

Historical Data on Occupational Regulation in the United States

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Abstract

This paper describes the construction and validation of a novel dataset that compiles over one hundred and fifty years of occupational licensing, certification, and registration requirements in all fifty states and the District of Columbia. It identifies the enactment and effective dates of state and federal policy changes for more than 300 distinct occupations that cover the vast majority of regulated jobs in the United States. Relative to existing data on occupational licensing and regulation, my dataset is more comprehensive, reduces measurement error in enactment dates, and offers an internally-consistent taxonomy of regulatory methods. Linking my policy data to independent measures of occupational licensing and certification from recent household survey data and the text of online job postings, I show that state-level policy differences have an economically significant effect on the credentials workers hold and employers require. I discuss the interpretation of estimates based on these measures and conclude with recommendations and directions for future research.

Keywords: Occupational licensing; labor market regulation; legislative history

JEL Classification: C81, J08, J44, J48

*The views expressed in this paper are those of the author and do not necessarily represent the views or policies of the Board of Governors of the Federal Reserve System or its staff. An extract of the dataset described in this paper can be accessed at <https://github.com/ncarollo/licensing-data>. The complete dataset will be posted after final review and cross-validation is complete. I thank Moshe Buchinsky, Dora Costa, and Morris Kleiner for helpful comments and suggestions. Special thanks to Jason Hicks for many productive conversations and for independently reviewing my coding decisions for certain occupations. All remaining errors are my own. Simon Dong and Katie Xu provided outstanding research assistance. I gratefully acknowledge support from the Institute for Humane Studies received while a graduate student at the University of California, Los Angeles.
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1 Introduction

Occupational licensing and certification requirements are a pervasive feature of the U.S. labor market. Over one in five workers currently report that their job requires some form of government-issued credential, yet historical data on occupational regulation is extremely limited. This presents a major obstacle for researchers interested in the development of this institution or in leveraging policy changes over time to evaluate the economic effects of these laws.¹

In this paper, I describe the construction, validation, and potential uses of a new dataset that offers a near-comprehensive and internally-consistent history of state and federal regulatory requirements for more than 300 occupations. I focus on a class of laws that require individual workers to become licensed, certified, or registered with a government agency before they may legally work or use protected job titles. The data record enactment and effective dates for approximately 8,500 legal changes that adopted, amended, or repealed such policies.² It also documents specific provisions of these laws including practice and title restrictions, the level of government responsible for issuing the credential, and geographic coverage. I produce both an event-level dataset and a balanced panel characterizing policy variation across states and occupations from 1870 to 2020.

To facilitate linking my policy data to labor market outcomes, I harmonize the regulatory definitions of occupations using the job titles and task descriptions provided in legal sources. I then assign each distinct occupation an identifier based on the Standard Occupational Classification (SOC) system using the Census Classified Index of Occupations and Industries. Like the SOC system, these identifiers are hierarchical, allowing the user to differentiate between occupations that correspond to existing six-digit classification codes and those which are even more granular. This harmonization helps maximize the comparability of policies that use different terminology to refer to essentially the same time of work.

I assemble the data using documentation from both current statutes and administrative regulations, as well as a database of historical session laws available through HeinOnline. Verifying policy changes in session laws – which compile the full text of statutory changes enacted during each legislative session – is essential for historical research since revised statutes rarely preserve information about laws that have been superseded or recodified. I am therefore able to identify the first policy that was adopted for each state-occupation pair and track any subsequent amendments using real-time legal sources. After locating the origin of each policy, I read the legislation and hand-code a set of variables characterizing its provisions. I then use these features to classify policies as licensing, certification, or registration requirements following widely-accepted definitions of these regulatory methods (Kleiner, 2006).³

¹A lack of comprehensive national policy data may be one reason why there has been relatively little research on the effects of occupational licensing compared to other labor market policies and institutions. From January 2000 to December 2023, for instance, 119 papers in the National Bureau of Economic Research working paper series have included the term “occupational license” while 1,504 papers reference minimum wages.

²For comparison, there were a total of 308 state-level minimum wage increases between May 1974 and June 2016 (Vaghul and Zipperer, 2016).

³Licenses are mandatory to engage in occupational practice, while certifications are required only to use certain job

I also digitize and process dozens of secondary sources to cross-validate the historical regulation data. Taking the union of these studies, I estimate that my dataset covers roughly 90% of all state licensing, certification, and registration laws when weighted by occupational employment estimates. Unweighted coverage, at 60%, is lower, as many credentials apply to jobs so narrowly-defined that they cannot be linked to any major datasets that record workers' occupational affiliation. Further, by comparing the timing of the policy changes I find to the (largely cross-sectional) information in these secondary sources, I am also able to identify and review potential errors. Reassuringly, my dataset is highly consistent with this documentation, and the vast majority of discrepancies can be attributed to differences in occupational classification or the type of policies covered.

I next assess the relationship between the historical policy data and independent measures of occupational licensing and certification drawn from household survey data and the text of online job postings. This serves, first, as another validation check, as we would expect policy differences to be reflected in other datasets that measure credential requirements. Second, understanding the relationship between policy coverage and worker credential attainment within statistical occupation codes is vital to the interpretation of estimates based on these measures. This is especially true given that the Census and Bureau of Labor Statistics have only recently added questions on licensing and certification to their surveys.⁴ Researchers wishing to leverage changes over time or study any period before the late 2000s must therefore rely exclusively on policy variation.

I first link my regulation data to occupations in the Current Population Survey (CPS), which asks respondents if they hold a professional certification or license, and if so, whether it was issued by the federal, state, or local government. Across all state-occupation cells, the correlation between survey and policy measures of licensing is 0.8. This comparison, however, primarily captures between-occupation variation. Within occupations, I find that having a licensing law increases the probability that workers report a government-issued credential by 16 percentage points relative to states with no requirement. Certification and registration laws have slightly smaller effects on credential attainment. I then repeat this analysis using an alternative database of licensing requirements from CareerOneStop, a website sponsored by the U.S. Department of Labor. Regression estimates based on this dataset are significantly smaller, providing strong evidence that the new data I compile is a more accurate classification of policy variation.

A similar pattern emerges when examining a database of job vacancies from Lightcast (formerly Burning Glass Technologies). The Lightcast data covers nearly all online job postings since 2010, and identifies specific licenses and certifications appearing in the text of these postings. Although not all employers choose to specify licensing requirements in their advertisements, I find that within occupations, licensing policies increase the share of postings with a potential government credential by 6 percentage points relative to an overall mean of 12.5%. Licensing, however, has little effect on

titles. Registration is mandatory, but unlike licensing and certification does not require proof of competency.

⁴Questions related to professional credentials were first added a topical module of the Survey of Income and Program Participation in 2012 and then to the Current Population Survey beginning in 2015. Prior to this, custom surveys commissioned by [Kleiner and Krueger \(2010, 2013\)](#) were the only available source of survey data on this topic.

the likelihood of employers requiring a credential that is clearly issued by a private organization. Further, both the probability of policy coverage in my regulation data and the share of workers reporting a credential in the CPS increase at a similar rate as the share of postings with a license rises relative to the average within an occupation and state.

Results from both the CPS and Lightcast data confirm that state policy differences have an economically significant effect on the credentials workers hold and employers require. That said, I find that this relationship is weaker within detailed occupations between them, a fact that has been documented by other researchers as well (Kleiner and Soltas, 2023). In the last section of this paper, I discuss potential explanations for this pattern, including measurement error in credentials and occupations, exemptions, and non-compliance. Using the Lightcast data, I also show that specific licenses are often found in postings for several occupation categories, even when they have an exact statistical counterpart. Such spillovers are likely to be present in survey data as well, but cannot be directly observed. All of these factors would tend to weaken the empirical relationship between policy differences and self-reported credential attainment.

Given these findings, I conclude first, that the regulatory data I assemble is an accurate and internally-consistent classification of policy differences across states and occupations. As with any policy dataset, however, studying the effect of these laws on labor market outcomes requires assumptions about the set of workers they cover. While many regulated occupations have direct statistical counterparts, the quality of these matches ultimately depends on the accuracy and granularity of the occupation categories in researchers' outcome data. Second, even when these categories are well-defined, researchers should be attentive to potential spillovers between occupations in their design and interpretation of regression estimates. Third, the imperfect correlation between policy and survey measures of occupational licensing suggests that estimates based on these concepts are not directly comparable, though both may be independently informative about the prevalence and effects of these requirements.

The dataset I introduce therefore complements recent survey data on occupational licensing and significantly expands upon existing sources of historical policy data such as the [Council of State Governments \(1952\)](#). It is most similar to the Northwestern Licensing Database, which records the enactment dates of occupational licensing statutes enacted between 1970 and 2017 ([Redbird, 2017](#)). Relative to this dataset, I draw on a much broader set of current and historical documentation to assemble and validate my data. Session laws, in particular, allow me to observe statutes enacted as early as the 1800s in their entirety, and consequently build both a much longer panel and one that is less susceptible to measurement error. Further, I provide richer information about the features of these policies that can be used to differentiate between alternative regulatory methods, which are qualitatively important but seldom documented in other sources.

This paper is organized as follows. [Section 2](#) defines the main regulatory methods covered in this project and highlights other institutional features of occupational regulation in the United States. [Section 3](#) describes the new dataset I assemble, the methodology used to construct it, and its

advantages relative to existing datasets. In [Section 4](#) I assess the coverage and accuracy of my data relative to secondary sources and in [Section 5](#) I study the relationship between policy differences, self-reported credential attainment, and requirements in the text of online job vacancies. [Section 6](#) discusses the implication of these findings for researchers and [Section 7](#) concludes.

2 Background

In the United States, hundreds of distinct occupations are subject to some form of regulation at the federal, state, or local level. As background for the policy data described in this paper, I first outline the essential features of these laws.

2.1 Regulatory approaches

Policymakers have traditionally recognized three main approaches to occupational regulation ([Shimberg, 1980](#)). The most restrictive (and most prevalent) of these are licensing requirements, under which workers must obtain a government-issued credential before they may legally perform the set of tasks enumerated in an occupation’s scope of practice. To become licensed, workers must first demonstrate competency by completing specific education, training, or examination requirements. Additional qualifications such as surety bonding, criminal background checks, and continuing education may also be required to obtain or renew a license.

State certification is a less restrictive method of occupational regulation. In contrast to licensing requirements, certification policies do not prohibit uncertified workers from performing specific tasks. Only certified individuals, however, may legally use protected job titles to advertise their services. For this reason, state certification is also called title protection or voluntary licensing.⁵ It is worth emphasizing that although private-sector organizations may also certify workers, state certification is a direct method of labor market regulation with standards set by law. Apart from restrictions on occupational practice, certification and licensing policies are broadly similar in their administration and enforcement.

Registration requirements are the least restrictive approach to occupational regulation. These laws require workers to file their name, address, and qualifications with a regulatory agency, but unlike licensing and certification, do not require a specific demonstration of competency. Although registration requirements are generally minimal, workers may still be required to post a bond, provide proof of insurance, or undergo a background check. A worker’s registration can also be revoked in the event of malpractice, effectively prohibiting them from legally working in the occupation until their registration is reinstated.⁶

⁵Most licensing statutes also include title protections, in particular when an occupation’s scope of practice is difficult to define or overlaps with other regulated occupations. See [Fischer \(1980\)](#) for a discussion of the differences between licensing and certification legislation in the field of psychology.

⁶Many other laws could plausibly be included under the umbrella of occupational regulation ([Hemphill and Carpenter II, 2016](#)). These include safety inspections, limitations on eligibility for insurance reimbursement, security

2.2 Institutional details

Occupational regulation occurs at the federal, state, and local level, though in practice, states are responsible for the vast majority of licensing, certification, and registration laws.⁷ Using data from a topical module added to the Survey of Income and Program Participation in 2012, [Gittleman et al. \(2018\)](#) found that roughly 90% of workers who reported a government-issued credential obtained it from a state agency. About 7% of government credentials were issued at the federal level and the remaining 3% were obtained locally.

Statutes and regulations. State occupational regulation is generally enacted by the legislature and codified in statutory law. A typical licensing act will define the regulated occupation’s scope of practice, make it unlawful to perform these tasks without a license, and delegate the implementation and enforcement of the law to an administrative agency or licensing board. These agencies – which are often led by appointees from the regulated occupation itself – write the rules and regulations covering specific provisions of the licensing program such as application and disciplinary procedures ([Allensworth, 2017](#)). In some cases, a board’s authority is broad enough to adopt credentialing requirements for occupations not explicitly identified in the enabling statute, though this is rare compared to the enactment of separate legislation when new occupations are regulated.⁸

Statutes (and potentially administrative regulations) are therefore the authoritative source for determining which occupations are currently regulated in each state. While statutory code will typically include historical citations, these are not ideal for the type of research necessary to determine the origin of specific *policies*. First, statutes are routinely replaced and recodified, and revised code rarely documents superseded legislation. Thus, the earliest citation attached to the current version of the law may not reflect the first policy that was actually in effect. This issue is pervasive and becomes increasingly severe the longer an occupation has been regulated.⁹ Second, annotations rarely describe the effect of individual amendments in detail, making it difficult to determine, for example, whether an occupation that is currently licensed was previously certified or registered. Third, policies that have been repealed may no longer appear in statutes at all.

clearance, and minor training mandates such as food safety or basic life support training. Others such as false advertising laws or public service qualification apply to an entire class of workers. Compiling data on this broader set of policies is beyond the scope of this project, which focuses on occupation-specific credentialing requirements.

⁷The authority to regulate occupations is a power granted to states under Article X of the U.S. Constitution ([Brinegar, 2006](#)). While some occupations are subject to both state and federal regulation (e.x. investment advisers), most federally-licensed occupations are engaged in interstate transportation (e.x. airline pilots and ship engineers). Municipal licensing requirements are common in the construction industry.

⁸For example, in 1991 the Minnesota Department of Public Health adopted rules implementing title protection for speech-language pathologists and audiologists under the authority of a statute regulating hearing aid specialists (Minnesota Rules 1991, part 4750.0030). The state legislature enacted a statute codifying this regulation five years later (Laws of Minnesota 1996, chapter 363).

