Medical Malpractice and Contract Disclosure: A Study of the Effects of Legal Rules on Behavior in Health Care Markets

Thesis by

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Abstract

A theoretical model is developed to explain how specific legal rules affect the types of contracts managed care organizations ("MCOs") use to compensate physicians. In addition, the analysis provides insights into how physician treatment decisions and the patient litigation decisions react to different legal rules. In particular, the model predicts that outcomes in jurisdictions forcing MCOs to disclose contract terms to patients differ from those that do not. Contracts vary depending on the disclosure rule and how treatment costs relates to expected damages and litigation costs. Moreover, the model predicts that jurisdictions forcing contract disclosure observe higher rates of legally compliant treatment and lower rates of medical malpractice claims.

The model's results also provide insights into how expected damages affect treatment and litigation decisions. Using these insights, an efficient damage rule is constructed and then compared to two commonly used damage rules to illuminate the rules' inefficiencies. Finally, it is shown that, regardless of the disclosure rule, treatment and litigation decisions do not depend on whether the patient can sue only the physician, only the MCO, or both. MCO contract choices, however, do vary with the composition of the group of potential defendants.

In addition, an empirical study is employed to test three predictions of the theoretical model. The study uses data on medical malpractice insurance premiums per physician in the 50 U.S. states for the period 1991–2001 as a proxy for ex ante expected damages arising from medical malpractice claims. The data support the prediction that mandatory disclosure laws (weakly) decrease ex ante expected damages. The data also support the prediction that implementing damage caps in the presence of a disclosure law (weakly) increases ex ante expected damages. The results on the final prediction, that implementing damage caps in the absence of a disclosure law most likely increases ex ante expected damages, are mixed.

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Chapter 1 Introduction

The purposes and consequences of legal rules were once thought to be very simple. For example, conventional wisdom held that the main purpose of tort law was to compensate injured victims for losses caused by culpable injurers. Relatively recent examinations of legal rules, however, have demonstrated that the law can lead to much more complex consequences than once thought. For example, tort law might, in fact, encourage change in the behavior of potential injurers.

The goal of this thesis is to investigate the consequences of legal rules designed to regulate health care markets. Regulation of this industry is necessary, in part, because of the asymmetry of information between MCOs and physicians, between physicians and patients and between MCOs and patients.[1] Legislators and judges have formulated a patchwork of legal rules to mitigate the negative effects of market imperfections in an attempt to reach more efficient outcomes. In addition, rules have been formulated to address other concerns including medical malpractice insurance crises and MCO advertising practices.

The usefulness of these normative prescriptions is bounded, however, by our limited understanding of how various legal rules affect the behavior of actors participating in health care markets. For example, we do not yet fully understand how changes in the law affect MCO choices over provider contracts. In addition, we are only beginning to grasp how health care providers (e.g., physicians) react to different provider contract structures and the legal rules governing their behavior. Finally, our theories regarding injured patients' decisions to file claims for medical malpractice are often in conflict with observed behavior.

This thesis investigates the consequences of three particular legal rules: mandatory contract disclosure rules, medical malpractice damage rules and tortfeasor rules

[1] Arrow [5] was the first to formalize how health care markets are different from perfectly competitive markets. He noted asymmetric information as one of the most important distinctions.

(i.e., rules specifying the parties a plaintiff may sue). Although mandatory contract disclosure rules were meant to provide consumers with information during the health care plan selection process, it is quite possible that these rules have unintended consequences. By changing the information structure of the interactions between actors in health care markets, mandatory disclosure rules affect not only the types of contracts used by MCOs to compensate providers, but also treatment and litigation decisions by providers and injured patients, respectively. Similarly, damage rules and tortfeasor rules have the ability to change the behavior of actors in health care markets. Until we develop a solid understanding of how the law affects behavior, changes in the law have the potential to lead to unintended (and perhaps undesirable) consequences.

This thesis is organized as follows. Chapter 2 provides a review of the literatures to which this thesis contributes. Several theoretical literatures covering different topics are described including general litigation and deterrence studies, analyses of how legal rules affect behavior in health care markets and studies specifically investigating mandatory disclosure laws, medical malpractice damage rules and tortfeasor rules. In addition, the chapter provides a review of empirical investigations of how legal rules affect medical malpractice insurance premiums, often used as a proxy for claim rates or expected damages arising from medical malpractice claims. Finally, the previous empirical findings are critiqued and reconciled with both the theoretical predictions presented in Chapter 3 and the empirical results presented in Chapter 4.

Chapter 3 provides a theoretical model of how these different legal rules affect behavior in health care markets. The results set out predictions of MCO contract choices, physician treatment decisions and injured patient litigation decisions made in the context of particular legal environments (e.g., in the presence of mandatory disclosure rules and in the absence of such rules). In addition, based on the model's results, an efficient medical malpractice damage rule is constructed to act as a benchmark for the evaluation of two commonly used damage rules: the all-or-nothing rule and the loss-of-a-chance rule. Finally, an investigation of how different tortfeasor rules affect behavior and outcomes is provided.

Chapter 4 includes an empirical investigation of predictions derived from the theoretical model. The model predicts that disclosure rules decrease ex ante expected medical malpractice damages. In addition, the model's results regarding the effects of damage caps on ex ante expected damages[2] challenge conventional theories that caps necessarily decrease ex ante expected damages. The present theory suggests that caps actually could increase or decrease ex ante expected damages depending on certain conditions. The study uses data on medical malpractice insurance premiums from all 50 U.S. states for the years 1991–2001 to test the model's predictions. Medical malpractice premiums are used as a proxy for ex ante expected damages. The empirical study's results, for the most part, support the model's predictions.

Finally, Chapter 5 offers conclusions and discussion.

[2]Ex ante expected damages are calculated prior to the physician's treatment choice and before the patient's outcome and litigation decision are known. The calculation incorporates expected damages along with the probability that the physician will satisfy the standard of care, the probability that the patient experiences a negative outcome and the probability that the patient, if injured, sues for medical malpractice. These factors depend highly on the legal rules in effect when the decisions are made.

Chapter 2 Literature Review

2.1 Introduction

This thesis contributes to several literatures addressing general theoretical law and economics, the theory of health care law and economics and empirical work focusing on how various legal rules affect the health care industry. The purpose of this chapter is to provide a review of these various literatures.

Section 2.2 summarizes several literatures pertaining to the theoretical analysis of health care law and economics (or general law and economics) to which this thesis contributes. First, the general literature covering the theoretical relationship between litigation and deterrence is summarized. Second, a general literature regarding health care markets is discussed. Third, a relatively short literature covering mandatory disclosure laws is summarized. Fourth, the literature focusing on medical malpractice damage rules is described. Finally, the studies focusing on tortfeasor rules as they relate to medical malpractice cases are discussed.

Section 2.3 provides a short summary of empirical studies related to the effects of medical malpractice damage caps on the health care industry. These studies include evaluations of how damage caps affect medical malpractice insurance premiums, losses and prices,[1] malpractice claim frequency and severity, profitability of the insurance industry and underwriting risk. The studies are then critiqued and reconciled with the theoretical predictions presented in Chapter 3 and the empirical results reported in Chapter 4.

Lastly, Section 2.4 concludes and summarizes the contributions of the remainder of this thesis to the various literatures.

[1]The price of insurance is measured by dividing premiums by losses. The inverse of this measure is referred to as the loss ratio.

2.2 Theoretical Analyses

2.2.1 Litigation and Deterrence

Law and economics scholars have taken significant steps toward untangling the relationship between litigation and deterrence[2] in cases in which the victim is not certain about the level of care taken by the injurer.[3] These studies focus on two decisions influenced by the legal environment: (1) a victim's decision regarding whether to file or pursue a claim against an injurer, and (2) a potential injurer's decision regarding the amount to expend on costly precautions to avoid injury to a potential victim.

