certificates, including but not limited to those issued by community colleges, are also known to increase graduates’ earnings. Dadgar and Trimble (2012) found in a longitudinal study of individuals who completed sub-baccalaureate certificates that such credentials are associated with higher wages, especially for women; another estimate put the average earnings premium for a sub-baccalaureate certificate at 20% (Carnevale, Rose, and Hansen 2013). Certificates are also associated with increased employability, though the returns to certificates vary dramatically across fields of study (Xu and Trimble 2016; Jepsen et al. 2014) and tend to be lower when a certificate is issued by a for-profit institution (Deming 2016) or a community college that serves relatively disadvantaged populations (Jacobson 2011). These returns have been found to be lower than the returns to associate’s degrees (Bahr et al. 2015). Another longitudinal study of the earnings premium found more modest returns in

terms of earnings to certificates and other non-degree postsecondary credentials (“diplomas”), though returns were stronger in the health sciences than in other fields (Liu et al. 2015). This relatively recent research contrasts with prior findings of no significant earnings premium at all for men who earn sub-baccalaureate certificates and only a modest premium for women (Grubb 1992).

In contrast to other types of credentials, research on licensure paints a mixed picture of the effect of licensure on the overall dynamics of the labor market and the income of individual workers. Recent research estimates a 17-27% reduction in the overall supply of workers in licensed occupations (Blair and Chung 2018), creating scarcity that should drive up wages. In the European Union, licensure is associated with an average 4% earnings premium for those who attain it, with about one-third of those gains being related to the restriction on labor market entry imposed by licensure and two-thirds of those gains related to licensure’s signaling power (Koumenta and Pagliero 2018). However, the effect of licensure on wages varies greatly from occupation to occupation; in the UK, the wage premium varies from 1.7% to 19% (Koumenta et al 2014). While some of the benefit of licensure may be difficult to differentiate from credentials one must complete in order to qualify for a license, licensure seems to contribute to wages independently of other credentials (Bailey and Belfield 2018).

The benefits of licensure tend to vary across demographic and socioeconomic strata. Licensure requirements impose tangible costs that may dissuade individuals from pursuing work in a licensed occupation, such as an average of \$262 in application and examination fees in the United States (Carpenter et al. 2018); these costs may also discourage interstate migration by workers in licensed occupations (Johnson and Kleiner 2017). However, immigrants and minorities are thought to benefit from licensure (Zhang 2018; Redbird 2017) – if not in terms of wages, then in terms of access to regulated occupations in which credentialing requirements give employers less room to exclude qualified workers for subjective reasons such as ethnic discrimination (Redbird 2017). Licensure has an especially strong impact on the earnings of non-Western immigrants in Norway, though such benefits do not appear to exist for other immigrants who obtain it (Drange and Helland 2019). Licensure also seems to have limited effects on nurses who move between US states (DePasquale and Strange 2015). However, individuals earning more than \$40,000 per year are more likely than those who earn less to report that their credentials are very useful for getting a job, increasing their pay, or improving their skills (Columbus 2019). Interestingly, Columbus finds that this class bias in the value of non-degree credentials persists for all types of credentials he studied using 2016 ATES Survey data, including certifications, licenses, certificates, and work-based learning programs such as apprenticeships.

Across the board, registered apprenticeships appear to yield substantial returns for participants in the United States; in a major study of registered apprenticeships in 10 states, an average annual wage premium of \$5,839 persisted nine years after program completion; it is unclear whether these returns result from apprenticeship functioning as a barrier to entry, improved human capital and productivity, or some combination of reasons (Reed et al. 2012). Formal apprenticeships provide different benefits to different subpopulations and may depend on institutional characteristics. For example, apprenticeships jointly managed by labor unions and employers tend to be more diverse in terms of gender and race than comparable programs managed solely by employers (Glover and Bilginsoy 2005). Research on apprenticeships in the European context finds that apprenticeships are often sought by immigrants



transitioning to new countries, but immigrants tend to face challenges in securing permanent positions after completing their apprenticeship programs (Protsch and Solga 2015). The high returns to apprenticeship in the United States contrast with the findings of research on apprenticeship in the United Kingdom, where apprenticeships often fail to upgrade skills, tend not to be accessible to disadvantaged workers (Fuller and Unwin 2017), and are deeply segregated by gender (Fuller, Beck, and Unwin 2005).

The value of non-degree credentials on work hours and qualitative aspects of work (e.g., job satisfaction) remains largely unexplored – though recent work in Germany has suggested that the increasing prevalence of certifications in a given occupation can function as a barrier to entry that prevents firms from turning to temporary and contingent/freelance workers (Stuth 2017). Research using Canadian data found that licensure, unlike unionization, does not affect workers' access to tangible fringe benefits such as profit sharing and incentive pay (Zhang 2018); however, in the US there is evidence that licensure is associated with a higher probability of access to a pension plan and lower turnover (Gittleman, Klee, and Kleiner 2015). The completion of work-based learning programs, such as apprenticeships, is also associated with future job quality (broadly defined to include income, hours of work, and job satisfaction) in a longitudinal study of early-career workers (Ross et al. 2018). The effect of certificates and other instruction-based non-degree credentials (e.g., bootcamps) on outcomes other than wages and turnover remains unknown.

In interpreting the above findings, it is important to note that substantial differences between occupations and industries, and across states and regions, exist that complicate efforts to declare that a particular type of credential is associated with a particular benefit. Moreover, non-degree credentials can be earned concurrently with each other, making it difficult to disentangle the labor market value of any one specific credential – though we lack data on how common it is for individuals to earn multiple non-degree credentials. Research using job posting data suggests that certifications are heavily concentrated in certain occupations, and that their value varies greatly from occupation to occupation. In some occupations, certifications have little to no labor market value (Markow, Restuccia, and Taska 2017), while in others (such as information technology) certification can be instrumental to advancement (Adelman 2000). Many of the above studies have failed to identify specific occupations in which the returns to credentials are highest, and very little effort has been made by researchers to identify whether specific credentials issued by specific organizations are more rewarding than others. Thus, research on the characteristics of specific credentials that may contribute to the value of non-degree credentials appears to be a sizeable gap in the literature.

### **Research Question 3. Why have non-degree credentials proliferated?**

Non-degree credentials vary widely in the reasons that they emerge, with commonly-identified reasons ranging from concerns on the part of professional societies or employers about human capital development to rent-seeking behavior on the part of incumbent workers. Certifications in particular are thought to emerge to satisfy labor market demand on the part of job-seekers for training and credentials not available in the formal higher education system, whether due to the inability of colleges to keep up with demand or a preference on the part of higher education institutions to avoid subjects

considered too applied or vocational in nature. Indeed, escalating skill requirements as technology becomes more complex and the prevalence of short-term employment relationships that require workers to consistently master new skillsets for different projects, such as proprietary programming languages (Adams and Demaiter 2008). Scholars have argued that this “filling the gaps” hypothesis explains the proliferation of certification programs in fields in which demand for degrees outstrips (or has historically exceeded) supply, including information technology (Adelman 2000; Bartlett 2012; Gallagher 2016) and tourism (Morrison et al. 1992). Likewise, certificates have a long history of popping up in fields in which demand for credentials outstrips the supply of degrees from accredited colleges, with many business-oriented vocational schools dating back to the mid-1800s and a significant number of cosmetology programs emerging in the 1920s (Brown and Kurzweil 2017). However, the rapid obsolescence of narrowly specialized credentials can also be a deterrent to obtaining them for some workers in a comparative survey of US, Australian, and Canadian IT workers (Adams and Demaiter 2008). Certificates may also be quicker to complete than traditional education and more targeted to the final work task, which could be desirable for individuals who are more hands-on learners.

Protection of the public from unqualified service providers is often stated as a reason for the adoption of licensure and explains the persistence of licensure in healthcare occupations (Kleiner 2016) and other professional fields (Kleiner 2013; Schmitt 2015). Similarly, isomorphism or institutional mimicry between states, educational institutions, corporations, and occupational/trade associations also cannot be ruled out as factors contributing to the spread of non-degree credentials, although the concept of diffusion is more commonly applied to quality certifications held at the organizational level than personnel certifications (see. e.g., Corbett and Kirsch 2001). In the case of occupational licensure, substantial evidence exists to suggest that policies diffused across between American states in the early 20<sup>th</sup> century, with licensure laws in specific occupations tending to diffuse outward from early adopters (Zhou 1993). Similarly, occupational associations and educational institutions could be learning from and to some degree copying each other in launching certification and certificate programs, though empirical research is needed to test this hypothesis.

Another potential factor leading to the adoption of non-degree credentials is the perception that such credentials can generate revenue for credentialing organizations and, in the case of licensing, state governments. Albert, in a 2016 dissertation, argued that the proliferation of certification programs in the 1980s and 90s was related in part to a growing concern among association managers for non-dues revenue. This coincided with falling rates of association membership in the United States, which threatened traditional revenue streams for professional associations. Research published by the American Society of Association Executives confirms the importance of certification programs for the revenues of professional associations (Albert and Dignam 2011; Tschirhart, Lee and Travinin 2014). Professional associations do not appear to be the only organizations with an interest in generating revenue through non-degree credentials, however. Certificate programs and other non-degree credentials can also, on net, contribute to the financial stability of established colleges and universities (Alstete 2014; Fong, Janzow, and Peck 2016). Four year higher education institutions invest heavily in promoting their certificate programs, though their marketing often fails to help prospective students differentiate between certificates and other types of credentials such as baccalaureate degrees and

relies heavily on the overall branding of the college or university offering the certificate (Van Rooij and Lemp 2010).

Professional prestige and status is also cited in some studies as a benefit of certification that accrues both to individual practitioners (Davis and Rubin 1976) and to entire professions, which can use certification as a tool to claim legitimacy and cement their place in the overall division of labor (see, e.g., Osagie 1996). Establishing the boundaries of an occupation and field of practice is one of the reasons that occupational leaders are thought to want to establish certification programs and licensure requirements (Abbott 1991; Schmitt 2015). Indeed, profession-building and competition with related occupations likely motivated the National Association of Realtors to push for certification and licensure in the early to mid-20<sup>th</sup> century (Hornstein 2005). Occupations differ in the extent to which they prioritize the enactment of certification or licensure, with many preferring to maintain certification programs while keeping licensure at bay (Schmitt 2015). However, in general, sociologists and economists have tended to view the enactment of credentialing requirements as consistent with the interests of occupational associations and their members, even in cases where a credential may not necessarily benefit (or may even work to the disadvantage of) employers.

#### **Research Question 4. How do employers perceive and use non-degree credentials?**

A substantial body of literature has emerged in recent years on how employers use credentials and where credentials fit into the overall hiring process. The role of non-degree credentials is the subset of this literature that we survey here. The literature we find is particularly dense in implications for the study of certificates and work-based credentials. Because licensure is mandatory for the performance of certain tasks, there will not be as much research to cite on employer preferences for licensed workers. Nonetheless, it is possible that licensure can be viewed by employers as a signal of competence that is relevant for individuals seeking to work in areas related to a license but for which a license is not directly required. For example, a license in accounting (CPA) could be an asset for tax preparation work, even though tax preparation does not require a license in most states. This signaling value of a credential of any type could both signal a potential employee's competence to an employer and help an employer (or self-employed individual) signal the competence of a service being offered to the public. Moreover, non-degree credentials – particularly licenses - are hypothesized to signal non-felony status that could be particularly valuable in the hiring process for disadvantaged workers (Blair and Chung 2018).

Employers tend to report that they do consider certifications to be signals of quality and that, at least in certain fields such as human resource management, there is at least a limited preference for certified workers when making hiring decisions (Lester, Fertig, and Dwyer 2011). Indeed, research on hiring managers' use of information technology certifications suggests that certifications provide a means of differentiating between candidates that improves the efficiency of the hiring process (Bartlett et al. 2005). Similarly, even if not specifically required, the majority of manufacturing employers report that non-degree credentials have value for selecting applicants – and this preference for credentialed workers is strongest in large organizations (Workcred 2018). However, employer preferences are often unstated in job postings and vary substantially by occupation and industry. Despite being a certification-rich field, only 0.5% of job postings in human resource management indicate that certification is a job

requirement (Aguinis et al. 2005). Yet, a survey of directors of IT departments found that a substantial portion (45%) of respondents expected or desired certification in their employees, suggesting substantial variation between sectors in the extent to which employers demand certification (Wierschem et al. 2010), a finding that was confirmed in 2017 research by BurningGlass Technologies that examined the relative rate at which job postings state a preference for certifications across sectors. The inconsistency between employers in their demand for credentialed workers is not new, and does not only apply to certification; with so many different types of credentials that employers must be familiar with and differing legal environments across firms and occupations that may make certification desirable, heterogeneity in the use of non-degree credentials could be inevitable. Moreover, employer confusion on non-degree credentials could lead them to not invest heavily in learning to differentiate between credential providers and ascribe the same preferences across all credentials of a particular format and level (Deterting and Pedulla 2016).

Registered apprenticeships are valued by employers because they can facilitate the recruitment of new workers, though employers also view apprenticeships as a means of ensuring the skill development of their new hires and ensuring compliance with occupational regulations (Lerman, Eyster, and Chambers 2010; Lerman, Eyster, and Kuehn 2014). In some organizations, individuals who complete apprenticeships also tend to advance faster and be more productive than workers recruited through other channels (Kenyon 2005). Thus, researchers seem to associate employers' pursuit of apprentices with human capital accumulation to a greater extent than the signaling of commitment or competence.

#### **Research Question 5. What motivates individuals to pursue non-degree credentials?**

Non-degree credentials are sometimes earned because they are embedded in or required to pursue another credential such as an occupational license or college degree, in which case students may have little agency in deciding to pursue a non-degree credential; in such cases, the fees associated with non-degree credentials can become significant barriers to attainment (McCarthy and Prebil 2018). However, other credentials – especially certifications – are selected by an individual among several different credential options.

Research suggests that individuals tend to seek non-degree credentials in order to signal their capability to clients. The earnings premium associated with certification seems more likely to come from the human capital that a certification represents rather than the certification itself. Signals of competence are particularly important for self-employed individuals who can use certification as a marketing tool; this element of certification is thought to drive the proliferation of certifications in financial planning (Cohen 1996) and tax preparation (Albert, Galperin, and Kacperczyk 2017).

Probably the most studied occupation with respect to examining why employed individuals pursue certification is nursing. A series of studies was funded by the American Board of Nursing Specialties in the first decade of the twenty-first century, much of it using a “perceived value of certification tool” (i.e., survey instrument) that was developed to examine the value of specialty certifications. Such studies consistently found strong evidence that certification provides emotional benefits such as a sense of accomplishment and recognition among one's peers, but did not find

consistent evidence that higher earnings or professional advancement is associated with certification (Gaberson et al. 2003). Similar evidence of perceived non-economic benefits have been found to motivate certification attainment in the construction industry (Tucker et al 2012). And, international research on project management certification suggests that the nature of benefits individuals reap from certification changes over time, with individuals reporting more economic benefits as their credentials age (Blomquist et al 2018). Thus, cumulative evidence points to a potentially important effect of non-degree credentials on individual well-being and the formation of occupational communities.

We were unable to locate literature specifically addressing the reasons that individuals pursue certificate programs, though we note that research exists on why individuals leave such programs (Lohman and Dingserson 2005) and finds that individuals often decide that they only need to complete a portion of a certificate to meet their goals.

### **Conclusion: What are the most pressing research needs?**

The NCRN exists in part to identify the most critical areas for future research and this literature scan is intended to be a starting point that inspires further reflection on the part of the research network, which may include the identification of essential research questions not even mentioned in this document. The NCRN may also want to facilitate research on credential types that fall outside the categories discussed above, such as badges and internships. Thus, the below areas of potential future research should be interpreted as merely suggestions rather than definitive guidance. However, in the absence of other efforts to identify gaps in the literature on non-degree credentials, the gaps in the literature that were highlighted in this literature scan are useful as starting points as the NCRN develops working groups that seek to design new research studies and advance our understanding of credentialing phenomena.

An examination of each of the above questions leads to the identification of areas in which the existing research is incomplete or neglects critical analyses necessary to advance our understanding of non-degree credentials. On the subject of the prevalence of credentials, we clearly need more data on certain types of credentials and credential combinations. The relative prevalence of different types of non-credit certificates by occupation and industry and practices with respect to the accumulation of multiple non-degree credentials, either independently or through coordinated programs of study, remain relatively unexplored as research topics. It may be helpful to know, for example, whether certain pathways or pairings of different credentials are particularly helpful for workers. Credentialing institutions would be better able to design non-degree credentials and policymakers would be better able to incentivize the acquisition of credentials if we knew whether, and where, synergies improve outcomes associated with accumulating non-degree credentials alongside college degrees or in conjunction with other non-degree credentials. We know that drawing connections and pathways between different types of degrees and non-degree credentials can result in tangible gains for workers (Fain 2018), but empirical research on the specific combinations that benefit workers is elusive.

The existence of an earnings premium for the median non-degree credential is supported in the current literature, though the relation between non-degree credentials and other labor market

outcomes may be of interest to researchers. More research is certainly needed on why credential issuers are launching non-degree credentials and to what extent they line up with labor market demand, including how well new credentials meet the needs of employers. Such research could stimulate public policies that incentivize the creation and growth of credentials that contribute to economic development.

We also know little about how individuals choose between different non-degree credential options (or choose between degrees and non-degree credentials) when they are presented with different options, and how clearer or more complete information about non-degree credentials would change consumer behavior. While we have data points about why some individuals choose to pursue certification, generalizable reasons for pursuing certificates, bootcamps, licenses, and apprenticeships are largely unknown. Existing theories guide researchers toward explanations grounded in signaling and human capital theory. However, alternate explanations, such as the networking value of completing certain credentials and the signaling of membership in occupational communities, could be explored.

Another topic on which minimal research exists is the extent to which non-degree credentials improve the quality of service provided by credentialed workers, which may manifest itself through productivity or customer satisfaction. Where this research question has been studied, prior research has mostly been in the context of specialist certifications pursued by individuals who already hold a professional degree such as an M.D., and therefore falls outside the NCRN's topical focus (e.g., Anderson 2016; Barrios 2019; Deyo 2016). Nonetheless, there is a clear need for research on how non-degree credentials compare to each other, and to degrees, with respect to learning outcomes and long-term occupational competency. Indeed, we know little about the extent to which non-degree credentials correspond to even basic skills. The value of the continuing education and recertification requirements associated with some credentials may also be worthy of exploration.

The review of research relevant to the third research question –why non-degree credentials have proliferated in recent years – also points us to deficiencies in the current literature. We know little about why different types of institutions create credentials, and why they choose to launch those credentials in formats other than college degrees. Our understanding of the origins of apprenticeship, bootcamp, and other certificate programs is particularly lacking. It seems likely that the state plays a role in determining whether particular programs will emerge and grow, but the factors that motivate new credentials are largely unexplored. Similarly, the motivations of individuals to pursue non-degree credentials – and the extent to which those motivations are based on a clear understanding of the credentialing options available to workers – is largely unexplored for three of the five types of non-degree credentials that were emphasized in this literature scan. Clearly, there is a need for research that examines whether the factors that motivate institutions to offer and individuals to pursue particular types of non-degree credentials in particular industries, such as nursing certifications, also motivate the development and attainment of other types of credentials.

Finally, little research is published on who passes examinations for certifications and licenses and the characteristics of those who start but do not complete certificates. A study of Certified Financial Planner candidates found that college entrance test scores and one's prior educational background is

highly predictive of passing one's examination, as is the amount of time one invests in studying for the test (Cutler 2005). Research also exists on completion rates in apprenticeship programs, suggesting that the structure of a program affects the likelihood that students drop out before completion and that individuals who drop out tend to do so relatively early in their training (Bilginsoy 2007). However, we have no idea whether these findings are representative of the broader universe of non-degree credentials, and knowing more about the factors that predict success in attaining a non-degree credential may help researchers contribute to the design of credentials that effectively meet the needs of disadvantaged workers.

## References

Abbott, Andrew. 1991. "The Order of Professionalization: An Empirical Analysis." *Work and Occupations* 18(4): 355–84. <https://doi.org/10.1177/0730888491018004001>.

Adams, Tracey L., and Erin I. Demaiter. 2008. "Skill, Education and Credentials in the New Economy: The Case of Information Technology Workers." *Work, Employment and Society* 22(2): 351–62. <https://doi.org/10.1177/0950017008089109>.

Adelman, Clifford. 2000. *A Parallel Postsecondary Universe: The Certification System in Information Technology*. Washington, DC: ED Pubs. <https://eric.ed.gov/?id=ED445246>.

Aguinis, Herman, Sarah E. Michaelis, and Nicole M. Jones. 2005. "Demand for Certified Human Resources Professionals in Internet-Based Job Announcements." *International Journal of Selection and Assessment* 13(2): 160–71. <https://doi.org/10.1111/j.0965-075X.2005.00310.x>.

Albert, Kyle. 2016. *Why Certify? Examining the Consequences of Occupational Certification for Individuals and Professional Associations*. Ph.D. dissertation, Cornell University.

Albert, Kyle. 2017. "The Certification Earnings Premium: An Examination of Young Workers." *Social Science Research* 63: 138–49. <https://doi.org/10.1016/j.ssresearch.2016.09.022>.

Albert, Kyle, Roman Galperin, and A. Kacperczyk. 2018. "Occupational Licensure and Entrepreneurs: The Case of Tax Preparers in the U.S." *Industrial and Labor Relations Review*, forthcoming. <http://lbsresearch.london.edu/1016/>.

Albert, Lillie and Monica Dignam. 2010. *The Decision to Learn: Why People Seek Continuing Education and How Membership Organizations Can Meet Learners' Needs*. Washington, DC: American Society of Association Executives.

Alstete, Jeffrey W. 2014. *Revenue Generation Strategies: Leveraging Higher Education Resources for Increased Income*. New York: John Wiley & Sons.

Anderson, Mark, Ryan Brown, Kerwin Charles, and Daniel I. Rees. 2016. "The Effect of Occupational Licensure on Consumer Welfare: Early Midwifery Laws and Maternal Mortality." Working paper. Cambridge, MA: National Bureau of Economic Research. <https://www.nber.org/papers/w22456>

Arbeit, Caren Sanders, Alexander Bentz, Emily Forrest Cataldi, and Herschel Sanders. 2019. *Alternative and Independent: The Universe of Technology-Related 'Bootcamps'*. Research Triangle Park, NC: RTI Press. <https://doi.org/10.3768/rtipress.2018.rr.0033.1902>.

- Bailey, Thomas, and Clive Belfield. 2018. "The Impact of Occupational Licensing on Labor Market Outcomes of College-Educated Workers." <https://ccrc.tc.columbia.edu/publications/impact-occupational-licensing-labor-market.html>.
- Bahr, P. R., Dynarski, S., Jacob, B., Kreisman, D., Sosa, A., & Wiederspan, M. 2015. *Labor market returns to community college awards: Evidence from Michigan*. New York, New York: Center for the Analysis of Postsecondary Education and Employment, Teachers College, Columbia University.
- Baird, Matthew, Robert Bozick, and Melanie Zaber. 2019. *The Labor Market Returns to Occupational Credentials*. Pittsburgh, PA: RAND Corporation.  
[https://www.rand.org/pubs/working\\_papers/WR1299.html](https://www.rand.org/pubs/working_papers/WR1299.html)
- Barrios, John M. 2019. "Occupational Licensure and Accountant Quality: The 150-Hour Rule." Becker Friedman Institute for Research in Economics Working Paper No. 2018-32.  
[https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2893909](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2893909)
- Bartlett, Kenneth R., Sujin K. Horwitz, Minu Ipe, and Yuwen Liu. 2005. "The Perceived Influence of Industry-Sponsored Credentials on the Recruitment Process in the Information Technology Industry: Employer and Employee Perspectives." *Journal of Career and Technical Education* 21(2): 51-65.  
<https://doi.org/10.21061/jcte.v21i2.661>.
- Bartlett, K. R. 2012. "A Theoretical Review of the Signaling Role of Certifications in Career and Technical Education." Paper presented at the annual conference of the Association for Career and Technical Education Research, Atlanta, GA.  
[http://www.nrccte.org/sites/default/files/uploads/barlett\\_acter\\_nexus\\_paper.pdf](http://www.nrccte.org/sites/default/files/uploads/barlett_acter_nexus_paper.pdf)
- Bilginsoy, Cihan. 2007. "Delivering Skills: Apprenticeship Program Sponsorship and Transition from Training." *Industrial Relations: A Journal of Economy and Society* 46(4): 738–65.  
<https://doi.org/10.1111/j.1468-232X.2007.00495.x>.
- Bilginsoy, Cihan, and Robert W. Glover. 2005. "Registered Apprenticeship Training in the US Construction Industry." *Education + Training* 47(4/5): 337–49.  
<https://doi.org/10.1108/00400910510601913>.
- Blair, Peter Q, and Bobby W Chung. 2018. "How Much of Barrier to Entry Is Occupational Licensing?" Working Paper. Cambridge, MA: National Bureau of Economic Research.  
<https://doi.org/10.3386/w25262>.
- . 2018. "Job Market Signaling through Occupational Licensing." Working Paper. Cambridge, MA: National Bureau of Economic Research. <https://doi.org/10.3386/w24791>.
- Blomquist, Tomas, Ali Dehghanpour Farashah, and Janice Thomas. 2018. "Feeling Good, Being Good and Looking Good: Motivations for, and Benefits from, Project Management Certification." *International Journal of Project Management* 36(3): 498–511. <https://doi.org/10.1016/j.ijproman.2017.11.006>.
- Bol, Thijs, and Kim Weeden. 2015. "Occupational Closure and Wage Inequality in Germany and the United Kingdom." *European Sociological Review* 31(3): 354-369.
- Brown, Jessie and Martin Kurzweil. 2017. *The Complex Universe of Alternative Postsecondary Credentials and Pathways*. Cambridge, MA: American Academy of Arts and Sciences.



- Carnevale, Anthony P., Stephen J. Rose, and Andrew R. Hanson. 2013. *Certificates: Gateway to Gainful Employment and College Degrees*. Washington, DC: Center for Education and the Workforce, Georgetown University. <https://repository.library.georgetown.edu/handle/10822/559297>.
- Carpenter, Dick M., Lisa Knepper, Kyle Sweetland, and Jennifer McDonald. 2018. "The Continuing Burden of Occupational Licensing in the United States." *Economic Affairs* 38(3): 380–405. <https://doi.org/10.1111/ecaf.12319>.
- Carter, Shani D. 2005. "The Growth of Supply and Demand of Occupational-Based Training and Certification in the United States, 1990–2003." *Human Resource Development Quarterly* 16(1): 33–54.
- Credential Engine. 2018. *Counting U.S. Secondary and Post-Secondary Credentials*. Washington, DC: Credential Engine.
- Cohen, Randi. 1996. *Who's Planning for Your Future? Jurisdictional Competition Among Organizations and Occupations in the Personal Financial Planning Industry*. Ph.D. dissertation, Stanford University.
- Columbus, Rooney. 2019. *Nondegree Credentials, Work-Based Learning, and the American Working Class*. Washington, DC: American Enterprise Institute.
- Corbett, Charles J., and David A. Kirsch. 2001. "International Diffusion of ISO 14000 Certification." *Production and Operations Management* 10(3): 327–342.
- Council of Economic Advisors. 2015. *Occupational Licensure: A Framework for Policymakers*. [https://obamawhitehouse.archives.gov/sites/default/files/docs/licensing\\_report\\_final\\_nonembargo.pdf](https://obamawhitehouse.archives.gov/sites/default/files/docs/licensing_report_final_nonembargo.pdf)
- Cronen, Stephanie, Meghan McQuiggan, and Emily Isenberg. 2017. *Adult Training and Education: Results from the National Household Education Surveys Program of 2016*. Washington, DC: National Center for Education Statistics. <https://eric.ed.gov/?id=ED580875>.
- Cutler, Richard, E. Vance Grange, Vickie L. Hampton, Adele Cutler, Thomas P. Langdon, and Michael T. Ryan. 2005. "Analysis of Factors Relating to Success on the CFP® Certification Examination." *Financial Services Review* 14(1): 55–72.
- Dadgar, Mina, and Madeline Joy Trimble. 2015. "Labor Market Returns to Sub-Baccalaureate Credentials: How Much Does a Community College Degree or Certificate Pay?" *Educational Evaluation and Policy Analysis* 37(4): 399–418. <https://doi.org/10.3102/0162373714553814>.
- Davis, Herbert J., and Harvey W. Rubin. 1976. "Perceived Benefits of Professional Certification." *The Journal of Risk and Insurance* 43(1): 152–55. <https://doi.org/10.2307/251618>.
- Deming, David J., Noam Yuchtman, Amira Abulafi, Lawrence F. Katz, and Claudia Goldin. 2016. "The Value of Postsecondary Credentials in the Labor Market: An Experimental Study." *American Economic Review* 106(3): 778–806.
- DePasquale, Christina, and Kevin Strange. 2015. "Labor Supply Effects on Occupational Regulation: Evidence from the Nurse Licensure Compact." Working paper. Cambridge, MA: National Bureau of Economic Research. <https://www.nber.org/papers/w22344>

Deterding, Nicole M., and David S. Pedulla. 2016. "Educational Authority in the "Open Door" Marketplace: Labor Market Consequences of For-Profit, Nonprofit, and Fictional Educational Credentials." *Sociology of Education* 89(3): 155–70. <https://doi.org/10.1177/0038040716652455>.

Deyo, Darwyn. 2016. "Licensing and Service Quality: Evidence Using Yelp Customer Reviews." Presented at the annual meeting of the American Economics Association. <https://www.aeaweb.org/conference/2017/preliminary/paper/efy2hraQ>

Drange, Ida, and Håvard Helland. 2019. "The Sheltering Effect of Occupational Closure? Consequences for Ethnic Minorities' Earnings." *Work and Occupations* 46(1): 45–89. <https://doi.org/10.1177/0730888418780970>.

Ewert, Stephanie, and Robert Kominiski. 2014. *Measuring Alternative Educational Credentials: 2012*. Washington, DC: US Census Bureau.

Everhart, Deborah, Evelyn Ganzglass, Carla Casilli, Daniel Hickey, and Brandon Muramatsu. 2016. *Quality Dimensions for Connected Credentials*. Washington, DC: American Council on Education.

Fain, Paul. 2018. *On-Ramps and Off-Ramps: Alternative Credentials and Emerging Pathways Between Education and Work*. Washington, DC: Inside Higher Education.

Fertig, Jason. 2011. "Evaluating That Piece of Paper: The Effect of Motivation and Certification Status on Occupational Commitment and Job Competence." *Journal of Leadership & Organizational Studies* 18(1): 118–26. <https://doi.org/10.1177/1548051810369342>.

Fong, Jim, Peter Janzow, and Kyle Peck. 2016. *Demographic Shifts in Educational Demand and the Rise of Alternative Credentials*. Washington, DC: University Professional and Continuing Education Association and Pearson Education.

Fuller, Alison and Lorna Unwin. 2017. *Better Apprenticeships: Access, Quality and Labor Market Outcomes in the English Apprenticeship System*. London: University College London and the Sutton Trust.

Fuller, Alison, Lorna Unwin, and Vanessa Beck. 2005. "The Gendered Nature of Apprenticeship: Employers' and Young People's Perspectives." *Education + Training* 47(4/5): 298–311. <https://doi.org/10.1108/00400910510601887>.

Fuller, Joseph and Matthew Sigelman. 2017. *Room to Grow: Identifying New Frontiers for Apprenticeship*. Cambridge, MA: Harvard Business School. <https://www.hbs.edu/managing-the-future-of-work/Documents/room-to-grow.pdf>

Gaberson, Kathleen B., Kathryn Schroeter, Aileen R. Killen, and Wendelny A. Valentine. 2003. "The Perceived Value of Certification by Certified Perioperative Nurses." *Nursing Outlook* 51(6): 272–76. <https://doi.org/10.1016/j.outlook.2003.09.003>.

Gallagher, Sean R. 2016. *The Future of University Credentials: New Developments at the Intersection of Higher Education and Hiring*. Cambridge, MA: Harvard Education Press.

Gittleman, Maury, Mark A. Klee, and Morris M. Kleiner. 2018. "Analyzing the Labor Market Outcomes of Occupational Licensing." *Industrial Relations: A Journal of Economy and Society* 57(1): 57–100. <https://doi.org/10.1111/irel.12200>.

- Grubb, W. Norton. 1992. "Postsecondary Vocational Education and the Sub-Baccalaureate Labor Market: New Evidence on Economic Returns." *Economics of Education Review* 11(3): 225–48. [https://doi.org/10.1016/0272-7757\(92\)90054-7](https://doi.org/10.1016/0272-7757(92)90054-7).
- Haimson, Joshua and Michelle Van Noy. 2004. *Developing the IT Workforce: Certification Programs, Participants, and Outcomes in High Schools and Two-Year Colleges*. Princeton, NJ: Mathematica Policy Research.
- Hornstein, Jeffrey M. 2005. *A Nation of Realtors: A Cultural History of the Twentieth-Century American Middle Class*. Durham: Duke University Press.
- Jacobson, Lou. 2011. *Improving Community College Outcomes Measures Using Florida Longitudinal Schooling and Earnings Data*. Washington, DC: New Horizons Economic Research. <https://www.brookings.edu/wp-content/uploads/2016/07/Jacobson-2011.pdf>
- Jepsen, Christopher, Kenneth Troske, and Paul Coomes. 2014. "The Labor-Market Returns to Community College Degrees, Diplomas, and Certificates." *Journal of Labor Economics* 32(1): 95–121. <https://doi.org/10.1086/671809>.
- Johnson, Janna E, and Morris M Kleiner. 2017. "Is Occupational Licensing a Barrier to Interstate Migration?" Working Paper. Cambridge, MA: National Bureau of Economic Research. <https://doi.org/10.3386/w24107>.
- Kenyon, Rod. 2005. "The Business Benefits of Apprenticeships: The English Employers' Perspective." *Education + Training* 47(4/5): 366–73. <https://doi.org/10.1108/00400910510601931>.
- Kim, Jeounghee, and Sangetta Chatterji. 2018. "Gender and Educational Variations in Earnings Premiums of Occupational Credentials." Rutgers University Center for Women and Work. [https://smlr.rutgers.edu/sites/default/files/documents/Centers/gender\\_and\\_educational\\_variations\\_in\\_earnings\\_premiums\\_of\\_occupational\\_credentials.pdf](https://smlr.rutgers.edu/sites/default/files/documents/Centers/gender_and_educational_variations_in_earnings_premiums_of_occupational_credentials.pdf).
- Kleiner, Morris M. 2016. "Battling over Jobs: Occupational Licensing in Health Care." *American Economic Review* 106(5): 165–70. <https://doi.org/10.1257/aer.p20161000>.
- . 2013. *Stages of Occupational Regulation: Analysis of Case Studies*. Kalamazoo, MI: W.E. Upjohn Institute.
- Kleiner, Morris M., and Alan B. Krueger. 2010. "The Prevalence and Effects of Occupational Licensing." *British Journal of Industrial Relations* 48(4): 676–87. <https://doi.org/10.1111/j.1467-8543.2010.00807.x>.
- Koumenta, Maria, Amy Humphris, Morris Kleiner, and Mario Pagliero. 2014. *Occupational Regulation in the EU and UK: Prevalence and Labour Market Impacts*. London: UK Department for Business, Innovation and Skills.
- Koumenta, Maria, and Mario Pagliero. 2018. "Occupational Regulation in the European Union: Coverage and Wage Effects: Occupational Regulation in the European Union." *British Journal of Industrial Relations*, forthcoming. <https://doi.org/10.1111/bjir.12441>.
- Kuehn, Daniel, and Diane Jones. 2018. *Sub-Baccalaureate STEM Education and Apprenticeship*. Washington, DC: Urban Institute.

Lerman, Robert, Lauren Eyster, and Kate Chambers. 2010. *The Benefits and Challenges of Registered Apprenticeship: The Sponsors' Perspective*. Washington, DC: Urban Institute.  
<https://eric.ed.gov/?id=ED508268>.

Lerman, Robert I., Lauren Eyster, and Daniel Kuehn. 2014. "Can We Upgrade Low-Skill, Low-Wage Occupations? The Case of Apprenticeships in the Long-Term Care Occupations." *Journal of Women, Politics & Policy* 35(2): 110–32. <https://doi.org/10.1080/1554477X.2014.890835>.

Lester, Scott W., Jason Fertig, and Dale J. Dwyer. 2011. "Do Business Leaders Value Human Resource Certification?" *Journal of Leadership & Organizational Studies* 18(3): 408–14.  
<https://doi.org/10.1177/1548051811404422>.

Leventoff, Jenna. 2018. *Measuring Non-Degree Credential Attainment*. Washington, DC: Workforce Data Quality Campaign.

Liu, Vivian Y. T., Clive R. Belfield, and Madeline J. Trimble. 2015. "The Medium-Term Labor Market Returns to Community College Awards: Evidence from North Carolina." *Economics of Education Review* 44: 42–55. <https://doi.org/10.1016/j.econedurev.2014.10.009>.

Lohman, Elizabeth M., and Michael R. Dingerson. 2005. "The Effectiveness of Occupational-Technical Certificate Programs: Assessing Student Career Goals." *Community College Journal of Research and Practice* 29(5): 339–55. <https://doi.org/10.1080/10668920590911850>.

Markow, Will, Dan Restuccia, and Bledi Taska. 2017. *The Narrow Ladder: The Value of Industry Certifications in the Job Market*. Boston, MA: BurningGlass Technologies.

