More Battles among Licensed Occupations: Estimating the Effects of Scope of Practice and Direct Access on the Chiropractic, Physical Therapist, and Physician Labor Market

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ABSTRACT

Primary-care physicians, chiropractors, and physical therapists (PTs) may all potentially treat patients experiencing back and neck pain—a $300 billion market. In this paper, we examine how state-level changes in chiropractic scope of practice and PT direct access to patients influence the wages, hours worked, and employment of each practitioner. Our results suggest that expansions in chiropractic scope of practice are associated with an increase in average chiropractor wages and a slight reduction in the average hours chiropractors work per week. We find little evidence that PT direct access has affected the labor market for any of the three studied practitioners.

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The number of workers directly affected by occupational licensing has grown from about 4 percent in the 1950s to about 29 percent as of 2006 (Kleiner and Krueger 2010). The issue has attracted attention from policymakers at both the state and federal levels (US Treasury 2015). Licensing statutes restrict the practice of a profession to only those individuals who have met a specific set of requirements (typically minimum training levels and examinations). In theory, restricting the supply of potential entrants into a profession through licensing may increase a professional's earnings. Recent literature suggests this effect is important when a broad profession includes two types of service providers that might compete for clients (Perry 2009; Kleiner et al. 2014) and when one service provider can influence the licensing of the other (Kleiner and Won Park 2011; Kleiner 2013).[1]

In this paper, we focus on the practice of medicine, chiropractic, and physical therapy, which are each licensed in all 50 states. Licensing statutes typically specify the tasks that license holders are allowed to perform. Chiropractors, physical therapists (PTs), primary-care physicians, and (in complex cases) orthopedic surgeons all have treatment modalities for back and neck pain. Each profession has historically had a different philosophy of the sources of pain and its management, different evidence bases supporting each approach's efficacy, and different views on the quality of each profession's evidence. Stated simply, there has

1. Some restrictions imposed through occupational licensing have drawn the recent attention of the antitrust authorities. The Supreme Court recently decided *N.C. Bd. of Dental Exam'rs v. Fed. Trade Comm'n*, 717 F.3d 359 (4th Cir. 2013), *aff'd*, 135 S. Ct. 1101 (2015)). In response to the rise in teeth-whitening services provided by nondentists, the North Carolina Dental Board sent cease-and-desist letters to nondentist teeth whiteners, indicating that they were practicing illegally and should stop offering these services because teeth whitening is the practice of dentistry. The Federal Trade Commission (FTC) challenged the Board's conduct, alleging that their actions led to higher prices, reduced consumer choice, and suppressed competition. The US Court of Appeals for the Fourth Circuit sided with the FTC. The Supreme Court ruled that the board failed the "state action doctrine" requirement of active state supervision because the board comprises members that are active participants in the occupation that it regulates.

"In theory, the extent to which these providers are complements or substitutes should be evident from observable changes in their labor supply and wages arising from changes in the law."

been historical animosity among the professions. Animosity between chiropractors and physicians has been driven by the validity of the science, whereas in the case of physical therapists and physicians, it is an issue of professional subordination akin to that of dentists and dental hygienists studied by Kleiner and Won Park (2011). This historical animosity, coupled with different philosophies of treatment, has led to substantial competition for patients seeking relief from back and neck pain, a market which involves approximately $300 billion in spending per year (Armstrong 2011).

Because of the increasing number of individuals seeking relief from back and neck pain (Freburger et al. 2009; Waterman, Belmont, and Schoenfeld 2012) and related musculoskeletal conditions, chiropractors and PTs now have an important role in the market for medical services directed at treating these conditions. Furthermore, as patients come to trust these nontraditional providers, there has also been an expanding role, at least in the case of chiropractic, for the delivery of other medical services (e.g., allergy treatments) typically provided by primary-care physicians.

Whether these providers serve as complements to or substitutes for physicians depends on perspective. The nature of the relationship between these professions is partially driven by the legal environment. Specifically, scope-of-practice and direct-access laws define the boundaries between the professions. Variation in these laws across states and over time allows for an empirical examination of the relationship between all three providers. In theory, the extent to which these providers are complements or substitutes should be evident from observable changes in their labor supply and wages arising from changes in the law.

We examine how and to what extent state-level scope of practice for chiropractors and direct-access laws for PTs impact the earnings, hours worked, and employment of chiropractors, PTs, and physicians. We match state-level scope-of-practice data obtained from the Federation of Chiropractic Licensing Boards and data on the presence of direct-access laws from the American Physical Therapy Association (APTA) with 1970–2000 census

data and 2001–2010 American Community Survey (ACS) data. Our results suggest that more permissive scope-of-practice laws increase chiropractor wages. We find no evidence that direct-access laws affect PT or chiropractor wages. Overall, the net effect of these laws for consumers may be positive since consumers have access to a wider choice of providers (PTs, physicians, and chiropractors) at potentially lower cost.[2] Finally, we test for the possibility of policy endogeneity by examining whether growth in professional wages or practitioner supply predicts the adoption of policy in the next 10 years. We find limited evidence of policy endogeneity for scope-of-practice laws and no evidence for direct-access laws.

I. BRIEF HISTORY AND BACKGROUND

A. Brief History of Chiropractic Licensing and Overview of Scope of Practice

For much of its history, chiropractic has been at odds with the allopathic medical profession.[3] The origins of the practice of chiropractic can be traced to Daniel David Palmer in the United States in 1886. Palmer offered "magnetic healing" with his hands as a substitute to the services provided by physicians in Iowa. Chiropractic practitioners in the early nineteenth century were often prosecuted for violating state allopathic or osteopathic licensing laws. Palmer was one of the first individuals in the United States to be found guilty of practicing medicine without a license and served 23 days in prison in 1906 (Keating, Cleveland, and Menke 2004).