Polinsky and Shavell [82] construct a general model to study the effect of court error on a potential injurer's level of care decision and a victim's litigation decision when the victim does not observe the injurer's level of care. They show that Type I errors[4] lead to suboptimal levels of care by potential injurers and Type II errors[5] lead to superoptimal litigation rates. They suggest that these inefficiencies can be mitigated by fining losing plaintiffs or subsidizing lawsuits. They also demonstrate the effect of legal errors on the incentive to comply with the law by observing that errors determine, in part, whether a suit will be filed. They suggest various policy instruments to mitigate the effects of legal errors.

The model assumes that the plaintiff's belief that the defendant is truly "guilty" is exogenous and "not essential to the analysis." This assumption ignores the fact that the plaintiff's belief about the probability that the injurer complied with the law, in large part, drives the plaintiff's litigation decision. The method by which this belief is formed is crucial to determining the level of care a potential injurer will take and the probability that an injured party will file a claim. The model presented in Chapter 3 allows the injured party's beliefs to form endogenously. This modelling technique greatly affects the predictions regarding the behavior of both the potential

[2]See Brown [19], Landes and Posner [66] and Shavell [91] for comprehensive analyses of tort law and deterrence.

[3]Note that the literature reviewed here is not meant to be all-inclusive. Instead, it is meant to provide a few examples of how injurer and victim decisions are modelled.

[4]A Type I error results when a truly "guilty" party escapes liability.

[5]A Type II error results when a truly "innocent" party is held liable.

injurer and the injured.

Several other studies modelling litigation decisions do not tie the litigation decision to the legal environment, but make very simple assumptions about the formation of beliefs regarding the injurer's action. First, Simon [92] models how costly litigation and imperfect information regarding the quality of products in the market and the outcome of litigation affect the choices of producers.[6] The model demonstrates that firms will take differing levels of care depending on the distribution of consumer risk aversion. The intuition behind the result hinges on the fact that risk averse consumers will file claims less often. This leads to the production of lower quality products. The model shows that litigation costs work in much the same way. Any circumstance that makes litigation less likely will allow the production of less costly, but less safe, products.

Simon extends this result to medical malpractice. She notes that risk-averse patients will be hesitant to expend the necessary costs to collect information regarding whether the physician complied with the legal standard of care for medical malpractice. In addition, as litigation costs increase, the likelihood that an injured patient will file suit decreases. Therefore, highly risk averse patients with relatively high litigation costs will, in equilibrium, receive a relatively low quality of medical care.

Second, Schweizer [88] uses similar modelling techniques to study the settlement process when both parties make decisions under conditions of incomplete information. His model focuses on the parties' decisions regarding whether to settle the dispute prior to pursuing costly litigation. The purpose of the paper is to explain why some suits proceed to the litigation stage even though the efficient outcome suggests that the parties should always settle. He finds that under all possible equilibria the parties will decide to pursue litigation with some positive probability when each potential litigant's information regarding the utility function of the other party is incomplete. The paper also considers refinements to eliminate all but one equilibrium. This equilibrium is used to develop comparative statics regarding how information affects the probability that the parties will settle the dispute without resorting to costly litiga-

[6] The model assumes that low quality products lead to buyer injury more often.

tion.

Third, Cooter and Rubinfeld [23] review models of the choice between settlement and litigation. The study accounts for the sequential nature of dispute resolution by considering theories on behavior during the following stages of the process: (1) injurer's choice of the level of care to take, (2) the victim's decision under uncertainty regarding whether to assert a legal claim, (3) strategic bargaining during the settlement negotiations, and (4) litigant and court behavior if the case proceeds to trial including effort levels of both plaintiff and defendant and the outcome of the trial. Several assumptions are made regarding the actors' beliefs that the injurer did not meet the legal standard of care. For example, the litigants' expenditures on the trial, which are exogenously given, signal the probability that the court will find negligence. In addition, the injurer's decision regarding the level of costly care to expend is based on the assumption that all victims will file claims.

Fourth, Kaplow [57] compares two different ways to increase plaintiff's incentives to sue: shifting victorious plaintiffs' litigation costs to defendants and increasing damage awards. He finds that increasing damages is more efficient because "fee shifting is more valuable for plaintiffs with higher litigation costs." Using damages rather than fee shifting as the incentive to sue leads to a decrease in total litigation costs because the costliest suits are eliminated.

As discussed previously, these models assume that the injured party's beliefs over the injurer's "guilt" are formed exogenously. Simon assumes that, to form beliefs, the potential plaintiff costlessly collects a signal of the injurer's negligence. The signal is in no way related to the legal environment or any other parameters of the model. This assumption ignores the fact that victims are able to use information about the legal environment (e.g., the level of damages a negligent injurer may face in an environment which imposes a statutory cap on damages) in which the injurer decides on his level of care. Likewise, Schweizer assumes that nature simply provides the parties with information on the merits of the case. Cooter and Rubinfeld assume that the subjective probability of a trial payoff to the plaintiff is determined solely by the parties' expenditures on the trial. In addition, to determine the deterrence effect of legal rules, they assume that a victim will file a claim with certainty. Finally, Kaplow assumes the plaintiff's probability of victory does not depend on the incentives of the defendant to take care and concludes that increasing damages will lead to an increase in the plaintiff's willingness to sue.

The present study[7] employs an equilibrium model of deterrence and litigation to account for the fact that, when deciding whether to take costly precautions, a potential injurer considers the possibility of litigation and, when deciding whether to sue the injurer, a victim updates her belief of injurer "guilt" by considering how legal rules affect injurer behavior. Modelling behavior in this way captures the subtle interactions between legal rules, the likelihood of compliant treatment and the rate of claims filed by injured patients. The injured party's beliefs are formed endogenously by taking into account how the legal environment affects the injurer's level of care decision. In addition, the model assumes that physicians choose levels of care by considering not only the legal environment but also an injured patient's beliefs about the physician's action given the legal environment. These assumptions might lead to more accurate predictions regarding behavior in health care markets and help to explain observed behavior that does not comport with the predictions of conventional theoretical models.

Others have studied litigation and deterrence in different settings by considering the equilibrium effects of various legal environments. For example, Png [80] models litigation, liability and incentives for care to analyze the effects of various legal reforms. His model assumes that the victim does not know the type of the defendant (i.e., negligent or non-negligent) prior to deciding whether to file a claim but that beliefs are formed endogenously by considering the probability of harm given negligence. He finds that if the negligence standard is tightened, some potential injurers will take more care, but some will take less. He also finds that increasing damages will induce a general upward shift in the level of care taken by potential injurers. With respect to litigation rates, the results suggest that increasing the standard of care will lead to less litigation and increasing damages could lead to an increase or de-

[7]See *infra* Chapter 3.

crease in litigation. The latter result hinges on the model's assumption that potential injurers differ with respect to the cost required to satisfy the legal standard of care. The model also considers the effects of the settlement process and the transmission of information regarding the merits of the case during settlement negotiations. The analysis, however, does not seem to address the fact that the legal environment not only affects the potential injurer's exposure to liability, but also the probability that a victim will file a claim. The model presented *infra* in Chapter 3 emphasizes both effects to make sharper predictions of level of care decisions and litigation decisions.

In addition, Bernardo, Talley and Welch [10] construct an equilibrium model to study the effects of legal presumptions on principal-agent relationships. In this seminal paper, they construct a Bayesian game of incomplete information to analyze the capacity of court presumptions[8] to mediate between costly litigation and ex ante incentives of agents who perform unobservable and unverifiable actions on behalf of principals. They find that strong pro-agent presumptions will eliminate lawsuits but also allow agents to shirk. On the other hand, strong pro-principal presumptions encourage principals to bring lawsuits whenever a bad outcome occurs. In this case, agents will never shirk. The authors find that the socially optimal presumption balances agency costs with litigation costs, and depends on three exogenous variables: (1) social importance of effort, (2) costs of filing suit and (3) the comparative advantage that diligent agents have over their shirking counterparts in mounting a defense. They also show that giving more weight to agents' evidence in court can lead to *more* litigation because the principals find it more likely that agents shirked.[9] One important point emphasized by Bernardo et al. is that complex interactions deserve attention and warrant careful analysis. One cannot fully understand the implications of tinkering with one parameter or another unless these complex interactions are well understood.[10]

[8] A presumption is a legal device that operates in the absence of other proof to require that certain inferences be drawn from the available evidence. The most famous presumption is one that presumes an accused's innocence until guilt is proven by the state.

