



What is the objective of professional licensing? Evidence from the US market for lawyers

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ABSTRACT

According to public interest theory, professional licensing solves the lemon problem generated by asymmetric information. In contrast, the capture theory claims that licensing aims at increasing professional salaries by restricting supply. This paper shows that the two theories can be identified using data from one regulated profession and provides an empirical application to the US market for entry level lawyers. The empirical results support capture theory.

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1. Introduction

Entry into many professions is contingent upon approval by a state licensing board and demonstration of a certain level of competency. This paper focuses on licensing in the legal profession, but other examples of regulated professions include accounting, auditing, teaching, nursing, engineering, psychology and hairdressing. In fact, according to Kleiner (2000), more than 800 occupations are licensed in at least one US state. Occupational licensing is widespread, directly affecting 18% of US workers, even more than those affected by minimum wage or unionization. Professional regulation has been the subject of academic and political debate for decades. Evaluation of the impact of policy reform proposals relies on a clear understanding of the objectives pursued by licensing boards.

Although professional associations argue that the only goal of professional licensing is to protect the public, economists have long held two opposing views on the subject. The first falls into the category of public interest theory. Building on the work of Akerlof (1970), Leland (1979) showed that professional licensing may serve to remedy the market failure derived from asymmetric information. In markets where consumers cannot observe the quality of professionals, the imposition of a minimum quality standard by the social planner may lead to increased welfare (relative to the free entry

equilibrium). Establishing the optimal minimum standard implies a trade-off between the quality-enhancing and the competition-reducing effects of licensing. The stated objective of licensing is to protect the public from unqualified professionals. The underlying assumption is that asymmetric information is relevant and that professional regulation serves the public interest.¹

Capture theory, pioneered by Stigler (1971), argues instead that “regulation is acquired by the industry and is designed and operated primarily for its benefit”. This position can be traced back to Adam Smith (1776, I.x.c.5), who claimed that the objective of licensing requirements is to limit competition by reducing the number of practitioners willing to enter a trade. In this view, professional examinations serve to limit the number of professionals, increase prices, and weaken competition, thereby introducing the typical inefficiencies caused by market power. Obviously, licensing boards do not necessarily operate in pursuit of a single goal. In practice, they may assign a different weight to the two objectives in response to the

¹ The stated purpose of the examination is “to protect the public, not to limit the number of lawyers admitted to practice”. [27] summarize this as: “The public interest requires that the public be secure in its expectation that those who are admitted to the bar are worthy of the trust and confidence clients may reasonably place in their lawyers”. This motivation for entry regulation is common across all states. For example, the Rules for Admission to the Minnesota Bar (as of January 1, 2003) state that the examination exists “... to ensure that those who are admitted to the bar have the necessary competence and character to justify the trust and confidence that clients, the public, the legal system, and the legal profession place in attorneys”.

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relative influence of different interest groups. Therefore, both theories may provide some insight into how licensed professions are regulated.

To provide evidence for the effects and underlying motivation for professional licensing, one would need to compare the actual, observed salaries in a licensed profession with what salaries would otherwise be without licensing standards, or with a counterfactual socially optimal regulation. The counterfactual earnings may be obtained in different ways. The simplest is to compare licensed professions with similar unlicensed professions, or professions with different regulation (Kleiner, 2000). Another (Shepard, 1978; Haas-Wilson, 1986; Kleiner and Kudrle, 2000) is to use variability across states in licensing regulation to measure the impact of licensing on the price of professional services, possibly controlling for the quality of the services being provided. A third approach, taken by Kugler and Sauer (2005), is to measure the effects of occupational licensing by exploiting some specific features of a regulated market, such as the rules governing assignment of immigrant physicians to different retraining programs.

One limit to the first approach is that making comparisons across industries is typically problematic. Only in very specific cases can the researcher directly compare two different professional markets. Even in fairly similar professions, unobserved heterogeneity in the type of service being compared and in the market structure may impede direct comparisons. The second approach reduces unobserved heterogeneity by focusing on the same profession in different states, but heterogeneity in market structure or demand characteristics across states may still be substantial. While the third approach is not subject to these problems, it is only feasible in very specific cases and cannot be applied to a wide set of industries. It also requires detailed micro data, which are not always available.

This paper explores a different and complementary approach, starting from the basic assumption that counterfactual salaries are not observable and that it is therefore impossible to directly compare the observed salary with salaries in a different industry, in a different state, or for a different group of professionals. In this paper, the counterfactual salary and the licensing board behavior are taken as parameters to be estimated and the two theories are identified using aggregate data from a single regulated professional market.

To identify licensing board behavior, I focus on a static model of licensing and compare the first order condition of the social planner with that of the captured regulator. The model allows for asymmetric information, in the sense that consumers observe only the minimum standard set by the licensing board, and not the lawyers' quality. According to public interest theory, the social planner optimally trades off the welfare-increasing effects of admitting one additional candidate with the social cost of lowered standards. The social cost derives from the fact that the consumers' valuation decreases with the observed minimum standard. According to capture theory, instead, the regulator attempts to maximize rents within the profession. In addition to considering the effect of minimum standards on consumers' valuation, such a regulator takes into account that admitting one additional candidate decreases wages for existing members of the profession.

The empirical implementation uses data on the US market for entry level lawyers, which is regulated at the state level. The data is comprised of a panel of states for which information is available on bar exam outcomes, bar exam difficulty, entry level salaries and a number of control variables. Estimates of the structural parameters are not consistent with the public interest view but support capture theory. There is little evidence that more difficult entry examinations significantly increase demand for legal services. The estimated parameters can be used to compute the welfare impact of alternative behavioral hypotheses. In terms of efficiency, current regulation implies standards that are too stringent, resulting in too few lawyers with salaries that are too high. The efficient benchmark would imply a

22% increase in lawyers and a 46% decrease in salaries, leading ultimately to a substantial increase in consumer welfare.

The problem of identifying the behavior of a licensing board is related to the classic problem of identifying market power with market level data (Bresnahan, 1982, 1987). In fact, under the capture theory, the regulator limits the number of lawyers and generates the classic deadweight loss associated with market power. The licensing problem, however, is different from the identification of market power because it requires modeling the entry examination, and a feedback mechanism from exam difficulty to consumers' demand.

This paper is related to the literature on regulation in professional markets. For example, Harrington and Krynski (2002), and Harrington (2007) study the funeral industry, Federman et al. (2006) the market for manicurists, and Timmons and Thornton (2008) radiologic technologists. The paper is also related to Schaumans and Verboven (2008), who investigate the impact of entry regulation in the market for pharmacies. This paper does not estimate an entry model, but rather directly models the behavior of a licensing board setting the difficulty of a licensing exam. From a policy perspective, the results of this paper can be used to inform the ongoing debate on the applicability of competition rules in professional markets, both in the US and in the European Union (Andrews, 2002; Paterson et al., 2003; European Commission, 2004).

The structure of the paper is as follows: the theoretical framework is introduced in the first section, followed by a section on empirical implementation, which describes the empirical specification and identification. The final two sections of the paper present the results and conclusions. An appendix provides a description of the data, and the construction of the variables used in the empirical analysis.

2. A static model of professional licensing

2.1. Consumers

Consumers do not observe the quality of the professionals, but rely on publicly available information. Following Akerlof (1970) and Leland (1979), the demand for legal services is a function of a quality summary statistic. I assume that each professional supplies exactly one unit of services, and that the valuation of consumers depends on the minimum quality D allowed in the market.² Consumers can observe the minimum quality level (i.e., the exam difficulty) at no cost.³

The demand equation derives naturally from a standard model with heterogeneous consumers. There are Z consumers willing to pay $v(D, \varphi, Y, \varepsilon)$. Their type φ is randomly drawn from the uniform distribution on $[0, 1]$, Y is a vector of exogenous variables (observed by the researcher) affecting consumers' willingness to pay; ε is the unobserved (to the researcher) heterogeneity in consumers' valuations.