As chiropractic expanded at the beginning of the twentieth century, the Flexner report (published in 1910) addressed concerns over heterogeneity in the training and practice of medicine in the United States and Canada. Although chiropractic medicine was not a focus of his report, it was mentioned in a negative light:

2. According to data from the American Chiropractic Association, American Physical Therapist Association, and American Medical Association, a chiropractic visit costs about $65, a PT visit costs $80, a primary-care visit costs about $100, and an orthopedist visit costs about $232.
3. Allopathic medicine, sometimes referred to as Western or evidence-based medicine, has traditionally been the majority philosophy and source of training for physicians in the United States. Osteopathic medicine, which takes a more "holistic" approach, has come into the mainstream more recently. Importantly, it includes some role for manual spinal manipulation, which is a core treatment modality among chiropractors, though there are differences in the training and philosophy of the two groups. Other divisions in medicine include naturopathy and homeopathy, but these are beyond the scope of this paper owing to data limitations within the census and ACS.

> The chiropractics, the mechano-therapists, and several others are not medical sectarians, though exceedingly desirous of masquerading as such; they are unconscionable quacks, whose printed advertisements are tissues of exaggeration, pretense, and misrepresentation of the most unqualifiedly mercenary character (Flexner 1910).

In order to establish chiropractic as a viable and legal alternative to physician services, chiropractors began lobbying for licensing legislation (Wardwell 1992). Kansas was the first state to license chiropractors in 1913. Over the next decade, 26 additional states adopted licensing legislation. By the end of 1933, all but 11 US jurisdictions had passed licensing statutes. The final state to pass a statute was Louisiana in 1974 (Wardwell 1992).

To combat encroachment by chiropractors and other nontraditional medical practitioners in the market for physician services, the American Medical Association (AMA) and regional and state medical societies lobbied for "basic science" statutes that required all medical practitioners, including chiropractors, to pass a common entry exam consisting of questions on anatomy, bacteriology, and physiology (Keating, Cleveland, and Menke 2004). The laws were quite successful in blocking entry of aspiring chiropractors. For example, between 1929 and 1950, not a single new chiropractor was licensed in Nebraska (Metz 1965). Chiropractic services were also originally excluded from Medicare coverage.

Because of the view that chiropractic practice was based on dubious science, the AMA actively fought the expansion of chiropractic care and barred any association of physicians with chiropractors and other practitioners of "unscientific" healing. In 1963, the AMA formed a "Committee on Quackery," which attempted to eliminate chiropractors. But chiropractors eventually fought back, beginning with intense and successful lobbying efforts for Medicare to cover some chiropractic services beginning in 1973 and a landmark antitrust lawsuit filed in 1976.[4] By 1980, the "basic science test" requirement was repealed in all states, and in 1990 the AMA was found to have violated the Sherman Act.[5] Nevertheless, the influence of physicians in shaping chiropractic licensing laws remains visible in the scope-of-practice sections of these statutes. Further, recent evidence suggests that, because they want to protect market share, physicians are reluctant to accept chiropractic as a viable substitute (Kelner et al. 2004), and willingness to make referrals to chiropractors still appears limited

4. Wilk v. Am. Med. Ass'n, 719 F.2d 207 (7th Cir. 1983).
5. Wilk v. Am. Med. Ass'n, 895 F.2d 352 (7th Cir. 1990).

(Greene et al. 2006). The scope-of-practice section of a licensing statute specifies the tasks licensees are allowed to perform. If physicians are able to successfully prevent chiropractors from performing certain procedures, they may conceivably be able to defend their market share. The market share of physician visits related to back and neck pain is economically meaningful, with recent estimates suggesting 5 out of every 100 adults aged 18–64 seek nonoperative care for back and neck pain in a given year (Feuerstein, Marcus, and Huang 2004).

Chiropractic scope-of-practice laws vary tremendously from state to state. There is no complete source of information on scope of practice for each state, but the Federation of Chiropractic Licensing Boards conducts a survey of licensing regulations for each state that does contain some important information on chiropractic scope of practice.[6] Utilizing data furnished by the Federation of Chiropractic Licensing Boards, we identify phlebotomy (i.e., the process of inserting a needle into a vein), advice and recommendations on the use of proprietary drugs, and physiotherapy (i.e., physical therapy) as three key elements of scope of practice that have the greatest potential to influence the market for chiropractors, physical therapists, and physicians. Table 1 presents data on important changes to chiropractic scope of practice in each state. Beginning in 1994, six states (Arkansas, Colorado, Iowa, Illinois, Nevada, and Wisconsin) began to allow chiropractors to perform phlebotomy. In the 1990s, 24 states began to allow chiropractors to discuss the use of proprietary drugs with their patients, and 34 states broadened the scope of practice of chiropractors also to include physiotherapy. Phlebotomy is a routine medical service, but it is nonetheless an important diagnostic procedure because it opens the door to performing blood tests and other routine medical procedures. Patients often seek advice on proprietary drugs from primary-care physicians and obtain physiotherapy services from physical therapists. Granting chiropractors the ability to perform phlebotomy, discuss proprietary drug treatments with patients, and perform physiotherapy may serve as a signal to the patient of provider quality and legitimacy; patients may be more likely to use chiropractic services in the future or may share the information with peers. In addition, chiropractors will be able to deliver a broader scope of services to patients. There are significant regional differences in chiropractic use among older adults (Weigel et al. 2010). Unfortunately, there are no data that track chiropractic utilization at the state level over our period of study.

6. There have been attempts to gather nearly complete data on scope of practice (for instance, Lamm and Wegner (1989) and Lamm and Pfannenschmidt (1999)), but unfortunately the data are only available for 1988, 1992, and 1998.

TABLE 1. CHANGES TO CHIROPRACTOR SCOPE OF PRACTICE IN THE UNITED STATES

PANEL A. ALLOWING PHLEBOTOMY

State	Year
AR	1995
AZ	1995
CO	1994
IA	1994
IN	1997
NV	1994
WI	1994

Source: FCLB (1991–2010).

PANEL B. ALLOWING ADVICE ABOUT PROPRIETARY DRUGS

State	Year	State	Year	State	Year
AL	1996	MD	1997	OH	1997
CO	1995	MI	1997	OK	1991
CT	1997	MO	1997	OR	1997
FL	1998	MS	1997	PA	1997
IA	1995	NE	1997	RI	1998
KS	1997	NM	1997	TN	1998
LA	1997	NV	1995	UT	1999
MA	1997	NY	1995	WV	1995

Source: FCLB (1991–2010).