[9] This is akin to the results found in Chapter 3.

[10] The model presented *infra* in Chapter 3 is similar in construction to the model employed by Bernardo et al. [10].

The theoretical model presented in Chapter 3 focuses not on legal presumptions, but on mandatory disclosure laws, statutory damage caps and medical malpractice damage rules. Using an equilibrium model to analyze the complex interactions between damages, treatment decisions and litigation decisions (e.g., endogenizing the victim's belief regarding the action of the injurer) illuminates the non-obvious potential effects of changes in legal rules. For example, the results suggest that the intended goal of reducing lawsuits might not be achieved by reducing damages. Depending on the relationship between treatment costs and damages, lowering damages might lower the probability that the physician's treatment choice satisfies the legal standard of care, which in turn could increase the probability that the patient is negligently injured. Therefore, lowering damages could increase the rate of litigation, contrary to the intended effect.

2.2.2 Health Care Markets

Health care economics scholars draw on general models of agency relationships and litigation and deterrence to explore the imperfections of health care markets. Arrow's [5] seminal paper is the first of many to address health care market imperfections. The purpose of the study is to compare perfectly competitive markets with health care markets. Arrow notes several significant differences: demand is irregular and unpredictable, sellers are not expected to be motivated by profits, supply is restricted, price competition is frowned upon (although price discrimination is common) and buyers are uncertain about the quality of the product. The present study focuses on the problem of incomplete information that leads to uncertainty regarding quality. Supplier-induced demand opens the door for physicians to act in their own self interest and disregard the benefits of medical care for their patients. Legal institutions address this market imperfection by implementing rules to achieve efficient outcomes (i.e., the provision of medical care when the expected benefits of care outweigh the costs of providing it).

A handful of studies focuses on how physicians respond to various legal rules.

Green [44] constructs a model to analyze how changes in the legal standard of care affect physician behavior when patients are not able to observe physician action. In addition, the model considers how the standard of care influences the probability that an injured patient will file a claim. Green predicts that an increase in the negligence standard will lead to an increase in the level of compliant treatment and an indeterminate change in claim rates. The results suggest that the patient's cutoff point for filing a claim will increase as the court's cutoff point for finding negligence increases, but that the likelihood of the court finding negligence decreases, leading to the indeterminacy. The present model sharpens this prediction by endogenizing the probability that the patient will file a claim, the probability that the physician will satisfy the standard of care and the probability that the court will find negligence. Therefore, a definite prediction can be made regarding claim rates. In addition, Green's model does not consider the influence of MCO-physician contracts on physician behavior. The present model takes into account how legal rules affect contract choices and how different contracts affect physician behavior.

Blomqvist [14] develops a formal model of health care markets with incomplete information to evaluate the efficiency of two structures: (1) the provision of medical services by physicians paid by conventional insurers under fee-for-service contracts and (2) the provision of medical services by physicians employed by MCOs. The study also proposes a liability rule designed to mitigate the negative effects of information asymmetries that cannot be remedied by simply switching to the second structure. The study's results are limited, however, by the fact that the industry's organization is exogenous to the model. The present study assumes that the organization of health care markets (specifically, how insurers contract with health care providers) will adjust to the legal regime. This allows for a richer understanding of how behavior adapts to various legal environments.

Danzon's [26] study of physician behavior under various legal regimes[11] appears to be most closely related to the present study. She uses simulation analysis to examine behavior and outcomes under various MCO contracts (i.e., capitation and

[11]Specifically, she considers no liability, negligence and strict liability regimes.

fee-for-service reimbursement). The main result of the study is that outcomes depend greatly on whether the physician is assumed to be purely selfish or a moderately good agent for patients. As in the previously mentioned studies, however, the model does not allow physician contracts to adjust to various legal regimes. Therefore, the predictions of the model are limited in their descriptive ability.

These studies, while providing important insights into the behavior of various actors in health care markets, do not consider how MCOs adjust contracts to account for changes in legal rules. Given the modern structure of the health care industry, a richer understanding of treatment and litigation decisions is gained by exploring how various contract types affect physician treatment choices and how these contracts change as legal rules evolve.

2.2.3 Mandatory Disclosure Laws

As of 2001, 21 states have passed some form of mandatory disclosure statute. The purpose of these rules is to force MCOs to disclosure information about the types of health care provider contracts used to obtain medical services for their enrollees. Rather than regulate the types of contracts MCOs are able to use, the states simply force disclosure and allow consumers to choose a health plan based, in part, on the types of provider contracts used by MCOs.

Several papers addressing disclosure rules provide useful background information. For example, Hellinger [50] provides details on disclosure rule proliferation and a brief discussion of the debate surrounding these rules. The study lists the states with a disclosure law in place and discusses the variations in content required to be disclosed. Proponents of mandatory disclosure laws argue that the consumer should be provided with the appropriate information to be able to make an informed decision about which plan to join. On the other hand, opponents argue that consumers are unable to assess the ramifications of certain types of contracts.

Morreim [76] focuses on who should be required to disclose contract information, what information should be disclosed and how disclosure rules should be implemented.

Morreim suggests that both MCOs and physicians should be required to disclose information about provider contracts. He also provides a sample disclosure and discusses the importance of balancing the provision of information on cost controls and conflicts of interest with an explanation of why cost controls are sometimes in the patient's best interest.

Miller and Horowitz [73] address the challenge of informing consumers about MCOs provider contracts without doing harm to the physician-patient relationship. The article discusses data suggesting that patients do not understand fully the incentives used in provider contracts. Patients tend to trust physicians despite the incentives and are hesitant to believe that physicians make treatment decisions based on financial considerations. Miller and Horowitz offer suggestions for altering disclosures to increase the salience of incentive information without eroding the trust relationship between the patient and physician.

Hall, Kidd and Dugan [46] evaluate whether disclosure accomplishes the goals it sets out to achieve. The study is based on interviews of academics, public policy analysts, regulators, health plan representatives, patient and consumer advocates and a private lawyer. A general consensus was reached among the participants that consumers generally do not understand disclosures or use them to choose a health care plan. In addition, the participants agreed that disclosures should also aim to educate consumers about the benefits of cost controls; but, many pointed out that MCOs might avoid this because of the risk of disclosing information that does not comply with the law. The article offers suggests using a "layered approach" to provide information to consumers in a manner that is best fitted to the decisions and concerns faced by them at different times.

Miller and Sage [74] provide a useful summary of the state of disclosure laws and discuss the potential problems with implementing the rules. The authors note that forced disclosure has many benefits. It increases consumer bargaining power and results in informed choices over health plans. In addition, forcing disclosure might discourage use of compensation methods that compromise patient's access to treatment.[12] The study considers how the content, timing and scope of disclosure might affect the physician-patient relationship.

In a recent and quite comprehensive study, Sage [83] summarizes the debate over whether information disclosure is an effective means to regulate health care markets. The debate is presented in terms of the various rationales supporting disclosure laws: (1) to increase competition among MCOs, (2) to strengthen agency relationships and enforce fiduciary duties, (3) to mitigate the negative effects of incomplete information, and (4) to increase public awareness and political accountability. The article offers specific recommendations for optimal methods of disclosure.

While these papers provide interesting perspectives on disclosure rules, none studies the complicated effects of these rules on health care actors' behavior. In particular, no study evaluates how these rules lead MCOs to choose different contracts which influence treatment and litigation decisions. Without a comprehensive analysis of the behavioral effects of these rules, the usefulness of normative prescriptions is limited.