⁹Inferring enactment dates from statutory citations can therefore result in significant measurement error. For example, in the edition of Arizona’s revised statutes published by LexisNexis, the earliest citation in the section of nurse practice act making it unlawful to practice as a registered or practical nurse without a license is to a law passed during the 1995 legislative session (A.R.S. §32-1666). In fact, Arizona adopted voluntary certification for registered nurses in 1921 (Arizona Laws 1921, Ch. 70) and mandatory licensing in 1952 (Arizona Laws 1952, Ch. 39).

Session laws – an alternative form of legal documentation – are better suited to historical research. In contrast to statutes, which record the state of existing law at a fixed point in time, session laws are published annually or biennially at the end of each legislative session and document changes made to statutory law in real time. They contain the full text of all new legislation and document amendments to existing sections of code through strikeout and emphasis. This allows researchers to directly confirm the enactment of specific policies and track subsequent changes, rather than attempting to infer these from retrospective sources. That said, session laws are arranged chronologically rather than by topic, which requires prior knowledge of which terms to search for (i.e. regulated occupation titles).

3 Occupational regulation data

In this section, I introduce the new occupational regulation data I construct and describe the sources and methodology used to compile it. I then highlight its main advantages over existing data.

3.1 Overview

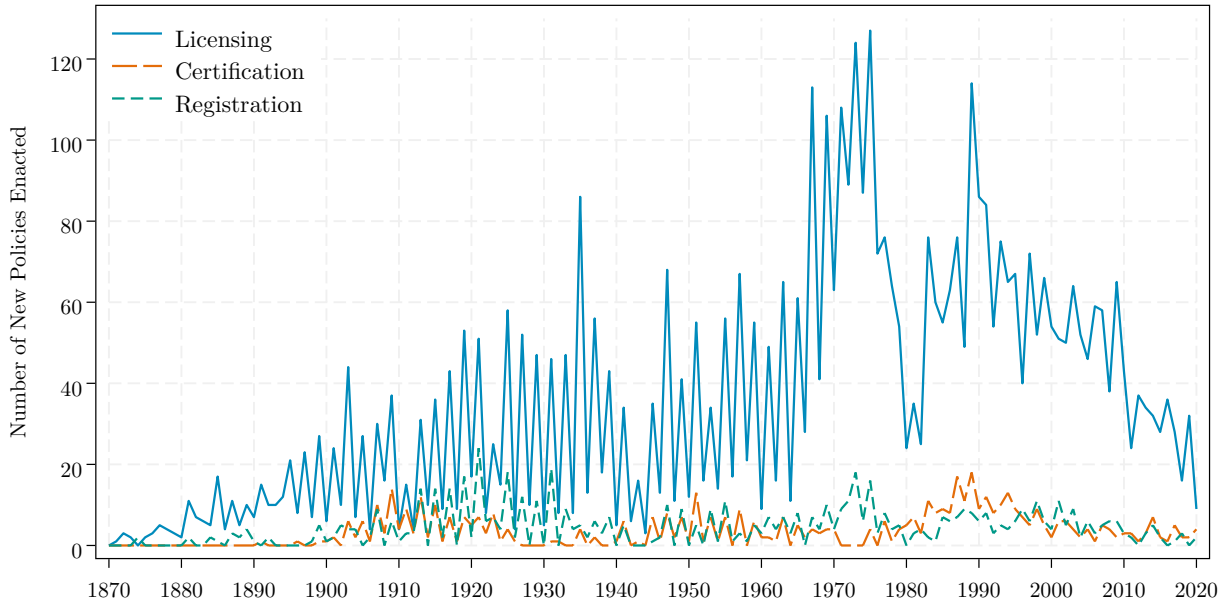
The main dataset I produce records the enactment and effective dates of state and federal policy changes for a broad set of regulated occupations. The current vintage of the data identifies 8,852 regulatory events for 343 unique occupation categories. It covers policies in all fifty states and the District of Columbia and captures legislation enacted as early as the late 1800s.

Regulatory taxonomy. The dataset includes three variables that I use to differentiate between licensing, certification, and registration requirements. First, whether workers without a credential are legally prohibited from performing certain tasks. Second, whether a credential is required to use specialized job titles. Third, whether any specific evidence of competency is required to obtain the credential. Based on these provisions, I classify policies according to the regulatory definitions introduced in [Section 2.1](#).¹⁰ Deriving the main policy variables from these features of the law helps maximize comparability across states and occupations, as discussed further below.

I also introduce a more detailed regulatory taxonomy to capture some of the considerable nuisance within these regulatory methods. Right-to-practice may be complete, covering all work typically done by members of the occupation, or partial, applying only to supervisors or certain tasks. I refer to these cases as “mandatory” and “quasi-mandatory” licensing respectively. Likewise, right-to-title may be relatively weak, only applying the use of adjectives like “certified” and “registered,” or stronger, applying to any form of the occupation’s title (e.x. “architect” or “psychologist”). While certification is clearly voluntary in the first case, the latter may be sufficiently restrictive that it

¹⁰The data also include a handful of instances where a credential from a private organization (usually national professional associations) is legally required to work, though without direct administration or verification of compliance by the regulator. These laws are coded separately to distinguish them from true licensing requirements, which by definition require government authorization to work.

Figure 1: Enactment of State Licensing, Certification, and Registration Laws



Notes: This figure excludes federal policy changes. The cyclicity of policy enactments is driven by the timing of legislative sessions, which vary across states and have changed over time.

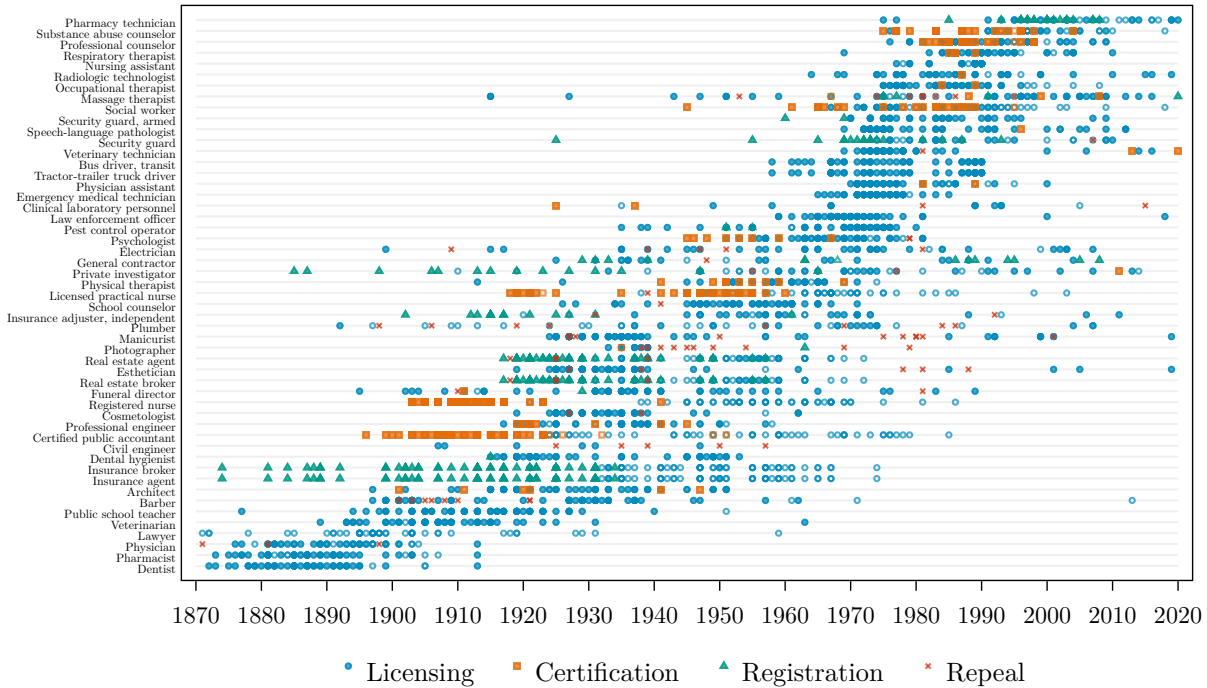
amounts to “effective licensure” for the occupation even when the law does not expressly prohibit unlicensed practice.¹¹

Figure 1 plots the number of policy changes occurring each year according to the broader regulatory definitions I adopt. Occupational regulation picks up around the turn of the 20th century and peaks in the early 1970s. Since 1990, however, the enactment of new policies has slowed significantly. The figure also shows that licensing requirements are far more common than alternative methods of regulation, though certification and registration policies were more prevalent in relative terms between 1900 and 1930. Even within the set of licensing policies, the most stringent regulations are more common. I classify only 12.1% licensing policies as quasi-mandatory and 4.0% as effective licensure. Figure 2 shows that many occupations that are currently licensed were previously certified or registered, also implying that regulatory stringency tends to rise over time.

Additional variables. In addition to the main policy variables, I also record the jurisdiction that issues the credential and note whether the regulatory requirements are applicable statewide. Some state licensing statutes, for instance, exempt workers in small or remote counties, while others exempt municipalities that previously enacted their own regulatory requirements.

¹¹I thank Jason Hicks for suggesting the terminology to refer to this case. Interestingly, laws of this type appear to be implemented when an occupation’s scope of practice may be difficult to define or intersect with other regulated occupations. Alaska Statutes § 08.84.150, for example, explicitly makes it unlawful to practice physical therapy without a license, but with respect to occupational therapy provides only that “a person may not provide services that the person describes as occupational therapy without being licensed.”

Figure 2: Timing of Policy Changes by Occupation



Notes: This figure displays the timing and type of policy changes for a subset of 50 occupations. Solid markers denote the regulation of a previously-unregulated occupation. Open markers denote a policy change that replaced a different method of regulation already in effect. Darker markers indicate multiple policy changes in the same year.

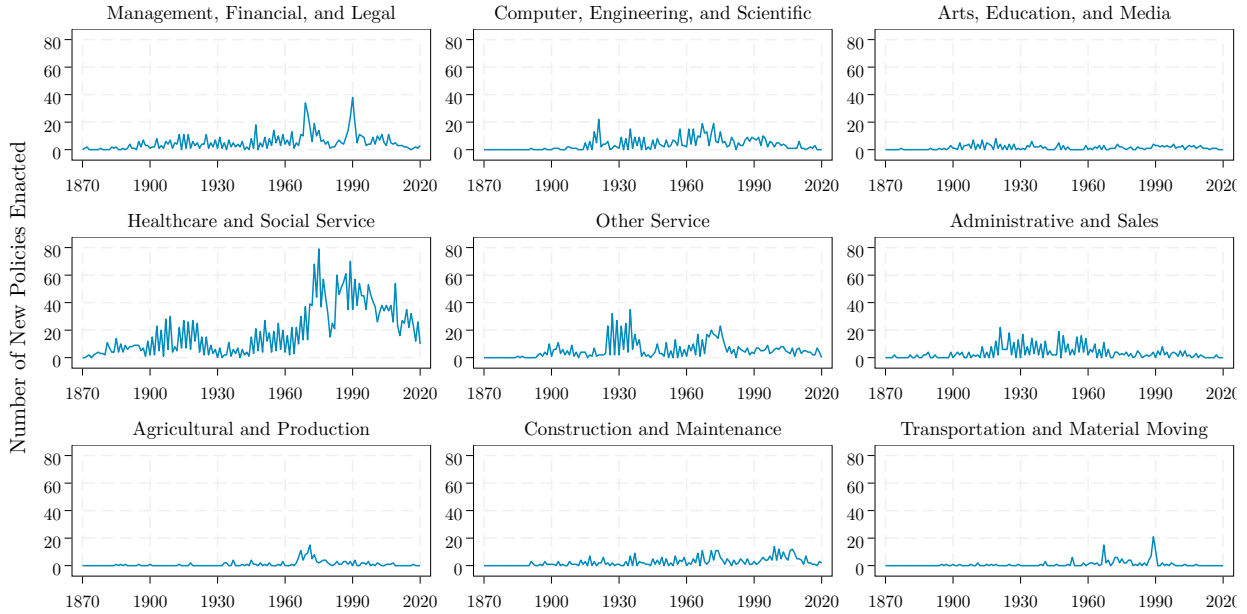
Although the data include only laws enacted at the state or federal level, there are some cases (especially in the South) where the state legislature established local licensing or registration. Some of these laws apply to a specific county or municipality, while others are statewide in application, but delegate administration and enforcement to local authorities.¹² These local acts are recorded in the data, but should be interpreted with caution since policies enacted directly by municipal governments are not observed. Further, I make no attempt to code geographic coverage below the state level, since applicability is often specified based on unobservable or time-varying factors.

Panel and crosswalk files. I also construct a balanced panel of occupation-state pairs between 1870 and 2020 from the main event-level dataset. Although a few occupations such as attorneys and physicians were initially regulated prior to 1870, the modern form of occupational licensing with fully-fledged practice acts administered by state regulatory boards did not pick up until the late 1800s, as shown above.¹³ I end the panel in 2020, as the current version of the data does not consistently record policy changes enacted after this year for all occupations.

¹²See Alabama Acts of 1935, No. 290 (establishing a licensing board for barbers in Mobile County) or Tennessee Acts of 1919, Ch. 182 (requiring real estate agents to obtain a license from the clerk of the county court where their primary business is located).

¹³The first regulatory legislation for physicians enabled private medical societies to issue their own licenses. Under these acts, practicing medicine without a license was not unlawful, but unlicensed physicians had no legal recourse to recover unpaid fees. These early statutes were repealed in the mid-1800s, so that the practice of medicine was essentially unregulated in most states as of 1870 (Kett, 1968).

Figure 3: Enactment of State Regulation by Major Occupation Group



Notes: This figure plots the total number licensing, certification, and registration laws, including transitions that resulted in a policy change. It excludes federal policy changes. Management, financial, and legal occupations include SOC major groups 11, 13, and 23; computer engineering, and scientific 15-19; arts, education, and media 25-27; healthcare and social services 21, 29, 31; other services 33-39; administrative and sales 41-43; agricultural and production 45 and 51; construction and maintenance 47-49, and transportation and material moving 53.

To facilitate linking the data to external sources, each occupation is assigned a unique identifier based on the Standard Occupational Classification (SOC) system. The SOC defines over 800 occupation categories covering all civilian jobs and is the most detailed level at which the federal government collects wage and employment data. It is based on a 6-digit classification system that groups occupations into major, minor, and detailed categories. At the detailed level, these codes are sufficiently precise that the statistical and regulatory definitions of many occupations are highly comparable. Regulated occupations that nest entirely within a 6-digit code are assigned an 8 or 9-digit code that preserves the hierarchical classification structure. In my data 132 occupations have a 6-digit equivalent in the 2010 SOC system.

Figure 3 plots the number of licensing, certification, and registration laws by year, separately by major occupation group. Healthcare and social services occupations account for the bulk of policies overall, as well as the vast majority of policy changes since 1970. This is because these occupations are both highly regulated (almost all SOC codes in this group are licensed in at least one state) and classified into many granular specialities. Other services occupations experienced one wave of regulation peaking around 1930 (driven by personal services such as cosmetology) and another circa 1975 (driven by protective services such as law enforcement and security guards). For other occupation groups, the diffusion of regulation was more uniform over the last century.

3.2 Data sources and collection

I rely on a wide variety of primary and secondary data sources to compile and cross-validate the historical regulation database. This section describes those sources and how I use them to identify the timing of policy changes and code legal provisions.

Identifying regulated occupations. In the first step of the data collection process, I compile, digitize, and clean existing data on occupational licensing and regulation from contemporary and historical sources such as the [Council of State Governments \(1952\)](#) and the [CareerOneStop License Finder \(2019\)](#). A complete list of secondary sources, along with short description of their contents is provided in the appendix. While only a handful of these claim to be comprehensive and few have any information about enactment dates, taken together they provide the most complete enumeration of regulated occupations presently available.¹⁴

To form an initial list of regulated occupations, I harmonize the job titles listed in secondary sources, many of which include synonyms or multiple credential levels for the same occupation. I then assign occupations to SOC codes using an autocoding application developed for O*Net Online.¹⁵ Matches returned by the autocoder are checked for consistency with the 2010 Census Classified Index of Occupations and Industries, which provides classification instructions for around 30,000 individual job titles. Lastly, I note which occupations are approximately equivalent to their corresponding SOC code, and which are proper subsets (for instance, because they map to a residual classification). Throughout data collection, I update the crosswalk as necessary after reviewing how occupations are described in legal documentation.

Primary legal sources. I compile my main policy data using documentation obtained from two legal databases, LexisNexis and HeinOnline. The first has complete coverage of current statutes and administrative regulations, but relatively limited historical information apart from standard legal citations. The second is better suited to historical research, as it provides a fully-digitized collection of session laws that covers nearly every legislative session in the history of the United States.¹⁶

For each occupation, I perform a comprehensive search of these databases based on keywords including the occupation’s title and its variations from secondary sources. As noted in [Section 2.2](#), most occupations are regulated by statute, and the history of these polices can therefore be tracked in session laws. After identifying the earliest legislation for each state and occupation, I read the full text of the law and hand-code a set of variables characterizing key legal provisions. If any of these features differ from current law, I review amendments chronologically until I locate the source of these changes. For the small number of polices that appear only in administrative

¹⁴I exclude certain types of licenses from consideration throughout this project. These include licenses for gambling, horse racing, and martial arts; licenses for resource extraction such as commercial fishing; and business licenses that attach to an establishment rather than an individual.

¹⁵See <https://www.onetsocautocoder.com/plus/onetmatch>. I use an earlier version of this web application that classified titles based on 2010 vintage SOC codes.

¹⁶Historical data on federal regulations also comes from HeinOnline, which includes both annual versions of the Code of Federal Regulations from 1938 to present, and the U.S. Statutes at Large dating back to the 1700s.

code, I must usually infer enactment dates from secondary sources, as historical documentation of state regulatory code is sparse before the early 2000s. All policies whose enactment could not be confirmed with primary legal sources are assigned a data quality flag.

Cross-validation. While collecting the data, I compare the information I find in legal documentation with the secondary sources described above. I also search for any regulatory information related to the occupation in online libraries such as Google Scholar and HathiTrust, as well as on state and professional association websites. This helps minimize the risk of overlooking policies that were not picked up in my initial search and in some cases correct enactment dates. I consider primary legal sources authoritative but attempt to reconcile any conflicts with other documentation to avoid overreliance on any single data source.

3.3 Advantages relative to existing data

In addition to its breadth, the new data I compile offers three main advantages over existing data. These are (i) more accurate enactment dates; (ii) harmonized occupation and regulatory definitions; and (iii) detailed documentation of sources and coding decisions.

Enactment dates. Most existing data on occupational regulation is essentially cross-sectional, providing researchers with little information about the timing of specific policy changes. In the rare cases when they are reported for one or more occupations, enactment dates are often sourced from annotated statutes, which has the potential to introduce serious measurement error. By researching the history of occupational regulation in state session laws, the data I assemble is less susceptible to this type of measurement error, which improves confidence in the accuracy of the enactment dates I record. It also allows me to capture transitions between regulatory methods (including repeals), which are common for many occupations but rarely identified in other data sources.

Harmonized occupation and regulatory definitions. Although the definitions of licensing, certification, and registration introduced in [Section 2.1](#) are widely accepted among researchers and policymakers, these terms are often used interchangeably in practice. As a result, what a state chooses to name its regulatory framework for an occupation may have little relationship to the underlying practice or title restrictions specified in the law.¹⁷ Further, terms such as license and registration are also used in non-regulatory contexts such as the payment of privilege taxes. Data sources that do not attempt to harmonize this terminology may therefore produce misleading conclusions about the extent of variation in regulatory stringency across states and occupations. This project addresses these challenges by classifying policies based solely on legal provisions, which helps ensure that the policies are indeed comparable.

¹⁷The term certification, for example, is typically used rather than licensing in the regulation of public-sector workers such as teachers and law enforcement officers. In other cases, credential titles may reflect their historical origin. Certified public accountants, for instance, were initially covered by voluntary state certification policies, as their title suggests. However, these statutes were later replaced by more stringent licensing acts under which only a CPA may legally provide certain professional accounting services.

As with differences in regulatory terminology, states may use different job titles to refer to otherwise comparable occupations. A classic example are licensed practical nurses, who are known as licensed vocational nurses in California and Texas. By harmonizing occupation titles and classifying policies based on the type of work they cover, I attempt to minimize spurious policy differences across states and over time.¹⁸ The crosswalk I create mapping these occupations to Standard Occupation Classification codes provides further guidance as to how researchers can identify workers covered by these regulatory policies in other data sources.

Detailed documentation. Lastly, I provide detailed documentation on sources and coding decisions for the data. In addition to recording a citation for each session law, the data for individual occupations include citations for the secondary sources consulted while assembling and validating the database. I also include comments describing the assumptions and coding decisions made when any information was unclear or ambiguous. These notes are provided to assist researchers wishing to expand on the dataset or trace the source of any discrepancies they might identify.

4 Data validation

Here, I discuss the coverage and accuracy of the dataset I construct relative to existing compilations of state licensing requirements. I first show that my data include most occupations and policies other sources identify, the union of which is likely to be nearly comprehensive. Next, I demonstrate that the regulatory panel I build is highly consistent with secondary sources in the cross-section, and, if anything, captures a non-trivial share of policies the latter miss. Finally, I show that almost a third of initial regulation dates reported by secondary sources are almost certainly incorrect, underscoring the value of my approach to data collection.

4.1 Coverage of regulated occupations

Table 1 compares the coverage of the historical regulation data to other collections of occupational licensing and certification policies. Column one lists the number of unique job titles appearing in each source prior to standardization and deduplication but after applying the sample restrictions described in the previous section. Column three reports the total number of policies these sources enumerate, where a policy is defined as a regulated state-by-title pair.

In columns two and four, I report the share of titles and policies covered by the main regulation database. Job titles are considered covered if they map to a harmonized occupation that I have collected data for. All state policies associated with that occupation are also considered covered, which for the moment avoids taking a stand on whether they are correctly classified or not. Focusing on Panel A, which lists sources that purport to be nearly comprehensive at they time they were

¹⁸Another example is massage work. While the preferred terminology is now “massage therapist,” early laws licensed this occupation under the title “masseur” or “masseuse.”

Table 1: Coverage of Historical Regulation Data Relative to Secondary Sources

| | Unique Titles in Source (1) | Share of Titles Covered by Data (%) (2) | Total Policies in Source (3) | Share of Policies Covered by Data (%) (4) |
|--|-----------------------------------|---|------------------------------------|---|
| <i>Panel A: Comprehensive Sources</i> | | | | |
| CareerOneStop License Finder (2019) | 5,426 | 66.24 | 8,127 | 72.99 |
| Gale Research Inc. (Bianco 1996) | 2,058 | 61.56 | 5,763 | 72.77 |
| Council on Licensure, Enforcement, and Regulation (1994) | 703 | 59.74 | 5,832 | 73.94 |
| CLEAR and the Council of State Governments (1990) | 841 | 56.24 | 4,621 | 75.14 |
| U.S. Department of Labor (1969) | 780 | 40.90 | 3,098 | 70.88 |
| The Council of State Governments (1952) | 72 | 81.94 | 1,216 | 97.70 |
| <i>Panel B: The Book of the States</i> | | | | |
| The Book of the States (2006 edition) | 63 | 93.65 | 2,509 | 94.82 |
| The Book of the States (2005 edition) | 64 | 93.75 | 2,483 | 94.93 |
| The Book of the States (2004 edition) | 58 | 96.55 | 2,375 | 96.00 |
| The Book of the States (2000-2001 edition) | 58 | 96.55 | 2,161 | 96.02 |
| The Book of the States (1998-1999 edition) | 58 | 96.55 | 2,152 | 96.24 |
| The Book of the States (1994-1995 edition) | 59 | 96.61 | 2,129 | 97.04 |
| The Book of the States (1992-1993 edition) | 60 | 96.67 | 2,287 | 95.98 |
| The Book of the States (1990-1991 edition) | 61 | 96.72 | 2,139 | 95.70 |
| The Book of the States (1988-1989 edition) | 43 | 95.35 | 1,355 | 93.21 |
| The Book of the States (1986-1987 edition) | 30 | 93.33 | 1,078 | 92.21 |
| The Book of the States (1982-1983 edition) | 82 | 82.93 | 2,331 | 85.07 |
| <i>Panel C: Other Sources</i> | | | | |
| National Conference of State Legislatures (2017) | 31 | 93.55 | 1,406 | 93.74 |
| Institute for Justice (Carpenter et al. 2017) | 95 | 49.47 | 2,591 | 47.47 |
| U.S. Department of Health, Education, and Welfare (1977) | 31 | 100.00 | 907 | 100.00 |
| The Council of State Governments (1968) | 134 | 66.42 | 1,824 | 87.99 |
| U.S. Department of Health, Education, and Welfare (1967) | 25 | 100.00 | 799 | 100.00 |
| U.S. Department of Commerce (1942) | 30 | 100.00 | 930 | 100.00 |
| Temple Law Quarterly (Graves 1939) | 21 | 100.00 | 831 | 100.00 |

Notes: This table reports the share of regulated job titles and policies listed in various secondary sources that are covered by the main historical regulation data. Federal licenses are not included in this table. Other types of policies excluded from all samples are described in the text.

collected, my data covers about 60% of job titles and just over 70% of policies on average. The fact that coverage of policies exceeds coverage of titles implies that my data tends to include occupations that are regulated in more states. Panels B and C include sources that focus on a smaller set of occupations that are usually larger and more widely-regulated. With the exception of data compiled by the Institute for Justice, coverage of the policies in these sources is nearly complete.¹⁹

How representative are the occupations in my data relative to regulated occupations overall? Pooling across all sources, Table 2 reports the share of policies covered by major (2-digit) occupation group. To account for differences in job titles, I first collapse the data to harmonized occupation definitions to avoid double counting policies. I then count the number of state-by-occupation cells that are identified as regulated in *any* source. Across all occupations, the secondary sources I collect cumulatively list around 9,600 policies. Notably, this is significantly more than appear in any individual source despite the use of broader occupation categories. Since repeals are fairly rare, this suggests that each source alone likely misses some policies that were actually in effect. Nonetheless, when taken together, they should capture virtually all known licensing, certification,

¹⁹I use data from the second edition of the Institute for Justice’s “License to Work” report (Carpenter et al., 2017). A large fraction of licenses in this study apply to various specialty trade contractors. In most states that regulate contracting, specialty trade classifications are enumerated only in administrative code, making it unusually difficult to identify when these policies initially went into effect.

Table 2: Coverage of Historical Regulation Data by Major Occupation Group

| <i>Standard Occupational Classification Group</i> | Total Policies, All Sources (1) | Policies Covered, Unweighted (%) (2) | Policies Covered, Weighted (%) (3) |
|--|---------------------------------------|--|--|
| All Occupations | 9,636 | 59.82 | 89.41 |
| 11. Management Occupations | 1,166 | 19.98 | 26.74 |
| 13. Business and Financial Operations Occupations | 770 | 35.97 | 95.00 |
| 17. Architecture and Engineering Occupations | 246 | 100.00 | 100.00 |
| 19. Life, Physical, and Social Science Occupations | 215 | 100.00 | 100.00 |
| 21. Community and Social Service Occupations | 306 | 96.41 | 99.91 |
| 23. Legal Occupations | 123 | 100.00 | 100.00 |
| 25. Education, Training, and Library Occupations | 529 | 40.64 | 96.08 |
| 27. Arts, Design, Entertainment, Sports, and Media Occupations | 202 | 79.21 | 97.87 |
| 29. Healthcare Practitioners and Technical Occupations | 1,900 | 91.63 | 97.29 |
| 31. Healthcare Support Occupations | 354 | 90.40 | 81.77 |
| 33. Protective Service Occupations | 180 | 76.67 | 88.89 |
| 37. Building and Grounds Cleaning and Maintenance Occupations | 171 | 71.35 | 95.06 |
| 39. Personal Care and Service Occupations | 646 | 77.24 | 91.88 |
| 41. Sales and Related Occupations | 790 | 34.05 | 78.66 |
| 43. Office and Administrative Support Occupations | 86 | 56.98 | 7.07 |
| 45. Farming, Fishing, and Forestry Occupations | 253 | 1.98 | 0.22 |
| 47. Construction and Extraction Occupations | 785 | 42.80 | 95.26 |
| 49. Installation, Maintenance, and Repair Occupations | 280 | 31.43 | 81.15 |
| 51. Production Occupations | 219 | 74.43 | 99.29 |
| 53. Transportation and Material Moving Occupations | 415 | 65.06 | 73.25 |

Notes: This table reports the share of deduplicated policies listed in any secondary source that are covered by the main historical regulation data. Here, total policies refer to the number of state by standardized occupation title pairs identified as regulated in any of the secondary sources consulted. Federal licenses are not included in this table. Other types of policies excluded from all samples are described in the text. Employment weights are constructed using data from the Current Population Survey, the Occupational Employment Statistics Survey, and the Census Classified Index of Occupations and Industries.

and registration requirements at the state level.

Column two shows that my data cover roughly 60% of all regulatory policies. Coverage, however, is closer to 90% when weighting cells by estimates of employment in these states and occupations.²⁰ The large difference between the weighted and unweighted estimates implies that my data include the most economically significant policies these sources identify, which in turn are the regulations likely to be of most interest to researchers and policymakers. The policies my data does not cover generally apply to extremely granular job titles (e.x. “fish dealer”, “sprinkler inspector”, “whitewater rafting operator”) that are either regulated in only a handful of states or employ so few workers that they cannot be directly observed in any major datasets with occupational wage and employment information. Employment-weighted coverage is nearly complete for about half of major occupation groups, though professional occupations are somewhat overrepresented. Only three major groups

²⁰I construct employment weights for regulated occupations using three datasets. First, I use total national employment by 6-digit SOC from the 2015 Occupational Employment and Wage Statistics survey. Because this survey does not include self-employed workers, I adjust these estimates to match the distribution of occupational employment in the 2015-2019 Current Population Survey, which combines some 6-digit codes. Specifically, I estimate employment by state and 6-digit occupation by allocating CPS employment across sub-occupations using weights computed from the OEWS data. Lastly, for regulated occupations that nest entirely within 6-digit codes, I assume that employment is proportional to the count of job titles in their 6-digit classification, which I obtain from the 2010 Census Classified Index of Occupations and Industries.

Table 3: Cross-Validation of Historical Regulation Data and Secondary Sources

| | Consistent (1)+(4) | Regulated in Secondary Source | | Unregulated in Secondary Source | |
|--|-----------------------|-------------------------------|------------------------|---------------------------------|------------------------|
| | | Regulated (%) (1) | Unregulated (%) (2) | Regulated (%) (3) | Unregulated (%) (4) |
| <i>Panel A: Comprehensive Sources</i> | | | | | |
| CareerOneStop License Finder (2019) | 85.24 | 29.06 | 0.80 | 13.95 | 56.18 |
| Gale Research Inc. (Bianco 1996) | 87.30 | 31.31 | 1.23 | 11.47 | 55.99 |
| Council on Licensure, Enforcement, and Regulation (1994) | 89.04 | 33.44 | 0.99 | 9.97 | 55.60 |
| CLEAR and the Council of State Governments (1990) | 84.53 | 29.68 | 2.31 | 13.17 | 54.85 |
| U.S. Department of Labor (1969) | 85.46 | 36.02 | 6.02 | 8.52 | 49.44 |
| The Council of State Governments (1952) | 91.10 | 46.25 | 1.10 | 7.80 | 44.85 |
| <i>Panel B: The Book of the States</i> | | | | | |
| The Book of the States (2006 edition) | 94.64 | 79.59 | 1.73 | 3.62 | 15.05 |
| The Book of the States (2005 edition) | 93.85 | 78.33 | 1.56 | 4.59 | 15.52 |
| The Book of the States (2004 edition) | 95.47 | 80.46 | 1.64 | 2.89 | 15.01 |
| The Book of the States (2000-2001 edition) | 90.30 | 73.94 | 1.00 | 8.70 | 16.36 |
| The Book of the States (1998-1999 edition) | 90.91 | 73.76 | 1.07 | 8.02 | 17.15 |
| The Book of the States (1994-1995 edition) | 93.12 | 72.62 | 0.78 | 6.10 | 20.50 |
| The Book of the States (1992-1993 edition) | 93.95 | 73.07 | 3.58 | 2.48 | 20.88 |
| The Book of the States (1990-1991 edition) | 89.68 | 67.80 | 3.78 | 6.54 | 21.88 |
| The Book of the States (1988-1989 edition) | 93.33 | 61.32 | 2.35 | 4.31 | 32.01 |
| The Book of the States (1986-1987 edition) | 93.32 | 65.32 | 3.49 | 3.19 | 28.00 |
| The Book of the States (1982-1983 edition) | 88.98 | 55.85 | 1.93 | 9.09 | 33.13 |
| <i>Panel C: Other Sources</i> | | | | | |
| Institute for Justice (Carpenter et al. 2017) | 90.77 | 45.24 | 4.35 | 4.88 | 45.53 |
| National Conference of State Legislatures (2017) | 95.07 | 85.94 | 3.18 | 1.76 | 9.13 |
| U.S. Department of Health, Education, and Welfare (1977) | 93.07 | 56.80 | 0.37 | 6.56 | 36.27 |
| The Council of State Governments (1968) | 89.73 | 43.00 | 3.42 | 6.86 | 46.73 |
| U.S. Department of Health, Education, and Welfare (1967) | 97.26 | 61.65 | 1.02 | 1.73 | 35.61 |
| U.S. Department of Commerce (1942) | 95.42 | 64.10 | 0.49 | 4.10 | 31.32 |
| Temple Law Quarterly (Graves 1939) | 90.53 | 82.10 | 1.14 | 8.33 | 8.43 |

Notes: This table tabulates the share of state by standardized occupation title pairs that are identified as regulated or unregulated in various secondary sources and whether these classifications agree with the main historical regulation data. The sample is restricted to occupations and states that appear in both datasets, excluding federal policies.

are significantly underrepresented in my data: management; office and administrative support; and farming, fishing, and forestry occupations.

4.2 Consistency of policy variation

As another validation exercise, I assess the extent to which the historical regulation data I compile is consistent with policy variation documented by secondary sources. After collapsing to harmonized occupation definitions, I merge each compilation with my regulatory panel based on the date it was collected or published, keeping only states and occupations that appear in both datasets, so that comparisons do not reflect sample differences. I then cross-tabulate the share of state-by-occupation cells identified as regulated or unregulated.²¹ The first column of [Table 2](#) shows that, on average, over 90% of observations are coded consistently across datasets.

When the data do disagree, the most concerning discrepancies are those where a secondary source identifies a regulation that does not appear in my data. Fortunately, the share of such observations is generally low. Moreover, while compiling the data, I attempt to reconcile these conflicts and find that the vast majority can be attributed to differences in terminology or regulatory classification.

²¹Due to inconsistencies in the use of regulatory terminology, I do not attempt to compare whether these sources agree with my classification of regulatory methods, only whether we agree that a regulation exists or not.

For example, 6% of cells are identified as regulated by the [U.S. Department of Labor \(1969\)](#), but are unregulated in my data. Because this dataset was collected from documentation of state and local taxes (which would include license fees), I find that many of these cases were in fact privilege taxes called licenses, not regulatory requirements. Similarly, differences between my data and the Institute for Justice’s primarily reflect different choices in how to classify certain occupations like makeup artists rather than actual disagreements about policy variation.

Observations I identify as regulated that secondary sources do not account for the majority of discrepancies. These cases are less concerning since policies in my data are confirmed with a primary legal source. For these to be errors in my data, it would have to be the case that a policy was repealed (or struck down in court) then later re-enacted. While there are some cases in the data where this occurs, repeals are sufficiently rare that this is an implausible explanation for these discrepancies. Rather, these cases likely reflect errors in the secondary sources, a claim that I test formally in [Section 5.1](#).

4.3 Enactment dates

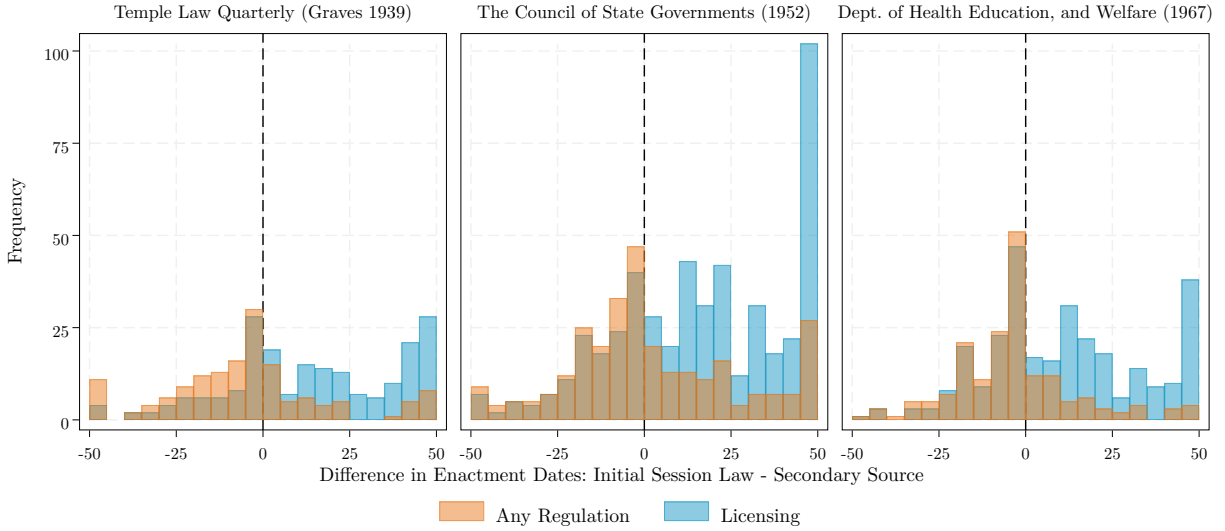
While my data are highly consistent with secondary sources at the time those studies were published, the same is not true of enactment dates. This is to be expected, since determining whether a policy *currently* exists is generally much easier than determining *when* it was first enacted, as discussed in [Section 2.2](#). Only three sources I consider report enactment dates, which were obtained through a combination of statutory research and contact with state regulatory agencies ([Graves, 1939](#); [U.S. Department of Health, Education and Welfare, 1967](#); [Council of State Governments, 1952](#)).²² On average across these studies, the year of initial regulation they report differs from my data for almost one-third of observations, even though [Table 2](#) showed that over 90% of state-occupation cells are consistent in the cross-section. On the other hand, because these sources do not differentiate between licensing and alternative methods of regulation, they tend to significantly *overstate* licensing durations, which is not always clear from their description of the data.

[Figure 4](#) shows that although the modal discrepancy in initial regulation dates is less than five years (likely reflecting effective rather than enactment dates), a surprising share differ by decades. In all cases, the distribution of differences in enactment dates is somewhat left-skewed, indicating that I tend to identify earlier enactment dates. These are almost certainly errors in the other sources, as my legal documentation confirms a law was passed. Moreover, as with cross-sectional discrepancies, I attempt to reconcile conflicting enactment dates while building the data. I find that many observations reporting a later enactment date than I find are picking up statutory recodifications or reenactments. On the other hand, when secondary sources report an earlier enactment date than I do, it is often because multiple occupations were regulated under the same statute at different times (e.x. insurance brokers and agents).

Although these findings cannot necessarily be generalized to other studies, the fact that patterns

²²It is likely that regulatory agencies themselves were sourcing this information from state statutes.

Figure 4: Comparing Initial Regulation Dates to Secondary Sources



Notes: This figure displays the distribution of differences in policy enactment dates relative to my data. For readability, differences are capped at 50 years.

discussed above are extremely similar across three separate datasets collected for different occupations and at different points in time suggests that there is a systemic component to measurement error in enactment dates collected from retrospective sources such as statutory citations. All told, the comparisons in this section are highly reassuring about the quality of my data, though some amount of measurement error is inevitable given the challenges associated with compiling this type of historical information.

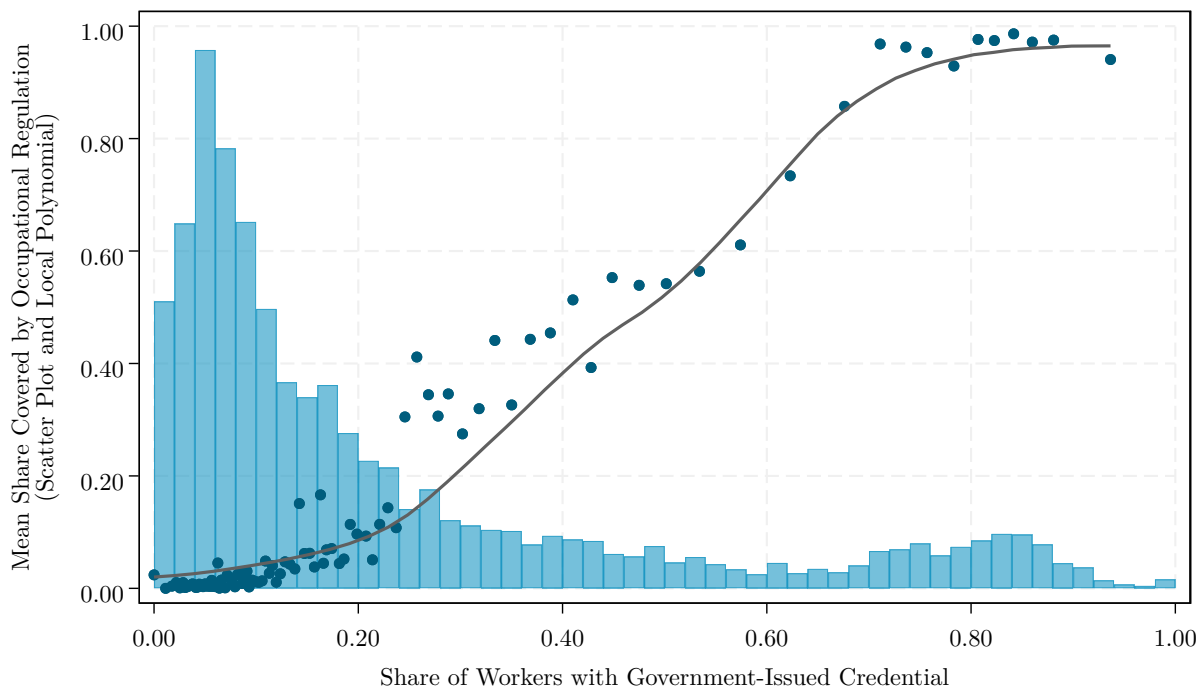
5 Relationship to survey data and job postings

I now turn to an assessment of the relationship between policy coverage and alternative measures of occupational licensing and certification from survey data and the text of online job postings. This serves, first, as another validation exercise, since policy differences should be detectable in other independent datasets. More importantly, it offers insights into how researchers can interpret variation in these measures across states and occupations.

5.1 Current Population Survey

I use data from the Current Population Survey, which since January 2015 has asked respondents whether they hold an active professional certification, state, or industry license, and if so, whether it was issued by a government agency or is required for their main job (Flood et al., 2023). I follow standard convention when working with this dataset and define an occupational license to be any government-issued credential, though this potentially captures workers who are state certified or

Figure 5: Regulation Coverage and Credential Attainment (CPS 2015-2019)



Notes: This figure uses data from the 2015 to 2019 Current Population Survey, treating the entire sample as a single cross-section. The histogram displays the distribution of credential attainment across 23,000 state-by-occupation cells weighted by total employment. The markers overlay a binned scatter plot, which shows share of employment covered by any occupational regulation within 100 equal-sized bins of the CPS credential attainment rate. The gray line is a fitted local polynomial regression of regulation coverage on credential attainment with a bandwidth of 0.1.

registered as well (Cunningham, 2019).

Linking my regulation data to the CPS requires aggregating the policy indicators in my panel to the level of Census occupation codes, which are direct aggregations of 2010 SOC codes from 2015 to 2019. For each CPS occupation, I use data from the 2015 Occupational Employment and Wage Statistics survey to derive national employment share weights for each 6-digit suboccupation. Regulated occupations that nest entirely within 6-digit codes are assigned a weight proportional the count of job titles in their classification from the 2010 Census Classified Index of Occupations and Industries. I then use these weights to compute the share of CPS employment covered by some form of occupational regulation within each state and occupation.

Regulation coverage and credential attainment. Across all state-occupation cells, the correlation between my measure of policy coverage and the share of workers who report a government-issued credential is 0.8. This strong positive relationship is illustrated graphically in Figure 5. Three aspects of the figure are worth highlighting. First, although there are local peaks in credential attainment around 10% and 85%, few cells are either fully-licensed or fully-unlicensed in the CPS data. Second, the probability of policy coverage rises almost linearly with attainment between

these values. Third, near the extremes of the distribution, cells with fewer than 10% of workers reporting a credential are almost entirely unregulated in my data, while cells with greater than 75% credential attainment are almost all covered by regulatory requirements.

The relationship between credential attainment and regulation coverage shown above confirms that my policy data is broadly consistent with patterns in the CPS. Importantly, though, this exercise includes comparisons between occupations that are licensed by all or no states, which together account for the vast majority of U.S. employment. Another relevant test is whether policy variation predicts within occupation differences in credential attainment across states, among the subset of occupations that are regulated in some jurisdictions but not others.

To that end, I estimate variations of the following linear probability model in the CPS microdata,

$$Y_{ijst} = \alpha_j + \sum_k \beta_k \times D_{jst}^k + \gamma_s + \Omega_{ijst} + \delta_t + \epsilon_{ijst} \quad (1)$$

where Y_{ijst} is an indicator equal to one if individual i reports holding a credential and D_{jst}^k measures the share of their four-digit occupation j covered by regulation policy type k in state s . Occupation fixed effects α_j sweep out between-occupation variation in regulation and credential attainment, implying that $\hat{\beta}_k$ is identified from variation along the margin of occupations whose regulatory status differs across states. Year fixed effects δ_t absorb common time trends across all states and occupations.²³ Finally, Ω_{ijst} is a collection of fixed effects for detailed demographic groups, which I define following [Kleiner and Soltas \(2023\)](#).

Estimates from this regression are reported in [Table 4](#), where CPS credential attainment is alternatively measured as an indicator for holding any professional credential, holding a government-issued credential, and holding a credential that is required for the respondent’s main job (regardless of who issued it). The point estimate in column one indicates that fully licensing a state-occupation cell is associated with an increase the probability that workers report any credential by about 14 percentage points relative to states with no requirement. State certification and registration policies increase credential attainment about half as much as licensing requirements do. Finally, the effect of other policies (which include local acts and mandatory private certification) on credential attainment is also positive, but small and statistically insignificant.

The estimated effect of licensing coverage rises to 17 percentage points in column three, where the dependent variable is restricted to government-issued credentials. Point estimates for certification and registration policies are also about 20% larger in this specification, which is consistent with the view that the CPS definition of a license is somewhat broader than the regulatory definitions used in this paper. Estimates for required credentials in column five fall between those for the other

²³Because treatment occurs at the state and occupation level, this specification is *not* a difference-in-differences estimator. Rather, it uses cross-sectional variation in regulation status and credential attainment within four-digit occupation codes, after partialling out common time trends across all occupations. Although a difference-in-differences estimate would be informative about the change in the likelihood of credential attainment before and after a regulation is adopted, the CPS data has not been available long enough to estimate this first-stage effect with any precision for recent policy changes.

Table 4: Effect of Policy Coverage on Credential Attainment (CPS 2015-2019)

| | Dependent Variable: Indicator for Worker Credential Attainment | | | | | |
|---------------------------------|--|---------------------|-----------------------|---------------------|---------------------|---------------------|
| | Any Credential | | Government Credential | | Required Credential | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Licensing policy | 0.144*** (0.015) | 0.145*** (0.013) | 0.168*** (0.015) | 0.169*** (0.013) | 0.161*** (0.016) | 0.161*** (0.015) |
| Certification policy | 0.074** (0.030) | 0.079*** (0.027) | 0.100*** (0.026) | 0.104*** (0.024) | 0.079*** (0.028) | 0.084*** (0.026) |
| Registration policy | 0.067** (0.028) | 0.060** (0.026) | 0.090*** (0.027) | 0.084*** (0.025) | 0.072** (0.031) | 0.070** (0.029) |
| Other policy | 0.029 (0.043) | 0.037 (0.037) | 0.021 (0.038) | 0.027 (0.033) | 0.029 (0.037) | 0.037 (0.034) |
| Observations | 994,400 | 993,507 | 994,400 | 993,507 | 760,447 | 759,561 |
| R-squared | 0.301 | 0.316 | 0.311 | 0.325 | 0.362 | 0.375 |
| Dependent variable mean | 0.252 | 0.252 | 0.226 | 0.226 | 0.211 | 0.211 |
| Occupation FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| State FE + Demographic Controls | | ✓ | | ✓ | | ✓ |

Notes: This table reports the effect of regulation coverage on the probability that individuals report having attained a credential using data from the 2015 to 2019 Current Population Survey. The sample is limited to employed civilian adults who are asked about professional licenses and certifications, excluding unpaid family workers. Observations with imputed occupation or credentialing status are excluded. Whether a credential was required for the individual’s job is not recorded in 2015. Data on licensing and certification policies occurs at the six-digit SOC level and is aggregated to three-digit CPS occupation codes using national employment share weights derived from the Occupational Employment Statistics survey. Demographic controls are fixed effects for categories defined by sex, race, Hispanic ethnicity, ten year age bins, marital status, the presence of children in the home, metropolitan area, disability, and veteran status. All regressions include occupation and year fixed effects. Regressions are weighted using CPS basic monthly weights and standard errors are clustered by state. Significance levels are indicated by *** 1%; ** 5%; and * 10%.

two dependent variables, while policies other than licensing, certification, and registration have no significant effect on credential attainment in any specification. Lastly, the estimates are robust to including state fixed effects and a broad set of demographic controls.

To put these estimates into context, [Kleiner and Soltas \(2023\)](#) conduct a similar analysis using policy data on 55 occupations obtained mostly from the Institute for Justice and the National Conference of State Legislatures. They find that regulation of these occupations predicts a 6.6 percentage point increase in licensing attainment in the CPS, a smaller effect than I find using my regulatory data. Taken together, these results confirm that policy variation within occupations is reflected in differences in credential attainment across states, and that the relative size of these effects are consistent with the ordering of regulatory stringency. That said, I find that credential attainment varies less within detailed occupations than between them.

Robustness. Here, I explore the sensitivity of these results to several factors that could potentially attenuate the relationship between regulation coverage and credential attainment. First, [Table 5](#) splits licensing coverage into mandatory licensure and quasi-mandatory or effective licensure, since we would expect the latter to have a smaller effect on attainment. While point estimates are indeed smaller for quasi-mandatory and effective licensing, the effect of mandatory licensing is only a touch larger than the main estimates reported above.

Table 5: Effect of Detail Policy Coverage on Credential Attainment (CPS 2015-2019)

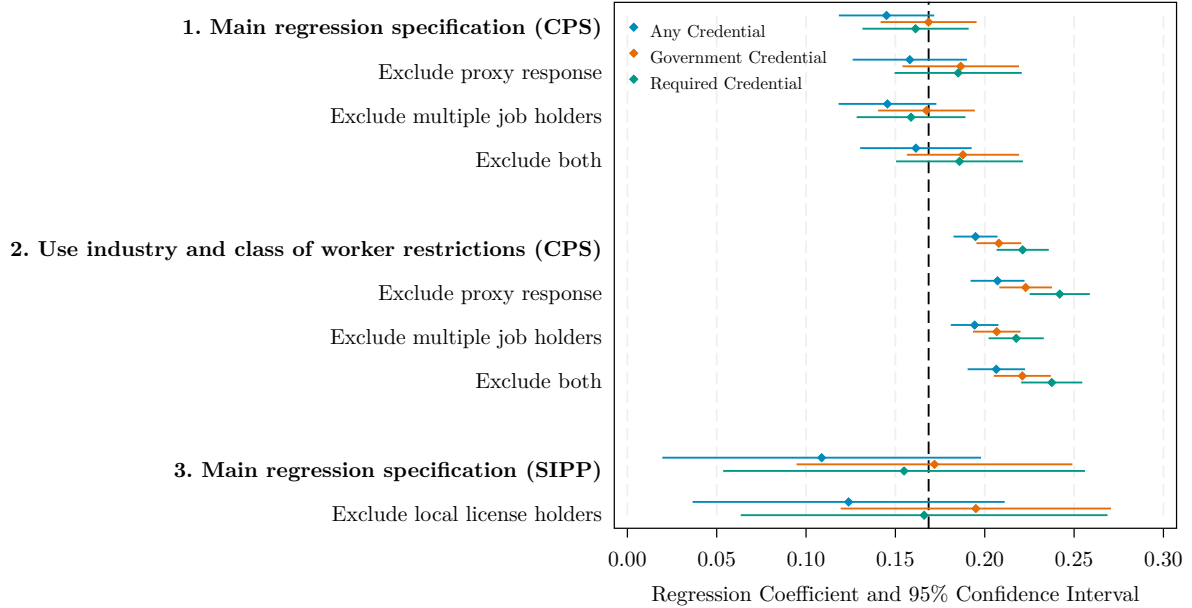
| | Dependent Variable: Indicator for Worker Credential Attainment | | | | | |
|----------------------------------|--|---------------------|-----------------------|---------------------|---------------------|---------------------|
| | Any Credential | | Government Credential | | Required Credential | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Mandatory licensing policy | 0.147*** (0.015) | 0.147*** (0.014) | 0.171*** (0.015) | 0.170*** (0.014) | 0.164*** (0.016) | 0.164*** (0.015) |
| Quasi-mandatory licensing policy | 0.124*** (0.030) | 0.133*** (0.030) | 0.150*** (0.031) | 0.157*** (0.031) | 0.132*** (0.023) | 0.139*** (0.024) |
| Certification policy | 0.063** (0.028) | 0.073*** (0.026) | 0.090*** (0.026) | 0.098*** (0.025) | 0.063** (0.024) | 0.072*** (0.023) |
| Registration policy | 0.068** (0.028) | 0.060** (0.026) | 0.091*** (0.027) | 0.085*** (0.025) | 0.073** (0.031) | 0.071** (0.029) |
| Other policy | 0.030 (0.043) | 0.037 (0.038) | 0.021 (0.038) | 0.027 (0.034) | 0.030 (0.037) | 0.038 (0.034) |
| Observations | 994,400 | 993,507 | 994,400 | 993,507 | 760,447 | 759,561 |
| R-squared | 0.301 | 0.316 | 0.311 | 0.325 | 0.362 | 0.375 |
| Dependent variable mean | 0.252 | 0.252 | 0.226 | 0.226 | 0.211 | 0.211 |
| Occupation FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| State FE + Demographic Controls | | ✓ | | ✓ | | ✓ |

Notes: This table reports the effect of regulation coverage on the probability that individuals report having attained a credential using data from the 2015 to 2019 Current Population Survey. The sample is limited to employed civilian adults who are asked about professional licenses and certifications, excluding unpaid family workers. Observations with imputed occupation or credentialing status are excluded. Whether a credential was required for the individual’s job is not recorded in 2015. Data on licensing and certification policies occurs at the six-digit SOC level and is aggregated to three-digit CPS occupation codes using national employment share weights derived from the Occupational Employment Statistics survey. Demographic controls are fixed effects for categories defined by sex, race, Hispanic ethnicity, ten year age bins, marital status, the presence of children in the home, metropolitan area, disability, and veteran status. All regressions include occupation and year fixed effects. Regressions are weighted using CPS basic monthly weights and standard errors are clustered by state. Significance levels are indicated by *** 1%; ** 5%; and * 10%.

Proxy responses in the CPS could also introduce measurement error if these respondents are less likely to report the correct occupation or credential status for other members of their household. Likewise, multiple job holding could be a source of error if workers hold a license for their secondary, but not primary, occupation. [Figure 6](#), however, shows that excluding proxy responses and multiple job holders from my sample has little effect on the magnitude of my estimates. Imposing industry and class of worker restrictions to narrow the set of workers likely covered by licensing requirements, on the other hand, raises estimates of the effect of licensing coverage on credential attainment to around 22 percentage points. While larger than my main estimates, this effect is still far smaller than the average difference in credential attainment between licensed and unlicensed occupations.

The last set of rows in [Figure 6](#) replicate my analysis using data from the Survey of Income and Program Participation. Here, I find that the effect of licensing coverage on the probability of reporting a government-issued credential is virtually identical to the estimate in my main CPS sample, though confidence intervals are much wider given the smaller sample. An advantage of the SIPP is that it records the source of workers’ credentials, which allows me to assess whether local licenses might be affecting the estimates above given that I only observe state and federal policies. Dropping all respondents who report a locally-issued license, however, has little effect on

Figure 6: Robustness of Policy Coverage and Credential Attainment Estimates



Notes: This figure repeats the specifications shown in even-numbered columns of Table 4 with different sample definitions. I estimate the full regression specification, but report only coefficients on licensing policies here. For comparison, the dashed line shows the effect of licensing coverage on attainment of a government-issued credential in my main CPS sample and specification.

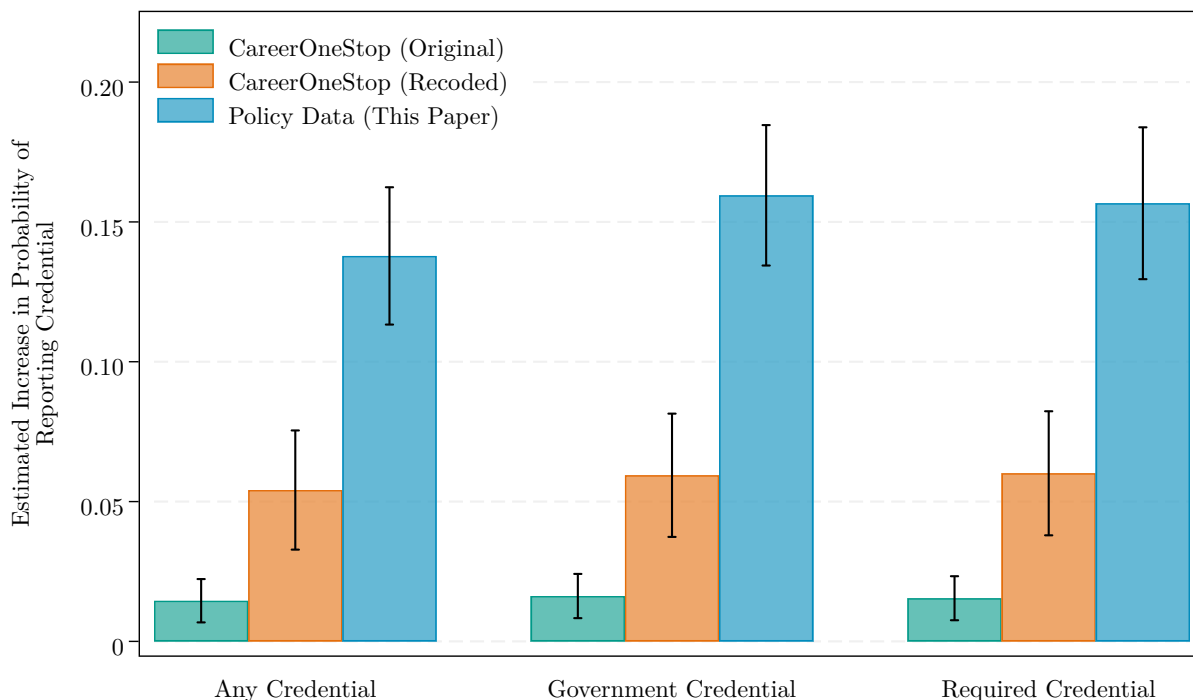
the estimates.

Comparison to the CareerOneStop database. As an alternative benchmark for the relationship between policy coverage and credential attainment, I also replicate my CPS analysis using alternative measures of policy measures from the CareerOneStop License Finder.

I create two policy variables using the CareerOneStop data. The first uses the database’s original crosswalk, which maps each regulation to a 6-digit Standard Occupational Classification code. I treat a state-occupation cell as regulated if the data identify any policies for that cell. For the second measure, I recode the data using the crosswalk developed for this project and apply the same sample selection criteria such as dropping casino and horsetrack licenses. I then aggregate both variables to CPS occupation codes using the method described above. To obtain comparable definitions of regulation, I do not differentiate between licensing, certification and registration policies in this exercise, since it is not possible to make this distinction in the CareerOneStop data.

Figure 7 displays estimates of Equation 1 for each of these alternative measures of policy coverage. I find that the original CareerOneStop data performs poorly in both absolute and relative terms. Although it predicts a statistically significant difference in credential attainment between regulated and unregulated cells, the point estimates are extremely small and fall near 1.5 percentage points for all CPS credential definitions. Cleaning the data improves its accuracy substantially,

Figure 7: Effect of Alternative Measures of Policy Coverage on Credential Attainment



Notes: This figure displays the estimated effect of regulation coverage on the probability that individuals report having attained a credential using data from the Current Population Survey. The original CareerOneStop regulation measure treats any state by 6-digit occupation cell as regulated if any policy for that cell appears in the database. The recoded measure uses a cleaned version of the database described in the text. All regressions include, state, occupation, year, and demographic strata fixed effects. Bars denote 95% confidence intervals for these estimates with standard errors clustered by state.

raising the point estimates to approximately 5 percentage points. However, this is still less than half the estimate obtained from my data, suggesting that the discrepancies reported in Table 3 are the result of misclassification in the CareerOneStop data rather than the other way around. These results provide additional evidence that this paper’s data improves on alternative sources and accurately classifies state-level policy variation.

5.2 Lightcast job postings

In addition to worker-level credential attainment, I also estimate the relationship between variation in policy coverage and the credentials appearing in the text of online job postings. The key advantage of the vacancy data relative to survey data is the ability to observe exactly which licenses and certifications employers require for each state and occupation.

Sample and estimation. I use vacancy data from Lightcast (formerly Burning Glass Technologies), which covers the near universe of online job postings since 2010. The data are constructed by compiling job advertisements from around 40,000 websites, removing duplicates, and processing the raw text to extract information such as expected wage, location, and skill requirements.

Lightcast also uses the ad text to standardize job titles and assigns each posting to a 6-digit Standard Occupational Classification code. While the data are available from 2010 onward, I focus on 2015-2019 to coincide with the availability of licensing and certification questions in the CPS. This sample includes 144 million total postings, of which 56 million are for SOC codes matched to the historical regulation data.

The main variable I use is a list of credentials appearing in each posting that are extracted and standardized by Lightcast. There are around 3,000 unique credentials identified in the data, including both state licenses (e.x. "licensed barber") and private certifications (e.x. "Microsoft Certified Professional"). Many credential titles, however, are too general to classify from their name alone. For instance, "interior design certification" could refer to a government license or certification issued by one of the 26 states that regulate interior designers, but it could also mean a professional certification such as the National Council for Interior Design Qualification. For this reason, I only distinguish between credentials that are *clearly* privately-issued or *potentially* government-issued.²⁴ About 20% of total job postings specify at least one credential, two-thirds of which are potentially government-issued.

Rather than working with the data at the postings level, I collapse to state-occupation cells, treating the entire five-year sample as a single cross-section. I do this separately for 6-digit (SOC) and 4-digit (CPS) occupation codes to assess the potential consequences of aggregation. The Lightcast data are broadly representative of U.S. vacancies and employment overall, but are somewhat skewed toward higher-skilled occupations (Hershbein and Kahn, 2018). For this reason, I reweight the data to match the occupational distribution of the CPS. Specifically, the weight for each state by 6-digit occupation cell equals the product of 4-digit CPS employment times the share of employment in each of its 6-digit subcomponents from the 2015 OEWS survey. I then estimate a two-way fixed effect specification similar to Equation 1, where the outcome is the share of Lightcast postings with a government or private credential.

Regulation coverage and job postings. Column 1 of Table 6 shows that having a licensing policy raises the share of job postings with any credential by 5.7 percentage points relative the same occupation in non-licensing states. Columns 2 and 3 show that this effect is driven by potential government credentials. In fact, postings in licensing states are somewhat *less* likely to include private certification requirements. While this negative effect is small and only marginally statistically significant, it suggests that there may be some substitution between licenses and other professional certificates. In contrast to findings using the CPS data, regulatory methods other than licensing have little effect on the credentials employers include in their job advertisements.

Columns 4 to 6 repeat the analysis on data aggregated to 4-digit CPS occupation codes. This aggregation has little impact on the magnitude of the estimates, implying that aggregation itself is not a major source of bias in this context. As with the relationship between policy coverage and

²⁴I exclude several common credentials including non-commercial driver's licenses, security clearance, basic first aid certification, and food handler cards.

Table 6: Effect of Policy Coverage on Credentials in Job Postings (Lightcast 2015-2019)

| | 6-Digit Occupation (SOC) | | | 4-Digit Occupation (CPS) | | |
|-------------------------|--------------------------|---------------------|--------------------|--------------------------|---------------------|-------------------|
| | Any Type (1) | Government (2) | Private (3) | Any Type (4) | Government (5) | Private (6) |
| Licensing policy | 0.057*** (0.008) | 0.064*** (0.007) | -0.006* (0.003) | 0.062*** (0.009) | 0.067*** (0.008) | -0.003 (0.003) |
| Certification policy | 0.014 (0.019) | 0.020 (0.018) | -0.001 (0.005) | 0.030 (0.024) | 0.033 (0.024) | 0.008 (0.007) |
| Registration policy | 0.021 (0.014) | 0.026* (0.014) | -0.006 (0.005) | 0.014 (0.017) | 0.016 (0.016) | -0.002 (0.004) |
| Other policy | 0.021 (0.015) | 0.024* (0.014) | 0.002 (0.006) | 0.024 (0.019) | 0.024 (0.018) | 0.007 (0.010) |
| Observations | 38,604 | 38,604 | 38,604 | 22,880 | 22,880 | 22,880 |
| R-squared | 0.938 | 0.945 | 0.862 | 0.947 | 0.953 | 0.884 |
| Dependent variable mean | 0.165 | 0.125 | 0.053 | 0.169 | 0.128 | 0.054 |
| Occupation FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| State FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Notes: This table reports the effect of policy coverage on the share of Lightcast job postings that include a credential requirement. Data on occupational regulation occurs at the level of 6-digit SOC codes. Columns 4 to 6 aggregate the data to four-digit CPS occupation codes, where policy indicators are weighted using national employment share estimates from the OEWS, as in the main CPS sample. All regressions include state and occupation fixed effects. Regressions and variable means are weighted to match the distribution of occupational employment in the Current Population Survey and standard errors are clustered by state. Significance levels are indicated by *** 1%; ** 5%; and * 10%.

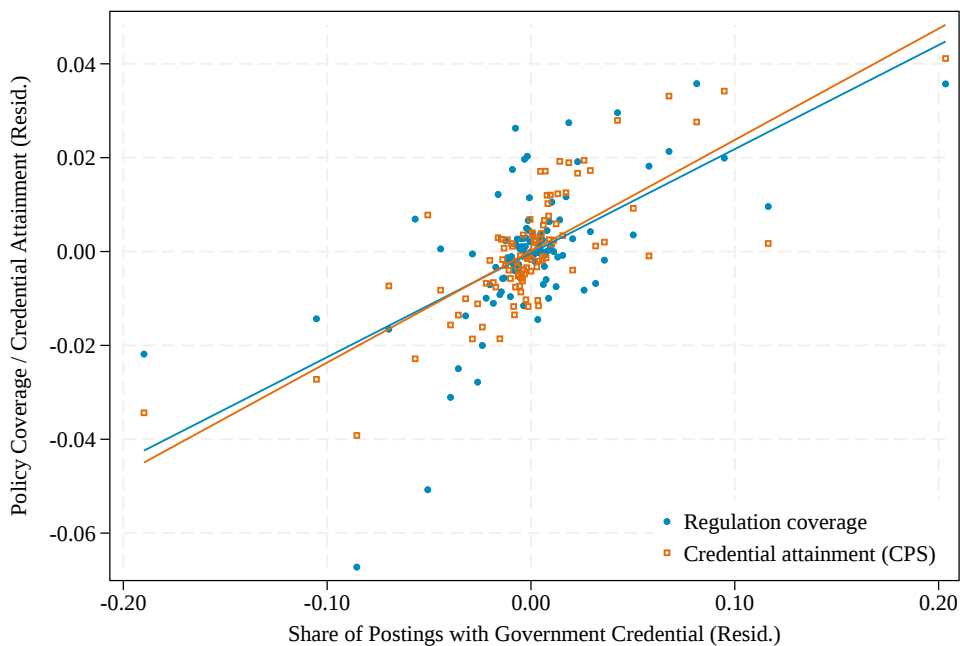
worker credential attainment, variation in licensing requirements across states is clearly reflected in the Lightcast data. The size of this effect, however, is smaller in absolute terms than the effect of policy coverage on the share of workers who report a professional license or certificate. This is to be expected since not all employers choose to specify qualifications and some private credentials are almost certainly misclassified as government credentials.

Figure 8 presents a direct comparison between policy coverage, CPS credential attainment, and Lightcast postings. It superimposes two binned scatterplots summarizing the relationship between these variables after netting out state and occupation fixed effects. Cells that have a larger fraction of postings with a potential licensing requirement (relative to their occupation and state) are more likely to be covered by a licensing policy and have a larger share of workers reporting that they hold a government-issued credential. More importantly, both regulation coverage and credential attainment display a similar relationship to job postings.

6 Interpreting variation in measures of licensing

Results from both the CPS and Lightcast data show that state-level policy differences have an economically significant effect on the credentials workers hold and employers require. Given that this correspondence is imperfect, however, how should researchers interpret variation in these measures across states and occupations?

Figure 8: Comparing Policy Coverage and Credential Attainment to Postings



Notes: The scatterplots shown in this figure are constructed by first computing variable residuals net of state and occupation fixed effects, then plotting the mean of these residuals within 100 equal-size bins of the independent variable (share of postings with a potential government credential). Observations are state by 4-digit occupation cells, which are weighted to match the distribution of occupational employment in the Current Population Survey.

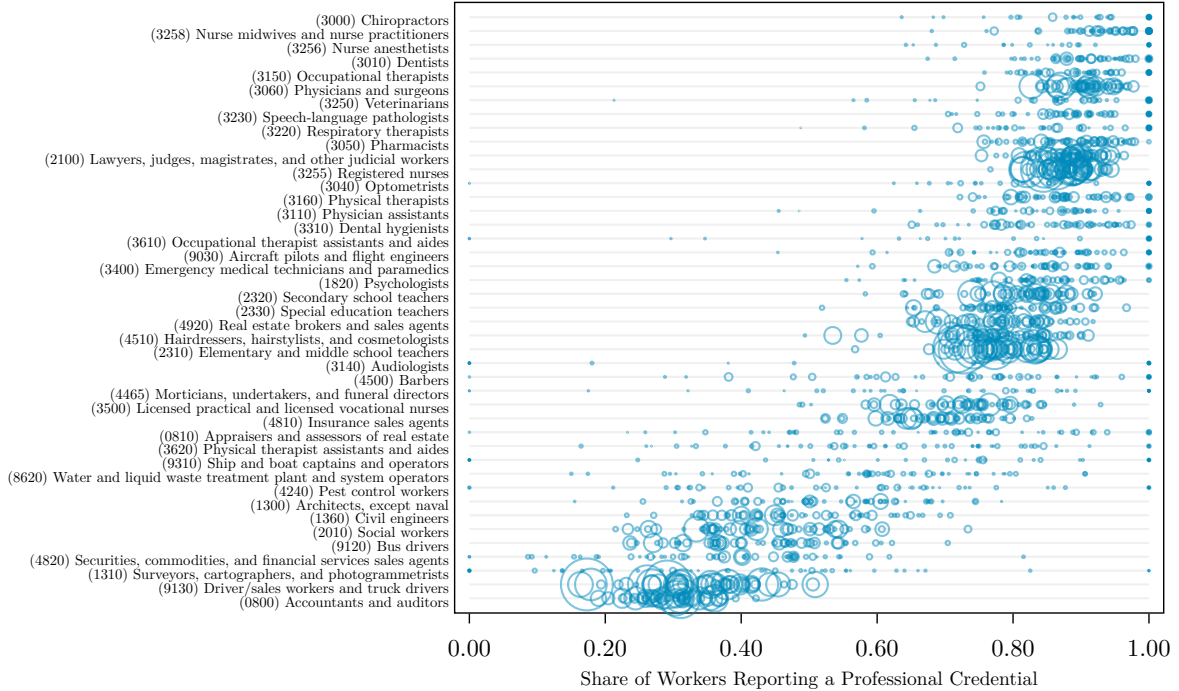
6.1 Discrepancies between policy coverage and credential attainment

First, it is important to note that even within occupations regulated by all states or the federal government, there is substantial variation in CPS credential attainment, as shown in Figure 9. While some occupations such as accountants and auditors have lower average credential attainment than others (since a license is only required for certain tasks), differences across states within these occupations, by construction, *cannot* be explained by policy variation.

Conversely, many workers report licenses in states and occupations with no clear policy correspondence. For example, 50% percent of diagnostic technologists and technicians (a category that includes radiologic technologists, nuclear medicine technologists, and diagnostic medical sonographers) report a license in states that have no credential requirement for medical imaging, while 70% report a license in states that regulate some or all specialities in this classification.²⁵ Discrepancies between policy coverage and credential attainment are therefore present even within narrowly-defined occupation categories with well-defined policy variation. In the rest of this section, I step through a non-exhaustive set of factors that may contribute to these patterns.

²⁵Similarly, Furth (2016) finds that credential attainment rates are statistically distinguishable across licensing states and non-licensing states for only 2 of 18 occupations in the Institute for Justice data matched to the CPS (dispensing opticians and dental assistants).

Figure 9: Credential Attainment by State in Universally-Licensed Occupations



Notes: This figure displays the share of workers reporting any professional credential by state and occupation for a subset of occupations that are regulated in every state (or by the federal government). Two unlicensed cells are excluded: respiratory therapists in Alaska and funeral directors in Colorado. Marker sizes are proportional to total employment in these cells.

Survey and coding error. There is some evidence that credential attainment is underreported in survey data. A pilot study conducted to evaluate the proposed CPS questions in 2010, for instance, found that 14 percent of workers who were known to hold a license based on information obtained directly from credentialing organizations did not identify as licensed when surveyed (Al-lard, 2016). Consistent with this possibility, surveys designed specifically to elicit information on occupational licensing have tended to find higher rates of credential attainment, albeit using much smaller samples than the CPS (Kleiner and Krueger, 2010, 2013). The type of credentials workers consider to be a professional certification or license could also differ from researchers' definitions. For example, in my data I do not consider alcohol server permits, food handler cards, or forklift operator certification to be licenses, but some individuals who hold these credentials might.²⁶

Measurement error in occupational affiliation is even more concerning. By some estimates, as many as 40 to 50% of 3-digit occupations conflict with information provided by workers' employers (Mellow and Sider, 1983; Mathiowetz, 1992). Although these estimates are relatively dated, occupational misclassification in survey data is still understood to be a pervasive issue, especially

²⁶It is also possible the workers misreport the source of their credential, leading them to be classified as (privately) certified instead of licensed. However, among 43 universally-licensed occupations in the CPS, the share of workers reporting any professional certification or license is only 2 percentage points higher than the share reporting a government-issued credential, so the magnitude of potential bias from this channel appears small.

at more detailed levels of aggregation (Abraham and Spletzer, 2009; Kambourov and Manovskii, 2013). Moreover, occupations are also subject to misreporting. Fisher and Houseworth (2013), for example, argue that some workers report higher skilled and higher paying jobs than they actually hold. If these are more likely to be licensed than workers' actual jobs, occupational inflation will bias estimates of credential attainment in the former downward.

Exemptions, non-compliance, and other truthful reporting. Although measurement error almost certainly attenuates the relationship between policy coverage and credential attainment, it is unlikely to be the only reason why these measures are not perfectly correlated. Even if measurement of both credentials and occupations were perfect, there are a number of reasons why we might expect self-reported licensing rates to vary even when policy does not.

First, some workers might be legitimately exempted from licensing requirements. This is especially true for occupations such as accounting and engineering, where licensing is only mandatory for certain tasks. As differences in exemptions across states are typically minimal within regulated occupations, however, variation in licensing shares across states could reflect some combination of sampling variation and differences in demand for workers performing these specific tasks. Similarly, workers who are eventually required to obtain a license may not have obtained it at the time they were surveyed. Cunningham (2019), for instance, notes that many of the 15% of physicians and surgeons who do not report a license in the CPS are probably medical residents who are not yet licensed to practice independently.

Compliance with licensing requirements could also be incomplete (Ingram, 2019). Only two-thirds of barbers, for example, report a government-issued credential, despite being licensed in every state. Other reasons survey reports could differ from apparent regulation coverage include workers holding an active license for a job other than the one in which they currently work; working in a jurisdiction with different requirements than their state of residence; employers requiring licenses that are not legally mandatory; and workers obtaining a license voluntarily.

Licensed occupations or licensed jobs? Another factor contributing to these patterns may be an imperfect mapping between regulatory and statistical occupation categories. Since the Lightcast data records which licenses and certifications appear in each posting, it can offer some insight into this classification issue.²⁷

Table 7 lists a subset of common credentials found in the data for licensed occupations. For each of these, I report the three most common SOC codes attached to postings that include these

²⁷Occupations in the Lightcast data could also be misclassified, but there are several reasons to think that measurement error is less of a concern than it is in the CPS. First, Carnevale et al. (2014) find that 6-digit occupation codes in the data are 73% accurate. Hershbein and Kahn (2018) note that this figure is likely a lower bound, as Lightcast has improved its methods over time, applying any changes retroactively to the entire dataset. Second, the occupational classification is based on job titles and descriptions provided by employers rather than worker self-reports. Third, Lightcast provides both occupation codes and the original job titles found in the posting, which allows users to spot-check the sample of interest. For the occupations discussed in this section, Lightcast's classification appears to be highly accurate.

Table 7: Lightcast Certifications and Associated Occupational Classification

| License and SOC Codes | Postings (%) | License and SOC Codes | Postings (%) |
|--|--------------|--|--------------|
| Registered Nurse (N = 8,997,414) | | Pharmacist License (N = 123,262) | |
| Registered Nurses (29-1141) | 91.37 | Pharmacists (29-1051) | 83.71 |
| Medical and Health Services Managers (11-9111) | 5.54 | Medical and Health Services Managers (11-9111) | 3.62 |
| Health Educators (21-1091) | 0.71 | Medical Records and Health Information Technicians (29-2071) | 1.69 |
| CDL Class A (N = 3,069,585) | | Licensed Attorney (N = 98,935) | |
| Heavy and Tractor-Trailer Truck Drivers (53-3032) | 89.55 | Lawyers (23-1011) | 84.74 |
| Light Truck or Delivery Services Drivers (53-3033) | 2.30 | Financial Managers (11-3031) | 2.78 |
| Driver/Sales Workers (53-3031) | 0.98 | Accountants and Auditors (13-2011) | 2.50 |
| Certified Public Accountant (N = 1,277,358) | | Electrician Certification (N = 98,075) | |
| Accountants and Auditors (13-2011) | 41.52 | Electricians (47-2111) | 57.43 |
| Financial Managers (11-3031) | 33.09 | Maintenance and Repair Workers, General (49-9071) | 6.77 |
| Financial Analysts (13-2051) | 7.52 | Electrical and Electronics Engineering Technicians (17-3023) | 3.39 |
| Licensed Practical Nurse (N = 1,127,349) | | Cosmetology License (N = 97,515) | |
| Licensed Practical and Licensed Vocational Nurses (29-2061) | 81.07 | Hairdressers, Hairstylists, and Cosmetologists (39-5012) | 46.35 |
| Registered Nurses (29-1141) | 8.02 | Retail Salespersons (41-2031) | 16.99 |
| Nursing Assistants (31-1014) | 3.29 | First-Line Supervisors of Personal Service Workers (39-1021) | 12.98 |
| Certified Nursing Assistant (N = 901,642) | | Psychologist License (N = 61,664) | |
| Nursing Assistants (31-1014) | 85.35 | Clinical, Counseling, and School Psychologists (19-3031) | 50.47 |
| Home Health Aides (31-1011) | 7.14 | Medical and Health Services Managers (11-9111) | 8.25 |
| Health Technologists and Technicians, All Other (29-2099) | 4.83 | Mental Health Counselors (21-1014) | 6.28 |
| Insurance License (N = 297,543) | | Security Guard Certification (N = 51,036) | |
| Insurance Sales Agents (41-3021) | 33.43 | Security Guards (33-9032) | 77.03 |
| Personal Financial Advisors (13-2052) | 13.93 | Managers, All Other (11-9199) | 5.92 |
| Sales Representatives, Wholesale and Manufacturing (41-4012) | 12.65 | Protective Service Workers, All Other (33-9099) | 4.14 |
| Social Work License (N = 294,955) | | Licensed Marriage and Family Therapist (N = 48,870) | |
| Social Workers, All Other (21-1029) | 20.85 | Mental Health Counselors (21-1014) | 17.59 |
| Healthcare Social Workers (21-1022) | 13.89 | Medical and Health Services Managers (11-9111) | 12.47 |
| Registered Nurses (29-1141) | 11.30 | Marriage and Family Therapists (21-1013) | 11.32 |
| CDL Class B (N = 237,023) | | Licensed Barber (N = 45,301) | |
| Heavy and Tractor-Trailer Truck Drivers (53-3032) | 40.60 | Hairdressers, Hairstylists, and Cosmetologists (39-5012) | 74.36 |
| Driver/Sales Workers (53-3031) | 11.36 | First-Line Supervisors of Personal Service Workers (39-1021) | 18.63 |
| Light Truck or Delivery Services Drivers (53-3033) | 9.59 | Barbers (39-5011) | 3.38 |
| Registered Dietitian (N = 138,684) | | Adjuster License (N = 38,200) | |
| Dietitians and Nutritionists (29-1031) | 55.53 | Claims Adjusters, Examiners, and Investigators (13-1031) | 52.70 |
| Food Service Managers (11-9051) | 9.15 | Insurance Claims and Policy Processing Clerks (43-9041) | 12.88 |
| Registered Nurses (29-1141) | 6.00 | Insurance Appraisers, Auto Damage (13-1032) | 5.63 |
| Registered Respiratory Therapist (N = 133,161) | | Plumbing License (N = 23,819) | |
| Respiratory Therapists (29-1126) | 74.26 | Plumbers, Pipefitters, and Steamfitters (47-2152) | 69.47 |
| Medical and Health Services Managers (11-9111) | 5.51 | Maintenance and Repair Workers, General (49-9071) | 6.62 |
| Registered Nurses (29-1141) | 3.64 | Construction Managers (11-9021) | 2.85 |

Notes: This table lists the three most common Standard Occupational Classification codes associated with 20 license or certification categories appearing in online job postings data from Lightcast. The total number of postings from 2015 to 2019 that include each credential is shown in parentheses. Columns two and four report the share of these postings assigned to each SOC code by Lightcast.

requirements. In all but two cases, the most common code identified by Lightcast agrees with how these licenses are classified in my data. The exceptions are “licensed marriage and family therapist,” which appears in more postings for mental health counselors than marriage and family therapists, and “licensed barber,” which appears in more postings for hairdressers, hairstylists, and cosmetologists than postings for barbers.²⁸

However, licenses also frequently appear in postings for multiple occupation codes, even when they have a close or exact statistical equivalent. For instance, while more than 90% of postings

²⁸This can be attributed to the relative size of these occupations. As of 2015, there were 4 mental health counselors for every marriage and family therapist and 25 cosmetologists for every barber reported in the Occupational Employment and Wage Statistics survey.

requiring a registered nurse credential appear in the SOC code for registered nurses, there were also nearly a million job postings requiring an RN license in other occupations between 2015 and 2019. Similarly, the majority of postings requiring a CPA license are not classified as accountants and auditors. Broadly speaking, [Table 7](#) shows that licenses often spill over into management and related occupations, which may or may not be directly licensed themselves. Without knowledge of the specific tasks these jobs require, however, it is impossible to know whether licensing in these cases is a legal requirement or potentially valued by employers for other reasons.

The Lightcast data therefore offers another plausible explanation for why we might observe licensed workers in unlicensed states and occupations: a specific *job* may require a license even when the worker’s broader *occupation* does not. Such spillovers are likely to be present in survey data as well, though they cannot be directly observed.

6.2 Implications and recommendations for researchers

As data on worker-level credential attainment has only recently become available, researchers wishing to study changes in regulatory requirements over time *must* leverage policy variation. While my dataset offers a highly accurate and internally-consistent resource to do so, like any policy dataset, it requires users to make assumptions about the set of workers most affected by these laws.²⁹ Given the discussion above, this implies:

1. Linking regulated occupations to labor market outcomes ultimately depends on the accuracy and granularity of the coding system in researchers’ *outcome* data. While the crosswalk I provide is consistent with BLS and Census documentation, in practice, self-reported occupations are measured with significant error in many datasets, which may attenuate regression estimates. Occupational misclassification may be less concerning in establishment surveys or in datasets such as Lightcast that include granular job titles. It may also be less severe for occupations whose titles are highly specific or descriptive (e.g. architects) compared to those that are more general (e.g. counselors).
2. Since exemptions, take up, and the task composition of specific jobs are generally unobserved, estimates based on policy data should be interpreted as the average effect on the occupation as a whole (however narrow or broadly defined). These are akin to intention-to-treat effects, and are conceptually different from worker or task-level treatment effects. This cautions against directly comparing point estimates based on policy data to those based on alternative measures, though both may be parameters of interest to researchers and policymakers.

²⁹The challenge of identifying the relevant population to study state-level policy changes is not unique to the occupational licensing literature. Minimum wage studies, for instance, have often focused on how these laws affect low-wage industries such as restaurants ([Dube et al., 2010](#)) or certain demographic groups like teenagers ([Neumark and Wascher, 1995](#)) or immigrants ([Orrenius and Zavodny, 2008](#)). Just as minimum wage increases are not necessarily binding for all workers in these groups, not all workers in occupations covered by licensing requirements are necessarily required to obtain a license themselves.

3. Researchers should be attentive to potential spillovers across related occupations. Depending on the research design, these externalities may be a serious threat to causal inference. Additional data on credentials, occupational transitions, or task similarity could be used to assess the likelihood of these spillovers and choose treatment and control groups accordingly.
4. Since policy data captures regulatory coverage rather than attainment, survey data is a more reliable source of statistics such as the share of the workforce who actually holds a license nationally or across states. Within detailed occupation categories, however, it is less clear that credential attainment is a useful proxy for policy variation, as the later may also reflect sampling error, misclassification, or differences in demand for specific tasks and sub-occupations. This makes it difficult to isolate exogenous variation in regulatory requirements across disaggregated state-occupation cells without additional assumptions.
5. Both policy and survey-based measures of licensing contain useful information as well as limitations. Which of these measures researchers prefer will depend on the question they are interested in and on the type of data required for their research design.

7 Conclusion

In this paper I present a novel database that for the first time compiles a comprehensive history of professional and occupational credentialing regulations for a broad set of occupations. The data collection methodology I introduce overcomes the limitations of existing approaches by allowing me to observe the full text of all state legislation exactly as it appeared when enacted. As a result, I am able to locate superseded laws and trace the statutory development of each policy from its origin. My data are also the first to differentiate between alternative approaches to regulation with differing legal restrictions and economic implications.

My data can potentially be used to study a range of questions within a literature that until recently has been constrained by a lack of data. In [Carollo \(2020\)](#), for instance, I exploit recent policy differences across states to study the impact of occupational licensing requirements on earnings and employment. Similar designs could be applied to evaluate the effect of these laws on other outcomes, specific demographic groups, or at different points in time. In other work, [Carollo et al. \(2023\)](#) use the data to study the political and economic factors associated with the enactment and diffusion of licensing statutes across states and over time. The data are also sufficiently comprehensive that it could be used to explore the macroeconomic implications regulatory trends.

As with any policy dataset, my data has certain limitations. Linking policies to other datasets, in particular, requires users to make assumptions about the set of workers these regulations apply to. The quality of these matches may not be ideal for all outcomes researchers might wish to study. Likewise, my data provide a measure of licensed occupations, not licensed jobs, which matters for the interpretation of estimates. Without additional information on the tasks individuals perform,

policy coverage can only be assigned based on workers' occupation, industry, and job title. Further, regulatory compliance and enforcement is unobservable. Despite these limits, my data offer a highly accurate and internally-consistent record of policy differences across states and occupations.

There is also scope for additional research and data collection. First, researchers and policymakers may be interested in how the specific requirements to obtain occupational licenses have changed over time. The Occupational Licensing Law Research Project at the University of Minnesota is currently collecting exactly this type of information for a subset of licensed occupations. Second, many other features of these laws including scope of practice, the composition of board members, reciprocity agreements between states, or the extent of grandfathering provisions could be fruitful avenues for future research. Third, natural language processing could be applied to extract additional features from the text of these laws. The citations and documentation I provide along with the raw data may facilitate these extensions.

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Appendix

This appendix describes existing compilations of data on occupational licensing, certification, and registration policies (listed chronologically). To the best of my knowledge, these cover all previous sources that have attempted to compile this type of data for more than a handful of individual states or occupations. I report sources consulted while researching individual occupations in the underlying data for this project rather than in the text of this appendix.

A1. Sources included in data cross-validation

CareerOneStop License Finder. 2019. [Dataset], <https://www.careeronestop.org/Toolkit/Training/find-licenses.aspx>, Accessed March 8, 2019.

The CareerOneStop License Finder is an online database that publishes occupational credentialing requirements collected by state labor market information units under a grant from the U.S. Department of Labor. The version of the data used in this paper does not consistently differentiate between credential types or report legal citations. A crosswalk of license titles to Standard Occupational Classification codes is provided with the data.

Institute for Justice. 2017. [Dataset] “License to Work: A National Study of burdens from Occupational Licensing (2nd edition).” <https://ij.org/report/license-to-work-2/>.

The Institute for Justice has compiled licensing requirements for 102 lower-income occupations (many of which apply to various specialty trade contractors). It reports standardized measures of entry qualifications including exams, education/training days, and fees. The data do not cover voluntary state certification. I work with the 2nd edition of the data in my analysis, but a 3rd edition of the data was released in 2022 (and the 1st in 2012).

National Conference of State Legislatures. [Dataset.] 2017. “The National Occupational Licensing Database.” <https://www.ncsl.org/labor-and-employment/>.

Similar to the Institute for Justice, the National Conference of State Legislatures has published data on licensing qualification for 48 occupations that are licensed in 30 or more states, require less than a four-year degree, and have positive projected employment growth over the next 10 years.

Bianco, David P., ed. 1996. *Professional and Occupational Licensing Directory: A Descriptive Guide to State and Federal Licensing, Registration, and Certification Requirements*. 2nd ed. Detroit: Gale Research Inc.

This directory provides a complete list of occupations licensed, certified, or registered in each state, along with contact information for regulatory agencies and a detailed description of credential qualifications. Data was obtained from federal and state licensing agencies and boards, publications of professional associations, and compilations of state law. Some entries include legislative citations. I work with the second edition of this report (the first was published in 1994).

Council on Licensure, Enforcement and Regulation. 1994. *The Directory of Professional and Occupational Regulation in the United States and Canada.* Lexington, KY.

Provides an update to the 1990 study by CLEAR and the Council of State Governments.

National Clearinghouse on Licensure, Enforcement and Regulation (CLEAR) and the Council of State Governments. 1990. *Occupational and Professional Regulation in the States: A Comprehensive Compilation.* Lexington, KY.

Claims to provide a complete list of all occupations, licensed, certified, or registered in each state at the time of publication. This data was obtained from state agencies and boards.

Council of State Governments. 1982–2006. *The Book of the States.* Lexington, KY.

The Book of States series periodically tabulated licensing, certification, and registration requirements for several dozen occupations. The sources of this data vary, but include other studies by the Council of State Governments, national associations, and state boards.

U.S. Department of Health, Education, and Welfare. 1977. *State Regulation of Health Manpower.* Washington, D.C.: U.S. Department of Health, Education, and Welfare.

This report updates the 1967 study by the same organization. It provides detailed information about qualifications, but does not differentiate between mandatory and voluntary credentials or provide enactment dates.

U.S. Department of Labor. 1969. *Occupational Licensing and the Supply of Nonprofessional Manpower: Manpower Research Monograph No. 11.* Washington, D.C.: Educational Testing Service and U.S. Department of Labor.

This monograph provides a list of regulated occupations by state that must meet at least one of the following requirements: payment of a fee, bonding, examination, or training. Uniquely, the data in this report was collected from *State and Local Taxes* published by Prentice-Hall Inc. This methodology appears to result in many false positives, as privilege taxes cannot be distinguished from regulatory requirements.

Council of State Governments. 1968. *Occupations and Professions Licensed by the States, Puerto Rico, and the Virgin Islands.* Chicago, IL.

This document provides an update to the Council of State Governments' seminal 1952 study. Data were obtained through questionnaires sent to state legislative services and central licensing agencies.

U.S. Department of Health, Education, and Welfare. 1967. *State Licensing of Health Occupations.* Washington, D.C.: U.S. Department of Health, Education, and Welfare.

This policy report lists the year of first enactment of state licensing statutes for a number of health occupations. It differentiates between “compulsory” and “voluntary” licensing, but reports only a single enactment date (and therefore misses transitions between voluntary and compulsory requirements). It also contains information about license qualifications for these occupations.

Council of State Governments. 1952. *Occupational Licensing Legislation in the United States*. Chicago, IL: The Council of State Governments.

This seminal study compiled enactment dates for nearly all occupational licensing policies known to be in effect at the time. These were obtained from questionnaires sent to state agencies and from occupational associations. The data do not differentiate between mandatory licensure and voluntary state certification (though there are some textual descriptions of these laws). It does not report legal citations and some enactment dates were not reported.

U.S. Department of Commerce. 1942. *State Occupational Legislation*. Washington, D.C.: U.S. Department of Commerce.

This report provides a comparative study of detailed statutory provisions (including qualifications) for a subset of licensed occupations.

Graves, Brooke W. 1939. "Professional and Occupational Restrictions." *Temple Law Quarterly* 13(3): 334–364.

This is the earliest comparative study of occupational regulation I am aware of. Table 3 reports policy enactment dates, though a significant share of these are coded as "not available." The data were obtained through correspondence with state agencies, and examination of published literature of national associations.

A2. Other data

The following sources also provide information on occupational licensing policies, but for various reasons are not included in the validation data used in this paper.

Knee Regulatory Research Center. 2023. [Dataset]. "Find Occupations." <https://csorwvu.com/find-occupations/> (Accessed August 6, 2023).

The Knee Center at West Virginia University has compiled current regulatory requirements for a large number of occupations and has made this information available to the public. It provides extensive information about specific qualifications such as degree requirements, exams, training, citizenship, and continuing education. I consulted this source while compiling my data, but do not include it in the cross-validation tests presented in this paper, as regulatory features are often provided as detailed textual descriptions rather than harmonized categorical variables.

Redbird, Beth. 2017. [Dataset], "The Northwestern Licensing Database." <http://www.bethredbird.com/want-the-data/>.

This database reports enactment dates of state and federal occupational legislation and regulations for all 50 states from 1970 to 2017. The data were collected through a census of licensing statutes in 2012-2013, then updated via notification of bill enactments. The data are no longer publically-available, and therefore are not included in my cross-validation tests.

Appendix Table 1: Comparison of Previous Data Sources

| | Enactment Dates | Regulatory Methods | Credential Qualifications | Policy data mostly obtained from: |
|--|-----------------|--------------------|---------------------------|--|
| This Paper | ✓ | ✓ | | Session laws; statutes and regulations |
| CareerOneStop License Finder (2019) | | * | * | State labor market information units |
| Institute for Justice (2017) | | * | ✓ | Statutes and regulations |
| National Conference of State Legislatures (2017) | | * | ✓ | Statutes and regulations |
| Bianco, David P. ed. (1996) | | ✓ | ✓ | Licensing agencies and boards; statutes and regulations |
| Council on Licensure, Enforcement, and Regulation (1994) | | ✓ | | State agencies and boards |
| CLEAR and the Council of State Governments (1990) | | ✓ | | State agencies and boards |
| Council of State Governments (1982-2006) | | ✓ | | Other CSG studies; national associations; licensing boards |
| Department of Health, Education, and Welfare (1977) | | | ✓ | Bureau of health manpower licensure information system |
| U.S. Department of Labor (1969) | | | | <i>State and Local Taxes</i> by Prentice-Hall Inc. (1960-1969) |
| Council of State Governments (1968) | | * | | Survey of legislative services and central licensing agencies |
| Department of Health, Education, and Welfare (1967) | ✓ | ✓ | ✓ | Survey of governors' offices and central licensing agencies |
| Council of State Governments (1952) | ✓ | | | Survey of state agencies; professional associations |
| Department of Commerce (1942) | | | ✓ | Statutes |
| Graves (1939) | ✓ | | | State licensing agencies; published literature and reports |
| Knee Regulatory Research Center (2023) | | ✓ | ✓ | Statutes and regulations; state websites |
| Northwestern Licensing Database (2017) | ✓ | | | Statutes and regulations |
| Angel (1970) | | | | Unclear |

Notes: A checkmark denotes that the source has the indicated information. An asterisk denotes that some information is available, but not consistently recorded or requires additional assumptions. For instance, the Institute for Justice does not record voluntary certification, but registration (according to the definitions used in this paper) can be inferred from qualifications. Similarly, the CareerOneStop License Finder provides some information about qualifications, but only for a subset of policies. Enactment dates and credential types are generally easy to extract from sources where they are available. Credential qualifications, by contrast, are often provided as textual descriptions rather than harmonized variables. The Institute for Justice (2017), NCSL (2017) and Knee Center (2023) provide the cleanest machine-readable data on qualifications.

Angel, Juvenal Londoño. 1970. *Directory of Professional and Occupational Licensing in the United States.* World Trade Academy Press.

This reference volume lists occupational licenses by state and provides contact information for relevant boards. However, it also appears to include local credentials, permits, business licenses, and privilege taxes. This makes it extremely difficult to identify credentials that are within the scope of this project. Further, initial examination of the data revealed an unusually large number of false positives, even when compared to other sources collected around the same time such as the U.S. Department of Labor (1969). For that reason, I do not work with data from this source.