McCarthy, Mary Alice and Mike Prebil. 2018. *Building Better Degrees Using Industry Certifications*. Washington, DC: New America.

Morrison, A. M., S. Hsieh, and C. Y. Wang. 1992. "Certification in the Travel and Tourism Industry: The North American Experience." *Journal of Tourism Studies* 3 (2): 32–40.

Osagie, Sylvester Osaze. 1996. "The Role of Credentialing in the Emergence of Employee Assistance as a Workplace Jurisdiction." Ph.D. dissertation, Cornell University.

Protsch, Paula, and Heike Solga. 2015. "How Employers Use Signals of Cognitive and Noncognitive Skills at Labour Market Entry: Insights from Field Experiments." *European Sociological Review* 31(5): 521–32.  
<https://doi.org/10.1093/esr/jcv056>.

Redbird, Beth. 2017. "The New Closed Shop? The Economic and Structural Effects of Occupational Licensure." *American Sociological Review* 82(3): 600–624. <https://doi.org/10.1177/0003122417706463>.

Reed, Debbie, Albert Yung-Hsu Liu, Rebecca Kleinman, Annalisa Mastri, Davin Reed, Samina Sattar, and Jessica Ziegler. 2012. *An Effectiveness Assessment and Cost-Benefit Analysis of Registered Apprenticeship in 10 States*. Oakland, CA: Mathematica Policy Research.

Renski, Henry. 2018. "Estimating the Returns to Professional Certifications and Licenses in the U.S. Manufacturing Sector." *Economic Development Quarterly* 32(4): 341–356.

Ross, Martha, Kristin Anderson Moore, Kelly Murphy, and Nicole Bateman. 2018. *Pathways to High-Quality Jobs for Young Adults*. Washington, DC: Brookings Institution.

- Schmitt, Kara. 2015. *Demystifying Occupational and Professional Regulation*. Orlando, FL: Professional Testing.
- Stuth, Stefan. 2017. *Closing in on Closure: Occupational Closure and Temporary Employment in Germany*. Baden-Baden, Germany: Nomos Publishing.
- Tesfai, Lul, Kim Dancy, and Mary Alice McCarthy. 2018. *Paying More and Getting Less: How Nondegree Credentials Reflect Labor Market Inequality Between Men and Women*. Washington, DC: New America.
- Tschirhart, Mary, Chongmyoung Lee, and Gary Travinin. 2014. *The Benefits of Credentialing Programs to Membership Associations*. Washington, DC: American Society of Association Executives.
- Tucker, Jacob R., Annie R. Pearce, Richard D. Bruce, Andrew P. McCoy, and Thomas H. Mills. 2012. "The Perceived Value of Green Professional Credentials to Credential Holders in the US Building Design and Construction Community." *Construction Management and Economics* 30(11): 963–79. <https://doi.org/10.1080/01446193.2012.728710>.
- US Network for Education Information. 2008. *Structure of the US Education System: Continuing Education Units*. Washington, DC: US Department of Education. <http://www.ed.gov/international/usnei/edlite-index.html>
- Van Noy, M., Jacobs, J., Korey, S., Bailey, T., and Hughes, KL. 2008. *Noncredit Enrollment in Workforce Education: State Policies and Community College Practices*. Washington, DC: American Association of Community Colleges and Community College Research Center.
- Van Rooij, Shahron William, and Larissa K. Lemp. 2010. "Positioning E-Learning Graduate Certificate Programs: Niche Marketing in Higher Education." *Services Marketing Quarterly* 31(3): 296–319. <https://doi.org/10.1080/15332969.2010.486691>.
- Voorhees, RA and Milam, JH. 2005. *The Hidden College: Noncredit Education in the United States*. Winchester, VA: HigherEd.org
- Weeden, Kim A. 1999. *From Borders to Barriers: Strategies of Occupational Closure and the Structure of Occupational Rewards*. Ph.D. dissertation, Stanford University.
- Weeden, Kim A. 2002. "Why Do Some Occupations Pay More Than Others? Social Closure and Earnings Inequality in the United States." *American Journal of Sociology* 108 (1): 55–101.
- Wierschem, David, Guoying Zhang, and Charles R. Johnston. 2010. "Information Technology Certification Value: An Initial Response from Employers." *Journal of International Technology and Information Management* 19(4): 89.
- Workcred Institute. 2018. *Examining the Quality, Market Value, and Effectiveness of Manufacturing Credentials in the United States*. Retrieved March 14, 2019 from <https://workcred.org/Documents/NIST-MEP-Report.pdf>.
- Xu, Di, and Madeline Trimble. 2016. "What About Certificates? Evidence on the Labor Market Returns to Nondegree Community College Awards in Two States." *Educational Evaluation and Policy Analysis* 38(2): 272–92. <https://doi.org/10.3102/0162373715617827>.

Zanville, Holly, Kelly Porter, and Evelyn Ganzglass. 2017. *Report on Phase I Study: Embedding Industry and Professional Certifications in Higher Education*. Indianapolis, IN: Lumina Foundation.

Zhang, Tingting. 2018. "Does Occupational Licensing Increase Income Inequality?" *Academy of Management Proceedings* 1: 10816. <https://doi.org/10.5465/AMBPP.2018.62>.

Zhou, Xueguang. 1993. "Occupational Power, State Capacities, and the Diffusion of Licensing in the American States: 1890 to 1950." *American Sociological Review* 58(4): 536–52. <https://doi.org/10.2307/2096075>.