The purpose of designing the model presented *infra* in Chapter 3 is to analyze the effects of contract disclosure rules on MCO contract choices, physician treatment decisions and patient litigation decisions. No study of disclosure laws seems to analyze formally the effects of these laws on behavior in health care markets.

2.2.4 Medical Malpractice Damage Rules

The theoretical model presented *infra* in Chapter 3 also provides a means to evaluate the efficiency of medical malpractice damage rules courts implement when an injured patient proves that a physician's negligent behavior caused her injury. The two most commonly used damage rules are the all-or-nothing rule[13] and the loss-of-a-chance rule.[14] Studies that analyze the efficiency of medical malpractice damage rules are sparse.

[12]The study presented in Chapter 3 focuses on this particular benefit.

[13]The all-or-nothing damage rule awards no compensation if the chance of recovery with treatment is less than one-half. If this probability is at least one-half, then the patient recovers full compensatory damages if the physician's treatment choice did not meet the legal standard of care.

[14]The loss-of-a-chance rule provides compensation for only the lost chance of recovery related to a physician's negligent action.

King [59] analyzes the all-or-nothing damage rule and suggests that courts employ a loss-of-a-chance framework to more fairly compensate an injured patient for losses due to negligent care. King points out the importance of properly valuing a "chance of avoiding some adverse result or of achieving some favorable result." In particular, he notes that allowing recovery for lost chances contributes to the optimal allocation of resources by internalizing externalities. In adopting the loss-of-a-chance rule, some courts expound on the deterrence effects of various medical malpractice damage rules.[15]

In a recent article, Fischer [36] justifies applying the loss-of-a-chance rule by arguing that it provides better deterrence than the all-or-nothing rule.[16] He lists several rationales for the loss-of-a-chance rule including (1) the fact that "chance has value" and is therefore entitled to legal protection, (2) interference with the victim's personal autonomy justifies imposing liability for the loss of a chance, (3) fairness requires recovery where "the defendant's tortious conduct creates the lack of evidence that prevents the plaintiff from proving damages by a preponderance of evidence," and (4) efficient deterrence is achieved by shifting the loss of a chance to the potential injurer.[17] Fischer offers limiting principals for the application of the loss-of-a-chance damage rule that will prevent the plaintiff from escaping the burden of proving that the defendant's action actually caused the injury.

The present study considers the efficiency of both the all-or-nothing rule and the loss-of-a-chance rule in the context of the model used to analyze the effects of different legal rules on behavior in health care markets. The analysis goes one step further than previous studies by analyzing how these rules affect MCO contract choices which in turn influence physician treatment choices and patient litigation decisions. By stretching the analysis to include the MCOs contract choice, the precise inefficiencies

[15]See *Roberson v. Counselman*, 235 Kan. 1006, 686 P.2d 149 (1984) (concluding that the all-or-nothing rule "declares open season on critically ill or injured persons."); *Shively v. Klein*, 551 A.2d 41 (Del. 1988) (arguing that the physician should be held responsible for any decrease in the patient's chance of recovery).

[16]This article refers to similar studies regarding the evolution and application of the loss-of-a-chance rule.

[17]The analysis presented in Chapter 3, however, will show that this damage rule will not lead to efficient behavior when litigation is costly and the victim is not able to observe the injurer's action.

of the damage rules can be characterized.[18]

2.2.5 Tortfeasor Rules

A significant literature is devoted to the study of enterprise liability (also known as vicarious liability) and the influence of tortfeasor rules on outcomes.

Kornhauser [61] shows that, under certain conditions, individual liability[19] and enterprise liability[20] will result in identical injurer behavior.[21] Kornhauser assumes that the principal can only condition the wage on whether an accident occurred (and not on the level of care taken by the agent). He offers two arguments to support the "equivalence" claim. First, if the legal environment allows employment contracts to include indemnification[22] and insurance claims,[23] the principal is able to transfer liability to or from the agent under any tortfeasor rule. Therefore, the principal can induce the agent to perform identically under any rule. In fact, Kornhauser argues that "[i]f these provisions were strictly barred, the two liability regimes would lead to different care levels...." Second, by conditioning wages on the outcome, the principal is able to create incentives for the agent to take the optimal amount of care (according to the principal).

The Neutrality Result presented *infra* in Section 3.8 shows that, under the conditions of the present study, individual liability and enterprise liability will result in identical treatment *and* litigation decisions. The formal result confirms that the conclusions drawn by Kornhauser apply in the presence of litigation costs and victim

[18]See *infra* Section 3.7 for a formal analysis of the inefficiencies of both damage rules when litigation is costly and the victim is unable to observe the action of the injurer.

[19]Individual liability holds the agent who acted liable, but not the principal.

[20]Enterprise liability holds the principal liable for the wrongful acts of its agents.

[21]The study also considers the effects of vicarious liability under various market conditions including the presence of wealth-constrained agents, significant transaction costs, the employer's ability to condition wages on care levels, proof problems, conflicts of interest and the employer's ability to communicate incentives, screen and supervise. If any of these conditions is present, then enterprise liability and individual liability might not produce identical outcomes. The present study does not consider these cases, but could easily be extended to account for them.

[22]Indemnification clauses bind the agent to reimburse the principal for any liability imposed on the principal due to the agent's actions.

[23]An insurance claim is a device the principal can use to insure the agent against liability resulting from the agent's action.

uncertainty over whether the injurer met the legal standard of care. In addition, the results show that, in contrast to Kornhauser's claim, indemnification clauses and insurance are not necessary for the result to hold. In other words, identical outcomes result even if the principal is not able to condition wages on outcomes. The Neutrality Result is based on the notion that the principal must compensate the agent through the wage contract in order for the physician to accept exposure to liability (i.e., agree to work as a physician). Therefore, regardless of the tortfeasor rule, the principal always incurs the cost of ex ante exposure to liability and induces the agent to perform identical actions regardless of the tortfeasor rule. The Neutrality Result provided in the following Chapter can be viewed as a generalization of Kornhauser's equivalence result.

Sykes [98] also considers the differences in outcomes caused by various liability regimes when precautionary behavior is influenced by financial incentives to exercise care, but the level of care is under the exclusive control of the agent.[24] Sykes considers only the case in which the agent is judgment-proof (i.e., the agent's wealth is less than the total damage award), arguing that "[i]f the agent is not judgment proof, then any Pareto optimal agency agreement in the absence of vicarious liability can be contractually recreated after the imposition of vicarious liability." Sykes does not make any claims regarding what the legal environment must allow for this claim to hold (e.g., indemnification and/or insurance).[25]

Others have considered the differences between enterprise liability and individual liability when the conditions are not such that equivalent outcomes result under each rule. For example, Latin [67] analyzes tortfeasor rules under the assumption that actors are severely restricted by cognitive constraints. Polinsky and Shavell [81] suggest that different tortfeasor rules result in different behavior if the principal is not

[24]The study also considers differences in outcomes under other circumstances such as when the principal can monitor the agent's level of care.

[25]In a second article covering the same topic, Sykes [97] analyzes the differences between Kornhauser [61] and Sykes [98]. The article focuses mainly on the trade off between optimal risk sharing between risk averse principals and agents and the optimal incentives for care. The analysis of the present study assumes risk neutrality of all parties. The model, though, could be extended to consider the effects of risk aversion.

able to penalize the agent an amount more than the amount of the harm his actions might cause.[26]

Relatively few studies focus on the theory of enterprise liability in the context of health care markets. Sage [84] considers the political aspects of imposing lability for medical malpractice on managed care organizations as they relate to the Clinton health plan proposal. The study includes an analysis of the law's response to managed care in terms of using medical malpractice liability as a deterrent. Sage makes several general suggestions for socially constructive federal legislation and identifies a set of principles that should guide policy.

Epstein [33] analyzes the efficacy of enterprise liability and other governmental regulation of health care markets by comparing the medical malpractice system to the federal workers' compensation system. He maintains that regulations, including imposing liability for medical malpractice on MCOs, might cause more problems than they solve. For example, he warns that if injured patients are allowed to sue MCOs, "the physician [could] join forces with the patient in attacking the health plan for its distant and hostile attitude to the welfare of plan participants." He argues for contract solutions and suggests that relying on reputation effects might lead to more efficient outcomes.[27]

While contributing greatly to the understanding of how the structure of liability affects health care markets, these studies do not analyze formally how tortfeasor rules combine with disclosure rules to affect contract, treatment and litigation choices. Without a clear understanding of the effects of legal rules on the behavior of actors in health care markets, normative prescriptions are severely limited in their ability bring about efficient outcomes. The theoretical model presented in Chapter 3 facilitates a formal analysis of tortfeasor rules. The present study offers predictions regarding how

[26]Other studies considering the differences between enterprise liability and individual liability include Stone [96], Kraakman [63], Macey [70], Chapman [22], Croley [24], Segerson and Tietenberg [90], Schwartz [87], and Arlen and Kraakman [4]. None of these provides a formal analysis of the differences between enterprise liability and individual liability given litigation costs and uncertainty regarding the injurer's action.

[27]Several other studies were written about enterprise liability after the demise of the Clinton health plan. See, e.g., Abraham and Weiler [1], Furrow [39], Sage et al. [85] and Havighurst [48].

MCO contract choices react to various tortfeasor rules.

The following section summarizes and critiques the empirical findings regarding how legal rules affect medical malpractice insurance premiums and other indicators.

2.3 Empirical Analyses

Chapter 4 presents an empirical analysis of the effects of mandatory disclosure laws and damage caps on claim rates and ex ante expected damages. Although no previous empirical study considers mandatory disclosure laws, many studies have examined the effects of damages caps, not only on claim rates, but on other variables of interest including severity of claims paid by insurance companies to cover losses caused by insured physicians, medical malpractice insurance premiums and insurance industry profitability. The evidence seems to be mixed: the literature does not provide a definitive answer regarding the effects of damage caps. To illustrate, a summary of several studies is provided here. Following the summary is a brief analysis of the literature.

2.3.1 Summary of Empirical Studies

Table 2.1 provides a summary of results from empirical studies described in this section.

Danzon's [29] seminal study on the effects of tort reforms on medical malpractice claim frequency and severity finds that torts reforms significantly affect both measures. Although Danzon does not estimate the effect on claim rates of damage caps independent of other legal reforms,[28] she includes damage caps as one of the legal reforms under investigation. She employs data on claims closed in 1970 and 1975–78 gathered by insurance company surveys. Results from pooled, cross-section equations show no evidence that tort reforms (including damage caps) taken together

[28]Danzon considers four independent variables in her study: an aggregate total number of 12 possible reforms which were passed, limits on attorney contingent fees, reduction in the statute of limitations and the number of years of the new statute of limitations.

Summary of Empirical Results Related to Damage Caps

	Effect of Damage Caps on					
	Premiums	Losses	Price	Claim Rate	Claim Severity	Risk
Danzon [29]					↓	
Danzon [27]					↓	
Sloan [93]					↓	
Sloan [94]	NE					
Zuckerman [103]	↓[a]			NE	↓	
Barker [8]			↑			↓[b]
Viscusi [101]	NE	↓[c]	NE			
Viscusi [100]	NE	↓	↑			
Gius [41]	NE					
Bhat [11][d]	↓			↓		
Bhat [11][e]	NE			↑		

Table 2.1: This table summarizes the empirical literature focusing on how damage caps affect various insurance industry measures. "NE" indicates "no effect." "Losses" are a measure of the amount paid out by insurance companies for claims against insured physicians won by injured patients though settlements or judgments. "Price" refers to the cost of $1 of coverage calculated by dividing total premiums received by total losses paid. "Risk" refers to the probability that the actual losses an insurer faces differ from expected losses. The standard deviation of the loss ratio is used as a proxy for underwriting risk.
Only first authors are mentioned. See bibliography for full list of authors.

a decrease for cap on total damage amount recoverable (NE for caps on non-economic damages only)
b decrease for some types of insurers only
c for non-economic damage caps only (not punitive damage caps)
d economic and non-economic damages taken together
e non-economic damages considered alone

contributed to post-1975 claim rates. She does, however, find that caps significantly lower claim severity.[29]

Sloan [94] performs a similar analysis, except that he uses premiums paid by physicians in three fields. The observational unit is the state, and the study incorporates data covering the years 1974–1978. Sloan runs two specifications: (1) premiums levels as the dependent variable and (2) annual percentage change in premiums as the dependent variable.[30] He finds that damage caps significantly affect neither premiums for any of the three fields tested nor annual percentage change in premiums.

Zuckerman et al. [103] take another look at similar issues using data covering a 13-year period—1974 through 1986. The unit of observation is individual insurance companies. Most states were included in the analysis. The study finds that caps significantly reduce premiums and claims severity. Interestingly, the study found that caps did not have a significant effect on claim rates. The authors suggest that the incongruent results might be due to the methods used to collect the data (i.e., many companies that provided data on premiums were not included in the survey of insurers to collect frequency and severity data).

Other studies take a different tack by investigating how tort reforms, including damage caps, affect the insurance industry's performance. Barker [8] empirically investigates how damage caps affect relative medical malpractice insurance prices, profitability of the insurance industry and underwriting risk. Barker uses statewide loss ratio data from 1977–1986. The loss ratio (i.e., the ratio of incurred losses to earned premiums) is often used as a proxy for the relative price of insurance. The standard deviation of the loss ratio acts as a proxy for underwriting risk. Barker finds that damage caps significantly improve relative underwriting profits. The effect of caps on underwriting risk depends on the type of insurance company. Caps had no

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[29] Danzon [27] updated this study using nationwide claims experience for the years 1975–1984 gathered through insurance company surveys. She controls for endogenity by using a two-stage least squares estimator. Again, she finds that damage caps significantly reduce claim severity. Sloan et al. [93] replicated this finding using data on indemnity payments during the years 1975–1978 and 1984.

[30] The models account for fixed effects with the use of a covariance model, using state dummies to control for omitted state effects on premiums and year dummies to account for time-related effects common to all states.

significant effect on the underwriting risk of national agencies or direct writers. They did, however, significantly decrease underwriting risk for state agencies.

Viscusi et al. [101] focus mainly on the effects of the second generation of tort reforms to be implemented by state legislators. These reforms took effect during the mid-1980s when the second (perceived) medical malpractice crisis hit the U.S. This study uses 1988 aggregated premiums and losses by state and considers the change in premiums and losses from 1985 to 1987. The analysis controls for differences in state regulation of insurers. The authors considered limits on non-economic damages and limits on punitive damages. The only significant result indicated that limits on non-economic damages significantly reduce losses. Limits on non-economic damages did not affect premiums or loss ratios. In addition, limits on punitive damages did not affect losses, premiums or loss ratios.

Viscusi and Born [100] extend the study of Viscusi et al. [101] by examining the effect of liability reform on medical malpractice insurance over the 1984–1991 period. Rather than using data aggregated by state, the authors employ firm-level data for every firm writing medical malpractice insurance during the period of interest. They find that damage caps significantly decrease loss ratios and incurred losses.[31] They find, however, that damage caps do not significantly affect earned premiums.[32]

Gius [41] challenges the methodology of some previous studies[33] by pointing out that state-level heterogeneity must be taken into account when examining the effects of tort reforms and other factors on medical malpractice insurance premiums. He employs a panel data set consisting of observations from all 50 states for the years 1976–1990. He finds that when state-level differences are controlled, damage caps do not have a significant effect on premiums. He concludes that results from previous studies that do not account for state-level differences might be biased.

The most extensive study of the effects of legal rules on medical malpractice insur-

[31] The study employs several specifications to test the robustness of the results.

[32] Born and Viscusi [16] find similar results using data from 1984–1991 and employing quantile regressions to account for differences in effects of the reforms across insurer profitability and size distributions. They do find, however, that damage caps do not have a uniform effect on premiums across the distribution of insurers.

[33] E.g., Barker [8], Sloan [94] and Zuckerman [103].

ance was recently reported by Bhat [11]. He examines the influences of legal reforms on several indicators including claim rates, severity of claims and premiums. Using data on the payment rate per physician of each state for the period 1991–1995, Bhat finds that caps on economic and non-economic damages (taken together) are likely to reduce malpractice payment rates. Caps on non-economic damages (taken alone), however, increase payment frequencies. In addition, using the same data, he finds that caps on economic and non-economic damages encourage settlement. Caps on non-economic damages, though, do not affect the likelihood of settlement. Finally, Bhat considers the effects of caps on medical malpractice insurance premiums.[34] He finds that caps on economic and non-economic damages significantly decrease premiums.[35] Similar to other results, he finds that caps on non-economic damages have no effect on premium levels.

2.3.2 Reconciliation and Critique of the Empirical Literature

The purpose of this section is to reconcile and critique the studies summarized in the previous section. In addition, the studies' results will be compared to the theoretical predictions of the model presented in Chapter 3 and the empirical results reported in Chapter 4.

Most studies, including the present analysis, find that damage caps have no effect on premiums. Zuckerman et al. [103] and Bhat [11], however, find that damage caps significantly decrease premiums. Although the studies testing the effect of caps on premiums employ different methodologies and incorporate different independent variables to control for other determinants of premiums, particular specification choices may account for the results obtained by Zuckerman et al. and Bhat.

Zuckerman et al. might have found that damage caps significantly decrease premiums because of the unique specification they use to test the prediction. They regress each year's premiums on *prior year* legal rules to account for the fact that insurers

[34]Bhat employs malpractice premiums of Class 3 doctor-mature claims-made rates at $1 million to $3 million limits of the St.Paul Fire and Marine Insurance Company for 1990–1994.

[35]This result is significant, though, at only the 0.10 level.

set premiums for a particular year at the beginning of that year; therefore, only legal rules in effect during the prior year can influence premium levels. The present study reported in Chapter 4 reports results derived from this particular specification and finds that the coefficient on damage caps becomes more negative and more statistically significant (although not statistically significant at the 10% level) compared to the results obtained by regressing each year's premiums on the current year's legal rules.

Bhat's analysis is also unique. His is the only study that controls for the lengthy delay from filing to resolution common among medical malpractice claims. This attempt to control for the timing of claims is akin to that used by Zuckerman et al. and the present study and may account for the significance of the coefficient on damage caps.

Next consider the findings regarding how damage caps affect losses incurred by insurers. Only two other studies investigate the relationship between losses incurred and damage caps (Viscusi and Born [100] (finding that damages caps reduce incurred losses by between 15% and 30% with estimates statistically significant at a 95% confidence level) and Viscusi et al. [101] (finding that limits on non-economic damages lower incurred losses by 45% with the estimate statistically significant at the 90% confidence level)). The present study finds that damage caps of any sort reduce incurred losses by roughly 30% (statistically significant at the 95% confidence level). Therefore, the present results are consistent with results from previous studies, but not with the theoretical predictions provided in Chapter 3.[36]

Finally, consider the results related to claim rates. The theoretical model presented in Chapter 3 predicts that damage caps lead to (weakly) higher claim rates.[37] The results reported by Zuckerman et al. [103] support this claim. Bhat's [11] study, however, reports inconsistent results. Using a generalized estimation equation methodology to account for the fact that claim rates follow a Poisson distribution, Bhat finds that claim rates are 0.5% *higher* when non-economic damages are capped

[36] See Section 4.4.3 for a possible explanation of this discrepancy.
[37] See *infra* Section 3.6 for details behind this claim.

and 0.8% *lower* when both economic and non-economic damages are capped.[38] Bhat does not offer an explanation for this discrepancy. Consider the following explanation derived from the theoretical model presented in Chapter 3. The model shows that claim rates will increase as damages decrease unless the damage cap is so restrictive that litigation costs exceed recoverable damages. When this occurs, claim rates actually decrease because injured patients will not pursue claims when the recoverable amount will not cover litigation costs. When both economic and non-economic damages are capped, damages are more likely to fall below litigation costs than when only non-economic damages are capped. Therefore, Bhat's results do not seem completely anomalous.

All empirical results related to claim severity indicate that the average severity of claims paid is lower when damage caps are imposed. These results are consistent with the theoretical predictions specified in Chapter 3. Finally, it should be noted that the theoretical model does not make predictions about the relationship between damage caps and the price of medical malpractice insurance or underwriting risk. These results are included in Table 2.1 to provide a more complete picture of the research regarding the effects of damage caps on the medical malpractice insurance industry.

2.4 Conclusion

Health care law and economics has received a great deal of attention from scholars. Much has been written about the effects of legal rules on behavior in health care markets. This study aims to contribute to each of the literatures described in this Chapter to advance our understanding of the behavior of MCOs, physicians and injured patients given particular legal regimes.

First, most formal models of litigation and deterrence in cases where the victim is uncertain about whether the injurer met the legal standard of care assume that the patient's belief regarding the injurer's action is exogenously determined. The

[38]Both coefficients are statistically significant at the 1% confidence level.

theoretical model provided in Chapter 3 assumes that the victim's belief over the injurer's action is a function of the legal environment and the injurer's incentives. The model monopolizes on the fact that as the legal environment changes, so will the actions of the injurer. This, in turn, will alter the beliefs of the victim and the likelihood that the victim will file a claim against the injurer. By noting this seemingly trivial aspect of litigation, we gain a more thorough understanding of behavior in health care markets.

Second, many important studies have advanced our understanding of how physicians react to changes in legal rules governing the provision of medical care. Many of these studies also focus on how physician behavior changes under different compensation structures. The formal model takes this research one step further by observing that MCOs will react to changes in the law, as well. Physician behavior is better understood if we fully comprehend how legal rules affect MCO decisions over physician compensation methods.

Third, since the first mandatory disclosure law went into effect in 1996, several scholars have commented on the efficacy of disclosure laws in bettering the health care plan selection process and suggested ways in which the rules can be implemented to least disturb the physician-patient relationship. None of these studies, however, considers how disclosure laws will affect behavior in health care markets. The present study investigates how disclosure laws affect MCO contract choices, physician treatment choices and patient litigation decisions.

Fourth, comparisons have been made between various damage rules courts use to compensate patients injured by negligent physicians. In particular, many studies argue that the loss-of-a-chance rule better compensates injured patients than the all-or-nothing rule. The results of the model in the following Chapter take the analysis of damage rules one step further. Using the predictions of behavior under varying legal regimes, an efficient damage rule is constructed. The efficient rule is used to characterize the specific inefficiencies of both the all-or-nothing rule and the loss-of-a-chance rule.

Fifth, several scholars have identified the pros and cons of enterprise liability, generally and in the context of health care markets. The model presented *infra* in Chapter 3 generalizes Kornhauser's equivalence claim. In addition, the model's results are extended to provide predictions of how various tortfeasor rules will affect the types of contracts MCOs will use to compensate physicians.

The empirical analysis presented in Chapter 4 attempts to update the results regarding how damage caps affect claim rates. In addition, the analysis provides a first look at how mandatory disclosure laws affect claim rates. Before the empirical analysis is presented, however, Chapter 3 will provide a theoretical framework facilitating the study of the interactions between legal rules and behavior in health care markets.

Chapter 3 An Equilibrium Model of Behavior in Health Care Markets

3.1 Introduction

National health expenditures as a percentage of gross domestic product have been increasing steadily. They rose from roughly 9% in 1980 to approximately 13% in 2000 and are projected to increase to approximately 16.5% by the year 2010.[1] The significant and growing size of the health care industry coupled with its inherent market imperfections justify the voluminous literature related to it.

How judicial and legislative rules affect behavior in health care markets has been widely studied.[2] Despite the attention devoted to this field, our understanding of the intricate interactions between legal rules and behavior remains blurred. Most studies focus narrowly on one or two actors and do not account for how legal rules affect the contracts managed care organizations ("MCOs") use to compensate physicians. These effects are important to study because they influence treatment decisions made by physicians and litigation decisions made by injured patients. The purpose of this paper is to take another step toward clarifying exactly how legal rules affect behavior in health care markets by including a wide range of actors and analyzing how the behavior of one affects the choices of the others. Understanding these interactions aids in discovering whether legal rules achieve desired goals and lead to efficient outcomes.

Even though judges and legislators create legal rules with specific goals in mind, they might perversely affect the behavior of actors they influence. For example, courts

[1]These statistics were reported by the Centers for Medicare & Medicaid Services, Office of the Actuary, National Health Statistics Group. Information is posted on the web at http://cms.hhs.gov/researchers/.

[2]See Danzon [25] and McGuire [72] for recent literature reviews.

might assume that decreasing damage awards will reduce the number of lawsuits filed. This might not be the case, however. When courts reduce damages, those with legal duties might benefit by taking fewer precautions even though they might face lawsuits if injuries result from their negligent acts. This, in turn, might lead to an increase in injuries and a resulting increase in lawsuits. Unless law makers consider the incentives of all actors involved, predictions of the effects of changes in the law could be misguided. Furthermore, unless we have a clear understanding of the effects of current legal rules on behavior in health care markets any normative analysis of these legal rules is severely limited. For these reasons, a theoretical investigation of how current legal rules affect behavior in health care markets is an important step toward successful legal reform.

The purpose of this paper is to investigate how particular judicial and legislative rules affect behavior in health care markets. Specifically, the paper develops a game theoretic model to provide insight into how certain legal rules affect contracting between physicians and "MCOs," physician treatment choices and litigation decisions by injured patients. In the first stage of the model, the MCO considers the cost of compliant treatment[3] and expected damages from a medical malpractice lawsuit and chooses a contract to obtain medical services for its insured patient (in need of medical treatment). Knowing the contract terms selected by the MCO, the physician then determines whether he will provide compliant treatment to the insured patient. Compliant treatment is assumed to be more costly than non-compliant treatment, but results in a positive outcome for the patient more often than non-compliant treatment. Given the physician's action, Nature chooses whether the patient will enjoy a positive outcome or suffer a negative outcome. If a positive outcome is realized, the game ends. If a negative outcome occurs, the patient, not able to ascertain whether the physician provided appropriate medical care, decides whether to file a costly negligence suit for medical malpractice. If a suit is filed, the court hears the case and

[3]Compliant treatment is treatment that meets the legal standard of care. For those not familiar with legal terminology, "standard of care" refers to the level of effort such that if an actor's effort level is equal to or above the specified level, the court does not assign liability to that actor for any related injuries.

rules on the issue of liability.[4]

The paper focuses mainly on how health care market actors react to disclosure rules. Some states require MCOs to disclose to their insured members the contract terms they use to compensate physicians for providing medical services to their members. As of 2001, 21 states require MCOs to disclose to enrollees physician compensation methods used (Miller and Sage [74]). Although mandatory contract disclosure is intended to provide prospective enrollees with information when choosing health plans, it also affects MCO contract choices, physician treatment decisions and litigation decisions by injured patients. Therefore, the analysis is performed assuming patients can observe the contract terms and again assuming they cannot. The results provide insights into the effects of disclosure laws on the behavior of health care market actors.

By analyzing a model of the interactions among actors in health care markets, I find that the relationship between the cost of compliant treatment and expected damages determines the MCO's contract choice. Also, the contract disclosure rule (i.e., whether the patient can observe the contract terms) affects the contract chosen by the MCO. Assuming damage awards exceed litigation costs, when contracts are observable and expected damages are high relative to the expected cost of compliant treatment, the MCO employs a standard fee-for-service contract with full reimbursement for cost and no fixed payment. The physician will compliantly treat with a probability high enough so that the patient will never sue, and the patient never sues. If damages are low relative to the expected cost of compliant treatment, the MCO prefers a capitated contract with no reimbursement for cost and a positive fixed payment to compensate the physician for exposure to liability. The physician will not provide compliant treatment and the patient will sue with certainty if a negative outcome is realized.

Actors behave somewhat differently when the patient is unable to observe the contract terms. In this case, when the court sets damages high relative to the cost

[4]Of course, a settlement might occur before this stage. See *infra* Section 3.4.3 for a discussion of this issue.

of compliant treatment, the MCO prefers a fee-for-service contract with partial reimbursement and a positive fixed payment to cover the physician's exposure to liability. The physician will compliantly treat at a probability high enough so that the patient does not sue with certainty. Unlike in the observable contract case, the patient will sue with some positive probability. Injured patients sue with a strictly positive probability because the patient is unable to observe the contract terms and so must use the threat of a lawsuit to ensure that the MCO encourages the physician to compliantly treat with some positive probability. When the court sets damages low relative to the cost of compliant treatment, however, actors behave as they would in the observable contract case. That is, the MCO employs a capitated contract with no reimbursement for the cost of treatment but a positive fixed payment to compensate the physician for exposure to liability. The physician never provides compliant treatment and the patient sues with certainty.

In addition, the model shows that, for any damage rule, regimes in which contracts are observable by patients will enjoy a lower rate of claims filed and a higher rate of compliant treatment than regimes in which contracts are not observable by patients. These results follow directly from the reasoning provided previously. First, consider the likelihood of claims. When contracts are observable, the patient can infer the physician's strategy based on the outcome and the contract terms. Therefore, upon realizing a negative outcome, the patient will never file a claim if the contract is fee-for-service and will file a claim with certainty if the contract is capitated. On the other hand, if the patient is unable to observe the contract, she cannot discover whether the MCO induced compliant treatment. When the cost of compliant treatment is low relative to expected damages, the patient finds it necessary to sue with some positive probability so that the MCO has an incentive to induce compliant treatment. Without the threat of a lawsuit, the MCO simply would never provide the physician with an incentive to meet the legal standard of care when making the treatment decision. For these reasons, the claims rate is higher in a regime in which contracts are not observable compared to a regime in which patients are able to observe them.

Next, consider the likelihood of compliant treatment under each regime. When the patient is able to observe the contract terms and the cost of compliant treatment is low relative to damages, the patient will never sue. Therefore, if the MCO induces compliant treatment, it will incur costs for the provision of treatment only. In contrast, if contracts are not observable, the patient always sues with some positive probability. This implies that if the MCO induces compliant treatment it incurs costs related to liability exposure in addition to the provision of compliant treatment. Therefore, the total expected costs incurred if the MCO induces compliant treatment are higher in a regime in which contracts are not observable. For this reason the MCO induces compliant treatment less often when patients are unable to observe the contract terms.

Given the analysis of behavior in observable and unobservable contract regimes, it is possible to characterize how adjusting damages (while holding constant all other variables not affected by behavior) affects behavior in each regime. Variations in treatment and litigation decisions resulting from changes in expected damages are examined both in observable contract regimes and in unobservable contract regimes. The observability of the contract significantly affects how treatment and litigation decisions react to changes in expected damages. In addition, when contracts are observable, patterns of behavior strongly depend on the cost of compliant treatment. These results display the danger in assuming that decreasing damages will lead to a decrease in medical malpractice claims. In addition, it might not be the case that increasing damages will lead to a subsequent increase in compliant treatment levels. The model's results suggest that changes in damages affect behavior in much more complex ways.

The results also suggest an efficient damage rule.[5] When compliant treatment is socially efficient (i.e., the cost of compliant treatment is low relative to its expected benefit), the court should set damages high so that the physician will (almost) always compliantly treat and the patient will (almost) never sue. The results show that, in this case, the MCO chooses a fee-for-service contract to compensate the physician.

[5]The efficient damage rule is constructed under the assumptions of the model. The model assumes that the court can perfectly verify the physician's action. Relaxing this assumption significantly changes the construction of the efficient damage rule. This is discussed *infra* in Section 3.7.

On the other hand, when compliant treatment is socially inefficient (i.e., the cost of compliant treatment is high relative to its expected benefits), the court should set damages equal to zero so that the physician will never provide compliant treatment and the patient will never sue. In this case, the MCO will pay the physician nothing. Interestingly, the court can obtain this (approximate) first-best outcome regardless of the observability of the contract terms. In addition, under the assumptions of the model, outcomes under the efficient damage rule do not depend on which parties an injured patient is allowed to sue.

The efficient damage rule is used as a benchmark to assess the efficiency of two commonly used damage rules: the all-or-nothing rule and the loss-of-a-chance rule. The analysis shows that both rules are inefficient because they merely attempt to compensate the patient for her loss in the event the physician does not meet the standard of care. For this reason, the rules provide inefficient incentives for the physician and the MCO to provide compliant treatment when it is socially optimal. The resulting inefficiencies depend on various parameters of the model and are summarized according to these parameters.

Finally, the model provides insight into the effects of allowing the patient to sue certain parties. Treatment choices and litigation decisions do not depend on whether the court allows the patient to sue the physician only, the MCO only or both. The expected costs of lawsuits effectively are built into the contract between the MCO and the physician. This result holds for any damage rule. Rules establishing potential defendants, however, might affect the type of contract the MCO prefers.

To summarize, the paper first presents predictions of the MCO's contract choice, the physician's treatment decision and the litigation decision by injured patients when the contract is observable and when it is not. Second, it presents results showing that more compliant treatment and fewer medical malpractice claims occur when contracts are observable. Third, it characterizes for all cases the reactions of treatment and litigation strategies to changes in damages. Fourth, it constructs an efficient damage rule to analyze two commonly used damage rules. Finally, it presents an analysis of how behavior is affected by rules regarding which parties the patient is allowed to sue.

The organization of the paper is as follows. Section 4.2 discusses the contributions made by this study in relation to several literatures. As a prelude to the details behind the formal model, Section 3.3 offers a simple numerical example to clarify the basic intuitions of the model. Section 3.4 develops the framework applied to study how legal rules affect behavior in health care markets. Section 3.5 provides a detailed analysis of the model's equilibria for observable contracts and unobservable contracts and discusses the intuition behind the results. The section also provides results showing that more compliant treatment and fewer claims occur when contracts are observable. All formal proofs can be found in the Appendix. Section 3.6 characterizes how treatment and litigation decisions vary as damages change. Section 3.7 suggests an efficient damage rule based on the results from Sections 3.5 and 3.6. The efficient damage rule is used as a benchmark to analyze the efficiency of two commonly used damage rules. Section 3.8 discusses the effects of rules regarding which parties the patient is allowed to sue. Finally, Section 3.9 concludes.

3.2 Background and Contributions

This paper contributes to several literatures related to general topics in law and economics and to more specific literatures devoted to the regulation of health care markets. This section is designed to identify the literatures to which the present study contributes and to clarify the insights that the analysis provides.

First, law and economics scholars have taken significant steps toward untangling the relationship between litigation and deterrence.[6] Polinsky and Shavell [82] construct a general model to study the effects of court error on a potential injurer's level of care decision and a victim's litigation decision when the victim does not observe the injurer's level of care. The model, however, assumes that the plaintiff's belief that the defendant is truly "guilty" is exogenous and not essential to the anal-

[6] See Brown [19], Landes and Posner [66] and Shavell [91] for comprehensive analyses of tort law and deterrence.

ysis.[7] The present study employs an equilibrium model of deterrence and litigation to account for the fact that, when deciding whether to take costly precautions, a potential injurer considers the possibility of litigation and, when deciding whether to sue the injurer, a victim updates her belief of injurer "guilt" by considering how legal rules affect injurer behavior.[8] Modelling behavior in this way captures the subtle interactions between damages, the likelihood of compliant treatment and the rate of claims. For example, in an attempt to reduce claim rates, many states have established maximum damage awards in medical malpractice cases (Browne and Puelz [20]). The present model suggests that the intended goal of reducing the number of claims might not be achieved by reducing damages. Depending on the relationship between compliant treatment costs and damages, lowering damages might lower the probability that the physician compliantly treats, which in turn could increase the probability that the patient is negligently injured and the probability that an injured patient will file a claim. Therefore, lowering damages could increase claim rates, contrary to the intended effect. Using an equilibrium model to analyze the complex interactions between damages, treatment decisions and litigation decisions illuminates the non-obvious potential effects of changes in legal rules.

Health care economics scholars draw on general models of agency relationships and litigation and deterrence to explore the imperfections of health care markets. Arrow's [5] seminal paper is the first of many to address health care market imperfections. A handful of studies focuses on how physicians respond to various legal regimes. For example, Green [44] constructs a model to analyze how litigation affects physician behavior when patients are unable to observe physician action. Blomqvist [14] uses a

[7]Several other studies do not account fully for the equilibrium effects of litigation. For example, see Simon [92] (assuming that the potential plaintiff costlessly collects a signal of the injurer's negligence); Schweizer [88] (modelling litigation and settlement by assuming that "nature provides the parties with information on the merits of the case"); Cooter and Rubinfeld [23] (modelling the choice between settlement and litigation by assuming that the subjective expected trial payoff to the plaintiff is determined solely by parties expenditures on the trial); Kaplow [57] (assuming the plaintiff's probability of victory does not depend on the incentives of the defendant to take care and concluding that increasing damages will lead to an increase in the plaintiff's willingness to sue).

[8]Examples of other models of litigation and deterrence that consider equilibrium effects in different settings include Png [80] (modelling litigation, liability and incentives for care to analyze the effects of the settlement process) and Bernardo, Talley and Welch [10] (constructing an equilibrium model to study the effects of legal presumptions on principal-agent relationships).

formal model of health care markets to propose a liability rule designed to mitigate the negative effects of information asymmetries. Danzon's [26] study of physician behavior under various legal regimes[9] appears to be most closely related to the present study. She examines behavior and outcomes under various MCO contracts (i.e., capitation and fee-for-service reimbursement). These studies, while providing important insights into physician behavior, do not consider how MCOs adjust contracts to account for changes in legal rules. Given the modern structure of the health care industry, a richer understanding of physician behavior can be gained by exploring how various contract types affect physician treatment choices and how these contracts change as legal rules evolve.

The purpose of designing the model presented here is to analyze the effects of contract disclosure rules on MCO contract choices, physician treatment decisions and patient litigation decisions. No study of disclosure laws seems to analyze formally the effects of these laws on behavior in health care markets.[10] Miller and Sage [74] provide a useful summary of the state of disclosure laws and discuss the potential problems with implementing the rules. In a recent and quite comprehensive study, Sage [83] summarizes the debate over whether information disclosure is an effective means to regulate health care markets. While these papers provide interesting perspectives on disclosure rules, neither studies the complicated effects of these rules on health care actors' behavior. In particular, no study evaluates how these rules lead MCOs to choose different contracts which influence treatment and litigation decisions. Without a comprehensive analysis of the behavioral effects of these rules, the usefulness of normative prescriptions is limited.

The model also provides a means to evaluate the efficiency of medical malpractice damage rules courts implement when an injured patient proves that a physician's

[9]Specifically, she considers no liability, negligence and strict liability regimes.

[10]Several papers addressing disclosure rules provide useful background information. For example, see Hellinger [50] (providing details on disclosure rule proliferation and a brief discussion of the debate surrounding these rules); