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ABSTRACT

This paper provides a positive analysis of how formal, periodic legislative oversight of regulatory agencies can influence market outcomes and the welfare of regulated industries. Whereas previous research has focused on the political distinction between passive and active legislative oversight, this paper shows that there exists an important economic difference between two mechanisms as well. We develop a principal-agent model that describes how a regulatory agent's incentives are influenced if its actions are publicly scrutinized. Our empirical analysis supports our claim that formal oversight leads to measurable economic effects.

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1. INTRODUCTION

The licensing of over 800 occupations and professions in the United States (Berry and Brinegar 1988) has been politically justified on the grounds that minimum quality standards protect the public against incompetent practitioners. Professionals know the quality of their services -- their abilities, their training, the number of complaints lodged against them, or personal habits that may influence their performance -- but consumers have difficulty in deciphering these productivity attributes either because they are too costly to obtain or because the information is simply not available to them. These informational asymmetries might lead to the type of market failure that Akerlof (1970) has described, in which case regulation might be welfare-enhancing (Leland 1979; Shaked and Sutton 1982; Shapiro 1986). According to the "public interest" theory of occupational licensing, requiring that professionals meet minimum quality standards ensures that consumers are protected from their own ignorance (Moore 1961; Leffler 1978; Zerbe and Urban 1988).

Operating under the assumption that professionals alone possess the technical understanding of their occupations, state legislatures have historically delegated regulatory authority to the industry itself. But, of course, self-regulation creates a moral hazard problem for the industry. Under the veil of protecting the public from incompetents, self-regulators can restrict entry into the profession and, consequently, increase the incomes of active members of the industry (Stigler 1971). As is characteristic of most principal-agent relationships, the self-regulators are likely to have a political or economic agenda that clashes with the objectives of the sanctioning legislative body. Legislative oversight, then, may become necessary in order to monitor the regulatory agency's behavior and to provide incentives for agency officials to take the actions desired by their legislative sponsors.

Recent research into the dynamics of legislative oversight has focused on the U.S. Congress and has found that for reasons of vote maximization and cost minimization, congressmen rationally choose to take a passive role in overseeing their bureaucratic agents (McCubbins and Schwartz 1984; Weingast 1984; Weingast and Marshall 1988). This is not to say, however, that Congress has no influence in bureaucratic decision-making. Weingast and Moran (1983) and Weingast (1984) have shown that congressional (sub)committees have institutionalized numerous control and incentive devices that provide indirect surveillance of regulatory agents. According to the theory, if these mechanisms operate as expected, then in equilibrium we should actually see very little direct legislative interference into regulatory affairs.

In fact, the theory may be taken one step farther. Suppose, without loss of generality, that we consider the market for a professional service that is self-regulated. In such a market environment, consumers' beliefs about the standards set by the self-regulators will influence the market outcome because these beliefs translate into expectations about the quality distribution of services that consumers will face in the marketplace. Consumers may want their congressmen to oversee the licensing board so that information about industry standards are revealed, but consumers know that their congressmen face a moral hazard problem of their own. Legislators always have the legal power to investigate their regulatory agents, but lawmakers benefit from passivity. Therefore, even if legislators decide to engage in a direct oversight review, little information is likely to be generated. Another explanation for the lack of direct legislative oversight, which is consistent with the aforementioned research on the subject, is that congressmen lack credibility in effectively carrying out the process.

For direct legislative oversight to be useful it must be credible. Congressmen have to commit time and resources to the effort and consumers must have confidence

that the monitoring will be carried out as promised. If this condition holds, then the economic differences between "police patrol" oversight (credible, active monitoring) and "fire alarm" oversight (passive monitoring used when problems arise) may be more important than previous researcher have realized.[1] Active oversight can serve as a communication device between the regulated industry and consumers and the information generated from the review process can alter consumers' beliefs about industry standards and, consequently, the market outcome.

The institutional details of our theoretical model of oversight control are drawn from sunset legislation. Sunset laws, discussed in detail below, are state specific and have many of the characteristics of an active legislative oversight control process. An aspect of sunset that is critical to our analysis is that they legally forced legislators to commit to periodic and public reviews of regulatory agencies. The context for our theoretical and empirical analyses is the regulation or licensing of physicians. We develop a principal-agent model that describes how a medical licensing board's incentives are influenced by active legislative monitoring and show how the market outcome will be different from that which would develop if direct oversight were not in place. We also derive sufficient conditions for the industry to benefit from oversight control. We then test our prediction empirically.

Our theoretical results also offer new insights into the political economy of government regulation. We show that there exist conditions under which a self-regulated industry's welfare increases from the active monitoring of its affairs. Whereas Stigler (1971) argued that an industry might lobby for a regulated status as a way to collect cartel rents, we argue that the political negotiations might be more complicated than previously considered. Since an industry might benefit if it can transmit credible

[1] The terminology "police patrol" and "fire alarm" oversight is borrowed from McCubbins and Schwartz (1984).

information to consumers about the distribution of quality, the particular form of regulatory control will simply become another variable subject to political haggling.

The paper follows the following format: In the next section we provide a description of sunset legislation and point out how it has served as a communication device between producers and consumers. Perhaps more importantly, we describe how sunset review solved the legislature's credibility problem in performing active oversight monitoring of their regulatory agencies. In section 3 we develop the theoretical model. In section 4 we test the main predictions of the theory using the medical profession as a case study. In section 5 we summarize the important features of the paper and suggest possible areas for further analysis. Although the licensing of physicians motivates our analysis and discussion in this paper, the specific model of legislative oversight depicted here might be generalized to study the political origins of government regulations, such as meat inspection, automobile safety, or drug safety standards, that were seemingly designed to put credibility behind the monitoring of product quality.

2. DIRECT LEGISLATIVE OVERSIGHT: SUNSET LEGISLATION

Sunset legislation was a state-level innovation promoted as an ambitious tool "to make regulation more effective, productive and responsive to the public" (Roederer and Palmer 1981, p. 1) and "as a means for eliminating unnecessary agencies, cutting the proliferation of rules and regulation, and forcing increased accountability of executive agencies." (Kearney 1990. p. 49). Sunset marked the beginning of a unique form of legislative oversight; it forced the abolition of specified regulatory bodies unless the state legislature renewed the agency's mandate through legislation. Sunset was first introduced in Colorado in 1976 and 35 states had sunset laws in place by 1981. The sunset cycle varies by state, usually ranging from four to twelve years. For example, if a state's sunset cycle is four years, then every forth year, the state legislature must

enact legislation recreating the regulatory board in question. Sunset has grown to encompass a wide variety of state agencies, boards, commissions, and departments -- ranging from occupational licensing boards of watchmakers, morticians, and medical doctors, for example, to relatively large regulatory bodies, such as public utility commissions and agricultural departments (Council of State Governments 1983).

Generally, once a regulatory body is scheduled for sunset termination, its review process operates as follows: the agency under review submits self evaluations; legislative or sunset commission staff members do research on the agency and submit a report to the legislature detailing their recommendations; public comment and review is accepted; the sunset review is sent to legislative committees for debate and proposed legislation; the legislation goes to the floor for debate and vote; and, finally, the proposed bill is sent to the governor.

In reaching a decision about the fate of a particular agency under sunset review, state legislatures seek the answers to two fundamental sets of questions. First, is the particular regulatory body needed? How would eliminating the regulation harm the public, if at all? Would less regulation offer adequate protection? Do the benefits of regulation outweigh the potential economic burdens imposed? The second set of questions attempts to gauge the performance of the agency. Has the agency accomplished its objectives (however defined)? Have its budget and personnel been allocated appropriately? Does the public have a say in its regulatory affairs? Are its objectives too similar to those of another regulatory agency's? Throughout the sunset review process the burden of proof is put upon the regulatory body to justify its existence. An agency that faces unfavorable review may be subject to greater legislative interference into its affairs, reorganization, or, possibly, extinction.

Critics of sunset legislation believed that the idea failed because the scheduled

termination of regulatory agencies did not lead to a widespread curtailment of government bureaucracy (Martin 1980; Francis 1985). But supporters of sunset, such as Common Cause, saw the law's role not so much in terms of paring down government, but in terms of forcing government to be more responsible. As Common Cause President David Cohen explained in 1978, sunset was a way "to get evaluation into the system." A Common Cause lobbyist reasoned that "Sunset is more of a 'yes, but' than a 'yes or no' process. Through sunset, the legislature says to most agencies: 'Yes, you will continue, but you are going to shape up.'" (Mitzman 1979, p. 50)

The real success of sunset lay in its ability to make regulators more accountable to the legislature (see, for example, Common Cause 1982 and South Carolina 1986). Prior to sunset, because many state regulatory agencies, such as occupational licensing boards, tended to be well-guarded and secretive in their practices, legislative oversight, if any occurred at all, tended to be perfunctory. By creating the sunset idea, legislators forced themselves to intrude -- to find out how and why regulators were making particular decisions. Of course, state legislatures always possessed the power to oversee a regulatory board, but in many states this opportunity went ignored, perhaps because of the reasons that McCubbins and Schwartz (1984), Weingast (1984), and Weingast and Marshall (1988) suggest. Even if legislators did choose to investigate an agency, they would have faced a credibility problem because consumers would see the monitoring as an isolated incident in which principal and agent had little incentive to reveal much information. In fact, in their analysis of the adoption of sunset legislation across the United States, Hamm and Robinson (1981) found that the law was adopted in states where the legislatures were least effective in carrying out the oversight review (e.g., low congressional salaries and high membership turnover).[2] Thus, sunset legislation enabled state legislators to overcome their credibility problem by institutionalizing a legal, periodic, public review process of their bureaucratic agents.

Regulators indeed took the intrusion of impending legislative oversight seriously. In some states regulatory agencies that were scheduled to be reviewed at some future date actually submitted legislation to reform their operations well in advance of the sunset review (Kearney 1990). Interestingly, the Council on Medical Education of the American Medical Association (1988, p. 1994) found that more than half of the physician licensing jurisdictions in the United States and territories had revised their licensing laws in the 1980s. The AMA cited sunset legislation as one of the driving forces behind the new licensing provisions. These political pressures, in the AMA's words, made "it appropriate for the AMA to reassess licensing requirements." Curry (1990, p. 61) noted that sunset achieved success because the review "process provides an opportunity for inbred relationships to be unsettled, at least for the sunset review. This unsettling allows legislators, executive officials, interest groups, and the general public to have a fresh look at the purposes and processes of what may be a closely guarded agency."

The overall impact of the sunset review has varied across states, but it is possible to describe general trends. Roederer and Palmer (1981) analyzed the effects of the sunset review process on health licensure boards in six states: Alaska, Colorado, Connecticut, Florida, New Mexico, and North Carolina. They found that sunset caused

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[2] It is interesting to note that legislators (even professional ones) not only lacked credibility because the formal oversight mechanism was seldom used, but also because the public's confidence in government had sunk to historical lows by the time sunset legislation was introduced. See, for example, Committee on Governmental Affairs (1978). In testimony before the Subcommittee on Intergovernmental Relations of the Committee on Governmental Affairs of the U.S. Senate, pollster Louis Harris presented evidence that the American public's confidence in formal institutions had generally been falling since the mid 1960s. For example, whereas 42 percent of the public had confidence in the U.S. Congress in 1966, only 12 percent did in 1978. Forty-one percent of the public had confidence in the executive branch of the federal government in 1966, but only 18 percent did in 1978 (no doubt a fallout from Watergate). Doctors were in high regard in the mid 1960s with 73 percent of the public's trust, but that had fallen to 39 percent by 1978. Businessmen experienced a similar decline, 55 percent to 21 percent.

a number of significant changes in the regulation of health professionals. Whereas the traditional licensing board was relatively free from legislative or public interference and was comprised solely of members of the regulated industry, sunset reform helped to dramatically change the relationship between licensed professional, politicians, and the public. As a first step, the autonomy of occupational licensing boards was no longer; they, like other elements of the bureaucracy, were accountable to the legislature. Moreover, consumers were given a stronger voice in the licensing process -- non-professionals were made voting members of some licensing boards and board meetings were opened to the general public. Graddy and Nichols (1989) argue that public membership on licensing boards has been associated with a reduction in, what they call, "nonsense requirements" that serve to limit entry.[3] The authors note, however, that public members have been less successful in achieving reforms that professionals tend to disfavor, such as continuing education requirements.

A second major set of changes that sunset introduced dealt with either licensing criteria or the actual operation of the licensing process. For example, some application requirements that the licensing board might use to arbitrarily restrict entry, such as minimum age or "good moral character," were eliminated. Since testing is the typical route to entry into a regulated occupation, licensing boards have traditionally had the liberty to set the standards at whatever level they saw fit to accomplish their objectives, which might include protecting the public against incompetents or, more cynically, limiting entry.[4] Sunset introduced more systematization into the testing process. For example, many states reduced the role of licensing board members, who typically are not testing experts, to create and score tests and hired professional testing services to

[3] As we argue below, however, sunset reform itself, not necessarily public membership, has also been instrumental in eradicating some of these hard-to-justify barriers to entry. In their cross-state estimation of the effects of public membership, Graddy and Nichols do not control for sunset legislation in a particular state.

administer standardized tests.

It is important to emphasize that the effects of sunset went beyond issues relating to entry into the profession, the reform also affected already practicing members of the industry. For instance, continuing education requirements were more seriously considered and, in some cases, adopted. Some states went so far as to require retesting after the courses were completed. Moreover, the definitions of negligence, incompetence, malpractice, and unacceptable care were clarified. Grounds for disciplinary action and the implementation of formal mechanisms to handle consumer complaints were systematically laid out. In addition, sunset created a mechanism whereby the public and the media could get access to information regarding disciplinary actions taken by state licensing or regulatory boards. It is interesting to note that prior to sunset physicians had hoped to implement quality control mechanisms through peer review, but they were blocked by the Federal Trade Commission (FTC) as being anticompetitive (Harrison 1980). The reforms generated by the sunset review provided a means for physicians to formally discipline their substandard peers without interference from the FTC.

In developing a model of the economic effects of direct legislative oversight, there are two critical features of the sunset review process that need to be highlighted. First, opening the licensing board up to legislative scrutiny enables the regulated industry to publicize what standards are being set for members of the profession. Second, this publicity would be meaningless unless an institution like sunset provided a formal mechanism whereby a third party -- in this case a state legislature -- had the incentives

[4] In fact, an individual who failed the Arizona bar exam sued the Committee on Examinations and Admission, claiming that the board members set testing standards at an artificially high level so as to control entry, instead of to protect the public against low-quality lawyers. In 1984 the U.S. Supreme Court ruled in Hoover v. Ronwin that bar examiners were exempt from suit under federal anti-trust law, but the Court indicated that this same criterion would not necessarily apply to other types of licensing boards.

and power to verify and investigate the actions taken by the licensing board. In such an environment, the standards set by a regulatory board become the endogenous outcome of an open communication between legislators, consumers, and the licensing board. In the section that follows we formalize the idea of sunset's role as a communication device and we analyze how the licensing board's incentives would be affected when the law is in place. This model provides an explanation for why we might expect different market outcomes in states where the licensing board is subject to oversight control and in states where it is not.

3. THEORETICAL MODEL

The quality of an individual physician is represented by a real number $\theta \in [\underline{\theta}, \overline{\theta}]$, larger numbers represent higher levels of quality. A physician of quality θ has a constant average cost $c(\theta)$ of providing a unit of service. $c(\theta)$ not only incorporates the "technological" cost of providing the service (i.e., staff salaries, lease of the medical office, rent on equipment, etc.), but also includes the expected cost due to the possibility of malpractice. This latter cost could be measured by the malpractice insurance premium paid by the physician. Since physicians of higher quality presumably face a lower probability of malpractice, we might expect the cost $c(\theta)$ to be a decreasing function of θ. We leave this possibility open and only assume that c is a monotonic function of θ. If a physician of quality θ provides q units of service for a price of p, then his profit is $q \cdot (p - c(\theta))$.

For simplicity, we suppose that there are M identical consumers,[5] each of whom wants to consume at most one unit of service. Hence total demand is bounded by M. An individual consumer is willing to pay at most a price $r(\theta)$ for a unit of service when

[5] This is obviously a strong assumption. We show in Appendix B how our analysis extends in a straightforward way when consumers are heterogeneous.

the physician is of quality θ. Consumers value quality, so $r(\theta)$ is increasing in θ. A consumer who purchases a unit of medical service and pays a price p has a utility of $r - p$, where r is the expected willingness to pay of this consumer given her beliefs about the quality of the physician who provides the service. Consumers do not search. This assumption is less restrictive than it appears. For instance, Satterthwaite (1979) argues that search becomes less efficient when the number of sellers is large in a model in which the reputation of a good is established by "word of mouth," i.e., that search is useless when the number of physicians is large enough.[6]

The legislature's role in our model is one of regulatory oversight. In other words, the legislature has an enforceable right to investigate the operation of the medical licensing board (its decision-making, its standards, etc.) and can disseminate this information to consumers. Provided the legislature engages in formal oversight, it is able to observe a signal y that is correlated with the action that the board took and with the quality distribution of the physicians. The signal y belongs to some compact subset of the real line. After observing the signal, the legislature transmits this information to the consumers and this transmission is noiseless. This last assumption is without loss of generality.

It is the licensing board's responsability to organize the industry. Therefore, it takes some action a in a compact interval A of the real line. Actions of the licensing board affect the number of physicians in the industry as well as the distribution of quality among these physicians. There is a cost of organizing the industry that is modeled as a continuous and increasing function $\hat{v}(a)$. $\hat{v}$ might be an agency cost. For example, physicians who are members of the licensing board can be directly affected by the action which is taken -- with higher standards they face the risk of being excluded

[6] Pauly and Satterthwaite (1981) offer econometric support for this theory. Wessel and Bogdanich (1992) provide anecdotal evidence that customers do not search.

from the industry themselves. Their preferences over actions, therefore, might be different from those that would arise from a benevolent licensing board. Alternatively, $\hat{v}(a)$ can embody the costs borne by individual members of the profession who are affected by the actions taken by the licensing board; for instance, new entrants or previous members can be excluded from the industry. We assume that the licensing board maximizes the total market profits of the physicians in the industry, net of organization costs.[7]

The timing of events is the following: first, the licensing board takes some action b. This action is not directly observed by the consumers or the legislature who might believe that the licensing board took a different action, say $a \neq b$. Without formal legislative oversight consumers do not observe any signal and have beliefs $f(\theta; a)$ about the distribution of quality of a given physician. If the legislature investigates the licensing board, through the sunset process for example, then the legislature observes some signal y. At this point, the legislature and the consumers have beliefs $f(\theta \mid y; a)$ about the quality of a given physician in the industry.[8] After the licensing board has taken its action and after the consumers obtain additional information (if there is oversight), the consumers go to a physician who announces a price p and the consumer either consumes the service at price p or does not buy the service at all.

Formally, we have to solve a two stage game. In the first stage, the licensing board takes an action and in the second stage the price for the service is determined by the market. At the end of the first stage, additional information is transmitted to the consumers if there is an oversight process. We note that the individual physicians know

[7] None of our conclusions would change if the industry can be organized without cost, i.e., if $\hat{v} \equiv 0$ -- or if the organization cost is independent of the action of the licensing board. As we have argued in the text, organization costs can be a nontrivial component of the industry welfare.

[8] A consumer who does not search must have beliefs about the distribution of quality of a given physician that are independent of the identity of the physician.

their actual quality, while the licensing board and the consumers only have some belief about the distribution of that quality. This is an aspect of our model that differentiates it from standard principal-agent models. In particular, since the price of the service is determined by the market, we cannot simply appeal to Holmström's (1979) informativeness result to predict the effects of oversight control on the action of the licensing board, on the welfare of the licensing board and of the consumers, on the distribution of quality in the industry, and on the market price.[9]

3.1. Equilibrium prices

We make the assumptions that physicians do not compete in prices and do not advertise. Because consumers do not search, each physician can be thought of as a local monopolist. Because there is a constant marginal cost of providing the service and because all consumers are alike, physicians do not price discriminate. These assumptions are consistent with conclusions of previous studies (e.g., Masson and Wu 1974; Frech and Ginsburg 1975) about the physician market structure.

For general cost functions c and willingness-to-pay functions r, physicians could possibly signal their quality through prices.[10] This phenomenon is well understood in the literature and is peripheral to our main purpose. For this reason and to simplify the exposition, we make assumptions that eliminate the possibility of signaling through prices.

We restrict ourselves to equilibria in which the consumers and the physicians use pure strategies. Thus, consumers either buy or do not buy the service and a physician

[9] Holmström (1979) proves that if a signal is informative then a risk neutral principal and a risk averse agent can be made better off by signing contracts contingent on the new signal.

[10] For a model of signaling through prices, the reader might consult Wolinsky (1983). Easterbrook (1981) argues that maximum price fixing could be a way for physicians to signal quality and reduces search costs of consumers.

of quality θ sets a price $p(\theta)$. We suppose that the maximum cost that a physician can bear for providing a unit of service is less than the minimum willingness to pay.

ASSUMPTION 1: $\max c(\theta) < r(\underline{\theta})$.

When physicians and consumers must use pure strategies, if there exist two prices that induce the consumers to buy the service, a physician will always choose the highest price. Hence, there can be only one equilibrium price that induces buying. Assumption 1 implies that it is always possible to find a price that induces exchange and that leads to a nonnegative profit for a physician, independent of his quality. Hence, equilibrium prices provide no information about the quality of the physician: there is full pooling. Pooling implies that the consumers do not modify their beliefs when the equilibrium price is quoted. The maximum price that can arise in equilibrium, therefore, is equal to the average willingness to pay of the consumers (given their prior beliefs). The minimum equilibrium price is clearly $r(\underline{\theta})$. These observations are summarized below and a formal proof appears in the appendix.

PROPOSITION 1: Suppose that consumers have initial beliefs $h(\theta)$ about the quality of a given physician. Let $R(h) \equiv \int_{\underline{\theta}}^{\bar{\theta}} r(\theta)h(\theta)d\theta$ be the average willingness-to-pay of a consumer with beliefs h. Let $p(\theta)$ be the price quoted by a physician of quality θ. Then, under Assumption 1, in any market equilibrium in pure strategies, there exists a price $p \in [r(\underline{\theta}), R(h)]$ such that for any θ, $p(\theta) = p$, at which each consumer buys the service.

PROOF: See Appendix A.[11] ■

Since we restrict ourselves to symmetric equilibria, if an individual physician sets

a price of p, all physicians in the industry will set a price of p. Consequently, we can think of p as the equilibrium price in the market for medical services.

In order to define an equilibrium of the whole game (i.e., to find an equilibrium action for the licensing board), it is necessary to specify the equilibrium price in the physician market for all possible consumer beliefs. We will focus attention on equilibrium prices that depend only on the average willingness to pay of the consumers. Consequently, we define an equilibrium price function as a measurable map $P:\mathbf{R}\to\mathbf{R}$ such that for any average willingness to pay $R\in\left[r(\underline{\theta}),r(\bar{\theta})\right]$, the price is $P(R)$, where $P(R)\in[r(\underline{\theta}),R]$.[12]

3.2. Analysis

No oversight control

In the absence of moral hazard, the licensing board would take an action that maximizes the expected industry profit minus the opportunity cost of implementing the action. Formally, the licensing board maximizes the function

$$\hat{U}(a)=M\cdot[P(R(f(\cdot;a))-\int_{\theta}c(\theta)f(\theta;a)d\theta]-\hat{v}(a).$$

where $R(f(\cdot\mid a))$ denotes the average willingness to pay of a consumer when quality is distributed according to the marginal $f(\theta;a)$. Defining $v=\hat{v}/M$ and $U=\hat{U}/M$, we can use U as the objective function of the licensing board. Hence,

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[11] Such a pooling equilibrium resists refinement criteria like Never a Weak Best Response of Kohlberg and Mertens (1986) if $c(\theta)$ is a decreasing function of θ. If $c(\theta)$ is increasing in θ, there is no pooling equilibrium that resists that criterion; the only price equilibria that resist the criterion are in mixed strategies. As we have already noted, the assumption that the function $c(\theta)$ is decreasing is very natural in our model.

[12] There exist equilibrium behaviors that cannot be represented by a price function P. For instance consider two beliefs h and h' such that $R(h)=R(h')$. In a perfect Bayesian equilibrium, it is possible that $p\neq p'$, where p (p') is the equilibrium price that arises when consumers have belief h (h'). We exclude this case since we impose that $P(R(h))=P(R(h'))$.

$$U(a) = P(R(f(\cdot;a)) - V(a),$$

where

$$V(a) \equiv \int_{\theta} c(\theta) f(\theta;a) d\theta + v(a).$$

Let U^* denote the maximum value of the function U. U^* is in general not feasible because the action of the licensing board is not observed by the consumers. The licensing board cannot credibly take an action that maximizes U.

If there is no oversight control, then there is no signal y for consumers to observe. In equilibrium, consumers have beliefs about the action that the licensing board took and this, in turn, will generate their beliefs about the quality of an individual physician. If the consumers believe that the licensing board took action a, they will believe that the distribution of quality is given by the marginal density $f(\theta:a) \equiv \int_{y} f(\theta, y; a) dy$. Because consumers cannot actually observe the action taken by the licensing board, their beliefs would not change if the licensing board were to take some other action. From the licensing board's perspective the consumers beliefs are "sunk," so it will choose an action b in order to maximize the function $U(b \mid a) = P(R(f(\cdot;a)) - V(b)$ (note that the equilibrium price is a function of the consumers' expectations while the expected cost is taken with respect to the true density). Consequently, without oversight control, the only equilibrium actions are those that minimize the function $V(b)$. This result is similar to the well known observation that a monopolist always produces the lowest quality in a static world (e.g. Shapiro 1982; Ramey 1986).

To simplify, we will suppose that there is a unique action that minimizes V and we denote this action by a^0. Let $\underline{U} \equiv U(a^0 \mid a^0)$ represent the expected welfare of the licensing board when there is no oversight and when the consumers believe that the licensing board has taken action a^0.

Oversight control

The licensing board has incentives to take actions different from a^0 only if consumers observe the action either directly or indirectly. Information about the action of the licensing board influences the consumers' beliefs about quality. Legislative oversight, then, can provide the incentives for the board to take an action different from a^0. As an extreme example of this possibility, if the signal y is a perfect signal of the action a, then the licensing board is able to take its first best action. In reality of course perfect oversight is not possible.

We make some standard assumptions about the density f. Because higher actions by the licensing board could be interpreted as stricter standards for licensing, better review of consumer complaints, etc., it is then natural to suppose that higher actions induce higher average qualities. Technically, the family of density functions $\{h(\theta;a)\}$ satisfies first order stochastic dominance (FOSD) if for any increasing function $w(\theta)$, it is true that $\int_\theta w(\theta)\,h(\theta;a)d\theta \leq \int_\theta w(\theta)\,h(\theta;\hat{a})d\theta$ whenever $a \leq \hat{a}$. This implies that the cumulative density shifts to the right (Milgrom 1981). To avoid the mundane problem of "out-of-equilibrium signals," we make the assumption that a particular realization of the signal y can be observed for any possible action. For technical reasons, we also assume that the density f is continuous in action. We summarize our assumptions about the relationships between y, a and θ as follows.

ASSUMPTION 2:

(i) For any signal y, the family $\{f(\theta \mid y;a), a \in A\}$ satisfies FOSD.

(ii) The family $\{f(\theta;a).a \in A\}$ satisfies FOSD.

(iii) The set $\{y \mid f(y;a) > 0\}$ is independent of a.

(iv) For any θ and y, $f(\theta.y;a)$ is continuous in a.

Suppose that consumers believe that the licensing board took an action a. If the signal y is observed as a result of the oversight activity, then consumers will believe that the distribution of quality is given by the conditional distribution $f(\theta \mid y;a) = f(\theta,y;a)/f(y;a)$, where $f(y;a) = \int_\theta f(\theta,y;a)d\theta$ is the marginal density of the signal y. This conditional density is always well defined by Assumption 2 (i). With oversight control, the beliefs of the consumers are fixed once the signal is observed. Hence, if the consumers believe that the licensing board took action a and if the signal y is observed, the price will be $P(R(f(\cdot \mid y;a)))$, where $f(\cdot \mid y;a)$ represents the conditional distribution of quality $f(\theta \mid y;a)$. Thus by taking an action b, possibly different from a, the licensing board is able to influence the marginal distribution $f(y;b)$ of the signal that the consumers will receive and thus the distribution of equilibrium prices. Formally, the licensing board wants to choose b in order to maximize the function $W(b \mid a)$,

$$W(b \mid a) = \int_y P(R(f(\cdot \mid y;a))\, f(y;b)\, dy - V(b).$$

If an equilibrium price function P is fixed, an equilibrium in pure strategies of the game with oversight is an action a that satisfies

$$\forall b \neq a,\ W(a \mid a) \geq W(b \mid a).$$

Supposing for the sake of argument that P is increasing in R, two, possibly countervailing, effects are at play and will determine the equilibrium action. First, the licensing board would like the consumers to believe that it took a high action because for any signal that the consumers receive the market price will be higher. Second, once the consumers' beliefs are fixed, the licensing board balances its desire to maximize the industry revenues -- by increasing the probability that the highest prices will be realized

-- and its desire to minimize the cost V. When there is no oversight control, the second effect is simply equivalent to cost minimization. Whenever oversight control transmits informative signals to the consumers, we would expect a different market price to arise in the market and therefore different income levels for the members of the industry. This is the "informational hypothesis" that we test in the empirical section below.

Equilibria in pure strategies exist. For instance, if the price function P is such that $P(R) = r(\underline{\theta})$ for all R, then a^0 is an equilibrium action. For arbitrary equilibrium price functions, we can only prove the existence of equilibria in which the licensing board uses a mixed strategy (this is where Assumption 2 (ii) becomes critical). For simplification, we will suppose that for the given price function P, equilibria in pure strategies exist.[13]

Denote $W(a)$ as the welfare function of the licensing board in some equilibrium a of the game with oversight, so $W(a) \equiv W(a \mid a)$. Informativeness of the signal is a necessary condition for having a different market outcome or a different level of welfare with oversight control than without. A signal y is said to be informative if there does not exist functions g and h such that for any θ, y and a, $f(\theta, y; a) = g(\theta; a)\, h(y; a)$ (see Holmstrōm 1979). If y is not informative, then for any a, $f(\theta \mid y; a) = g(\theta; a)$ (i.e., it is independent of y). It follows that for any a and b, $W(b \mid a) = P(R(f(\cdot; a))) - V(b) = U(b \mid a)$, which is the same problem as when there is no oversight control. Therefore, if y is not informative, the only equilibrium action is a^0 when there is oversight control and $W(a^0) = \underline{U}$. In the principal-agent literature,

[13] A mixed strategy of the licensing board is a (Borel) measure μ on A. The set of measures on A is compact in the weak topology; a direct application of Glicksberg (1952) fixed-point theorem proves the existence of an equilibrium in mixed strategy. An equilibrium in mixed strategy is a measure μ such that the function $W(\hat{\mu} \mid \mu)$ is maximum for $\hat{\mu} = \mu$. $W(\hat{\mu} \mid \mu)$ is defined as follows. Let $f(\theta, y; \mu) \equiv \int_A f(\theta, y; a)\mu(da)$ be the joint density of (θ, y) when the licensing board uses the mixed strategy μ, and let $f(\theta; \mu)$ and $f(\theta \mid y; \mu)$ be the corresponding marginal and conditional densities. Then, $W(\hat{\mu} \mid \mu) \equiv \int_A W(a \mid \mu)\hat{\mu}(da)$, where $W(a \mid \mu) \equiv \int_Y P(R(f(\cdot \mid y; \mu))\, f(y; a)\, dy - V(a)$.

informativeness of the signal is sufficient to generate Pareto improvements (Holmstrōm 1979). This is not the case in our model because the licensing board and the consumers cannot make side-payments contingent on the signal.[14]

3.3. The welfare consequences of oversight[15]

We discuss the issue of welfare comparisons in terms of physicians' incomes. In our model, a physician of quality θ earns $p - c(\theta)$ for each patient treated. We use incomes instead of variables like quality or prices for two important reasons. First, data on incomes exist and we can test whether average incomes in markets with legislative oversight are different from those in markets without oversight. Second, because industry's welfare is defined as the difference between the total incomes of all physicians in the market minus the organization cost, it might be possible to infer a change in welfare from a change in incomes if we can control for organization costs.

Some research on quality provision by a monopolist has assumed that the market price is equal to the average willingness to pay of the consumer (see, e.g., Leland 1979). This is a convenient assumption. As long as the price function is linear -- $P(R) = \alpha R + (1-\alpha)r(\underline{\theta})$,[16] where $\alpha \in [0,1]$ -- there is an equivalence having the equilibrium action a being larger than a^0 under oversight review, having the industry

[14] Holmstrōm's informativeness result could apply if the consumers (or the government) can set the price for the service. This assumption does not lead to theoretical difficulties under Assumption 1 since there always exists a price lower than any average willingness to pay that is compatible with physicians making positive profits. This assumption leads to theoretical difficulties if Assumption 1 is not satisfied. In either case, assuming that the government or consumers set prices is empirically suspect.

[15] Whenever a model predicts multiple equilibria, comparative static results are delicate. In our model, the price function could be P^0 when there is no oversight and $P^1 \neq P^0$ when there is oversight. We make the sensible assumption that the market behavior of the consumers and the physicians, as represented by the equilibrium price function P, is the same whether there is oversight control or not.

[16] The term $(1-\alpha)r(\underline{\theta})$ is needed since an equilbrium price function must satisfy $P(R) \geq r(\underline{\theta})$ and since $\bar{R} = r(\underline{\theta})$ is in the domain of P.

and the consumers being made better off, and having the expected price and the average quality rising. Linearity eliminates "price effects" since the expected price is simply an affine transformation of the average willingness to pay $R(f(\cdot;a))$.

PROPOSITION 2: Suppose that the price function is linear. Then, expected incomes are higher under direct oversight control if, and only if, the licensing board took higher actions. Consequently, expected incomes increase if, and only if, industry and consumer welfare increase, expected quality increases and the expected price increases.

PROOF: Appendix A. ■

If we abandon the assumption of linearity of the price function, welfare comparisons become more ambiguous. While it is sometimes possible to infer a change in the industry welfare from a change in expected incomes, it is in general impossible to infer a change in average quality, in actions, and in prices. The ambiguity concerning the change in industy welfare when expected incomes change obviously disappears if the organization cost $\hat{v}(a)$ is a constant independent of the action a, since, in this case, the industry welfare is equal to the expected incomes.

As we show below, if we know that expected incomes are higher when there is direct legislative oversight, we can infer that the industry has been made better off when the price function P is convex. If P is concave, however, higher expected incomes do not obligatorily imply that the industry has been made better off. This is because concavity of the price function implies a risk averse behavior of the licensing board.

PROPOSITION 3: If P is convex and if physicians' incomes are higher with oversight control than without, then the industry as a whole has been made better off from direct legislative oversight.

PROOF: See Appendix A. ■

In general, inferring changes in prices and quality from a change in incomes is not possible.[17] When P is convex, higher expected incomes imply higher industry welfare but it is theoretically possible that the licensing board took either a lower or a higher equilibrium action than a^0. The reason is that convexity of P implies a behavior of risk loving for the licensing board; in particular, a lower action $a < a^0$ could be compatible with higher incomes because the expected price is larger than the price corresponding to the expected willingness to pay. Hence average quality could increase or decrease. If incomes fall when oversight control is implemented, then it is not clear whether the industry is made better off or worse off when P is convex (when P is concave lower expected incomes imply that the industry is made worse off).

Taken as a whole, it is difficult to say in general whether the licensing board will actually take an action greater than a^0 or whether the industry will be better or worse off with oversight control. It is tempting to conjecture that since the licensing board can always take the action a^0 when there is oversight control, the industry cannot be made worse off if it is directly monitored. This intuition is incorrect because legislative oversight acts as a communication device between the licensing board and consumers. With their newly acquired information consumers update their beliefs about the standards of the industry and, consequently, their beliefs about the quality distribution

[17] However, it is possible to show that higher incomes on average imply that prices are also higher on average (see the proof of Proposition 3 in Appendix A). However testing this prediction would require building a price index for medical services and this task is beyond the scope of the paper.

of doctors. This updating, of course, will influence the average market price for medical services. Thus, there is no reason to expect that a^0 will be compatible with equilibrium behavior under this new environment. Oversight control adds a new dimension to the moral hazard problem of the licensing board and it is possible that the industry's welfare can ultimately fall as a result.

In Appendix C we provide two illustrative examples. In the first, the industry's welfare strictly decreases under oversight control because for any action greater than a^0 that the consumers believe that the licensing board took, the licensing board has an incentive to take an action lower than a^0. This is a case in which oversight control worsens the moral hazard problem of the licensing board. In the second example, the industry can attain the first best level of welfare.

4. EVIDENCE FROM THE MEDICAL PROFESSION

The model developed in the previous section suggests that legislative oversight can play an effective role in transmitting information from a self-regulated industry to consumers. In this section our goal is to test this "information hypothesis" using evidence drawn from the medical profession. Our empirical analysis is based on data on physicians' incomes from 1981 to 1985 (inclusive) for the 50 states and the District of Columbia.

We have argued in the previous section that if professionals earn different incomes when direct legislative monitoring is in place, then it must be the case that consumers have acquired information that has lead to different beliefs about the quality distribution of services in the market. Our question is straightforward: did physicians who practiced in sunset states earn different incomes from their peers in non-sunset states, holding everything else constant?

Because the American Medical Association (AMA) only reported the average incomes for physicians by census region ofr the period under consideration, we have had to estimate state-level incomes. Our procedure for computing the incomes is explained in Table 1. We should note, however, that if U.S. Bureau of Labor Statistics data on the average incomes of medical office personnel are used in lieu of our measure, the results reported below are virtually the same.[18]

Like other empirical studies of the market conditions of the medical profession, we estimate physicians' incomes in terms of a simultaneous supply and demand model and, therefore, use a two-stage least squares procedure (Pauly and Satterthwaite 1981; Noether 1986). Since the supply of physicians is endogenous to the income equation, we have numerous instrumental variables (see Table 1 for a listing) that enable us to identify the demand equation. To control for the demand for medical services, we include variables measuring real per capita income and the percentages of each state's population covered by Medicare and Medicaid insurance, who have a high school diploma. who live in urban areas, and who are black. Since cost-of-living indexes are not available at the state-level, we use as a proxy the average hourly wage paid to manufacturing workers in each state (in constant 1985 dollars). Wennberg (1984) has found that medical practices tend to vary across regions in the United States, so we have included dummy variables for the nine regions of the country as specified by the Census Bureau. Dummy variables for each year are included to capture any time effects.

The particular coefficient that we wish to pay close attention to here is that of the dummy variable indicating states that had put their medical licensing boards under

[18] The reader will note that our theoretical predictions were based on aggregate industry income, but our empirical test is based on average incomes. Since the equation that we are estimating includes the number of physicians on the right hand side, our empirical specification is consistent with our theoretical one.

sunset review by the early 1980s.[19] Our analysis also includes a time series element because we wanted to test whether the actual timing of the sunset review had any distinguishable effect on incomes. In our estimation we have included three dummy variables that indicate whether the particular state had a sunset review in year $t-1$, year t, or whether the state was scheduled to have a review in year $t+1$. We would expect that the informational benefits of sunset legislation would be greatest in years of sunset reviews, or perhaps the year after. A complete listing of the variables in our analysis, along with their definitions and summary statistics are presented in Table 1.

Although sunset legislation was enacted as a general principle, encompassing a wide variety of regulatory agencies, there were political fights over whether a particular agency would be included in the sunset law. This issue raises the possibility that sunset review of medical licensing boards may have been endogenous to the income of physicians. For example, consider a state in which the average quality of physicians was low and, consequently, doctors' incomes were low, all else constant. If, as suggested above, sunset indeed created a mechanism that enabled the medical licensing board to credibly commit to making quality improvements to the stock of physicians, then it is likely that these low quality doctors would have attempted to block the passage of sunset. To test for the possible simultaneity between income and sunset, we have performed two statistical tests. First, we tested whether physicians in states that subsequently adopted the sunset laws had different incomes from their peers in non-sunset states even before sunset was introduced. Using 1976 data we estimated a simultaneous equations model, like the one reported below, and included a dummy variable that took the value of one if the state adopted sunset legislation after 1976, and

[19] These states were: Alabama, Alaska, Arizona, Arkansas, Colorado, Connecticut, Deleware, Florida, Georgia, Hawaii, Illinois, Indiana, Maine, Maryland, Montana, Nebraska, New Hampshire, New Mexico, North Carolina, Oklahoma, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Utah, and Vermont.

zero otherwise. The coefficient of the variable was statistically insignificant (t-statistic of 0.573). Second, using our dataset for 1981 to 1985, we performed a Hausman (1978) test for endogeneity and again we could statistically reject the hypothesis that physicians' incomes and sunset review of medical licensing boards were simultaneously determined.[20]

Semi-log two-stage least squares estimates of the income equation are presented in Table 2, along with the results of the first stage regression. Because our estimates of physicians' incomes are rough, Table 2 also includes the results if we use BLS medical office personnel income data instead. After holding both supply and demand factors constant, there is evidence to suggest that sunset legislation has provided information to the market, as our model suggested. Our data indicate that physicians in states where the medical licensing board was under sunset scrutiny received, on average, a premium of approximately 4.6 percent of annual income. This result is statistically significant at the five percent confidence level. This empirical result is suggestive; its lends credence to our hypothesis that direct legislative oversight acts as a communication device that enables an industry to credibly commit to taking specific actions.

It is tempting to correlate an increase in average incomes with an increase in the industry's welfare. As our theoretical discussion of the welfare consequences of direct legislative oversight in section 3 established, however, such an inference will depend on the relative importance of organizational costs and on the particular form that the price function takes. The significance of organizational costs, for example, is not something

[20] The regression using the 1976 data is presented in Appendix D. For the Hausman test for endogeneity, we used two political variables as instrumental variables in the sunset law equation -- the average percentage of each state's popular vote for the Democratic candidate to the U.S. House of Representatives from 1981 to 1985 (off-year estimates were derived from a straight-line interpolation) and a dummy variable taking the value of one if the states governor was a Democrat, and zero otherwise. With 81 percent confidence, we could not reject the null hypothesis of exogeneity of the sunset variable.

to dismiss outright. Consider a situation in which the licensing board decided to set very stringent standards which consequently pushed some (substandard) doctors out of the market. The effect of the board's action might be to raise average incomes, but since some of the already-practicing physicians were made much worse off, total welfare could theoretically fall on net. Because empirically estimating the welfare consequences of sunset reform can be quite complicated, any definitive claim would be tenuous. We merely point out that our finding that average incomes rose under direct oversight is compatible with the industry as a whole being made better off.

None of the coefficients of the dummy variables that describe the timing of the sunset review is statistically significant. We might expect that the signal from the licensing board to consumers would have the strongest income effect during the year in which the review took place or the year after. Although the coefficient of the "sunset in year t" and "sunset in year $t+1$" variables are positive and similar in magnitude, neither is statistically significant at conventional levels. Since most states were undergoing their second round of sunset reviews during the period 1981 to 1985, the above results suggest that the earlier reviews of the 1970s were successful in institutionalizing the mechanisms that changed the informational relationship between physicians and consumers (as described in Section 2 above).

The remaining regression results are consistent with previous studies of physicians' incomes. As expected, a greater supply of physicians tended to lower average incomes and the coefficient is statistically significant at the five percent level. The variables that we have included to proxy the demand for medical service operate as expected. Presumably more wealthy people consumer more and better quality health care which, as the empirical results indicate. would lead to higher net incomes for physicians. While the percentage of the population covered by Medicaid insurance did

not affect incomes, Medicare coverage did. The statistically significant positive coefficient of the Medicare variable indicates either that elderly Americans demand relatively more medical services simply because ailments tend to be associated with old-age or that their subsidized health care tends to create a boost in their demand. In either case, the higher demand has translated into higher average incomes for the physicians who treat them.

Although our theoretical model provides no a priori expectations as to how education, urbanization, or racial composition should influence physicians incomes, our results tend to support the findings of Masson and Wu (1974) and Pauly and Satterthwaite (1981). These studies assume that consumers face a monopolistically competitive industry, which implies that consumers with less information about the industry (or who have relatively expensive search costs) will have relatively inelastic demand functions and, therefore. pay higher prices for medical services. The statistically significant negative coefficient of the education variable and the significant positive coefficient of the urbanization variable are consistent with these authors' thesis. More educated consumers are presumably better able to identify what their ailment is and to understand the opportunities available to them in seeking a cure. Better educated consumers, who presumably can search for a physicians relatively inexpensively. should tend to mitigate the power of individual physicians in a monopolistically competitive industry. It should be also noted that in Stigler's (1971) study of regulation he found that better educated consumers were more effective in keeping a self-regulated, cartel-like industry politically in check (i.e., well educated consumers were able to mitigate some of the monopoly power of the carter). Our results support that view as well.

A higher density of physicians, proxied by the urban variable, raises physicians'

incomes according to our results. Again, this finding is in accord with a model that predicts that a greater number of monopolistically competitive producers makes consumers' search for the most appropriate physician more difficult, thus raising the equilibrium price of medical services. The positive coefficient of the percentage black variable is also consistent with this model. As blacks tended to be lower educated than the average population and tended to be concentrated in rural southeastern states, we would surmise that monopolistically competitive physicians who serve them would earn higher profits than the norm.[21] Since the coefficient is both positive and statistically significant, this view cannot be rejected outright.[22]

Finally, we can reject the hypothesis that the regional dummy variable coefficients are jointly equal to zero, even after controlling for cost-of-living. This finding might offer some support for Wennberg's claim that medical practices vary across the United States. Certainly, if physicians in different parts of the country use more expensive or time-intensive procedures, this would translate into higher average profits, holding all else constant.

5. CONCLUSION

Previous research on legislative oversight has focused on the political distinctions between passive and active (or "fire alarm" versus "police patrol") oversight, but there exists an important economic element as well. Considering the case of a self-regulated industry, we have argued that if the legislature can credibly commit to monitoring the regulatory board, then the line of communication that develops between consumers and

[21] The simple correlation between the percent black and percent high school educated is -0.627 and between the percent black and South Atlantic region dummy variable is 0.632.

[22] Masson's (1973) model of racial discrimination provides an alternative, but similar, explanation for this result. If doctors discriminate against blacks, then black search costs rise which implies that monopolistically competitive doctors can charge them higher fees.

producers will affect the market outcome. Our empirical results suggest that physicians earned higher incomes in states where their medical licensing boards were under sunset scrutiny. The increase in industry profits might have translated into political support for sunset legislation. We find it illuminating that the American Medical Association, the most influential trade group for physicians, was openly in favor of sunset legislation.[23]

While a thorough political analysis is beyond the scope of our interest here, we believe that the analysis presented in this paper suggests an important new angle for the research into the politics of regulation. One of the main criticisms that Noll (1989:1271) has of this body of literature "is that it normally cannot distinguish between two quite different bases for political action by an interest group: the desire to cure a market failure that falls especially heavily on members of the group, and the desire to redistribute rents in their favor." We have shown here that regulations that provide direct oversight of a self-regulated industry serve to mitigate some of the informational asymmetries between consumers and producers. Information that consumers receive about the quality distribution of production can lead to income-generation. While income redistribution and income creation are clearly two separate issues, studies that attempt to explain the political origins of government regulation usually conflate the two. Our analysis of the economic effects of sunset legislation, we suggest, offers a framework for disentangling these two forces. Our focus on a legislature monitoring a licensing board could easily be applied to a situation in which the government acts as the monitor of a competitive industry. Such a model might offer new insights into the political origins of regulations that were long-thought to be in the public interest, such

[23] The AMA offered its public support for a federal sunset reform program, which was to be entitled "The Sunset Act of 1979" (see the letter of James H. Sammons, M.D., executive vice-president of the AMA in US Senate 1979, page 632). Although Congress did consider the sunset idea, it was never implemented at the federal level.

as meat inspection and drug safety standards.

APPENDIX A

Proof of Proposition 1

Fix a distribution of quality $h(\theta)$ and consider an individual physician. Let $p(\theta)$ be the price quoted if the physician is of quality θ. Since the consumers use pure strategies, for any price p that they face, they decide either to buy the service or not. For any price p, let $\Theta(p) = \{\theta \mid p = p(\theta)\}$ be the qualities that could have generated a price p. Then, upon observing a price $p \in \Theta(p)$, consumers have beliefs $h(\theta \mid p)$ and are willing to pay at most a price of $R(h(\cdot \mid p) = \int_{\theta} r(\theta)\, h(\theta \mid p)\, d\theta$, where $h(\theta \mid p) = h(\theta)/h(\Theta(p))$ if $\theta \in \Theta(p)$ and $= 0$ otherwise. Let $\mathcal{P}$ be the set of prices for which consumers buy the service. Then, $p \in \mathcal{P}$ only if $R(h(\cdot \mid p) \geq p$, i.e., if the average reservation price of the consumer exceeds the price.

If $p < r(\underline{\theta})$, then the consumers must buy the service since $p < R(h(\cdot \mid p))$ for any prior distribution h. It follows that in a continuation equilibrium, for any θ, it must be true that $p(\theta) \geq r(\underline{\theta})$. From Assumption 2, $\max c(\theta) < r(\underline{\theta})$; hence, in any equilibrium, $p(\theta) > c(\theta)$ and the individual rationality constraints of the physician are satisfied. This establishes that $\mathcal{P} \neq \emptyset$ since otherwise a physician could quote a price of $c(\theta) < p < r(\underline{\theta})$, induce the consumers to buy the service and make a positive profit.

If $p(\theta) \notin \mathcal{P}$, a physician of quality θ is strictly better off quoting a price p in $\mathcal{P}$ since the physician's profit per consumer is $p - c(\theta) > 0$. Hence, for each θ, $p(\theta) \in \mathcal{P}$. Suppose that there exists $\hat{\theta} \neq \theta$ such that $p(\theta) < p(\hat{\theta})$. Since both prices induce the consumer to buy, physician θ is strictly better off quoting a price of $p(\hat{\theta})$. Consequently, if $\mathcal{P} \neq \emptyset$, there exists a unique p such that $p = p(\theta)$ for all θ. This can be an equilibrium only if $p \leq R(h(\cdot \mid p)) = R(h)$ since p does not transmit any information about quality. Because $p \geq r(\underline{\theta})$, this proves Proposition 1 if we can show that physicians have no incentive to deviate from the pooling price.

Clearly, a physician cannot gain by deviating to $\hat{p} < p$. Suppose that when $\hat{p} > p$, the consumers believe that they face a physician of quality $\underline{\theta}$. Then, they will not buy the service since $R(h(\cdot \mid \hat{p})) = r(\underline{\theta}) < \hat{p}$. ■

Proof of Proposition 2

Suppose that $a < a^0$. By FOSD, this is equivalent to $\int r(\theta) f(\theta; a) d\theta < \int r(\theta) f(\theta; a^0) d\theta$. By definition of a^0, for any $a \neq a^0$, $V(a) > V(a^0)$. It follows that if $a < a^0$ then $W(a) < U(a^0)$ (note that when P is linear, W and U are the same functions). Suppose now that $W(a) < U(a^0)$. Since a is an equilibrium action, $W(a) \geq W(a^0 \mid a) = \int P(R(f(\cdot \mid y; a))) f(y; a^0) dy - V(a^0)$. Therefore, these two inequalities imply that $\int [P(R(f(\cdot \mid y; a))) - P(R(f(\cdot \mid y; a^0)))] f(y; a^0) dy < 0$. By linearity of P, this implies that $\int \{\int \alpha r(\theta) [f(\theta \mid y; a) - f(\theta \mid y; a^0)] d\theta\} f(y; a^0) dy < 0$. If $a \geq a^0$, the inside integral is nonnegative by FOSD which leads to a contradiction. Therefore, higher actions are equivalent to higher industry welfare.

Suppose that the expected incomes are higher with oversight control, i.e., that $\int [\alpha r(\theta) - c(\theta)] f(\theta; a) d\theta > \int [\alpha r(\theta) - c(\theta)] f(\theta; a^0) d\theta$. If c is a decreasing function of θ, then $\alpha r(\theta) - c(\theta)$ is an increasing function of θ and FOSD implies that expected incomes are higher if, and only if, the action is larger. If c is an increasing function of θ, then since v is increasing in a, $V(a) = \int c(\theta) f(\theta; a) d\theta + v(a)$ is an increasing function of a and it must be true that $a^0 = \min A$. But then $a > a^0$ obligatorily. Therefore, higher expected incomes are equivalent to higher actions as claimed.

The expected quality is equal to $\int \theta f(\theta; a)$ and the expected price is $\alpha \int r(\theta) f(\theta; a) + (1 - \alpha) r(\underline{\theta})$. These quantities are increasing in a by FOSD. Similarly, the expected consumer surplus can be written as $(1 - \alpha)[\int r(\theta) f(\theta; a) - r(\underline{\theta})]$ and is also increasing in a. ■

Proof of Proposition 3

We assume that P is a convex function of R. We use the following fact.

FACT: Suppose that the equilibrium action when there is oversight control is $a > a^0$. Then, $W(a) > \underline{U}$.

The following sequence proves this fact.

$$
\begin{aligned}
W(a) &\geq W(a^0 \mid a) && \text{since } a \text{ is an equilibrium} \\
&= \int_y P(R(f(\cdot \mid y;a)))\, f(y;a^0)\, dy - V(a^0) \\
&> \int_y P(R(f(\cdot \mid y;a^0)))\, f(y;a^0)\, dy - V(a^0) && \text{by FOSD, } P \text{ increasing, } a > a^0 \\
&\geq P(R(f(\cdot;a^0))) - V(a^0) && \text{since } P \text{ is convex} \\
&= \underline{U}.
\end{aligned}
$$

Hence $a \geq a^0 \Rightarrow W(a) \geq \underline{U}$ as claimed.

We consider two cases. Recall that we suppose that $v(a)$ is an increasing function of a.

Case 1: $c(\theta)$ is an increasing function of θ. Then by FOSD, the function $V(a)$ is increasing in a. It follows that $a^0 = \min A$. Therefore, for any equilibrium action with oversight control $a \geq a^0$. But then the Fact proves that the industry's welfare increases. If $a \geq a^0$, FOSD and convexity of P imply that the average price $\int P(R(f(\cdot \mid y;a))) f(y;a) dy$ is greater than $P(R(f(\cdot;a^0)))$. Note that in this case equilibrium incomes are obligatorily higher with oversight.

Case 2: $c(\theta)$ is a decreasing function of θ. Then $V(a)$ is not obligatorily monotonic in a and we should expect in general $a^0 > \min A$. Suppose that the incomes are larger with oversight control, i.e., that

(a) $\int P(R(f(\cdot \mid y;a)))f(y;a)dy - \int c(\theta)f(\theta;a)d\theta > P(R(f(\cdot;a^0))) - \int c(\theta)f(\theta;a^0)d\theta.$

If $a > a^0$ then we can use the Fact to conclude that $W(a) > \underline{U}$ and that the average price is higher with oversight control. If $a \leq a^0$, then $v(a) \leq v(a^0)$ since v is an increasing function. It follows from (a) that $W(a) > \underline{U}$. In this case, it would be possible to have lower prices. However, since c is decreasing, FOSD and $a \leq a^0$ implies that the average costs satisfy $\int c(\theta) f(\theta;a) d\theta \geq \int c(\theta) f(\theta;a^0) d\theta$. This can be compatible with (a) only if the average price $\int P(R(f(\cdot \mid y;a)) f(y;a) dy$ is greater than $P(R(f(\cdot;a^0)))$. This proves the Proposition and the claim made in footnote 17. ■

APPENDIX B

Equilibrium Conditions with Heterogenous consumers

The following specification was largely inspired from the literature on quality signaling through prices (e.g., Wollinsky 1983; Ramey 1986). Consumers are indexed by $I \in [0.1]$ where I is a random variable whose distribution is uniform. A consumer of type I has a reservation price for a unit of service provided by a physician of quality θ of $r(\theta, I)$. We suppose that $r_\theta > 0$ and $r_I < 0$ and that all consumers have the same prior beliefs $h(\theta)$. As in the text, we suppose that the physicians cannot price discriminate, use pure strategies, and that all physicians use the same strategy.

To simplify, we suppose that a consumer of type I visits a particular physician i with probability λ_i. where λ_i is independent of I. (λ_i could be a function of the action a taken by the licensing board since that action can influence the number of physicians in the market.) Consider a particular physician i. A strategy for i is to set a price $p(\theta)$ contingent on her quality. Let $\mathcal{P}$ be the set of all possible prices, i.e., $\mathcal{P} = \{p \mid \exists \theta, p = p(\theta)\}$. Let $\Theta(p) = \{\theta \mid p = p(\theta)\}$ be the set of quality levels that correspond to a price of p. Upon observing $p \in \mathcal{P}$, the consumers will believe that i's quality is distributed according to the conditional $h(\theta \mid p) = h(\theta)/h(\Theta(p))$. To simplify, if $p \notin \mathcal{P}$. we suppose that $h(\underline{\theta} \mid p) = 1$ and that $h(\theta \mid p) = 0$ if $\theta \neq \underline{\theta}$. Hence, consumers

believe that they face the lowest quality for any out-of-the-equilibrium price.

It follows that by quoting a price of p, the physician i of quality θ has an expected profit of $\lambda_i \cdot [p - c(\theta)] \cdot I(p)$, where $\lambda_i \cdot I(p)$ is the demand faced by the physician. Since $r_I < 0$ and since the consumers are uniformly distributed on $[0,1]$, the demand $I(p)$ solves the equation $p = \int r(\theta, I)\, h(\theta \mid p)\, d\theta$ if there exists such a solution (otherwise, if $p > \int r(\theta, 0)\, h(\theta \mid p)\, d\theta$, the demand is $I(p) = 0$, and if $p < \int r(\theta, 1)\, h(\theta \mid p)\, d\theta$, the demand is $I(p) = 1$). If we suppose that $\max_\theta c(\theta) \leq r(\underline{\theta}, 1)$, then in any equilibrium, $p(\theta) \geq c(\theta)$ and the physician's individual rationality constraints are satisfied.

Since the profit is proportional to λ_i, it is clear that the equilibrium price is not affected by the value of λ_i (as long as $\lambda_i > 0$). Hence, we will ignore λ_i in what follows. Contrary to the situation in which all consumers are alike, here there can exist equilibria in pure strategies for which prices reveal information about quality. The industry profit is equal to $\int [p(\theta) - c(\theta)] \cdot I(p(\theta))\, h(\theta)\, d\theta$.

As an illustration, consider the case in which $r(\theta, I) = r(\theta)/I$. (The consumer of type $I = 0$ has a completely inelastic demand schedule for medical services.) Suppose also that for all θ, $c(\theta) = 0$. For this specification, the demand for medical services at price p solves $p \cdot I(p) = \int r(\theta)\, h(\theta \mid p) d\theta \equiv R(h(\cdot \mid p))$ if $I(p) \in [0,1)$, and $p \leq R(h(\cdot \mid p))$ if $I(p) = 1$. (Note that since $r(\theta, 0) = \infty$, the demand is always positive.) Suppose that there are two different equilibrium prices p^1 and p^2 such that $\sup \Theta(p^1) \leq \inf \Theta(p^2)$. Then, for any prior beliefs $h(\theta)$, it is true that $R(h(\cdot \mid p^1)) < R(h(\cdot \mid p^2))$, which implies that $p^1 \cdot I(p^1) < p^2 \cdot I(p^2)$. This contradicts the equilibrium conditions. Consequently, if there exists two equilibrium prices, $p^1 \neq p^2$, it must be true that the corresponding pooling sets "overlap," e.g., that there exists $\theta^1 \in \Theta(p^1)$, $\theta^2, \theta^3 \in \Theta(p^2)$ such that $\theta^2 < \theta^1 < \theta^3$. These equilibria are complex (see Legros 1991 for the characterization of

these equilibria in a related model) and the information content of the price is weak. Reciprocally, if there exists an equilibrium in which the pooling sets do not overlap, then this equilibrium must involve full pooling, i.e., all qualities quoting the same price. From our assumptions, there exists a full pooling equilibrium p. Indeed, if $\hat{p} > p$, then $\hat{p} \cdot I(\hat{p}) = r(\underline{\theta}) \leq p \cdot I(p) = R(h(\cdot \mid p))$ and a physician does not want to deviate to $\hat{p}$ from p. It is clear that the full pooling equilibrium generates a model that cannot be distinguished from the model in the text with identical consumers in which the price function P is linear and in which costs are identically equal to zero.

Appendix C

Two examples of the welfare consequences of legislative oversight

In each example, we suppose that the physicians can extract the whole consumer surplus, i.e., that $P(R) = R$ (in this case, for any a, $W(a) = U(a)$). There are two levels of quality $\underline{\theta} < \overline{\theta}$, two possible signals α and β. The licensing board can take an action a in the interval $[0,1]$ and $v(a) = \frac{a^2}{2}$. We suppose that $r(\overline{\theta}) = \overline{r}$, $r(\underline{\theta}) = \underline{r}$, $c(\underline{\theta}) = c$, $c(\overline{\theta}) = 0$, and that $\overline{r} > \underline{r} > c \geq 0$. The two examples differ in the specification of the parameters $\overline{r}$, $\underline{r}$, c and the density function f.

Example 1. (The industry is strictly worse off with oversight control.) We suppose that $\overline{r} - \underline{r} + c < 2$, $\underline{r} \geq c$. The density is given by

$$f(\overline{\theta}, \alpha; a) = \frac{1}{2}; \; f(\overline{\theta}, \beta; a) = \frac{a}{2}; \; f(\underline{\theta}, \alpha; a) = \frac{1-a}{4}; \; f(\underline{\theta}, \alpha; a) = \frac{1-a}{4}.$$

Hence, the marginal densities are $f(\overline{\theta}; a) = \frac{1+a}{2}$, $f(\alpha; a) = \frac{3-a}{4}$.

$U(a) = \overline{r} \cdot \frac{1+a}{2} + (\underline{r} - c) \cdot \frac{1-a}{2} - \frac{a^2}{2}$ and the first best is attained at $a^* = \frac{\overline{r} - \underline{r} + c}{2}$. Without oversight control, the licensing board chooses an action that minimizes the function $V(a) = c \cdot \frac{1-a}{2} + \frac{a^2}{2}$, i.e., chooses $a^0 = \frac{c}{2}$.

Consider the situation with oversight control. Suppose that the consumers believe that the licensing board uses strategy $\hat{a}$. Then the licensing board wants to choose a in order to maximize the function

$$W(a \mid \hat{a}) = \overline{r} \cdot \left[f(\alpha;a) \cdot f(\overline{\theta} \mid \alpha;\hat{a}) + f(\beta;a) \cdot f(\overline{\theta} \mid \beta;\hat{a})\right] +$$

$$\underline{r} \cdot \left[f(\alpha;a) \cdot f(\underline{\theta} \mid \alpha;\hat{a}) + f(\beta;a) \cdot f(\underline{\theta} \mid \beta;\hat{a})\right] - V(a)$$

$$= \frac{1}{2} \cdot \overline{r} \cdot \left[\frac{3-a}{3-\hat{a}} + \frac{1+a}{1+\hat{a}} \cdot \hat{a}\right]$$

$$+ \frac{1}{2} \cdot \underline{r} \cdot \left[2 - \frac{3-a}{3-\hat{a}} - \frac{1+a}{1+\hat{a}} \cdot \hat{a}\right] - c \cdot \frac{1-a}{2} - \frac{a^2}{2}.$$

We show below that there exists a unique Nash equilibrium in pure strategies (a^N) such that $a^N < \frac{c}{2}$. Since $U(a)$ is concave in a and is maximized at $a^* = \frac{\overline{r} - \underline{r} + c}{2} < 1$, it follows that in any pure strategy Nash equilibrium of the game with oversight, the licensing board is strictly worse off than in the equilibrium $a^0 = \frac{c}{2}$ of the game without oversight. The marginal utility of the licensing board is the function,

$$\frac{\partial W(a \mid \hat{a})}{\partial a} = -\frac{1}{2} \cdot (\overline{r} - \underline{r}) \cdot \left[\frac{(1-\hat{a})^2}{(1+\hat{a}) \cdot (3-\hat{a})}\right] + \frac{c}{2} - a$$

$$= \phi(\hat{a}) - a.$$

Clearly, for any a, $\phi(\hat{a}) < \frac{c}{2}$. Hence, for any $\hat{a}$, the best response of the licensing board cannot be $a \geq \frac{c}{2}$. If $c > \frac{\overline{r} - \underline{r}}{3}$, it is possible to solve $\phi(a) = a$ since $\phi(0) > 0$. Otherwise, the equilibrium action is 0. In either case, the resulting equilibrium payoff to the licensing board, $W(a)$, is strictly less than $\underline{U}$.

Example 2. (The industry can attain the first best level of welfare with oversight control.) The parameters satisfy the inequalities $\overline{r} - \underline{r} + c < 4$, $\underline{r} > c$. The density $f(\theta, y; a)$ is defined as follows.

$$f(\overline{\theta}, \alpha; a) = \frac{1-a}{4};\ f(\overline{\theta}, \beta; a) = \frac{a}{2};\ f(\underline{\theta}, \alpha; a) = \frac{3}{4}\cdot(1-a);\ f(\underline{\theta}, \alpha; a) = \frac{a}{2}.$$

Hence, the marginal densities are $f(\overline{\theta}; a) = \frac{1+a}{4}$, $f(\alpha; a) = 1 - a$.

For any actions a and b and for any quality θ, the ratio $\frac{f(\theta, y; a)}{f(\theta, y; b)}$ is independent of y. Because the previous ratio varies with θ, the signals are informative about quality. Simple computations show that $U(a) = \overline{r}\cdot\frac{1+a}{4} + (\underline{r} - c)\cdot\frac{3-a}{4} - \frac{a^2}{2}$ and that the first best is attained at $a^* = \frac{\overline{r} - \underline{r} + c}{4}$. Without oversight control, the dominant strategy for the licensing board is to choose an action that will minimize the function $V(a) = c\cdot\frac{3-a}{4} + \frac{a^2}{2}$, i.e., to choose $a^0 = \frac{c}{4}$.

With oversight control, the licensing board has a strictly dominant strategy which is to take the first best action a^*. From the definition of the marginal densities, the conditional densities satisfy $f(\overline{\theta} \mid \alpha; a) = \frac{1}{4}$ and $f(\overline{\theta} \mid \beta; a) = \frac{3}{4}$, i.e., are independent of b. It follows that for any a and any b, $W(b \mid a) = U(b)$. This proves the claim that the unique Nash equilibrium in the game with oversight is a^*.

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TABLE 1

Descriptions of Variables and Summary Statistics

Variables	Descriptions	Mean	Standard Deviation
Dependent Variables:			
Estimated Earnings	Natural log of estimated average real annual income of physicians (1985 dollars)	11.560	0.170
BLS Earnings	Natural log of average real annual income of medical office personnel (1985 dollars)	10.183	0.349
Independent Variables:			
Physicians (endogenous)	Total number of non-federal physicians per civilian population (x1000)	1.982	0.731
Per Capita Income	Real per capita income (1985 dollars)	12,407	1,981
Medicaid	Share of population covered by Medicaid insurance	0.078	0.030
Medicare	Share of population covered by Medicare insurance	0.122	0.023
Urban	Percentage of population living in urban areas	67.929	14.961
Education	Percentage of population with high school diploma	67.604	7.851
Black	Percentage of the population black	10.435	12.389
Wages	Average real hourly wages of manufacturing workers (1985 dollars)	9.637	1.509
Sunset	1 if medical licensing board was under sunset review by 1981; 0 otherwise	0.529	0.500
Sunset (t-1)	1 if state had a sunset review in year t-1; 0 otherwise	0.082	0.275
Sunset (t)	1 if state had a sunset review in year t; 0 otherwise	0.075	0.263
Sunset (t+1)	1 if state planned a sunset review for year t+1; 0 otherwise	0.051	0.220

Year Dummy Variables:	1 if observation was from the respective year; 0 otherwise		
1981		0.200	0.401
1982		0.200	0.401
1983		0.200	0.401
1984		0.200	0.401
Regional Dummy Variables:	1 if state was part of the respective region; 0 otherwise		
New England		0.118	0.323
Middle Atlantic		0.059	0.236
East North Central		0.098	0.298
West North Central		0.137	0.345
South Atlantic		0.157	0.364
East South Central		0.078	0.269
West South Central		0.078	0.269
Mountain		0.157	0.364
Pacific			
Instrumental Variables:			
BSC	1 if state requires Basic Science Certificate for licensure; 0 otherwise	0.118	0.323
NBE	1 if state accepts National Board Examination for licensure; 0 otherwise	0.961	0.194
Pass Rate	Percentage of test-takers that passed state licensing examination	54.388	38.465
Licensure Fee	Fee required for issuing medical license by examination (1985 dollars)	231.857	115.184
Relicensure Fee	Per year fee required for relicensure (1985 dollars)	50.138	33.841
New Licenses	New licenses issued per civilian population	0.076	0.052
Beds	Supply of hospital beds per capita (x1000)	4.451	1.249
Hospital Cost	Average cost per day for hospital stay (1985 dollars)	392.203	90.314

Sources: As mentioned in the text, average physicians' incomes are not available at the state level, only at the regional census level. These regional income data were obtained from the American Medical Association, Socioeconomic Characteristics of the Medical Practice, 1986 edition, p. 106. In order to breakdown the AMA regional data into state level estimates, we first computed regional averages of the average annual state-level wages of personnel in physicians' offices as reported by the U.S. Bureau of Labor Statistics. See U.S. Bureau of Labor Statistics, Employment and Wages, 1981 through 1985 editions. Next, with the regional averages from the BLS data, we determined the ratio of each state's income level relative to its region's average income level. Finally, in order to determine the state-level estimates of average physicians' incomes, we multiplied the aforementioned ratio (of the state's income to its region's average income) with the appropriate AMA-reported regional income level. An equation for the earnings calculation can be represented as follows:

$$Earnings_{ijt} = \frac{1}{n_j} \frac{BLS_{ijt}}{\sum_{k=1}^{n_j} BLS_{kjt}} AMA_{jt},$$

where *Earnings* is the estimated average income of physicians in state i, region j, in year t; *BLS* is the state-level Bureau of Labor Statistics data on income of personnel in physicians' office; and *AMA* is the average income of physicians reported at the regional level by the American Medical Association. n_j represents the number of states in region j.

Data on Per Capita Income, Medicaid, Medicare, Urban, Education, Black, Beds, and Hospital Cost were obtained from the U.S. Bureau of the Census, Statistical Abstract of the United States, 1981 through 1987 editions. Manufacturing wages are reported in U.S. Bureau of Labor Statistics, Employment and Earnings, 1981 through 1985 editions, Table C-12. Data on whether or not a state's medical licensing board was under Sunset review and the timing of the reviews were found in the Council of State Governments, Sunset: A Schedule of State Sunset Reviews (Lexington, KY, 1983). The number of non-federal physicians is reported in American Medical Association, Physicians Characteristics and Distribution in the U.S., 1982 through 1986 editions. BSC and NBE data are from the Journal of the American Medical Association. Finally, data on Pass Rates, Licensure and Relicensure Fees, and New Licenses are from the American Medical Association, U.S. Medical Licensure Statistics and Licensure Requirements, 1981 through 1985 editions.

TABLE 2

Semi-Log 2SLS Estimates of Physicians' Earnings, 1981-1985
(absolute value of t-statistics parentheses)

Variables	First Stage Supply Equation	Second Stage Income Equation	
	Physicians	Estimated Earnings	BLS Earnings
Constant	-2.329* (6.408)	11.225* (54.167)	10.024* (48.971)
$\widehat{\text{Physicians}}$		-0.120** (2.529)	-0.128** (2.710)
Per Capita Income	0.00012* (5.614)	0.00006* (6.629)	0.00006* (6.159)
Medicaid	6.927* (7.103)	0.364 (0.643)	0.418 (0.749)
Medicare	6.379* (5.812)	1.746* (3.183)	1.613* (2.977)
Urban	0.0084* (3.896)	0.0023* (2.596)	0.0028* (3.212)
Education	0.021* (4.537)	-0.010* (4.306)	-0.0085* (3.633)
Black	0.018* (4.760)	0.0076* (3.525)	0.0080* (3.720)
Wages	-0.028 (1.324)	-0.0072 (0.797)	-0.0056 (0.633)
Sunset	0.154* (3.520)	0.055** (2.667)	0.060* (2.943)
Sunset (t-1)	-0.107*** (1.719)	-0.017 (0.583)	-0.029 (1.018)
Sunset (t)	-0.076 (1.161)	0.039 (1.300)	0.0075 (0.252)
Sunset (t+1)	-0.120 (1.555)	0.036 (1.014)	0.035 (0.975)
Regional Dummies:			
New England	0.095 (0.941)	-0.148* (3.227)	-0.119** (2.628)
Middle Atlantic	-0.224** (2.052)	-0.139* (3.156)	-0.092** (2.120)
East North Central	-0.361* (4.040)	0.063 (1.596)	-0.013 (0.325)
West North Central	-0.365* (3.874)	0.098** (2.687)	0.0011 (0.031)

South Atlantic	-0.100 (0.789)	-0.182* (3.501)	-0.209* (4.061)
East South Central	-0.224** (2.000)	0.043 (0.844)	-0.065 (1.279)
West South Central	-0.748* (6.296)	-0.0035 (0.066)	-0.119** (2.258)
Mountain	0.063 (0.771)	0.103* (2.820)	0.119* (3.321)
Year Dummies:			
1981[a]	-0.093 (1.267)	0.080* (3.113)	-0.776* (30.715)
1982	-0.027 (0.379)	0.083* (3.228)	-0.044*** (1.749)
1983	-0.0018 (0.028)	0.077* (3.096)	0.0025 (0.103)
1984	-0.0024 (0.045)	0.034 (1.457)	0.0013 (0.057)
BSC	0.181* (2.945)		
NBE	-0.580* (3.953)		
Pass Rate	-0.0005 (1.032)		
Licensure Fee	-0.00002 (0.078)		
Relicensure Fee	-0.0002 (0.325)		
New Licenses	3.596* (7.088)		
Beds	0.055** (2.555)		
Hospital Cost	-0.0005 (1.260)		
N	255	255	255
R^2	0.903	0.595	0.907
$\bar{R}^2$	0.889	0.553	0.897

Notes: * The BLS sharpened its income reporting from "health services" to "medical offices" in 1982. This change explains the very strong statistically negative coefficient for the 1981 year dummy in the BLS Earnings equation.

* Statistically significant at the ≤ 1 percent level.
** Statistically significant at the ≤ 5 percent level, > 1 percent level.
*** Statistically significant at the ≤ 10 percent level, > 5 percent level.

Sources: See Table 1.

APPENDIX D

Endogeneity of Sunset Variable Test

Semi-Log 2SLS Estimates of Physicians' Earnings, 1976
(absolute value of t-statistics parentheses)

Variables	First Stage Supply Equation	Second Stage Income Equation
	Physicians	BLS Earnings
Constant	-3.265 (2.828)	9.040 (28.965)
Physicians		-0.028 (0.453)
Per Capita Income	0.00028 (0.192)	0.00012 (4.262)
Medicaid	0.101 (1.866)	-0.0040 (0.312)
Medicare	-0.038 (0.709)	-0.0067 (0.742)
Urban	0.0073 (1.948)	0.0023 (3.301)
Education	0.023 (1.449)	-0.0080 (2.148)
Black	0.019 (1.682)	0.00053 (0.167)
Wages	0.067 (0.485)	-0.016 (0.587)
Sunset	0.070 (0.566)	0.015 (0.573)
Regional Dummies:		
New England	0.347 (1.179)	-0.102 (1.671)
Middle Atlantic	-0.468 (1.391)	-0.071 (0.981)
East North Central	-0.599 (2.142)	-0.074 (1.263)
West North Central	-0.486 (1.521)	-0.118 (2.094)
South Atlantic	0.171 (0.478)	-0.066 (0.965)
East South Central	-0.322 (0.875)	-0.096 (1.226)
West South Central	-0.332 (0.857)	-0.156 (2.186)

Mountain	0.081 (0.318)	0.0062 (0.117)
BSC	0.312 (1.623)	
NBE	0.099 (0.219)	
Beds	0.411 (3.186)	
Hospital Cost	0.0021 (0.520)	
N	51	51
R^2	0.848	0.844
$\bar{R}^2$	0.747	0.763

Sources: For the Sunset, BSC, NBE variables see Table 1. The BLS earnings data are from the 1976 Employment and Wages. The data for the rest of the variables were obtained from the Statistical Abstract of the United States, 1977 and 1978.