Consumers buy one unit of legal services if their valuation is higher than the cost of the service, $v(D, \varphi, Y, \varepsilon) - w \geq 0$, zero units otherwise. Higher types have a lower willingness to pay for the service, $\frac{dv}{d\varphi} < 0$. Given w , D , Y and ε , if L units of professional services are bought, the consumers buying the services are those with $\varphi \in [0, \frac{w}{v}]$. The price of one unit of services must then be equal to the valuation of the marginal customer, $w = v(D, \frac{w}{v}, Y, \varepsilon)$.

I assume linearity and rewrite the aggregate inverse demand function as

$$w = \alpha_0 + \alpha_1 D - \alpha_2 \frac{L}{Z} + \alpha_3 Y + \varepsilon \quad (1)$$

where w is the wage of a professional, and L is the number of professionals ($\alpha_1, \alpha_2 \geq 0$).

² One can relax this assumption with no significant change in what follows.

³ In the market for lawyers, for example, this information can be accessed easily.

2.2. The admission process

There are N candidates taking a professional examination. Each candidate receives an exam score s , which is a random draw from the continuous distribution $F(s)$, with density $f(s)$.⁴ The difficulty of the exam is D , which is the minimum quality allowed in the market. All candidates who score at or above the threshold pass the exam and enter the profession. Given the distribution of candidates $F(s)$, there is a direct relationship between the number of professionals admitted and exam difficulty. The number of successful candidates is $L = [1 - F(D)]N$ and exam difficulty can be written as

$$D = F^{-1}\left(1 - \frac{L}{N}\right). \tag{2}$$

To summarize, the bar exam filters the relatively good candidates, who are then allowed to enter the profession.⁵ However, as consumers observe only exam difficulty, and not the individual quality of entrants, all those who enter the profession receive the same salary w .⁶

2.3. Outside option salary

Those who fail the exam accept the outside salary w_0 of a non-regulated profession (assumed to be sufficiently low as to always be the second-best option), which depends on a set of exogenous variables X . As above, I will assume linearity and rewrite the outside option as

$$w_0 = \beta_0 + \beta_1 X + \eta. \tag{3}$$

The outside option salary w_0 is observed by both the potential entrants and the regulator. However, the researcher only observes X . The researcher does not observe w_0 , the parameters β_0 and β_1 , nor the realization of the random variable η , capturing unobserved heterogeneity in the outside salary.

The outside profession is assumed to be large, and is therefore not affected by changes in the number of professionals or exam difficulty. It does not necessarily require specific training (for example, if the regulated market is the legal market, then the outside profession may be the generic business market) and the signaling effect of D does not apply to it.⁷

2.4. The social planner

The supply of professionals is regulated by the licensing board. The social planner aims to set the number of entrants in order to maximize social welfare

$$\text{Max}_L W(L, D(L)), \tag{4}$$

⁴ Identification does not rest on any specific assumption on $F(s)$.

⁵ Once the number of entrants is determined through the entry examination, the supply of services is perfectly rigid. This is obviously a simplification of the real world: in reality, some professionals may adjust the number of hours worked, by working part-time, for example. As a rough estimate, however, the number of professionals in the market provides a measure of the amount of services offered.

⁶ The model can be extended to allow for some heterogeneity in the observed quality of successful candidates (from the point of view of consumers). This leads to heterogeneity in lawyers' salaries. The parameter ϑ is still identified (see Appendix 2).

⁷ With respect to Eq. (15) query, this model emphasizes the effect of the number of candidates and their quality, as well as demand shifters, and allows for a general distribution of scores. However, it simplifies the analysis by assuming that the outside option salary is the same for everyone who chooses the outside profession. This is realistic to the extent that exam performance depends on specific skills which do not imply a premium in the outside profession (such as the generic business market). In Appendix 2, I describe a more general model with heterogeneous outside options.

where welfare is defined as the integral of the difference between consumers' willingness to pay and the outside salary (Leland, 1979),

$$W(L, D) = \int_0^L \left[w\left(D(L), \frac{x}{Z}, Y, \varepsilon\right) - w_0 \right] dx. \tag{5}$$

Since the market is regulated and the licensing board chooses the number of entrants, there is no labor supply curve. Instead, substituting the demand function in Eq. (5), the first order condition of the problem (Eq. (4)) describes the behavior of the licensing board,

$$w = w_0 + \alpha_1 \frac{L}{Nf(D(L))}. \tag{6}$$

The regulated market is described jointly by the above expression for licensing boards behavior, consumers' demand (Eq. (1)), and professionals' outside option (Eq. (3)).

Eq. (6) can be rewritten as $L = (w - w_0)Nf(D(L))/\alpha_1$. More professionals are allowed to enter the profession when consumers willingness to pay, the number of candidates, and the density of the quality distribution at the minimum standard are higher, and when the outside option, or the impact of an increase in difficulty on consumers' valuation (α_1) is lower. From the point of view of the social planner, admitting one additional candidate by decreasing the standard has a social cost. This is because consumers' valuation is based on the observed minimum standard. This effect is stronger when the number of candidates is low and also depends on where the quality of the marginal candidate is located in the distribution of quality. Lower density of the distribution of candidates implies a larger effect on minimum quality. In this model, setting a binding minimum quality standard is optimal (unless $\alpha_1 = 0$). If $\alpha_1 = 0$ there is no signaling value for exam difficulty. Thus, the social planner chooses a free entry regime in which exam difficulty is not binding, and the salary in the profession is equal to the outside option salary ($w = w_0$).

2.5. The captured regulator

According to classic capture theory, the regulator maximizes professionals' rents by choosing the number of candidates allowed to enter the market. According to classic capture theory, then, the problem of the regulator is

$$\text{Max}_L \Pi(L, D(L)), \tag{7}$$

where extra profits (or rents) are the difference between market salary and the competitive outside salary w_0 ,

$$\Pi(L, D(L)) = \left[w\left(D(L), \frac{L}{Z}, Y, \varepsilon\right) - w_0 \right] L. \tag{8}$$

The salary- or labor-setting behavior of the licensing board is described by the relation

$$w = w_0 + \alpha_1 \frac{L}{Nf(D(L))} + \alpha_2 \frac{L}{Z}. \tag{9}$$

The regulated market is now described by licensing board's behavior (Eq. (9)), consumers' demand (Eq. (1)), and professionals' outside option (Eq. (3)).

Note that the only difference between Eqs. (9) and (6) is the presence of the term $\frac{L}{Z}$. From the point of view of the captured regulator, admitting one additional candidate has two separate effects on salaries. The first is the effect of minimum standards on consumers' valuation. The second is that admitting one additional lawyer implies lower wages for all lawyers. This is due to the fact that the consumers'

marginal valuation is decreasing in the number of professionals in the market. For the captured regulator, the marginal effect of one additional professional on salaries crucially depends on market size, and therefore Eq. (9) distinguishes the two theories.

2.6. Summary

In short, the market is described by the demand function (Eq. (1)) and the supply relation

$$w = \beta_0 + \beta_1 X + \alpha_1 \frac{L}{Nf(D(L), m)} + \vartheta \alpha_2 \frac{L}{Z} + \eta \quad (10)$$

in which the behavioral parameter ϑ is equal to 1 if the regulator is captured, while ϑ is equal to 0 if licensing is efficient. Alternative assumptions on the objective of professional boards are possible. In particular, boards may place some positive weight $0 \leq \vartheta \leq 1$ on both professionals' rents and social welfare. If this is the case, they face the problem

$$\text{Max}_L \vartheta \Pi(L, D(L)) + (1 - \vartheta) W(L, D(L)), \quad (11)$$

which provides the first order condition (Eq. (10)). Therefore, the behavioral parameter can be interpreted as the relative weight given to rent seeking by the licensing board.

