Medical Licensing Board Characteristics and Physician Discipline: An Empirical Analysis

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Abstract

What factors influence the strictness with which regulations are enforced? Does the level of organizational or budgetary autonomy regulators enjoy affect the degree of enforcement? Does public oversight matter for regulatory enforcement? Or is the level of enforcement driven by the total resources available to regulators? We explore these issues using medical licensing board disciplinary actions against physicians as a case study. Specifically, we take advantage of cross-jurisdictional and inter-temporal variation in the structure of medical licensing boards between 1993 and 2003 to determine the effect that organizational and budgetary independence, public oversight, and resource constraints have on the extent to which medical licensing boards discipline physicians. We find that larger licensing boards and boards that have greater resources at their disposal are more likely to discipline physicians. Medical licensing boards that are more organizationally independent from political influence also discipline physicians more frequently. However, public oversight and greater political control over board budgets do not appear to influence the extent to which medical licensing boards discipline doctors.

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I. Introduction

An understanding of what factors influence the degree to which laws and regulations are enforced is of clear importance for public policy. The effective design of new regulatory agencies and the fruitful reform of existing ones requires an appreciation of the incentives and constraints that regulators face. The theoretical literature suggests that factors such as political or public oversight of regulatory officials, and politicians' ability to control regulatory agency budgets play an important role in shaping the incentives that regulators face and the extent and nature of enforcement (McCubbins, Noll, and Weingast 1987). An empirical literature supports the view that political oversight and control over agency budgets are important determinants of the degree of enforcement (Weingast and Moran 1983; Weignast 1984; Moe 1985; Magat, Krupnick and Harrington 1986; Olson 1995, 1996a, 1996b). Nevertheless, much work remains to be done before scholars have a more complete understanding of what influences the degree of regulatory enforcement. This is for two reasons. First, studies tend to analyze a small handful of *federal* regulatory agencies (for instance, the Food and Drug Administration and the Environmental Protection Agency), making it difficult to generate broad generalizations, especially to state level regulatory agencies. Second, because authors generally focus on federal (*i.e*. national) regulatory agencies, identification of the factors that influence regulatory enforcement must come primarily from temporal changes in regulatory regime that influence the incentives and constraints that regulators face. Causal identification is hampered by the fact that there tend to be relatively few regime shifts over time, and by the possibility that temporal regime shifts are correlated with other factors that might also affect the degree of enforcement.

This study attempts to further our understanding of regulatory enforcement by analyzing the behavior of medical licensing boards—the organizations that are responsible

for licensing physicians and policing physician conduct. Our contributions to the regulatory literature are threefold. First, few have examined how medical licensing board characteristics affect the extent of physician discipline. Medical licensing boards are a novel subject because, unlike most regulatory agencies, they are run, not by bureaucrats who are (at least nominally) independent of the industries they regulate, but by professional "insiders" (*i.e.* other physicians). Dolan and Urban (1983), to our knowledge, are the only scholars who have empirically analyzed the links between medical board characteristics and physician discipline. However, the period they study (1960-1977), their identification strategy, and their measure of physician discipline differ from ours.[1] While there is a more recent literature that examines how variation in licensing board characteristics influences the degree of entry into the medical profession and as well as other regulated occupations (Graddy and Nichol 1989; Svorny and Toma 1998), these papers do not analyze the effect of licensing board characteristics on the extent of professional discipline imposed on existing practitioners. In a recent paper, Grant and Alfred (2006) systematically examine medical board disciplinary actions. However, the focus of their paper is on the specific offenses that lead to medical board sanctions, and the extent to which sanctioned doctors are sanctioned in the future.[2] Accordingly, our analysis of medical licensing board behavior sheds light on a type of regulatory agency (insider-dominated licensing boards), as well as an aspect of regulatory

[1] Although Dolan and Urban (1983) use panel data, their econometric model does not include fixed effects. Accordingly, their analysis does not control adequately for unobserved heterogeneity at the state level. Furthermore, these authors use the raw data on types of disciplinary actions to construct their own measure of the effectiveness of medical board disciplinary actions. We take a more agnostic approach and examine how board characteristics affect the different types of disciplinary actions separately.

[2] Clay and Conatser (2003), Morrison and Morrison (2001), Dehlendorf and Wolfe (1998), and Morrison and Wickersham (1998) also examine the types of offenses that lead to medical board disciplinary action. However these studies focus on actions taken in particular jurisdictions or on particular medical specialties and are therefore less comprehensive than Grant and Alfred (2006).

behavior (disciplinary actions taken against existing practitioners), that has not been widely studied by other regulation scholars.

Second, in this paper, we generate new insights into the issue of regulatory capture. Among regulation scholars, it is widely believed that occupational licensing regulation represents the canonical example of capture of the regulatory apparatus by the industry being regulated (Stigler 1971; Kleiner 2000). Not only does occupational licensing regulation serve as an entry barrier that potentially allows a profession to increase prices and profits, often with little offsetting improvement in the quality of professional services, but the enforcement of licensing laws is almost invariably left to the profession itself. Since "insiders" are given the authority to discipline physicians for unprofessional conduct, an effect of occupational licensing may be to reduce regulators' incentive to punish bad behavior (Derbyshire 1983). Capture of the regulatory apparatus by the profession may therefore manifest itself in lower rates of physician discipline. Because medical licensing boards vary in the degree of independence they enjoy from political officials as well as in the extent of outside (*i.e*. non-physician) oversight, we test this implication of the regulatory capture hypothesis.

Finally, our study represents a methodological improvement over other empirical scholarship of the factors that influence enforcement behavior. Across states and over time there is variation in the composition and size of medical licensing boards, in the degree of organizational and financial independence they have from state governments, and in the overall level of resources they possess. We can take advantage of a quasi-experiment afforded by cross-jurisdictional and inter-temporal variation in the structural characteristics of medical licensing boards to identify the factors that influence the extent of regulatory enforcement. Specifically, by matching information on the nature of medical licensing boards with data on how frequently doctors are disciplined by these boards, we estimate the

importance of board composition, budgetary and organizational independence, and overall resources in determining the degree of regulatory enforcement within a difference-in-differences framework. Identification of the effects of board structure and board resources on the extent of enforcement comes from within-board variation in medical board characteristics, which provides more compelling evidence of the causal effect of regulatory regime than existing scholarship that relies exclusively on temporal variation at the national level. Since our data set divides total disciplinary actions into different categories that vary in strictness, we also examine how board structure affects the type of disciplinary actions that boards impose.

Our primary findings are as follows. Larger licensing boards and licensing boards that have more resources at their disposal (*i.e.* more staff) discipline physicians more frequently. This finding is robust across different types of disciplinary actions imposed by the board. We also find some evidence that medical boards that are organizationally independent from the state government are more likely to discipline doctors. Other board characteristics, such as whether the board receives funds from the state government, or the share of outside members on the board, do not have a systematic effect on the frequency or severity with which medical licensing boards discipline doctors. Our results therefore suggest that independence from political influence may facilitate more effective enforcement, and that increasing the overall resources available to licensing boards to oversee the medical profession may increase the degree of physician discipline. In addition, it appears that the extent to which the medical profession has captured the regulatory apparatus may have been overstated,

The remainder of this paper is structured as follows. We outline hypotheses that might explain medical board regulatory behavior in Section II. This is followed in Section III by a description of the data that we use to estimate the relationship between medical board

characteristics and the extent of physician discipline. We argue in this section that the distribution of medical board characteristics across states is sufficiently exogenous for us to use this variation to identify the effects of board characteristics on physician discipline. We then discuss the empirical methodology, our regression results, and some robustness checks in Section IV. Our empirical analysis is followed by a conclusion.

II. Hypotheses about regulatory enforcement

Broadly speaking, the nature and extent of regulatory enforcement will depend on the incentives that regulators face, and the resources they possess. Other things equal, the degree of enforcement will be increasing in the resources regulators have at their disposal. Regulatory agencies that have larger budgets or more personnel can enforce laws more rigorously than those that are more constrained. This prediction is shared by all theories of regulatory behavior.

Theories of regulatory behavior differ, however, along other dimensions. At a general level, we can divide these theories into principal-agent (PA) theories and bureaucratic-autonomy (BA) theories. PA-theories posit an agency relationship between politicians (*i.e.* legislators), who want policies that cater to the median voter in their districts (because politicians are re-election seekers), and regulators, who are utility maximizers (Weingast and Moran 1983; McCubbins, Noll and Weingast 1989). Because politicians recognize that regulators have different objectives than they do, and because politicians cannot perfectly monitor regulators, politicians have an incentive to design an optimal contract with regulators that aligns the objectives of the regulator with their own. There are several mechanisms through which politicians can induce regulators to behave according to their wishes. One is through control over agency budgets. The threat of budget cuts in response to "bad" behavior

by the regulator and the potential for budgetary increases in response to "good" behavior may induce regulators to comply with politicians' desires. Another is through political or public oversight of the regulatory agency. If politicians or members of the public (who share politicians' preferences) can directly oversee the actions of the regulator, regulators are more likely to behave in ways that improve politicians' well-being. In the context of medical licensing boards, greater political control over medical board budgets, as well as measures that increase political oversight of medical board behavior (such as reducing the organizational independence of the board from state government, as well as altering medical board composition to include more outside members) should also increase the extent to which boards enforce standards and impose discipline on the medical profession.

BA-theories, on the other hand, highlight the important role that independence from political meddling has on the effectiveness of regulatory enforcement (Miller 2000; Carpenter 2001). Scholars in this vein argue that regulatory enforcement is likely to be more effective if regulators are granted greater independence from political influence. There are several reasons why independence may facilitate regulatory enforcement. First, effective enforcement of regulation may not always be in every politician's best interest. While some politicians may benefit from more strict enforcement of regulation, others may benefit from less strict enforcement. For instance, in the context of disciplinary actions taken by medical boards, politicians whose re-election campaigns receive significant contributions from organized medicine may desire weaker regulatory enforcement of medical practice legislation. Measures that increase the independence that regulators have from political influence therefore serve as devices that commit politicians not to intervene in the regulator process (Miller 2000). Second, regulatory officials, particularly in the context of medical regulation, are often "professionals," who are reputation maximizers (Carpenter 2001, 2004;

Law 2005; Tonon 2007). As professionals, they may be bound by a code of ethics and a selection mechanism that puts "doing the right thing" above other objectives. Enforcing regulation effectively may enhance their prestige and allow them to expand their budgets and authority. Freedom from political influence may, in turn, permit them the autonomy to enforce regulation more effectively. With respect to medical licensing boards, BA-theories posit that greater independence (organizational and financial) from political influence, as well as less political or public oversight of medical licensing boards should result in more effective enforcement. BA-theories and PA-theories therefore generate different predictions regarding the relationship between organizational and budgetary autonomy and regulatory effectiveness.

III. Data

Our data on physician discipline and medical board characteristics come from two sources: the Federation of State Medical Board's (FSMB) annual *Board Action Summary*, which provides information on the number and type of disciplinary actions taken by each medical board as well as data on the number of licensed physicians who are regulated by each board in each year from 1991-2003, and the FSMB's *Exchange* (Section 2), which publishes information on the characteristics of each medical board in selected years (1993, 1996, 1999, 2003).

Variable definitions

Our primary dependent variable is the total number of disciplinary actions per 1,000 licensed physicians taken by each medical board in each year. We divide by the licensed physician population because the number of physicians regulated by each board varies significantly across boards. Total disciplinary actions equal the sum of licenses removed,

licenses restricted, and other actions. Since we are also interested in determining how board characteristics affect the nature of physician discipline, we also use licenses removed per 1,000 licensed physicians, licenses restricted per 1,000 licensed physicians, and other disciplinary actions per 1,000 licensed physicians as dependent variables.

We construct a variety of variables to control for medical licensing board characteristics that might influence the degree and nature of physician discipline. PA and BA theories of regulatory behavior suggest that factors like the size of the medical board, the resources available to each board, the insider-outsider composition of each medical board, and the organizational and budgetary independence each board enjoys may influence disciplinary actions. Accordingly, we collected data on the number of board members per 1,000 licensed physician, the number of full time equivalent (FTE) staff members employed by each board per 1,000 licensed doctor, as well as information on whether board revenues are taxed by the state government to control for the resources available to each board to oversee the medical profession[3]; the share of outside (*i.e.* non-physician) members on each board to control for the degree of outside oversight over board behavior; and an index of medical board independence to measure the extent to which the board is organizationally independent of the state government. Boards that the FSMB *Exchange* classifies as "independent" are given a score of three on this index. Those that are classified as "semi-independent" are given a score of two, while those that are "advisory" are given a score of one. According to the Federation of State Medical Boards, a board is "independent" if it is fully empowered to made decisions regarding physician discipline without having to consult with other organs of state government. Independent boards exercise all licensing and disciplinary powers. "Semi-independent" boards are subject to some oversight by some other

[3] The FMBS *Exchange* does include data on medical board budgets. Unfortunately, there were too many missing observations to allow us to use this data.

state government department (for instance, departments of health). "Advisory" boards, in contrast, exercise a purely advisory role to some central agency within state government. Accordingly, political influence and control over board decisions is likely to be greatest for "advisory" boards and weakest for "independent" boards. Finally we include a binary variable that indicates whether the board receives funding from the state government. This variable measures the budgetary control that legislators may have over the board.[4]

Because we only have data on board characteristics for four years, our panel consists of four cross-sections representing medical board actions and board characteristics in 1993, 1996, 1999 and 2003. Fourteen states have separate medical boards to regulate MD physicians and DO (osteopathic) physicians; in the remaining jurisdictions, the same medical licensing board regulates both types of physicians. Accordingly, the number of medical boards in our sample (65) exceeds the number of states plus the District of Columbia (51). Due to missing observations, we do not have a balanced panel. Descriptive statistics on our key variables are displayed in Table 1.

Evolution of medical board characteristics, 1993-2003

While the statistics presented in Table 1 reveal the overall variation in medical board characteristics across the full sample, they do not show the extent of within-board variation in these characteristics over time. Since our identification strategy exploits within-board variation to estimate the effects of board characteristics on rates of physician discipline, we also present data on the distribution of board characteristics by year to illustrate how these characteristics evolve over the sample period.

[4] The FMBS *Exchange* also reports information on how board members are selected, whether boards were bifurcated by role, the length of board members' terms, how frequently the boards meet, and other characteristics. We did not collect data on these characteristics because they did not vary much over time. The inclusion of board-specific fixed effects control for the effect of these time invariant board characteristics on physician discipline.

Table 2 presents data on medical board independence from 1993-2003. The columns in the table report the number of medical boards that fall into each category in a given year. While the number of purely advisory boards remains the same between 1993 and 2003, there is some movement between the independent category and semi-independent category, albeit with no apparent trend towards greater or lesser autonomy. Upon closer inspection of the data, we found that no board switched from one category to another more than once, and the four advisory boards were the same throughout this period. Accordingly, identification of the effects of board independence on physician discipline comes from boards that switch between independent and semi-independent status.

Information on the changing distribution of board size per 1,000 licensed physicians and FTE staff per 1,000 licensed doctors are shown in tables 3 and 4. Our measures of board size and board staff can change because the number of board members or staff changes, or because the number of physicians regulated by the board changes. While the distribution of board size per 1,000 doctors appears to be relatively stable between 1993 and 2003, there is a trend towards more staff per 1,000 doctors: during this period the number of boards with fewer than one FTE staff member per 1,000 physicians declined from 14 to 6 while the number of boards with more than four FTE staff per 1,000 physicians increased from 8 to 13. The resources available to medical boards have therefore expanded, at least in terms of personnel.

Table 5 presents information on the evolution of the budgetary status of medical boards. Two trends are apparent from this table. First, there is a dramatic decline in the number of boards that receive state funds. Between 1993 and 2003, the number of medical boards that received funding from state governments fell from 19 to 11. Political control over medical board budgets therefore seems to have fallen over time. Second, the number of

medical boards whose revenues are taxed by the state government increased from 13 to 22. These two trends are also correlated. As shown in Table 7, the correlation coefficient between the two dummy variables is -0.27, which indicates that boards that receive state funds are less likely to be taxed by state governments. We offer two explanations for this correlation. The first is that political control over board budgets can be exercised either by subsidizing board expenditures or by imposing taxes on board revenues. The negative correlation between these two variables may be due to the fact that they are substitute mechanisms for exercising political control over regulators. A second, and, in our view, more likely explanation is that the decline in the number of boards receiving state funding and the increase in the number of boards that are taxed are driven by state-level fiscal needs. In response to growing fiscal imbalances, state governments respond by reducing expenditures on medical boards (*i.e.* requiring boards to be self-funded) and by expanding the tax base in search of greater revenues (*i.e.* imposing taxes on medical board revenues). These underlying fiscal trends are presumably uncorrelated with factors that influence trends in physician quality.

Table 6 reports information on the distribution of the share of outside (non-physician) membership on medical licensing boards. An inspection of this table reveals three important facts. First, no board had a majority of outside members.[5] Second, on the overwhelming majority of boards, the share of outside membership ranges between 10 and 30 percent. Third, the number of boards with no outside members fell from 6 in 1993 to 2 in 2003.

[5] If medical board disciplinary decisions are made under a simple majority rule, then our data set would have insufficient variation along this dimension for us to assess whether outside membership influences the extent of physician discipline. While we do not have information on the decision rules used by medical boards to make decisions, it seems unlikely that a simple majority is sufficient, given that the stakes associated with removing a doctor's license are very high. In all likelihood, something closer to unanimity is required, which implies that outsiders may have real influence, even if they are a minority.

Accordingly, there seems to be a weak trend toward greater outside participation on medical licensing boards.

Does variation in board characteristics constitute a quasi-experiment?

In order to make causal inferences about the relationship between board characteristics and physician discipline, we need to establish that board characteristics are exogenous with respect to other factors that might influence the quality of physicians and the demand for physician discipline across jurisdictions so as to constitute a quasi-experiment. While board characteristics are clearly not randomly distributed across jurisdictions, our belief is that these characteristics are sufficiently exogenous so as to allow us to make causal inferences from this variation. Two pieces of evidence support this perspective. First, as shown in Table 7, licensing board characteristics are only weakly correlated with each other across jurisdictions. While the size of the board is well correlated with the number of full time equivalent staff (correlation coefficient of 0.64), and, as noted earlier, boards that receive state funding are also less likely to be taxed by state governments (correlation coefficient of -0.27), none of the other characteristics is well correlated with any of the others, in either a positive or negative direction. If, for instance, board characteristics that are associated with greater political control and oversight over board behavior were highly correlated with each other, we might be concerned that some omitted factor might be at play that would also be correlated with rates of physician discipline. The fact that few of these characteristics have any significant correlation with each other provides some evidence in favor of the view that the distribution of characteristics is exogenous, at least with respect to underlying preferences for physician discipline.

Second, we are unable to uncover any systematic relationships among factors that might be correlated with changes in the demand for physician discipline within a given

jurisdiction and medical board characteristics. As controls for factors that might be correlated with changes in the demand for physician discipline we use lagged changes in rates of physician discipline, changes in real per capita personal income at the state level, changes in the state government's share of state GDP, changes in the Democratic vote share in the nearest Presidential election, and an indicator variable that equals 1 if the governor of the state is a Democrat and 0 otherwise. We include lagged changes in rates of physician discipline to determine whether increases in physician discipline give rise to changes in medical board structure. Changes in real per capita personal income are included to control for changes in the private demand for physician quality. The remaining variables are included to proxy for changes in political sentiment within a jurisdiction that might influence the demand for physician discipline. Ordinary least squares regression estimates of the effects of these variables on each licensing board characteristic are displayed in Table 8. While there is some evidence that states that experience faster per capita income growth have a smaller share of outsiders on the board, none of the other variables has a statistically significant relationship with any of the board characteristics. Board characteristics do not respond to past changes in rates of physician discipline, nor to changes in our various measures of political sentiment that might also be correlated with increased stringency of regulatory enforcement. Accordingly, we are confident that our empirical analysis of the effects of board characteristics on physician discipline will yield valid causal inferences.

IV. Empirical analysis

Our baseline regression for estimating the effect of medical board characteristics on the extent of physician discipline is as follows:

$$y_{ist} = \alpha + R_{ist}\beta + X_{st}\gamma + T_t + B_i + \varepsilon_{ist}$$

where y_{ist} is the number of disciplinary actions per 1,000 doctors taken by board i in state s in year t; R_{ist} is a vector of the characteristics of board i located in state s in year t; X_{st} is a vector of time varying state-level control variables; T_t and B_i are year and board fixed-effects, respectively; and ε_{ist} is an error term. Since this regression framework includes fixed-effects at the board and year level, identification of the effects of medical board characteristics on rates of physician discipline come from within-state changes in board characteristics over time. In other words, we estimate the effect of a given board characteristic on rates of physician discipline by comparing changes in rates of discipline across jurisdictions that experience a change in that characteristic with jurisdictions that do not experience changes in that characteristic. The coefficient estimates represented by the vector β are therefore difference-in-differences (DID) estimates of the effects of board characteristics on rates of physician discipline. The inclusion of board and year fixed-effects allow us to control for time-invariant, jurisdiction-specific factors that might affect rates of physician discipline, as well as nation-wide factors that influence rates of physician discipline.

We estimate this regression equation by ordinary least squares using four different dependent variables: total disciplinary actions per 1,000 doctors, number of licenses removed per 1,000 doctors, number of licenses restricted per 1,000 doctors, and other actions per 1,000 doctors. The board characteristics (R_{ist}) that we control for measure: (i) the resources available to the board to enforce physician discipline (number of board members per 1,000 licensed physician, the number of full time equivalent staff members employed by each board per 1,000 licensed doctors, and an indicator variable that equals 1 if the board's revenues are taxed by the state government); (ii) the organizational and budgetary autonomy enjoyed by the board (index of board independence and an indicator variable that equals 1 if the board receives state government funds); and (iii) the degree of outside oversight of the board (share

of board members who are not physicians). While both the PA and BA hypotheses outlined earlier indicate that greater board resources should increase rates of physician discipline, these two hypotheses have different predictions regarding the effects of budgetary and organizational autonomy, and the degree of outside oversight, on the extent of physician discipline. While the PA hypothesis argues that boards that enjoy less budgetary and organizational autonomy and that are subject to greater oversight should regulate the medical profession more strictly, the BA hypothesis argues the opposite. Finally, X_{st} includes a number of variables that capture state-specific, time varying factors that may influence the extent of physician discipline within each state (real per capita personal income, state government spending as a share of state GDP, a Democratic governor indicator variable, and the share of the popular vote that was Democratic in the nearest presidential election).

For each of the four dependent variables, we estimate three regression models. The first is simply a pooled OLS regression that omits the year and board fixed effects. The second includes year effects but not board effects. The third (the DID regression equation displayed above) includes both year and board effects. This third regression is obviously our preferred specification. Because it controls for unobserved heterogeneity across boards and over time, we can make more compelling causal inferences. Nevertheless, it is informative to compare the DID estimates with those obtained using less structured specifications. This is for two reasons. First, the inclusion of year and board fixed effects consumes degrees of freedom. It is possible that the statistical significance of some variables may therefore disappear when fixed effects are included, not because they are unimportant, but rather, because there is not enough data to identify an effect. This is a particular concern since the number of years included in our panel is small. Second, by comparing results obtained with

and without fixed effects, we can see whether the failure to control for unobserved heterogeneity significantly biases our findings.

Regression results

Table 9 presents the regression results obtained when total disciplinary actions per 1,000 physicians is the dependent variable. Each column represents a separate regression. Column (1) shows the pooled regression results. The regression displayed in column (2) includes year fixed effects. Column (3) shows the DID estimates obtained when year and board fixed effects are included. In each regression, there is a positive and statistically significant relationship between medical board organizational independence and total disciplinary actions. Including both year and fixed effects also increases the size of this coefficient. As shown in column (3), a one unit increase in the index of medical board independence increases the number of disciplinary actions per 1,000 doctors by 1.98. This is an economically significant magnitude, representing an increase of 28 percent above the sample mean. The regressions also suggest that board resources influences the extent to which medical boards discipline doctors. The number of board members per 1,000 doctors and/or the number of full time equivalent staff members per 1,000 doctors has a positive and significant impact on total disciplinary actions per 1,000 doctors. Both of these effects are also economically significant. According to the DID estimates shown in column (3), a one unit increase in the number of board members per 1000 doctors increases the total number of disciplinary actions per 1000 doctors by 1.17 percent (16.6 percent above the sample mean) while a one unit increase in the number of full time equivalent staff per 1,000 doctors raises the total number of disciplinary actions per 1,000 doctors by 0.28 (4 percent above the sample mean). As before, the DID coefficient estimates for these variables are larger in both size and significance. The failure to control for unobserved heterogeneity across boards and

over time therefore biases our estimates of board independence and board resources downward. Finally, none of the other board characteristic controls has a statistically significant effect on total disciplinary actions, regardless of whether fixed effects are included. The lack of statistical significance found for most of our board characteristics covariates is therefore not attributable to a reduction in degrees of freedom brought about by the inclusion of board and year fixed effects.

Tables 10, 11 and 12 display the regression results obtained using licenses removed per 1,000 doctors, licenses restricted per 1,000 doctors, and other disciplinary actions per 1,000 doctors (respectively) as the dependent variable. As before, in each table, column (1) displays the pooled regression results, column (2) shows the results that include year fixed effects, and column (3) shows the DID (year and board fixed effect) estimates. Glancing across the tables reveals the following pattern of results. First, at least one measure of board resources (either the number of board members per 1,000 doctors or the number of full time equivalent staff members per 1,000 doctors) generally has a positive and statistically significant effect on physician discipline. Larger and more statistically significant positive effects of board resources are found when both year and board fixed effects are included. Second, organizational autonomy has a significant impact on some but not all measures of physician discipline. The index of organizational autonomy is positive and statistically significant when licenses restricted per 1,000 doctors is the dependent variable, but is not significant when the remaining two measures of physician discipline are used. Third, other board characteristics do not generally have a significant effect on any measure of physician discipline. Boards that receive funds from the state government do not discipline physicians more or less frequently than boards that enjoy greater budgetary autonomy. Additionally, boards that are taxed by state government do not discipline doctors differently than those that

are not taxed. The degree of outside influence within the board also does not generally have a statistically significant relationship with different measures of physician discipline. In none of the DID regressions displayed in Tables 10-12 does the coefficient on the share of outside members on the board is not significant. This result is at odds with Dolan and Urban (1983), who, using data from 1960-1977, find that greater non-physician participation on medical boards increases the frequency with which physicians are disciplined.[6] Accordingly, it would appear that outside oversight and greater political control over medical board budgets are not associated with more frequent rates of physician discipline.

Taken as a whole, our regression results suggest the following broad conclusions. First, overall resources are a key determinant of the extent to which medical boards discipline doctors. Regardless of which measure of physician discipline used, larger medical boards and boards with more staff discipline doctors more frequently. This finding is consistent with both theories of regulatory enforcement behavior, which predict that the degree of enforcement should be increasing in the resources commanded by regulators.

Second, our results provide stronger support for bureaucratic autonomy theories of regulatory behavior than for principal agent theories. There is some evidence that more independent boards discipline doctors more frequently, at least for some measures of physician discipline. On the other hand, boards that are subject to greater outside participation, or greater political control over their budgets, do not discipline doctors more frequently. These findings are inconsistent with principal agent theories, which emphasize the importance of political oversight and control in inducing regulatory enforcement.

[6] There are several reasons why Dolan and Urban's findings are at odds with ours. First, their analysis focuses on a much earlier time period. Second, they use a different dependent variable to measure physician discipline. Third, they use a different and somewhat arbitrarily constructed measure of non-physician participation on medical boards. Finally, because they do not use fixed-effects, their identification strategy is different.

Third, our results shed some light on the issue of regulatory capture. Among regulation scholars, it is often argued that medical licensing board, because they are generally physician-dominated, can be easily captured by the medical profession and operated in ways that increase physicians' well being at the expense of the public. Capture of the medical board by the medical profession may manifest itself is through a reluctance on the part of physician-dominated boards to discipline doctors. One testable implication of the capture theory is that boards that are more physician-dominated should discipline doctors less frequently. Another is that boards that are more organizationally and financially independent should discipline doctors less frequently. The DID coefficient estimates displayed in Tables 9 through 12 do not support these hypotheses. Our preferred estimates suggest that the share of outside membership on the board has no statistically significant effect on the degree of physician discipline, regardless of which measure of physician discipline we use. Additionally, boards that receive state funds do not discipline physicians more frequently. Indeed, greater organizational autonomy, as noted earlier, is associated with higher, not lower, rates of physician discipline. The evidence accumulated therefore suggests that these implications of the capture theory are not well supported.

Robustness checks

We also undertook a number of robustness checks to investigate the sensitivity of our findings. First, we restricted the sample by eliminating all licensing boards that only regulate DO physicians. Perhaps DO licensing boards, because they regulate a very small number of physicians, behave differently than other licensing boards. Including exclusively DO licensing boards in the sample may bias our results. As shown in Table 13, excluding DO boards from the sample does not dramatically alter our findings. Measures of board resources appear to be positively related with rates of physician discipline and greater board

independence has a positive and statistically significant effect on one measure of physician discipline. As before, the remaining board characteristics have no statistically significant effects. Accordingly, the evidence supports the importance of board resources and organizational autonomy as determinants of regulatory behavior.

Second, we re-estimated the DID regressions including board specific trend terms. While the inclusion of board fixed effects controls for unobserved heterogeneity that is constant within a board, it does not account for unobserved heterogeneity that may be changing within a board over time. Accordingly, it is possible that the significant effects that we observe in our DID regressions are being driven by time-varying unobserved heterogeneity within medical boards. One reasonably agnostic way to control for this possibility is to include board-specific trend terms in our DID regressions. As shown in Table 14, a similar pattern of results is found when board-specific trends are included. The index of board independence has a positive and significant effect on three of four measures of physician discipline, as does board size, while the remaining board characteristic variables are still statistically insignificant. Accordingly, it would appear that our results are robust to the inclusion of board-specific trend terms.

Third, we re-estimated the regressions using a lagged value of each measure of physician discipline as the dependent variable. If our earlier regressions are correctly identifying the effect of current board characteristics on contemporaneous rates of physician discipline, current board characteristics should not affect past rates of physician discipline. Estimating the regressions using past rates of physician discipline as the dependent variable allow us to rule out the possibility that there is some trend that is driving both board characteristics and physician discipline. In none of these regressions are the coefficients on

the board characteristics variables statistically significant, which help establish that we have correctly identified the effect of board characteristics on rates of physician discipline.

Finally, we re-estimated each of our regressions using natural logarithmic transformations of the dependent variables and found qualitatively similar results. Taken as a whole, we are therefore confident that our results correctly identify the effects of board structure on physician discipline.

V. Conclusion

In this study we take advantage of quasi-experimental variation in the characteristics of medical boards across the United States to determine the effects of board characteristics on rates of physician discipline. This analysis allows us to shed some light on the empirical determinants of regulatory behavior and provides a partial test of different hypotheses about how regulators behavior in response to different constraints and incentives.

Our basic findings are threefold. First, the overall resources available to the regulator are a key factor determining the degree of physician discipline imposed by licensing boards. Larger medical licensing boards and boards with more staff support discipline doctors more frequently. Second, organizational autonomy from political influence also affects physician discipline. Licensing boards that are organizationally more independent from state government discipline physicians more frequently. This finding is supportive of bureaucratic autonomy theories of regulatory behavior, which argue that freedom from political influence plays an important role in helping regulators enforce regulation more effectively. Finally, other factors such as how boards are funded and board composition do not affect rates of physician discipline. Taken together, these findings provide partial support for the bureaucratic autonomy approach to understanding regulatory behavior, are inconsistent with

the principal-agent approach, which emphasizes the importance of political oversight and budgetary control, and are also inconsistent with an implication of the capture theory, which argues that independent boards and physician-dominated boards discipline doctors less frequently.

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Table 1. Descriptive statistics

Variable	Mean (standard deviation)	N
Total disciplinary actions per 1,000 doctors	7.05 (5.90)	248
Licenses removed per 1,000 doctors	2.85 (2.58)	248
Licenses restricted per 1,000 doctors	2.24 (2.63)	248
Other disciplinary actions per 1,000 doctors	1.95 (2.39)	248
Index of board independence (advisory = 1, semi-independent = 2, independent = 3)	2.65 (0.59)	258
Board members per 1,000 doctors	5.83 (14.53)	250
Full time equivalent staff per 1,000 doctors	4.59 (13.16)	231
Share of outside members on board	0.22 (0.11)	258
Board receives funding from state gov't (yes = 1, no = 0)	0.22 (0.42)	260
Board is taxed by state gov't (yes = 1, no = 0)	0.30 (0.46)	260

Sources: See text.

Table 2. Medical board independence, 1993-2003.

	1993	1996	1999	2003
Number of "independent" boards (Index = 3)	45	48	44	46
Number of "semi-independent" boards (Index = 2)	14	13	17	15
Number of "advisory" boards (Index = 1)	4	4	4	4
Total number of boards	63	65	65	65

Source: See text.

Table 3: Board size per 1,000 licensed physicians, 1993-2003

	1993	1996	1999	2003
Number of boards for which size < 0.5	5	6	6	8
Number of boards for which 0.5 < size < 1	11	10	9	8
Number of boards for which 1 < size < 1.5	9	7	12	9
Number of boards for which 1.5 < size < 2	7	9	7	7
Number of boards for which 2 < size < 4	12	10	11	11
Number of boards for which 4 < size < 6	7	7	5	6
Number of boards for which size > 6	11	14	14	12
Total number of boards	62	63	64	61

Source: See text. Calculations by authors.

Table 4. Full time equivalent (FTE) staff per 1,000 licensed physicians, 1993-2003.

	1993	1996	1999	2003
Number of boards for which FTE < 1	14	6	11	6
Number of boards for which 1 < FTE < 2	12	20	12	11
Number of boards for which 2 < FTE < 3	18	15	15	13
Number of boards for which 3 < FTE < 4	7	6	11	9
Number of boards for which FTE > 4	8	12	12	13
Total number of boards	59	59	61	52

Source: See text. Calculations by authors.

Table 5. Budgetary status of medical boards, 1993-2003

		1993	1996	1999	2003
Budgetary autonomy?					
	Boards that receive state funds (Yes = 1)	19	15	12	11
	Boards that are self-funded (No = 0)	46	50	53	54
	Total	65	65	65	65
State gov't taxes board revenues?					
	Boards that are taxed by state gov't (Yes = 1)	13	18	24	22
	Boards that are not taxed (No = 0)	52	47	41	43
	Total	65	65	65	65

Source: See text.

Table 6. Share of outside membership on medical licensing boards, 1993-2003.

	1993	1996	1999	2003
Number of boards for which share = 0.	6	4	3	2
Number of boards for which $0 < \text{share} \leq 0.1$	3	5	4	3
Number of boards for which $0.1 < \text{share} \leq 0.2$	26	21	21	21
Number of boards for which $0.2 < \text{share} \leq 0.3$	20	23	24	21
Number of boards for which $0.3 < \text{share} \leq 0.4$	7	11	11	14
Number of boards for which $0.4 < \text{share} \leq 0.5$	1	1	2	4
Number of boards for which share > 0.5	0	0	0	0
Total number of boards	63	65	65	65

Source: See text. Calculations by authors.

Table 7. Correlations among board characteristics

	Index of board independence	Board members per 1,000 doctors	Full time equivalent staff per 1,000 doctors	Share of outside members on board	Board receives state gov't funding	Board is taxed by state gov't
Index of board independence	1.0					
Board members per 1,000 doctors	-0.11	1.0				
Full time equivalent staff per 1,000 doctors	-0.09	0.64	1.0			
Share of outside members on board	0.01	0.17	-0.11	1.0		
Board receives state gov't funding	-0.18	-0.01	0.11	0.03	1.0	
Board is taxed by state gov't	0.05	0.05	0.00	0.08	-0.27	1.0

Source: See text. Calculations by authors.

Table 8. Correlates of board characteristics

	(1) Index of board independence	(2) Board members per 1,000 doctors	(3) Full time equivalent staff per 1,000 doctors	(4) Share of outside members on board	(5) Board receives state gov't funding	(6) Board is taxed by state gov't
Δ(Total disciplinary actions per 1,000 doctors)	-0.03 (0.04)	-3.10 (2.39)	-2.70 (2.29)	0.01 (0.01)	0.02 (0.03)	0.006 (0.04)
Δ(Real per capita income)	0.47 (1.44)	-12.91 (35.60)	-9.88 (23.54)	-0.62* (0.34)	-0.34 (1.52)	1.79 (1.82)
Δ(State gov't spending share of state GDP)	-0.09 (0.60)	18.80 (17.58)	17.26 (22.28)	-0.22 (0.25)	-0.06 (0.65)	3.06 (0.94)
Δ(Democratic vote share)	-0.26 (0.18)	3.27 (5.87)	-1.17 (6.59)	0.03 (0.05)	-0.13 (0.23)	0.41 (0.29)
Democratic governor indicator	-0.03 (0.05)	-2.70 (1.65)	-1.94 (1.50)	0.01 (0.01)	-0.02 (0.04)	0.08 (0.05)
N	239	236	229	239	239	239

Notes: Each column represents a separate regression. State-board and year fixed effects are included. Robust standard errors are reported in parentheses. * denotes statistical significance at the 10 percent level.

Table 9. Effects of medical board characteristics on total disciplinary actions per 1,000 physicians

	(1) Pooled	(2) Year FE only	(3) DID estimates
Index of board independence	1.00* (0.54)	0.85* (0.46)	1.98** (1.00)
Board members per 1,000 doctors	0.20 (0.16)	0.20 (0.16)	1.17*** (0.36)
Full time equivalent staff per 1,000 doctors	0.13** (0.05)	0.20 (0.16)	0.28* (0.16)
Share of outside members on board	1.35 (3.13)	1.67 (3.16)	4.99 (5.83)
Board receives state gov't funding	0.03 (0.72)	0.25 (0.73)	-0.16 (1.40)
Board is taxed by state government	1.06 (1.97)	0.96 (0.88)	-2.08 (1.52)
Year fixed effects	No	Yes	Yes
Board fixed effects	No	No	Yes
N	229	229	229

Notes: Each column represents a separate regression. Robust standard errors are reported in parentheses. Other state-level covariates include real personal income per capita, state government spending as a share of state GDP, Democratic governor indicator variable, and the Democratic vote share in the nearest presidential election. *, ** and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 10. Effects of medical board characteristics on number of licenses removed per 1,000 physicians

	(1) Pooled	(2) Year FE only	(3) DID estimates
Index of board independence	0.24 (0.35)	0.13 (0.35)	0.60 (0.50)
Board members per 1,000 doctors	0.11 (0.08)	0.10 (0.07)	0.33*** (0.12)
Full time equivalent staff per 1,000 doctors	0.05** (0.02)	0.05** (0.02)	0.05 (0.06)
Share of outside members on board	0.13 (1.42)	0.45 (1.42)	1.34 (2.37)
Board receives state gov't funding	0.11 (0.41)	0.29 (0.42)	-0.54 (0.71)
Board is taxed by state government	-0.24 (0.37)	-0.35 (0.37)	-1.04 (0.77)
Year fixed effects	No	Yes	Yes
Board fixed effects	No	No	Yes
N	229	229	229

Notes: Each column represents a separate regression. Robust standard errors are reported in parentheses. Other state-level covariates include real personal income per capita, state government spending as a share of state GDP, Democratic governor indicator variable, and the Democratic vote share in the nearest presidential election. *, ** and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 11. Effects of medical board characteristics on the number of licenses restricted per 1,000 physicians

	(1) Pooled	(2) Year FE only	(3) DID estimates
Index of board independence	0.51*	0.53**	0.75**
	(0.24)	(0.25)	(0.36)
Board members per 1,000 doctors	0.08	0.07	0.37**
	(0.08)	(0.08)	(0.17)
Full time equivalent staff per 1,000 doctors	0.04*	0.04*	0.08
	(0.02)	(0.02)	(0.07)
Share of outside members on board	-0.82	-0.95	1.24
	(1.31)	(1.37)	(2.12)
Board receives state gov't funding	-0.18	-0.18	-0.26
	(0.33)	(0.34)	(0.52)
Board is taxed by state government	0.56	0.58	-0.95
	(0.38)	(0.38)	(0.68)
Year fixed effects	No	Yes	Yes
Board fixed effects	No	No	Yes
N	229	229	229

Notes: Each column represents a separate regression. Robust standard errors are reported in parentheses. Other state-level covariates include real personal income per capita, state government spending as a share of state GDP, Democratic governor indicator variable, and the Democratic vote share in the nearest presidential election. *, ** and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 12. Effects of medical board characteristics on other disciplinary actions per 1,000 physicians

	(1) Pooled	(2) Year FE only	(3) DID estimates
Index of board independence	0.23 (0.26)	0.18 (0.27)	0.63 (0.45)
Board members per 1,000 doctors	0.02 (0.02)	0.02 (0.03)	0.46** (0.21)
Full time equivalent staff per 1,000 doctors	0.03 (0.02)	0.03 (0.02)	0.15* (0.08)
Share of outside members on board	2.02* (1.03)	2.16** (1.04)	2.41 (2.69)
Board receives state gov't funding	0.09 (0.34)	0.13 (0.36)	0.64 (0.52)
Board is taxed by state government	0.74* (0.39)	0.72 (0.48)	-0.10 (0.32)
Year fixed effects	No	Yes	Yes
Board fixed effects	No	No	Yes
N	229	229	229

Notes: Each column represents a separate regression. Robust standard errors are reported in parentheses. Other state-level covariates include real personal income per capita, state government spending as a share of state GDP, Democratic governor indicator variable, and the Democratic vote share in the nearest presidential election. *, ** and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 13: Omitting osteopathic boards (MD boards only)

	(1) Total disciplinary actions per 1,000 doctors	(2) Licenses removed per 1,000 doctors	(3) Licenses restricted per 1,000 doctors	(4) Other disciplinary actions per 1,000 doctors
Index of board independence	1.10	0.36	0.39*	0.36
	(0.82)	(0.47)	(0.21)	(0.43)
Board members per 1,000 doctors	0.48	0.12	0.14	0.22*
	(0.33)	(0.18)	(0.10)	(0.13)
Full time equivalent staff per 1,000 doctors	0.83**	0.40*	0.16*	0.27
	(0.40)	(0.21)	(0.09)	(0.18)
Share of outside members on board	2.60	1.12	0.71	0.76
	(3.96)	(1.63)	(1.48)	(2.48)
Board receives state gov't funding	-0.13	-0.19	0.02	0.04
	(0.92)	(0.54)	(0.27)	(0.34)
Board is taxed by state government	-1.06	-0.44	-0.37	-0.27
	(0.76)	(0.50)	(0.27)	(0.28)
Year fixed effects	Yes	Yes	Yes	Yes
Board fixed effects	Yes	Yes	Yes	Yes
N	188	188	188	188

Notes: Each column represents a separate regression. Robust standard errors are reported in parentheses. Other state-level covariates include real personal income per capita, state government spending as a share of state GDP, Democratic governor indicator variable, and the Democratic vote share in the nearest presidential election. ** and * denote statistical significance at the 5 percent and 1 percent levels, respectively.

Table 14. Including board specific trend terms

	(1) Total disciplinary actions per 1,000 doctors	(2) Licenses removed per 1,000 doctors	(3) Licenses restricted per 1,000 doctors	(4) Other disciplinary actions per 1,000 doctors
Index of board independence	2.85**	0.94	0.83**	1.09**
	(1.16)	(0.70)	(0.42)	(0.48)
Board members per 1,000 doctors	1.52**	0.59*	0.51*	0.42
	(0.74)	(0.31)	(0.29)	(0.35)
Full time equivalent staff per 1,000 doctors	2.16	0.68	0.81	0.68
	(1.59)	(0.52)	(0.65)	(0.47)
Share of outside members on board	9.72	2.09	2.44	5.18
	(10.42)	(4.48)	(3.40)	(4.55)
Board receives state gov't funding	1.94	0.98	0.28	0.68
	(1.42)	(0.81)	(0.47)	(0.63)
Board is taxed by state government	-0.74	-0.12	0.03	-0.68
	(1.18)	(0.58)	(0.45)	(0.37)
Year fixed effects	Yes	Yes	Yes	Yes
Board fixed effects	Yes	Yes	Yes	Yes
Board-specific trend	Yes	Yes	Yes	Yes
N	229	229	229	229

Notes: Each column represents a separate regression. Robust standard errors are reported in parentheses. Other state-level covariates include real personal income per capita, state government spending as a share of state GDP, Democratic governor indicator variable, and the Democratic vote share in the nearest presidential election. *, ** and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.