PANEL C. ALLOWING PHYSIOTHERAPY

State	Year	State	Year	State	Year
AK	1999	LA	1991	NV	1991
AL	1997	MD	2007	NY	1991
AR	1991	ME	1991	OH	1991
CA	1991	MN	1991	OK	1991
CT	1991	MO	1991	OR	1991
FL	2001	MS	1991	SD	1991
HI	1991	MT	1991	TN	1991
IA	1991	NC	1991	TX	1991
ID	1991	NE	1991	UT	1991
IN	1991	NJ	1991	VA	1991
KS	1991	NM	1991	VT	1991
KY	1991				

Source: FCLB (1991–2010).

Any expansion in chiropractors' clientele or the intensity of services delivered to a particular client may potentially increase earnings. The increase in earnings may result from the chiropractor delivering a higher-quality service to the patient, or from the patient's belief that the service is higher quality. The increase in earnings may also arise from the chiropractor working more hours. However, there is disagreement in the labor supply literature over whether the wage elasticity of labor supply is positive, zero, or slightly negative (Blundell and MaCurdy 1999). Expanded chiropractic scope of practice may also increase chiropractor employment. Unemployment is generally very low among medical professionals, but there is variation in the employment-population ratio at the state level. All of these factors taken together may in turn affect the earnings, hours worked, and employment of physicians and PTs, depending upon the nature of the relationships of the professions. By expanding access to medical services, changes to scope of practice may potentially increase consumer welfare. Consumers will have more choice in providers and may be able to obtain lower prices (either directly from medical professionals or indirectly through lower insurance premiums). Broader scope of practice may also help further establish chiropractors in the market for health care.

B. Brief History of Physical Therapy Licensing and "Direct Access" Laws

Historically, physical therapists have also faced professional conflicts with physicians.[7] This conflict was slightly different in nature than the conflict with chiropractors. Allopathic medicine has not been suspicious of the science behind physical therapy; rather, the profession has viewed physical therapy as treatment that is to be coordinated with other options and managed by physicians.

According to the APTA, physical therapists are "health care professionals who maintain, restore, and improve movement, activity, and health" (APTA 2011, 2). The modern field of physical therapy branched off from the ancient practice of massage in the early twentieth century (Thornton and Timmons 2013). In particular, the field of physical therapy began to evolve around 1916 with the polio epidemic and in 1917 with the beginning of World War I. There was a demand for specialized knowledge (including muscle testing and techniques for the restoration of muscle function) that would help those afflicted

7. Treatment methods of PTs and chiropractors overlap a great deal, although there are clear dividing lines. Some chiropractors believe that subluxation (or misalignment of the vertebrae) is generally the cause of most health problems. Mainstream chiropractors (or "mixers") de-emphasize subluxation and believe in the merits of more conventional medical treatments (Kaptchuk and Eisenberg 1998).

with polio and rehabilitate wounded soldiers. In 1921, the American Women's Physical Therapy Association, now the American Physical Therapy Association (APTA), was founded.[8] In 1955, the role of physical therapy in the healthcare system was clarified in the *Guide to Physical Therapy Practice*, which outlines a physical therapist's role in the "examination, evaluation, diagnosis, prognosis, intervention, re-examination, and assessment of outcomes" (APTA 2011, 8).

Similar to the development of licensing in many other professions, physical therapy licensing accelerated shortly after the formation of a professional association. In 1913, Pennsylvania became the first state to require PTs to obtain a license. Training requirements for physical therapists have also evolved over time. Originally, PTs were able to practice after obtaining a bachelor's degree. After January 1, 2016, all aspiring physical therapy applicants will be required to complete a doctorate of physical therapy (DPT) degree. State licensure for physical therapists is required in all states. Each physical therapist is required to pass a board-certified exam.

In much of the twentieth century in the United States, PTs were clearly subordinate to physicians. Patients were only permitted to seek treatment from PTs after receiving a physician's referral. In 1957, Nebraska was the first state to grant PTs direct access to patients, and California followed more than 10 years later in 1968. Direct access (sometimes referred to as self-referral) means that a patient may see a PT without a referral. Steps to achieve more independence began in the 1980s, when APTA adopted a nonreferral policy in which physical therapy practice was "ethical as long as it was legal in the state" (APTA 2011, 7). While there has been controversy over the appropriateness of direct access to PTs, the United States has seen direct-access movements in states with a number of different professions as a reaction to the growth in managed care (e.g., direct access to OB/GYNs). Opponents cite concerns that physical therapists are unable to correctly diagnose a condition such as cancer if the patient has not first seen a physician. Physical therapists challenge these criticisms, arguing that physical therapists do not provide a medical diagnosis but rather diagnose "impairments, functional limitations and disabilities related to medical conditions, movement dysfunction, and other health-related disorders" (APTA 2011, 26). The practice of physical therapy often involves referral to a physician when necessary. The 1980s and 1990s saw significant expansion of direct-access laws. At the time of our study, only seven states (Alaska, Hawaii, Indiana, Michigan, New Mexico, Oklahoma, and Texas) did not permit direct access to PTs. Table 2

8. Men were first admitted and the name was subsequently changed in the late 1930s.

TABLE 2. PHYSICAL THERAPY DIRECT ACCESS IN THE UNITED STATES IN 2010

State	Year of enactment	State	Year of enactment
AL	None	MT	1987
AK	1986	NE	1957
AZ	1983	NV	1985
AR	1997	NH	1988
CA	1968	NJ	2003
CO	1988	NM	None
CT	2006	NY	2006
DC	2007	NC	1985
DE	1993	ND	1989
FL	1992	OH	2004
GA	2006	OK	None
HI	None	OR	1993
ID	1987	PA	2002
IL	1988	RI	1992
IN	None	SC	1998
IA	1988	SD	1986
KS	2007	TN	1999
KY	1987	TX	None
LA	2003	UT	1985
ME	1991	VT	1988
MD	1979	VA	2001
MA	1982	WA	1988
MI	None	WV	1984
MN	1988	WI	1989
MS	2006	WY	2003
MO	1999		

Source: APTA (2016).

contains information on the presence of direct-access laws for PTs across the United States.[9]

Like scope-of-practice provisions, direct-access laws may influence the earnings, hours worked, and employment of PTs, chiropractors, and physicians. This is especially true for PTs and chiropractors who directly compete with

9. These data are from the American Physical Therapy Association as of 2010.

each other for clients. In many states, chiropractic organizations are some of the most vocal critics of PT direct access (Briem et al. 2007). The potential impact of direct access on the wages of PTs is ambiguous for multiple reasons. First, public perception of physical therapy may improve with direct-access laws if patients see direct access as a signal of quality, thereby elevating the profession and allowing PTs to increase prices. Alternatively, patients may be suspicious of PT quality in cases where physicians are not making the referral. Second, direct access increases demand because it removes the constraint of needing a physician referral; additional patients who would not have received PT referral under a regime without direct access will now be able to see a PT under a direct-access regime. PT productivity, however, will still moderate the wage effect. For PTs that operate with little idle time between patients, only the price effect will impact wages. Alternatively, for those PTs with idle time between patients, this increase in demand will unequivocally increase wages—though, as in the case of chiropractors, labor supply will depend on wage elasticity, which, as noted earlier, is often ambiguous.

C. The Market for Back and Neck Pain Treatment

Presumably chiropractors, physicians, and PTs are all competing for market share in the $300 billion market for treating back and neck pain. Therefore, we might surmise that the three professions are substitutes for one another. A patient experiencing lower back or neck pain will have some choice among healthcare providers. Patients may have a negative view of chiropractic services, or they may be required to seek referral from a physician to see a physical therapist. The significant changes in chiropractic scope of practice and PT direct access cause more patients to choose nonphysician treatment for back or neck pain. Each profession will prescribe a different set of treatments—chiropractors and PTs will generally prescribe less invasive treatments, whereas physicians will be more inclined to prescribe drugs or surgery (Adams 2014; Carroll 2010). If chiropractors have a broad scope of practice, patients may perceive that their services are of higher quality and legitimacy—essentially, the broad scope of practice serves as a signal. Direct access will allow PTs to make treatment recommendations first, potentially reducing the amount of more invasive treatments prescribed by physicians. Chiropractors and PTs are also likely to compete against each other for clientele because many prospective patients are likely to view them as alternative treatment providers for back and neck pain based on either word of mouth or previous experience. Furthermore, in the case of orthopedic surgeons, if chiropractor- or PT-directed

care is effective, it may reduce the downstream need for surgery. In this regard, chiropractic or PT services could substitute for surgery, not contemporaneously but across a patient's life course.

The relationships between providers, however, may be more complicated than pure substitution. It is also possible that the three providers may be providing complementary services. In particular, the services provided by physicians, especially physicians not engaged in general practice, may complement those provided by PTs and chiropractors. For example, a physician may prescribe surgery for a patient, and the PT may provide rehabilitation services afterward. In this instance, direct access would be expected to have little influence on the earnings, hours worked, or employment of any of the professionals. Alternatively, a patient may consult with a chiropractor or PT for an initial screening and then ultimately receive treatment from a physician. In this instance, direct access and broader scope of practice for chiropractors may increase physician earnings.

Another important factor that influences the market for each of these professional services is insurance coverage. Following the landmark *Wilk* decision, chiropractic services were covered by Medicare. Medicaid coverage is more varied, but Medicaid patients account for only 1.2–1.5 percent of chiropractor patients in the United States (Goertz 1996; Hurwitz et al. 1998). Several states have enacted mandates for private insurance policies to cover chiropractic services. Using data from Gruber (1994) and annual reports from the Council for Affordable Health Insurance, we compiled data on when and if states adopted mandates for insurance coverage of chiropractic services. Delaware was the first state to pass a chiropractic mandate in 1963. Seven more states passed mandates in the 1960s. Twenty-two more states followed the lead of the federal government and adopted a mandate in the 1970s. Ten more states passed mandates in the 1980s, and by 2010 all states except the District of Columbia, Hawaii, Idaho, and Oregon had mandates for

"The relationships between providers . . . may be more complicated than pure substitution. It is also possible that the three providers may be providing complementary services."

chiropractic coverage. We hypothesize that mandated insurance coverage for chiropractic services should positively affect chiropractor wages, hours worked, and employment. As for PT services, the 1967 amendments to the Social Security Act provide for Medicare coverage of outpatient physical therapy (Cohen and Ball 1968). PT services have historically been held in higher regard by the greater medical community, and state mandates were generally not necessary—most private plans began to cover PT services after 1968. Direct access does not seem to have significantly affected the provision of coverage; research conducted by the APTA suggests that insurers do not believe direct access is a significant risk factor.

II. LITERATURE REVIEW ON OCCUPATIONAL LICENSING OF MEDICAL PROFESSIONS

Economic theory suggests that occupational licensing presents a barrier to entry for particular occupations and thus increases practitioner earnings (Friedman and Kuznets 1945; Friedman 1962; Stigler 1971). Studies have found that stricter licensing increases earnings for healthcare occupations such as dentists (Shephard 1978; Kleiner and Kudrle 2000), radiologic technologists (Timmons and Thornton 2008), and physicians (Kugler and Sauer 2005). Several studies have examined occupational licensing in the legal literature as well (for example, Blair and Durrance 2015; Larkin forthcoming). In the area of chiropractic scope of practice, very little research exists; however, there are several papers that explore scope of practice in other occupations.

One paper by Perry (2009) examines competition between nurse practitioners (NPs), physician assistants (PAs), and physicians. Perry examines the effect of granting NPs and PAs the authority to write prescriptions and obtain payment from insurers on the earnings of each professional. He finds some evidence that broader scope of practice for NPs increases NP wages and slightly reduces physician wages. His findings also suggest that broader scope of practice for PAs may reduce NP wages and increase physician wages. A related paper by Stange (2014) examines the effects of the increasing number of practicing NPs and PAs on the price and use of healthcare services. Stange's results suggest that increasing the number of NPs and PAs only impacts patient use in states with more permissive scope-of-practice legislation for NPs and PAs—an important finding that highlights the importance of scope-of-practice legislation.

A recent paper by Kleiner and Won Park (2010) examines a related issue for dentists and dental hygienists. The authors find evidence that hygienists working in states with more autonomy (or broader scope-of practice legislation)

earn about 10 percent more and have 5 percent higher employment growth than their peers. Also, dentists in the same states earn 19 percent less and experience a 27 percent reduction in dental employment. Like dentists and hygienists, chiropractors, PTs, and physicians may be competing for business or potentially serving as complements in the medical-service market for back and neck pain. Although physicians have tightly controlled chiropractor licensing in the past, their grip has loosened. Thus, our hypothesis would be that the magnitude of the effects of scope-of-practice differences on chiropractors would be smaller than the effects found by Kleiner and Won Park (2010). The relationship between PTs and physicians is probably more similar to that between dentists and dental hygienists. Chiropractors and PTs, however, are more likely to be in direct competition with one another.

III. DATA

To investigate the effect that scope-of-practice and direct-access legislation has had on chiropractor, PT, and physician earnings, we use data from the 1970–2000 census and the 2001–2010 ACS. Since the census does not differentiate PTs from other therapists (e.g., speech therapists) until 1980, we do not use 1970 data for PTs. The census data is then matched to data on scope of practice from the Federation of Chiropractic Licensing Boards, as well as direct-access data from the APTA. All census data are retrieved using Integrated Public Use Microdata Series (IPUMS) (Ruggles et al. 2010).

We focus on census data from these years for two reasons. First, the greatest changes in chiropractic scope of practice and PT direct access occurred over this time period. Second, we are not able to identify enough PTs or chiropractors in the data available from the Current Population Survey (CPS). Summary statistics for the census data are presented in table 3. Hourly wage data are obtained by dividing annual earnings by reported hours worked per week and reported weeks worked.[10] Wage data are rendered into 2010 dollars using the Consumer Price Index. All wage data from the census and ACS are subject to top coding—in other words, there is a cap on the reported salary. Top coding is most likely to censor physician wages in the early census years (1970 and 1980). This may create a downward bias in all our estimates of average wages, particularly for

10. For the ACS, weeks and hours worked are available on an interval basis. For the purposes of calculating hourly wages and reporting summary statistics on hours worked, we use the midpoint of the interval provided in the data. Our results are not sensitive to this specification, however—we also performed regressions using annual earnings ("incwage" in IPUMS), and our main results were largely unchanged.

TABLE 3. SUMMARY STATISTICS FOR 1970–2000 CENSUS AND 2001–2010 ACS SAMPLES

	Chiropractors		Physical therapists		Physicians	
	Mean	Median	Mean	Median	Mean	Median
Age	43.1	41	37.8	36	45.8	44
Hourly wage (2010$)	41.87	26.40	28.96	25.4	73.93	56.20
Usual hours worked	35.1	40	34.6	40	49.1	50
	Mean (%)		Mean (%)		Mean (%)	
Female	33.4		74.0		25.8	
African American	1.7		4.8		3.6	
Other minority	9.5		9.0		16.6	
Hispanic	3.5		4.4		5.0	
Masters	6.3		20.8		0	
Doctorate	19.7		3.2		100	
N	7,012		34,630		129,049	

Notes: All data are taken from 1970, 1980, 1990, and 2000 US census and 2001–2010 ACS and retrieved using Ruggles et al. 2010. The PT sample does not include observations from 1970.

physicians.[11] Table 3 reveals a few items of interest. First, physicians are paid significantly more than chiropractors and PTs. We should again point out that we are unable to separate general practitioners from specialists or surgeons; physicians are broadly defined as those who diagnose or treat injuries and illnesses in patients. It should be noted, though, that physicians work more hours and also are required to obtain a doctoral degree in medicine. Additionally, the professions are split along gender lines: PTs are primarily female, but physicians and chiropractors are mostly male.

IV. EMPIRICAL MODEL

Our approach is to estimate models using two-way fixed effects. To empirically examine the effects of changes in scope of practice and direct access on the earnings of each professional *i* in state *s* at time *t*, we estimate the following wage equation (in natural log) for chiropractors, physicians, and PTs respectively:

$$\ln(hourlywage_{ist}) = \alpha + \beta(L_{st}) + \delta(T_t) + \xi(S_s) + \phi(Y_{ist}) + \varepsilon_{ist}, \quad (1)$$

11. Top coding may also result in a downward bias in our estimated coefficients of the effects of broader scope of practice for chiropractors and direct access for PTs and physicians. Our empirical estimates for physicians should therefore be considered a conservative lower bound of the magnitude of the effect.

where L is a vector of variables measuring changes in licensing legislation for chiropractors and PTs, T is a vector of year fixed effects, S is a vector of state fixed effects, and Y is a vector of individual characteristic indicator variables (e.g., age, education, ethnicity, gender, and race). Education is measured using a dummy variable for whether the respondent has completed a master's or doctoral degree. Ethnicity is measured using a Hispanic-origin dummy variable. Gender and race are measured using similar dummy variables (for females, African Americans, and other minorities). The rationale for each variable is explained below.

We use a similar, nonlogged equation to estimate the effects of scope of practice and direct access on hours worked for each profession. We also estimate the effects of scope of practice and direct access (L_{st}) on state-level employment population estimations. Because these models are at the state level, we include state and year fixed effects but no individual-level control variables.

We measure L using two state-level variables. The chiropractor scope-of-practice index variable ranges in value from 0 to 3 and counts the number of procedures (phlebotomy, physiotherapy, or discussion about prescribing proprietary drugs) state s allows chiropractors to perform at time t. The direct-access variable equals 1 if state s grants PTs direct access to patients at time t, where t is the census year. We also perform regressions to test for duration effects for direct access (including a continuous variable indicating the number of years since the change in licensing law), given that some studies have found that the effects of changes in occupational licensing laws are not realized immediately (Thornton and Timmons 2013). We hypothesize that the chiropractic scope-of-practice variable and direct-access variable should have positive coefficients for the wages of chiropractors and PTs, respectively. As for the other coefficients, the sign (positive or negative) will depend upon the nature of the relationship between the professionals. We suspect that chiropractors and PTs are in direct competition with one another for patients and should be substitutes. Thus, the sign of our chiropractic scope-of-practice variable should be negative for PTs, and the sign of the direct-access variable should be negative for chiropractors. The relationship between physicians and the other two professions is more complex—it is not clear how direct access may affect the relationship. Primary-care physicians may compete with chiropractors and PTs for patients experiencing back and neck pain. But without direct access, PTs are clearly complementary with physicians. Looking more broadly at all physicians including specialists, chiropractors are more likely to serve as complements.

As for weekly hours worked and employment, we suspect that expanded scope of practice and direct access would increase the hours worked of chiropractors and PTs. It is also possible, however, that after the passage of each law, patients may perceive that the quality of services being offered by each practitioner improves. Practitioners may have the ability to charge higher fees and therefore choose to work fewer hours. Employment may also be affected if changes in the level of competition influence demand for the professions.

As noted in preceding sections, there are differences across states and over time in whether or not private insurers are required to cover chiropractic care. This requirement is likely to have a positive relationship with chiropractor wages and may have a positive or negative effect on PT and physician wages depending on the nature of the relationship between the professions. We control for this factor in the estimation of equation (1). All estimations include census weights. Standard errors in these estimations are clustered at the state level.

V. EMPIRICAL FINDINGS

A. Impacts on Wages

Table 4 contains the results of our estimations of equation (1) for wages for each of the three occupations. Columns (1) and (2) contain the results of the specifications estimating the effect of the policies on the natural log of chiropractor wages, with one specification including PT direct access as a binary measure and a second including the duration of direct access as the measure.[12] Similarly, columns (3) and (4) model the natural log of physician wages as the dependent variable, while columns (5) and (6) model the natural log of PT wages as the dependent variable. Beginning with chiropractors, we do find some evidence that chiropractors earn more if they work in states that have more expansive scope-of-practice laws, as measured by the scope-of-practice index (7.2–8.6 percent per task allowed).[13] Broader scope of practice may allow chiropractors to attract more patients. Performing routine medical services usually done by physicians or in outpatient clinics may signal to potential patients that the services being offered by chiropractors are legitimate. There is also some evidence that chiropractors may face competition from PTs, as direct-access duration correlates with reduced chiropractor wages. The

12. The sample size changes in the table owing to the inclusion of education controls forcing the removal of 1970 census data.
13. Coefficients are converted to percentages using the $1-e^b$ transformation.

TABLE 4. TWO-WAY FIXED EFFECTS ESTIMATES OF THE EFFECTS OF SCOPE OF PRACTICE AND DIRECT ACCESS ON CHIROPRACTOR, PHYSICIAN, AND PT WAGES (LOG WAGES)

	Chiropractor wages		Physician wages		Physical therapist wages	
	(1)	(2)	(3)	(4)	(5)	(6)
Scope-of-practice	0.0823**	0.0696**	0.0055	0.0054	−0.0171	−0.0167
index	(0.0317)	(0.0314)	(0.00883)	(0.00882)	(0.0127)	(0.0129)
DA dummy	0.0364		−0.0014		0.0089	
	(0.0462)		(0.0090)		(0.0152)	
Duration DA		−0.0073**		−0.0000		0.0000
		(0.0033)		(0.0000)		(0.0000)
Chiro insurance	−0.0691	−0.0767	0.0223	0.0221	−0.0097	−0.0092
mandate	(0.104)	(0.104)	(0.0169)	(0.0172)	(0.0303)	(0.0308)
N	7,012	7,012	129,046	129,046	34,630	34,630
R^2	0.16	0.16	0.34	0.34	0.17	0.17

Notes: *p-value < 0.1; **p-value < 0.05; ***p-value < 0.01. Standard errors are clustered at the state level. All data are drawn from 1970–2000 US census and 2001–2010 ACS and retrieved using Ruggles et al 2010. All regressions use individual controls that include age, age-squared, female dummy, minority dummy variables, and Hispanic dummy variable, as well as whether the individual had a master's or PhD.

effects of both scope-of-practice and direct-access laws on physician wages are small and imprecisely estimated. Our inability to separate physicians of different specializations in the census and ACS may be driving this result. Turning our attention to PTs in columns (5) and (6), we find point estimates suggesting that chiropractors and PTs are substitutes, but these estimates are not precise. Direct-access laws do not have the same effects on PT wages that expanded scope of practice does for chiropractors. It is possible that our inability to estimate an effect of direct access on PT wages could be owing to the canceling of competing effects—direct access may potentially improve or reduce patient perceptions of quality. It is also possible that direct access is less impactful because the population that would use PT may be conditioned to seek treatment at a physician's office first.[14]

B. Impacts on Hours Worked and Employment

To better understand the mechanism for the wage effects we have esmated, we now estimate the effects of chiropractic scope of practice on hours worked

14. We also performed regressions estimating the effect of expanded chiropractic scope of practice and PT direct access on labor market outcomes for occupational therapists (OTs). We found no evidence of any measurable labor-market effects on the OTs from these changes.

and employment in each profession. Tables 5 and 6 report the results of these estimations. The sample sizes for each profession here are larger—survey respondents sometimes report hours worked but not earnings. Expansion of chiropractors' scope of practice decreases hours worked per week by approximately one hour. Taken together with our results in table 4, this slight decrease in weekly hours worked indicates that broad chiropractor scope of practice enhances patient perceptions of the quality of service. Chiropractors are not working more hours, but they are able to earn higher wages, suggesting that the increase in wages is a result of chiropractors' ability to charge higher fees. We also find some evidence that direct access has resulted in fewer hours worked for chiropractors (column (2)), again suggesting that they are potential substitutes. We should note that the each of the estimated effects is quite small—changes in scope of practice and direct access do not appear to have a large effect on the number of hours that chiropractors work. We find little evidence that physicians' hours worked are affected by changes in scope of practice or direct access.

In table 6, we find very little evidence that scope of practice and direct access have affected the employment population ratio of any of the professions. This result is not surprising in the case of physicians because training is long and supply responses take time. Furthermore, the competition from alternative providers like chiropractors and PTs is not a deterrent to entry into the profession.

In our previous regressions, we used an index to estimate the effects of changes in chiropractic scope of practice. We found little evidence that changes in scope of practice have affected the wages of PTs or physicians. In table 7, we disaggregate the index of chiropractic scope of practice and construct individual dummy variables for phlebotomy, physiotherapy, and advice regarding proprietary drugs. We continue to find little evidence that changes in chiropractic scope of practice have affected physician wages. We find some evidence that allowing chiropractors to prescribe proprietary drugs is associated with approximately 4 percent lower PT wages . This result is consistent with the theory that PTs and chiropractors are substitute providers of care. We continue to find little evidence (results not reported) that changes in chiropractic scope of practice are affecting hours worked or employment of PTs or physicians.

C. Policy Endogeneity

To assess whether these policies are potentially endogenous, we examined whether wage or supply growth rates in the preceding intercensal period

TABLE 5. TWO-WAY FIXED EFFECTS ESTIMATES OF THE EFFECTS OF SCOPE OF PRACTICE AND DIRECT ACCESS ON CHIROPRACTOR, PHYSICIAN, AND PT HOURS WORKED

	Chiropractor hours		Physician hours		Physical therapist hours	
	(1)	(2)	(3)	(4)	(5)	(6)
Scope-of-practice	−0.925*	−1.108**	−0.160	−0.161	0.0456	0.0388
index	(0.489)	(0.432)	(0.180)	(0.183)	(0.238)	(0.235)
DA dummy	0.155		−0.0300		0.0614	
	(0.389)		(0.159)		(0.158)	
Duration DA		−0.0786**		−0.0001		0.0001
		(0.0331)		(0.0001)		(0.0001)
Chiro insurance	0.936	0.856	−0.228	−0.240	−0.199	−0.180
mandate	(0.580)	(0.642)	(0.460)	(0.463)	(0.340)	(0.339)
N	12,735	12,735	151,083	151,083	36,260	36,260
R^2	0.13	0.13	0.01	0.01	0.18	0.18

Notes: *p-value < 0.1; **p-value < 0.05; ***p-value < 0.01. Standard errors are clustered at the state level. All data are drawn from 1970–2000 US census and 2001–2010 ACS and retrieved using Ruggles et al 2010. All regressions use individual controls that include age, age-squared, female dummy, minority dummy variables, and Hispanic dummy variable, as well as whether the individual had a master's or PhD.

TABLE 6. TWO-WAY FIXED EFFECTS ESTIMATES OF THE EFFECTS OF SCOPE OF PRACTICE AND DIRECT ACCESS ON CHIROPRACTOR, PHYSICIAN, AND PT EMPLOYMENT POPULATION RATIOS

	# Chiropractors/million		# Physicians/million		# Physical therapists/million	
	(1)	(2)	(3)	(4)	(5)	(6)
Scope of practice	−16.41	−7.120	−41.71	−52.33	−5.543	−0.884
index	(14.75)	(14.94)	(51.59)	(51.69)	(29.10)	(29.58)
DA dummy	−27.89		78.05		18.07	
	(21.09)		(68.26)		(38.71)	
Duration DA		2.421		−5.356		3.129
		(1.505)		(4.782)		(3.201)
Chiro insurance	24.42	27.20	43.38	62.47	−54.30	−53.20
mandate	(44.77)	(44.70)	(91.59)	(91.18)	(55.63)	(55.16)
N	675	675	714	714	661	661
R^2	0.41	0.41	0.67	0.67	0.54	0.54

Notes: *p-value < 0.1; **p-value < 0.05; ***p-value < 0.01. Standard errors are clustered at the state level. All data are drawn from 1970–2000 US census and 2001–2010 ACS and retrieved using Ruggles et al 2010. All regressions use individual controls that include age, age-squared, female dummy, minority dummy variables, and Hispanic dummy variable, as well as whether the individual had a master's or PhD.

TABLE 7. TWO-WAY FIXED EFFECTS ESTIMATES OF THE EFFECTS OF SCOPE OF PRACTICE AND DIRECT ACCESS ON PHYSICIAN AND PT WAGES (LOG WAGES)

	PT wages		Physician wages	
	(1)	(2)	(3)	(4)
Phlebotomy dummy	−0.0183	−0.020	0.0253	0.0257
	(0.0300)	(0.0289)	(0.0259)	(0.0259)
Physiotherapy dummy	0.00298	0.00254	0.0116	0.0114
	(0.0172)	(0.0171)	(0.0170)	(0.0167)
Proprietary drugs dummy	−0.0390*	−0.0400*	−0.00447	−0.00437
	(0.0205)	(0.0203)	(0.0154)	(0.0151)
DA dummy	0.00942		−0.00161	
		0.0146		(0.00861)
Chiro insurance	−0.0100	−0.00995	0.0195	0.0196
mandate	0.0296	0.0297	(0.0172)	(0.0173)
N	34,630	34,630	129,046	129,046
R^2	0.16	0.16	0.24	0.24

Notes: *p-value < 0.1; **p-value < 0.05; ***p-value < 0.01. Standard errors are clustered at the state level. All data are drawn from 1970–2000 US census and 2001–2010 ACS and retrieved using Ruggles et al 2010. All regressions use individual controls that include age, age-squared, female dummy, minority dummy variables, and Hispanic dummy variable, as well as whether the individual had a master's or PhD.

predict policy adoption in the most recent intercensal period. As a specific example using chiropractic, we estimated the following regression:

$$\begin{aligned}\Delta \text{ SOP INDEX}_{s,t} = \alpha_0 + \alpha_1 \text{ Chiropractic wage growth/capita}_{s,(t-1)} + \\ \alpha_2 \text{ Chiropractor supply growth/capita}_{s,(t-1)} + \\ \alpha_3 \text{ Physician wage growth/capita}_{s,(t-1)} + \\ \alpha_4 \text{ Physician supply growth/capita}_{s,(t-1)} + \\ \alpha_5 \Delta X_{s,t} + \alpha_6 \text{ Chiro college}_{s,(t-1)} + u_{s,t},\end{aligned} \tag{2}$$

where the dependent variable is the change in the state-level chiropractic scope-of-practice (SOP) index between the previous and current census, and chiropractic and physician wage and supply growth are in the lagged intercensal period. X is a vector of the change in characteristics of the population used in our main regression during the intercensal period, and "Chiro college" is an indicator variable capturing the presence of a chiropractic college in the state in the previous census.

TABLE 8. ESTIMATES OF THE EFFECTS OF WAGE AND SUPPLY GROWTH ON POLICY ADOPTION

ΔSOP index	Mean = .544	Adoption of DA	Mean = .145
Growth in chiropractor	−.00019	Growth in physical therapist	−.00014
wages	(.00033)	wages	(.00053)
Growth in chiropractors	.00107**	Growth in physical therapists	−.00010
per capita	(.00052)	per capita	(.00020)
Growth in physician	.00335	Growth in physician	.00048
wages	(.00232)	wages	(.00140)
Growth in physicians	−.00060**	Growth in physicians	.00011
per capita	(.00027)	per capita	(.00143)
Chiropractic college	−.00712	Physical therapy program	.06796
	(.16075)		(.12200)
N	112		101

Notes: *p-value < 0.1; **p-value < 0.05; ***p-value < 0.01. Models include state-level changes in the age, the proportion female, racial/ethnic composition, and education of the chiropractors and physical therapists in the most recent intercensal period. Because of missing data, some state-year observations are not included in the regression.

This estimation allows us to examine many of the factors raising endogeneity concerns. First, states that expand chiropractors' scope of practice may do so in response to growing demand for these services. The demand shift would, of course, increase wages in advance of policy adoption unless supply shifted by the same amount. By including both wage and supply growth among chiropractors in the prior period, the model is intended to estimate whether demand is in fact growing. Further, the chiropractic college variable acts as a proxy for the profession's political power in a state because having an institution of higher education in the chiropractic field may indicate broad support for the profession. Conversely, physician wage growth or supply growth in the prior period may impact the extent to which physicians, who typically occupy a majority of seats on state medical regulation boards, would fight scope-of-practice expansion for competing professions.

We also estimated an analogous model where we examined physical therapy direct-access law adoption in the most recent intercensal period and substituted lagged physical therapy wage and supply growth and presence of accredited physical therapy training programs for the chiropractor variables.

The results of these estimations are in table 8. Chiropractic scope of practice expanded by about 0.54 on average in an intercensal period. Increases in chiropractic supply widened the scope of practice. The average growth in the number of chiropractors in the intercensal periods was 147 per million residents. Thus, if a particular state had experienced the average increase in the number of chiropractors in one intercensal period, the state would have increased its

"Consumer welfare is likely to be improved by having greater access to lower-priced care and more choices for pain treatment."

scope-of-practice index by 0.16 in the subsequent intercensal period—about 1/5 of a standard deviation at the mean. Conversely, an increase of 212 physicians per million residents (the mean intercensal increase in physician supply) would lead to a 0.16 standard-deviation decrease in the chiropractic scope-of-practice index in the state in the subsequent intercensal period. There is, however, no discernible effect of lagged wage increases on contemporaneous policy. Thus, the most likely explanation of these effects is that the changes in supply per population are shifting the balance of power among the professions and thus affecting subsequent scope-of-practice changes (or lack thereof). We therefore believe that our estimated effects of chiropractic scope-of-practice changes on the labor market are likely conservative estimates—scope of practice and chiropractor supply are likely to be increasing simultaneously.[15]

In contrast to the scope of practice for chiropractors, we find no evidence that any of the lagged factors that might predict policy adoption had an effect on PT direct-access policy adoption.

VI. CONCLUSION

In this paper, we have examined the influence of changes in scope-of-practice and direct-access laws on the wages, hours worked, and employment of chiropractors, physical therapists, and physicians. Broader scope of practice seems to be associated with higher chiropractor wages. We also find evidence that expanded scope of chiropractor practice slightly reduces the average number of hours chiropractors work per week. In sensitivity checks, we find

15. It is possible that our estimation of the effect of changes in scope of practice could be capturing a change in demand for chiropractic services unrelated to changes in scope of practice. We believe that this is unlikely for at least two reasons. First, market changes are not likely to be as impactful without accompanying changes in regulation—as noted by Stange (2014) in the market for nurse practitioners and physician assistants. Second, patient preferences are very slow to adjust to new practitioners in the healthcare market. Half of Americans still prefer to receive care from a physician rather than an alternative healthcare provider (Dill et al. 2010).

that lagged increases in the supply of chiropractors lead to expanded scope of practice but that increases in the supply of physicians restrain this expansion. These results suggest our estimates of the wage effects of expanded scope of practice represent a lower-bound estimate. Expanded chiropractic scope of practice seems to affirm that PTs and chiropractors serve as substitutes in the market for pain treatment. We also find some evidence that expanded chiropractor scope of practice may be associated with lower PT wages.

Physical therapy direct-access laws do not seem to affect PT, physician, or chiropractor wages. We find some evidence that direct-access laws may be reducing chiropractors' hours worked. With the data used in our study, we can only speculate why PT direct access is not having a substantial effect. It is possible that patients continue to prefer to see doctors despite changes in the law. We also find little evidence that expanded chiropractor scope of practice or PT direct access has affected employment of chiropractors, physicians, or PTs. The changes in competition do not appear to substantially affect entry into any of the three professions. In the ongoing search for ways to reduce onerous healthcare costs in America, our study may guide policy making. Neither PTs nor chiropractors are perfect substitutes for primary-care physicians. In certain instances, such as when patients are experiencing neck or lower back pain, patients may receive better-quality care at lower prices by seeing a chiropractor or PT as opposed to a physician. Consumer welfare is likely to be improved by having greater access to lower-priced care and more choices for pain treatment. Expanding the scope of practice for mid-level healthcare providers such as chiropractors and PTs may potentially improve the efficiency of the healthcare market in the United States.

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