If $\alpha_1 = 0$ there is no scope for increasing efficiency by setting minimum standards. In such a case, ϑ can still be interpreted as the relative weight of rent seeking: $\vartheta = 1$ implies pure rent maximization, while $\vartheta = 0$ implies no significant deviation from a competitive market where the salary in the profession is equal to the outside salary w_0 .

Appendix 2 shows that the model can incorporate heterogeneity in salaries and in the outside option. Moreover, the assumption that exam difficulty does not affect the outside market may also be relaxed. Finally the model can incorporate additional effects of professional licensing, such as positive or negative externalities (Kraakman, 1986; Kleiner, 2006; Society of American Law Teachers, 2002).

3. Empirical implementation

The empirical application focuses on the US market for entry level lawyers. Focusing on the legal market has several advantages. First, the market for lawyers is regulated at the state level by different licensing boards. Each state has a different licensing exam, and different standards are used across states and over time.⁸

Second, licensing board decisions are observable, as detailed data is available on the difficulty of the bar exam. In practice, licensing boards choose a numerical threshold, which determines the number of successful candidates. This is due to the specific method used to grade licensing exams (see Section 3.1).⁹ Third, the number of first year lawyers entering the market can be precisely determined, since detailed data is available on the number of successful and unsuccessful bar exam candidates. Data availability has been a long-standing issue in the literature on licensing.¹⁰ In this context, my data set

⁸ A lawyer who is admitted to practice in one state is not automatically allowed to practice in another. Mobility across states is severely restricted by re-licensing requirements. Some states have reciprocal agreements that allow some licensed attorneys from other states (typically with substantial experience) to practice without sitting for another full bar exam, but these agreements differ significantly among the states (the Comprehensive Guide to Bar Admission Requirements, published every year by the American Bar Association, describes the rules for admission).

⁹ Pass rates are generally available, but they may vary because of changes in exam difficulty or in the quality of candidates. So they do not provide precise information on exam difficulty.

¹⁰ Kleiner (2000, p.199) notes that "...perhaps the largest barrier standing in the way of analysis of occupational licensing is that there is no well-organized national data set waiting to be exploited. (...) Moreover, state licensing boards often are reluctant to provide (...) information to the researchers".

provides a unique source of information on licensing board behavior. Finally, the legal market is the typical example of a large licensed profession, in which it has been argued that the entry examination may play a significant role in reducing asymmetric information. The regulation of the legal market has the explicit objective to protect the public from unqualified practitioners.

Focusing on the legal market has also some limitations. In practice, the estimation of the model using data for the entire population of lawyers is not feasible, and I need to restrict the analysis to the market for entry level lawyers. This limitation is due to the availability of data. Studying the entire profession requires very long time series, which are not available for a number of key variables (for example exam difficulty). In fact, lawyers of different age are not perfect substitutes, and so changes in minimum standards slowly influence salaries, as the number of professionals affected by the change increases in the population. Similarly, exam difficulty does not provide a good measure of quality of the entire profession, as lawyers of different age may have been subject to different minimum standards (this information is likely to be available to consumers, but not to the researcher). However, the observed changes in exam difficulty directly affect the pass rate and the salary in the market for entry level lawyers.

My estimate of ϑ may be biased upwards if the regulator compensates the welfare loss generated in the market for entry level lawyers, with the social surplus in the market for older lawyers. This may happen if the demand for entry level lawyers is high, relative to that of older lawyers. In this case, the social planner may deliberately set a relatively high standard and generate a shortage of lawyers in the entry level market, in order to avoid excessive entry in the market for older lawyers. This seems very unrealistic in the legal market, as demand is expected to be significantly higher for older lawyers.

A second reason why my estimates are unlikely to overestimate the weight of rent seeking is that entry level lawyers are typically young. This implies that the social planner is expected to allow for some additional entry among young lawyers, to compensate for the natural attrition in the profession. This further suggests that it is unlikely that the welfare loss deriving from shortages in the entry level market is compensated by the surplus generated in other segments of the market. In addition, the rationale for setting minimum standard is to reduce asymmetric information, which is higher for entry level lawyers (experience may provide a good signal of the quality of older lawyers). Thus, if there are significant inefficiencies in the market for entry level lawyers, it is unlikely that the entry examination can increase social welfare overall. Finally, obtaining an estimate of ϑ is an interesting descriptive result, independently of its the interpretation as a structural parameter. It provides a summary measure for the relative importance of rents in one specific market.

3.1. Brief overview of the bar exam and the data

The structure of the bar exam is the same in almost all states and has remained stable over the past two decades.¹¹ It consists of the Multistate Bar Examination (henceforth MBE), a standardized test, and essay and case questions. The MBE contains 200 multiple choice questions developed by the National Conference of Bar Examiners, who are also responsible for correcting this portion of the exam. Using the results of a small sample of questions, which are repeated in different examinations over time and across states, scores are scaled so that any single MBE score represents a standard level of performance, irrespective of when and where the exam is taken. MBE mean scores are a cardinal measure of the quality of bar exam

¹¹ The exam is administered twice a year, in February and July. Exceptions are Delaware, Nevada and North Dakota, where the bar exam is held only once a year.

candidates, and results can therefore be compared across states and years.¹²

Essay and case questions are set by state boards and graded at the state level, according to criteria set by each board.¹³ In this case, a particular score does not necessarily correspond to a standard level of performance across states and years. However, most states have introduced essay score scaling. The most common scaling procedure is mean and variance scaling. Mean and variance scaling requires that each essay score be transformed so that the mean and variance of the distribution of scaled essay scores is equal to the mean and variance of the standardized test scores. The scaled essay scores are therefore not affected by exam-specific unobserved differences in exam difficulty or in the severity of grading procedures (Crocker and Algina, 1986; Linn, 1993).¹⁴

The overall scores (the weighted average of the standardized test and essay test score) thus share the same metric across states and years and can be compared. Since the pass-fail decision is based on overall scores, the observed minimum quality standards for each state share a common metric and provide a simple measure for exam difficulty. (In the rest of the paper, I will refer to the overall minimum quality standard as exam difficulty, or the minimum standard).¹⁵ Data on minimum standards is available from either 1984 or the introduction of comparable standards (reported in Table 1, column 1), whichever is later, to 2005.¹⁶ Table 1, column 2 reports any changes in the minimum quality standards, while column 3 reports the corresponding date of each change. Column 4 reports the minimum quality standard in the last year of the sample. With this information, this table is sufficient to reconstruct the time series of the minimum standard in each state. Standards differ significantly across both states and years. For example, holding candidate ability constant, a change in exam difficulty from the standard in Alabama to the standard in California would imply a drop from 79% to 39% in the pass rate.¹⁷

Minimum quality standard data is matched with the number of total and successful candidates for each examination.¹⁸ I aggregate the information at the yearly level by summing the number of total and successful candidates for the two exams each year. The data set also includes data on MBE scores, consisting of MBE mean scores at the state level for each examination. Exam-specific information was

Table 1
Bar exam difficulty.

State	Starting date of comparable standards	Observed changes in bar exam difficulty	Date of change	Bar exam difficulty in 2005 (0–200)
	(1)	(2)	(3)	(4)
Alabama	1990	–	–	128
Minnesota	1984	–	–	130
Missouri	1984	5, –3	1996, 2005	130
Montana	1999	–	–	130
New Mexico	1984	3, –3	1990, 96	130
North Dakota	1986	–	–	130
South Dakota	1989	–	–	130
Utah	1991	–	–	130
Connecticut	1984	–	–	132
Illinois	2000	–	–	132
Indiana	2001	–	–	132
Mississippi	1995	–	–	132
D.C.	1984	–	–	133
Kansas	2000	–	–	133
New Jersey	1992	–2	1993	133
New York	1984	1	2005	133
Hawaii	1993	–	–	134
Arkansas	2002	–	–	135
Georgia	1984	5	1997	135
Massachusetts	1984	–	–	135
Nebraska	1996	–	–	135
Ohio	1984	–10, 3.33, 6.67	1992, 96, 97	135
Oklahoma	1984	2, 1, 4, 1	1991, 92, 95, 97	135
Texas	1994	–	–	135
West Virginia	1994	–	–	135
Maryland	Jul-00	–	–	135.33
Florida	1984	2, 3	2003, 04	136
Pennsylvania	Jul-01	–	–	136
Arizona	1991	–	–	136.67
Colorado	1987	–	–	138
Maine	1984	1, 2, 2, –2	1990, 92, 95, 2003	138
North Carolina	1984	–2.8, 0.8, 0.8, 0.8, 0.8, 1.6	1988, 90, 92, 94, 95, 96	138.4
Alaska	1992	–	–	140
New Hampshire	1984	–	–	140
Virginia	1998	–	–	140
California	1984	4	1990	144
Delaware	2000	–	–	145

Note: Bar exam difficulty is the minimum overall score (mean of the MBE score and essay scaled score) required to pass the bar exam (minimum scores are measured on a 0–200 scale) in each state. Data on difficulty is available from either 1984 or the introduction of comparable standards (reported in Column 1), whichever is later, to 2005. Column 2 reports changes in difficulty, while column 3 reports the corresponding date of each change. Column 4 reports difficulty in 2005. The information in Table 1 allows reconstruction the time series of exam difficulty in each state.

furnished by the state Bar Association or the Supreme Court office responsible for administering the exam.

My proxy for w , the salary in the regulated profession, is the median entry level salary in law firms, available from the National Association for Law Placement (NALP, 2003), which surveys law school graduates one year after graduation.¹⁹ The National Association for Law Placement also reports median entry salaries of graduates

¹² A more detailed description of the MBE can be found at <http://www.ncbex.org>. A similar standardized test is the Graduate Record Examination (GRE), often used in the admission process to graduate courses.

¹³ Some states have recently started to use essay and case questions developed by the National Conference of Bar Examiners (known as the Multistate Essay Examination and Multistate Professional Test). When this is the case, the Conference provides state boards with possible exam questions and some analysis of the issues involved in each question in order to facilitate grading. Even when using this service, state boards grade the answers independently, using standards set locally.

¹⁴ An alternative scaling procedure is quantile by quantile equating. The results of the two techniques are not necessarily the same but differences are empirically small (see Lenel, 1992).

¹⁵ The weights given to the two exam components may vary across states. Empirically, the weight given to the standardized test varies between 50% and 65%. For realistic distribution of scores and standards, however, these differences do not affect the comparability of minimum standards.

¹⁶ The main source of standard and grading procedure data is The Comprehensive Guide to Bar Admission Requirements, published annually by the American Bar Association and the National Conference of Bar Examiners. This source is complemented by information from various issues of The Bar Examiner, published by the National Conference of Bar Examiners (NCBEX). When standards are comparable, but not expressed on a 0–200 point basis, the standards have been converted to a 0–200 basis to increase the consistency of Table 1. In the Comprehensive Guide there is some uncertainty as to when some standards changed. Wherever possible, additional sources have been used to pinpoint the exact date of change. In the few cases where no such data was available, the earliest date compatible with the information in the Comprehensive Guide was used.

¹⁷ I use for comparison a normal distribution, with a mean equal to the mean MBE score and the variance equal to the mean variance in the US over the period 1981–2003.

¹⁸ Published yearly by the National Conference of Bar Examiners.

¹⁹ This is a good proxy for two reasons. First, about three out of four law graduates go into private practice. Second, virtually all positions in private practice require passing the bar exam. Focusing on salaries in private practice accounts for about 80% of jobs requiring the bar exam. Jobs in the government tend to have somewhat lower salaries, and often require the bar exam. Thus, my proxy may overestimate the entry salaries for jobs requiring the bar exam. To the extent that this bias is constant over time, however, it will be captured by the state fixed effects in the empirical specification (Section 3.2) and will not affect the results. The survey response rate is good (about 36%), but the number of respondents is small for states with few candidates (e.g., Alaska, Montana, Nebraska, North Dakota, and South Dakota). The results are not affected by excluding such states.

who enter the business sector. Overall, the data used for the empirical analysis consist of an unbalanced panel of 37 states for a total of 448 yearly observations between 1991 and 2005, where each state is observed on average for 12 years, with a minimum of 4 and a maximum of 15 years. Summary statistics are reported in Table 2.

3.2. Identification of ϑ

Each state i and year t differs in the number of bar exam candidates $N_{i,t}$, exam difficulty $D_{i,t}$, successful candidates $L_{i,t}$, market size $Z_{i,t}$ (measured by the population of the state) and entry level salaries $w_{i,t}$. The number of successful candidates per capita is $\tilde{L}_{i,t} = \frac{L_{i,t}}{Z_{i,t}}$, and the pass rate $\frac{L_{i,t}}{N_{i,t}}$. Assuming Gaussian score distributions, I estimate the density of the score distribution evaluated at the minimum standard, $f_{i,t}(D_{i,t})$ and compute the weighted pass rate $\tilde{P}_{i,t} = \frac{1}{f_{i,t}(D_{i,t})} \frac{L_{i,t}}{N_{i,t}}$.

The outside salary w_0 is not observable to the researcher but is a function of observable variables and parameters to be estimated.²⁰ The empirical specification of Eq. (3) is

$$w_{0,i,t} = \delta_0 + \delta_1 \tilde{X}_{i,t} + \mu_i + \eta_{i,t}. \quad (12)$$

where δ_0 and δ_1 are parameters, μ_i state specific fixed effects capturing state specific heterogeneity in the outside option salary, and $\eta_{i,t}$ a random variable capturing idiosyncratic shocks to the outside option. The empirical specification of the demand (Eq. (1)) and the supply relation (Eq. (10)) are thus

$$w_{i,t} = \gamma_0 + \gamma_1 D_{i,t} + \gamma_2 \tilde{L}_{i,t} + \gamma_3 \tilde{Y}_{i,t} + \xi_i + \varepsilon_{i,t} \quad (13)$$

$$w_{i,t} = \delta_0 + \delta_1 \tilde{X}_{i,t} + \delta_2 \tilde{P}_{i,t} + \delta_3 \tilde{L}_{i,t} + \mu_i + \eta_{i,t} \quad (14)$$

where $w_{i,t}$ is the median entry salary in law firms; ξ_i are state specific fixed effects, capturing systematic differences across states in the demand for legal services; $\tilde{X}_{i,t}$ and $\tilde{Y}_{i,t}$ are vectors of exogenous variables; and $\varepsilon_{i,t}$ captures further unobserved heterogeneity in consumers' valuation.²¹ The model puts some restrictions on the sign of the estimated parameters. First, $\gamma_1 \geq 0$, second $\gamma_2 \leq 0$, and finally $\delta_3 = -\vartheta \gamma_2$. So the weight of rents in the objective of the board is $\vartheta = -\delta_3/\gamma_2$.²²

Following the literature (Pashigian, 1977), $\tilde{Y}_{i,t}$ includes variables affecting the demand for entry level lawyers, such as the population in the state, Real Gross State Product per capita, and the number of existing lawyers per capita.²³ This last variable controls for the possible substitution effects between entry level lawyers and older professionals. No restriction is put on the sign of this effect, so that young lawyers may be substitutes or complements to old lawyers.²⁴

$\tilde{X}_{i,t}$ includes variables capturing the size and the quality of the cohort of individuals of the same age as the bar exam candidates in

Table 2
Summary statistics ($N = 448$).

Variable	Mean	Std. Dev.	Min	Max
Median salary (/1000, 1996\$)	55.2	19.3	23.1	113.8
Successful candidates per capita (*1,000,000), \tilde{L}	177.7	97.5	48.7	626.8
Bar exam difficulty, D_t	134.1	4.0	125	145
Population (index)	1.0	0.076	0.91	1.43
Lawyers per capita	0.006	0.014	0.005	0.101
Real GSP per capita (/1000, 1996 \$)	32	12	19	109
Weighted pass rate, P	29.35	11.17	13.32	85.78
Bachelor degrees ($t-3$), (/1000)	25.78	25.82	0.99	125.94
SAT verbal ($t-8$)	525.4	32.93	468	607
SAT math ($t-8$)	519.9	32.41	449	602
SAT candidates ($t-8$), (/1000)	25.04	33.55	0.28	140.70

Note: median salary is the median entry salary in law firms. The Bar Exam difficulty is measured on a 0–200 scale. The population index is the population/mean population in the state.

year t , and potentially competing in the same outside market (for example, the generic business market). These variables are the number of bachelor degrees awarded in the state (three years before), the average SAT verbal and math score, and the number of students taking the SAT test in the state (eight years before).²⁵ The SAT is a standardized entry test often required by colleges awarding degrees in the arts, social sciences and natural sciences. It has the advantage of measuring the performance of a large pool of candidates.²⁶ Some of these students will eventually choose to go to law school 4 years later, upon graduation from college. A smaller subset will eventually take the bar examination, after graduation from law school (3 years after entering law school).²⁷

In order to estimate ϑ , I need to simultaneously estimate Eqs. (13) and (14). There are three endogenous variables in Eqs. (13) and (14): $D_{i,t}$, $\tilde{L}_{i,t}$, and $\tilde{P}_{i,t}$. Three conditions must hold for consistent estimation: first, the regressors $\tilde{P}_{i,t}$ and $\tilde{L}_{i,t}$ must not be perfectly correlated. They will not be in my sample, given the variability in market size $Z_{i,t}$ and number of exam takers $N_{i,t}$. Second, the remaining variables, stacked in the matrices \tilde{Y} and \tilde{X} for the two equations respectively, are exogenous in the sense that $E(\tilde{Y}'\varepsilon) = 0$ and $E(\tilde{X}'\eta) = 0$. Finally, the rank conditions are satisfied.

Although I will estimate Eqs. (13) and (14) as a system of simultaneous equations by 3SLS, it is useful to think of the estimation process in two steps. First, to identify γ_1 and γ_2 , I need exogenous variables correlated with the two endogenous variables in Eq. (13) but not included in \tilde{Y} . Supply shocks in \tilde{X} are the natural candidates. Given the long lag and the fact that SAT scores refer to a large portion of students applying to college (not only those who will eventually earn a law school degree), SAT scores are not plausibly correlated with the error term in Eq. (13). Similarly, the lagged number of bachelor degrees awarded in the state is unlikely to be correlated with unobserved determinants of the demand for legal services $\varepsilon_{i,t}$. This makes the exclusion restriction valid.

²⁰ This is an innovation in the literature on licensing, which typically compares salaries of regulated and similar but unregulated professions, or of the same profession in markets with different forms of regulation (see Section 1).

²¹ In the theoretical model, the state fixed effects ξ_i and μ_i , and the exogenous variables in X and Y are included in X and Y .

²² The model also predicts that $\delta_2 = \gamma_1$, but this is not a robust prediction, and is not used for identification (see Appendix 2 for details).

²³ Data on population and Real Gross State Product are from the Bureau of Economic Analysis. Data on the number of lawyers is from the American Bar Foundation (see Appendix 1).

²⁴ The results are not affected if I use the lagged number of lawyers per capita (which is not affected by the inflow of new lawyers). The number of lawyers per capita varies marginally from year to year, because of the difference between (lagged) entry into and exit from the profession, and demographic changes. This variable may also be affected by some migration of experienced lawyers to and from the state, while the number of entry level lawyers is not affected by migration. The number of lawyers per capita tends to follow long term trends.

²⁵ Data on bachelor degrees awarded is from the U.S. Department of Education, National Center for Education Statistics. Information on SAT tests by state and year is from The College Board.

²⁶ There are differences across states in the fraction of high school graduates taking the SAT, but these differences are captured by the state fixed effects. The fraction of high school graduates taking the SAT in each state is relatively stable. For example, the mean participation rate in 2005 for the states in my sample is 52%, while the average absolute change between 2005 and 2006 is just 1.4%.

²⁷ Although a student can complete college and law school within 7 years, there are a number of reasons to suspect that the average time lapse between college admission and the bar exam is longer. First, about one in four matriculated law students attends only part-time. Second, one third of candidates fail the bar exam, and many of them repeat the test in later years (in 2004, 29% of candidates were repeaters). Finally, not all candidates take the exam immediately upon graduation. The results are robust using different time lags.

By shifting the outside salary, these variables affect the number of professionals allowed to enter into the market, \tilde{L} , and thus the exam difficulty D (which is a non-linear function of \tilde{L}). Once an estimate of γ_2 is available, I can then estimate the second equation by exploiting demand shocks in \tilde{Y} . Finally, since $\delta_3 = -\vartheta\gamma_2$, one can then compute ϑ .

3.2.1. An alternative identification strategy

Identification of ϑ is easier if one assumes that the outside salary w_0 in Eq. (3) is observable. In this case, the supply relation is simply

$$w_{i,t} = w_{0,i,t} + \delta_2 \tilde{P}_{i,t} + \delta_3 \tilde{L}_{i,t} \tag{15}$$

where $w_{0,i,t}$ is the observed outside salary in state i and year t . Since the theoretical model implies $\delta_3 = -\vartheta\gamma_2$ and also $\delta_2 = \gamma_1$, identification of ϑ only requires knowledge of the parameters γ_1 and γ_2 of the demand function, which can be estimated using supply shocks in \tilde{X} . Once γ_1 and γ_2 are known, the behavioral parameter can be computed using the supply relation, minimizing the squared difference between the left and the right hand side of Eq. (15).²⁸

This identification strategy is parsimonious, in that it requires estimating only one of the two equations of the system. However, it requires two strong assumptions. First, w_0 needs to be observable. In most applications, this may not be the case. This important empirical issue will be discussed in the next section. Second, the identification strategy requires the restriction $\delta_2 = \gamma_1$ to be valid because the identification strategy is now based on the estimated parameters of only the demand function.²⁹ The lack of information from the supply equation needs to be compensated for by using an additional theoretical restriction.

4. Results

Table 3 reports the results of estimating Eqs. (13) and (14) by 3SLS. The estimated behavioral parameter ϑ is 0.69, with a standard error of 0.3. The magnitude of this estimate is consistent with the theory, which predicts that $\vartheta \in [0, 1]$. Note that I do not impose any constraint on the possible values of the parameter ϑ in the estimation. Welfare maximization implies that $\vartheta = 0$, which is rejected at a 3% confidence level. Capture theory predicts $\vartheta = 1$, which is not rejected at conventional levels.

Overall, the estimated parameters have the expected sign. The coefficient of the number of entry level lawyers is negative in the demand equation and positive in the supply relation. The implied elasticity of demand for the market for entry level lawyers is 2. In the supply relation, the elasticity of the number of bar exam passers is 0.3, implying that, as demand varies, the licensing board allows a 0.3% increase in the number of entry level lawyers only if there is a 1% increase in salaries. The impact of exam difficulty on the demand for entry level lawyers is positive, as predicted. The point estimate implies that a 1% increase in the exam difficulty implies a 7% increase in consumers' marginal valuation for entry level lawyers. However, the standard error is large and the coefficient is significantly different from zero at a 15% confidence level.

Larger population implies relatively higher demand for legal services, although the magnitude of this effect is small (elasticity equal to 0.3). The impact of Gross State Product per capita is positive, as predicted, but relatively small and not significantly different from

Table 3
Estimation results.

	(1) Demand	(2) Supply
Successful candidates, \tilde{L}	-0.134 (0.049)***	0.092 (0.023)***
Bar exam difficulty, D	2.822 (1.984)	
Population index	17.099 (10.157)*	
Lawyers per capita (*1000)	2.28 (0.71)***	
Real GSP per capita	278.721 (353.402)	
Weighted pass rate, P		-1.819 (0.378)***
Bachelor degrees ($t-3$), (/1000)		-0.222 (0.339)
SAT verbal ($t-8$)		-0.829 (0.154)***
SAT math ($t-8$)		0.652 (0.163)***
SAT candidates ($t-8$), (/10,000)		0.0017 (0.0023)
Observations	448	448
Theta	0.69 (0.31)**	

Note: the dependent variable is median salary (/1000, 1996 \$). Successful candidates is the number of successful candidates divided by the population in a specific state and year (*1,000,000). State specific fixed effects are included in both equations. Summary statistics are reported in Table 1. The two equations are estimated by 3SLS.

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

zero (elasticity 0.1). The impact of the number of existing lawyers per capita is positive and significantly different from zero at conventional levels (elasticity 0.2). This suggests that entry level lawyers and more senior lawyers are complements in the production of legal services. In the supply relation, the coefficient of the weighted pass rate is negative, which is consistent with the existence of some external effects of entry standards, as discussed in Appendix 2. Cohorts of students with relatively high SAT math scores and low verbal scores tend to have higher outside option salaries, while larger cohorts (more bachelor degrees in $t-3$) tend to have lower outside option salaries.

4.1. Discussion and robustness results

As argued in Section 2, the model allows for, but does not require, the existence of asymmetric information. The weak statistical significance of the coefficient α_1 casts some doubt on the relevance of the public interest view. In fact, if α_1 were exactly equal to zero, then professional licensing could not increase welfare (see Section 2). However, the weak statistical significance of α_1 does not necessarily imply that boards will in practice raise salaries to the level implied by full rent maximization ($\vartheta = 1$). Therefore, the behavioral parameter ϑ is still pertinent as a measure of the importance of rent seeking, relative to a competitive market with no entry restrictions (which is the preferred option of the social planner if $\alpha_1 = 0$). Thus, measuring the magnitude of ϑ is still a relevant empirical question.

A second interpretation can be offered for the weak statistical significance of the impact of minimum standards on consumers' valuation. It is possible that consumers are not interested in minimum standards, but in some other measure of lawyers' competence. For example, they may care about the mean quality of successful bar exam candidates, rather than the quality of the weaker lawyers admitted into the profession.

I estimate the mean quality of successful candidates using information on the variance of the score distribution by state, and by making the realistic assumption that standardized exam scores are

²⁸ In principle, one behavioral parameter for each state could be computed, rather than a common parameter ϑ . In my application, however, I will be constrained by the number of available observations to assume that γ_1 and γ_2 are constant across states, and so I will estimate a common behavioral parameter ϑ .

²⁹ This prediction of the theory - which is not used in the first identification strategy - is sensitive to the existence of heterogeneity in w and w_0 , and alternative specifications of the objective functions of the board (see Appendix 2).

Table 4
Robustness results.

	(1) Demand 3SLS	(2) Supply 3SLS	(3) Demand 2SLS
Successful candidates, \bar{L}	-0.130 (0.047)***	0.093 (0.023)***	-0.134 (0.049)***
Bar exam difficulty, D			2.768 (1.993)
Mean quality of successful candidates	2.574 (2.733)		
Population index	19.832 (10.248)*		18.18 (10.86)*
Lawyers per capita (*1000)	2.18 (0.67)***		2.29 (0.71)***
Real GSP per capita	372.0 (331.6)		264.3 (357.0)
Weighted pass rate, P		-1.881 (0.376)***	
Bachelor degrees ($t-3$), (/1000)		-0.283 (0.338)	
SAT verbal ($t-8$)		-0.830 (0.154)***	
SAT math ($t-8$)		0.636 (0.163)***	
SAT candidates ($t-8$), (/10,000)		0.0002 (0.0002)	
Observations	448	448	448
Theta	0.72 (0.33)		

Note: The dependent variable is median salary (/1000, 1996 \$). Successful candidates is the number of successful candidates divided by the population in a specific state and year (*1,000,000). State specific fixed effects are included in both demand and supply. Summary statistics are reported in Table 1. The demand and supply in columns 1 and 2 are jointly estimated by 3SLS. In column 3, the demand equation is estimated by 2SLS.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

normally distributed.³⁰ I then substitute for minimum standards in the demand function with this new measure of average competency. I find no significant differences in the estimated results (Table 4, columns 1 and 2) nor in the implied behavioral parameter ϑ , which is now 0.72. The magnitude of the impact of mean quality in the demand function is almost identical to that of the minimum standard. Overall, the results seem to be robust to the way consumers are assumed to measure increases in lawyers' quality deriving from increased standards.³¹

A second robustness test is related to the introduction of heterogeneity in w and w_0 , and the specification of the objective function of the board. The results do not significantly change when I estimate a more general specification that allows for heterogeneity and the possible external effects of licensing (see Appendix 2 and Table A1), and ϑ is estimated to be 0.70.³²

4.2. Results assuming that w_0 is observable

The alternative estimation strategy described in Section 3.2 requires estimating the demand function in isolation rather than as part of a

³⁰ Standardization is described in Section 2. See also Appendix 1.

³¹ In principle, consumers may care about some other measure of quality that is not correlated with bar exam difficulty. If this is the case, public interest theory cannot explain the observed entry requirements, which are based on bar exam performance. This leads to a rejection of public interest theory as an explanation of entry regulation and leaves us to interpret ϑ as the empirical weight of rent seeking, relative to a competitive market.

³² Finally, the results are robust when I change the estimation method (LIML) and reduce the number of instruments, so that the model is just identified. Similar results are also obtained using average LSAT scores instead of (or in addition to) SAT scores in the set of excluded instruments. Information on LSAT scores for admitted law school students in the state is obtained from the Official Guide to ABA Approved Law Schools. This variable is lagged three years to account for the average law school duration.

Table 5
The impact of reducing rent seeking.

	Theta = 0
Number of lawyers	+22%
Median salary	-46
Consumer welfare	+65
Wage bill	-35

Note: Counterfactual changes deriving from a decrease of theta from 0.69 to 0, based on estimated coefficients in Table 3.

system. The estimated parameters are reported in Table 4, column 3. The estimated coefficients of the demand equation are not significantly different from those obtained before. This is an interesting robustness check, since the wrong specification of the supply relation could in principle contaminate the results for the other equation in the system.

In order to estimate ϑ , this second strategy requires using some observable measure of the outside option salary. The median entry salary of law school graduates who choose to enter the business market in each state and year is a natural choice, as the business market is the natural alternative for law graduates not pursuing a legal career.³³ However, some jobs taken by law school graduates in the business sector require the bar exam, so the median salary in the business sector is likely to overstate the true outside option salary of law graduates. This in turn implies that the difference between salaries in the legal profession and the outside option may be underestimated, so ϑ may be biased toward zero. I find a significant correlation between the wage gap $w_{i,t} - w_{0it}$ (on average \$10,000) and the number of successful candidates per capita $\bar{L}_{i,t}$, which suggests a significant deviation from the public interest motive ($\delta_3 > 0$ in the supply relation). The implied lower bound for ϑ is 0.5.

I also consider, as an alternative measure of w_0 , the median earnings of individuals aged 25–35 who have an advanced university degree, in each state.³⁴ This is a broad summary measure of earnings for the age group of interest, and for individuals with similar educational attainment. Since it includes all occupations and all fields of study (including humanities), it is not likely to be affected by the regulation of the legal market, but it is likely to underestimate the outside option of law school graduates. Thus, ϑ is likely to be biased upwards. The difference in salary between the legal profession and the outside option is now higher (around \$20,000), and the implied ϑ is equal to one. The two estimated behavioral parameters using different proxies for w_0 straddle the ϑ obtained above.

A more precise proxy for the outside option is the median earnings of individuals in the same age group, with the same educational attainment, but working in management and related occupations.³⁵ The outside option in this case lies in between the two previous figures, and the implied ϑ is 0.85. This third estimate is likely to be more accurate than the previous two. Overall, the results obtained using the second estimation strategy put bounds on ϑ and are consistent with my previous estimate of ϑ . However, they also show the great extent to which the results depend on the choice of the proxy for w_0 . From a methodological point of view, when a credible measure of the outside option salary is available, the second identification strategy seems natural. When it is not, assuming a

³³ Data from NALP, see Section 3.1.

³⁴ Data are from Census 2000 (<http://www.census.gov/hhes/www/income/earnings/earnings.html>), for Civilian Noninstitutional Population, full time workers (who worked 50 weeks or more and 35 or more hours per week in 1999). Earnings are measured in 1996\$.

³⁵ Data from Census 2000, 5% Public Use Microdata Sample. I only consider full time workers in occupations with Census Codes from 001 to 099, including management, business and financial operations occupations.

flexible parametric specification may be more appropriate, or may be the only feasible identification strategy.³⁶ However, the two empirical strategies are also complementary. In the case of the market for lawyers, for example, one can use the second strategy to estimate ϑ in different scenarios, and also place bounds on the behavioral parameter, since in some cases it is possible to sign the bias caused by different measures of w_0 .

4.3. The impact of licensing on entry, salaries and welfare

Having estimated the structural parameters, I can solve for the number of entrants allowed in the market under the counterfactual hypothesis of efficient regulation, that is with $\vartheta = 0$. Using the estimated parameters in Table 3, this change implies a 22% increase on average in the number of lawyers (Table 5). The increased supply drives down salaries directly because of increased competition, but also indirectly because of the decrease in consumers' willingness to pay as standards decrease. On average, salaries decrease by 46% or \$23,000. The increase in the number of lawyers does not compensate for the drop in salaries, and the overall wage bill goes down by 3%. The decreased cost of legal services more than compensates for the decrease in minimum standards, and consumer welfare increases on average by 65% (over \$800 million in total).

The total effect of licensing, as measured above, is a lower bound for two reasons. First, the analysis focuses on new professionals and entry salaries, and entrants are but a small fraction of the total number of professionals. Second, as salaries increase with seniority, one expects the absolute difference between salaries and outside option to increase.

There may be alternative interpretations of the estimation results. Imperfect competition may exist among law firms, which could generate joint market power independently of entry restrictions. However, this is unlikely to explain the results. In fact, I focus on the entry level market for lawyers, where imperfect competition among law firms has only an indirect effect. In contrast, the effects of the bar examination are direct, as the stock of entry level lawyers in each year is directly determined by exam difficulty. Another possible interpretation is that monopoly power is created by educational requirements, rather than by the bar examination. However, educational requirements are almost the same in all states and do not significantly change in the period studied in this paper. Educational requirements may create an additional barrier to entry, but they cannot explain the results of this paper.

5. Conclusions

This paper specifies and estimates a static model of professional licensing. An advantage of my set-up is that a model of licensing is used to guide the empirical analysis, so that the alternative hypotheses are made explicit. This paper shows that the objective of licensing boards can be estimated from available data on a single regulated profession. The estimated parameters support the capture

theory and not the public interest theory. There is little evidence of a significant impact of bar exam difficulty on the demand for legal services. The results imply that licensing, as implemented, increases salaries and decreases the availability of lawyers, thus significantly reducing consumer welfare (see also Pagliero, 2010).

There are some drawbacks to this approach. First, no dynamics are considered, and this is a problem common to the entire literature on professional licensing. Within a static framework, one cannot account for some important features of the data, such as the fact that exam difficulty is not changed every year. In practice, this may be caused by adjustment costs, implying that it is optimal for the licensing board to review the admission standard infrequently. Second, the results obviously depend on the specification of the demand and on outside option equations. Third, I deliberately keep the model specification and estimation as simple as possible, simplifying the description of the economy to the essential relationships among the key variables. With more detailed data, one could possibly add additional layers of complexity. The data set used in this paper is unique, but rather small. This implies that it is difficult to obtain narrow confidence intervals for the key parameters. This is the first paper attempting to estimate the objective of professional licensing boards, and the results should be taken with caution. However, the approach taken in this paper could also be applied to the evaluation of the impact of professional licensing in other professions. (Detailed data on exam results are available for other professions, and standardized examinations are also commonly used in licensing examinations.)

In my model of licensing, the counterfactual scenario of deregulation is implemented through lower standards. This setting ignores the possibility of a more radical reform in which certification markets are introduced (Kleiner, 2000). If these markets indeed existed, the consumer gains from the reform of the current regulation may be greater, as certification markets could reveal lawyers' quality without creating market power.

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Appendix 1. Data appendix

The number of successful candidates per capita in each state is computed by dividing the number of successful candidates (from the National Conference of Bar examiners) by the population of the state (from the Bureau of Economic Analysis). The weighted pass rate $\bar{P}_{i,t} = \frac{L_{i,t}}{N_{i,t}f_{i,t}(D_{i,t}(L))}$ is computed using data on the total number of exam candidates $N_{i,t}$ and the number of successful candidates $L_{i,t}$.

The density $f_{i,t}(D_{i,t})$ is the value of the pdf of the score distribution at the minimum standard. It is computed assuming that scores are normally distributed and using the observed pass rate and the estimated standard deviation of the score distribution. The procedure is the following:

- 1) I estimate the standard deviation of the score distribution σ_i^2 at the state level, if possible, or set it to the mean value otherwise;
- 2) For each examination I compute $f_{i,t}(D_{i,t}(L)) = f(D_{i,t}, 0, \sigma_i^2)$, where $D_{i,t} = F^{-1}\left(1 - \frac{L_{i,t}}{N_{i,t}}, 0, \sigma_i^2\right)$.

In order to estimate σ_i^2 I consider exam-specific results (that is two separate exams for each state and year). Consider how the pass rate data is generated. Each candidate passes the bar exam if his/her

³⁶ Direct measures of the outside option salary (or the counterfactual salary that would occur if there were no entry barriers) may suffer from a number of shortcomings. First, assuming that w_0 is observable does not account for the endogenous sorting of professionals into different occupations. Individuals who enter into two different professions may be different in terms of unobservable characteristics, which may be correlated with salary. Second, the comparison of salaries across different industries is problematic. In fact, job amenities, working hours, work ethics, and career prospects vary across industries, but these variables cannot be fully observed by the researcher. This is indeed one of the problems encountered by the literature on licensing when attempting to compare licensed and non-licensed occupations (see Section 1). Third, the characteristics of the outside market are likely to vary across states, as states specialize in different business activities.

overall score is above a given threshold. In exam k , in state i , the overall candidates' scores are independent draw from the (normal) distribution $F(m_k, \sigma_i^2)$, with mean m_k (equal to the mean MBE score for exam k) and unknown variance σ_i^2 . The likelihood of observing P_k successful candidates out of N_k exam candidates is

$$L = \prod_k F(D_k, m_k, \sigma_i^2)^{(N_k - P_k)} [1 - F(D_k, m_k, \sigma_i^2)]^{P_k} \tag{16}$$

where D_k is the observed exam difficulty. Maximization of the likelihood L provides estimates of σ_i^2 . The results are not significantly different when I assume that scores have a beta distribution, which can accommodate some skewness in the score distribution.

Average quality of successful candidates

In Section 4, I use the estimated average quality of successful candidates as an alternative measure of quality in the demand specification. This is computed under the assumption that exam scores s are normally distributed, with mean m_k and variance σ_i^2 . The mean quality of successful candidates is the mean of the truncated normal distribution $f(s, m_k, \sigma_i^2 | s > D_k)$.

Number of lawyers

There are two sources of information on the number of lawyers by state: the American Bar Association (National Lawyer Population Survey) and the American Bar Foundation (the Lawyer Statistical Report). The first provides annual data, while the second is published only every 3–5 years, but the second has the advantage of counting those lawyers admitted to more than one state bar only once. I used this second source of data to compute the number of lawyers per capita by state and year. I connected the series using the procedure

Table A1
Robustness results (additional effects, 3SLS).

	(1) Demand	(2) Supply
Successful candidates, \bar{L}	-0.13 (0.05)***	0.09 (0.04)***
Bar exam difficulty, D	2.77 (1.99)	0.18 (27.86)
Population index	18.2 (10.9)*	
Lawyers per capita (*1000)	2.29 (0.71)***	
Real GSP per capita	264.3 (357.0)	
Weighted pass rate, \bar{P}		-1.85 (1.64)
Bachelor degrees ($t-3$), (/1000)		-0.38 (1.94)
SAT verbal ($t-8$)		-0.84 (0.51)*
SAT math ($t-8$)		0.66 (0.73)
SAT candidates ($t-8$), (/10,000)		0.004 (0.004)
Observations	448	448
Theta	0.70 (0.38)*	

Note: the dependent variable is median salary (/1000, 1996\$). Successful candidates is the number of successful candidates divided by the population in a specific state and year (*1,000,000). State specific fixed effects are included in both demand and supply. Bar exam difficulty is treated as endogenous in both columns.

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

in Pashigian (1977): $L_t = L_{t-n}(1 - \delta_{t-n,t})^n + \sum_{i=1}^n A_{t-i}(1 - \delta_{t-n,t})^i$ where L_t is the observed stock of lawyers in year t , A_t the number of admissions to the bar in year t (NCBEX) and $\delta_{t-n,t}$ the exit rate from $t-n$ to t .

Appendix 2. Heterogeneity in salaries and external effects

The parameter ϑ can be identified, with no significant changes in the empirical results, when I extend the original model in three ways:

1. The outside salary may depend on the quality of the individual lawyer. This may occur if better lawyers are able to use their skills in the outside profession, thus obtaining a higher outside salary.
2. Salaries in the legal market may also depend on lawyers' quality (ex-post heterogeneity in the legal market).
3. The salaries in the outside market may depend on the difficulty of the bar exam. This relaxes the assumption, made in Section 2, that the outside profession cannot be affected by regulation of the legal market. The sign of this effect is ambiguous. On the one hand, the difficulty of the bar exam may provide a signal of quality, thus increasing the outside option salary. Having passed the bar exam may in fact be valuable for lawyers, even outside the legal market. On the other hand, increased exam difficulty may lead to an increased supply in the outside profession, as more unsuccessful bar exam candidates enter the outside market. More workers may also choose not to take the bar exam, or not to study law in the first place, and directly enter the non-regulated profession.
4. Professional licensing may generate positive or negative externalities.

Heterogeneity in w and w_0

The salary of a lawyer of quality s is

$$w_s = \alpha_0 + \alpha_1 D - \alpha_2 \frac{L}{Z} + \alpha_3 Y + \alpha_4 s + \varepsilon \tag{17}$$

where s is a random draw from the quality distribution $f(s)$, and his/her outside option salary is

$$w_{0,s} = \beta_0 + \beta_1 X + \beta_3 s + \beta_4 D + \eta. \tag{18}$$

There are now three extra parameters ($\alpha_4, \beta_3, \beta_4$), capturing the three additional effects described above. The sign of α_4 and β_3 is presumably positive, while the sign of β_4 can be either positive or negative. The licensing board solves problem (11), where social welfare is

$$W(L, D) = \int_0^L [\alpha_0 + \alpha_1 D(L) - \alpha_2 \frac{x}{Z} + \alpha_3 Y + \alpha_4 s(x) + \varepsilon - \beta_0 - \beta_1 X - \beta_3 s(x) - \beta_4 D(L) - \eta] dx \tag{19}$$

and lawyers' rents similarly account for heterogeneity in salaries. The first order condition, together with Eqs. (1) and (3), provides the new supply relation,

$$w = w_0 - (\alpha_4 - \beta_3 - \beta_4) D(L) + (\alpha_1 - \beta_4) \frac{L}{f(D(L))N} + \vartheta \alpha_2 \frac{L}{Z} \tag{20}$$

which generalizes Eq. (10). If $\alpha_4 = \beta_3 = \beta_4 = 0$, then this new supply relation collapses to Eq. (10). If $\alpha_4 - \beta_3 - \beta_4 = 0$, the supply relation is unchanged, but the coefficient of the weighted pass rate is not constrained to being positive. This also occurs if $\alpha_4 - \beta_3 - \beta_4 \neq 0$, but then one additional variable, $D(L)$, appears in the supply equation. Most importantly, the coefficient of $\frac{L}{Z}$ is still $\vartheta \alpha_2$, where α_2 is the coefficient of $\frac{L}{Z}$ in the demand equation. Hence, even in this case,

knowledge of these two parameters can be used to infer ϑ . Table A1 reports the estimated results obtained by adding exam difficulty to the supply relation. The estimated parameters are not significantly affected and ϑ is estimated to be 0.70. The sum $\alpha_4 - \beta_3 - \beta_4$ is not significantly different from zero.

External Effects

Setting minimum standards could increase or decrease social welfare in other ways. In the legal market, for example, there could be positive externalities, since more capable professionals may be more effective gatekeepers, in the sense of disrupting or deterring the potentially illegal behavior of their clients (Kraakman, 1986). Higher minimum quality standards in a profession may also improve the overall organization of work practices (Kleiner, 2006, p.12). However, higher standards may also generate overinvestment in exam-specific skills, which have no other use than that of increasing the chances of passing the bar exam (Society of American Law Teachers, 2002). In this case, the bar exam generates a waste of resources from the social point of view, which is increasing in the difficulty of the exam (since more difficult exams require more specific training) as well as in the size of the profession.

To take account of these additional factors in the model, I assume multiplicative decomposition and denote the additional social benefit (or cost if negative) by $C(D(L),L) = \chi DL$, where χ is a parameter, positive (negative) in case of positive (negative) externalities. The objective of the board is therefore

$$Max_L \vartheta \Pi(L, D) + (1-\vartheta)[W(L, D) + \chi DL] \tag{21}$$

and the decision rule of the board is

$$w = w_0 - [\alpha_4 - \beta_3 - \beta_4 + \chi(1-\vartheta)]D(L) + [\alpha_1 - \beta_4 + \chi(1-\vartheta)] \frac{L}{f(D(L))N} + \vartheta \alpha_2 \frac{L}{Z} \tag{22}$$

As before, the key parameter ϑ can still be identified and the robustness results in Table A1 remain valid.

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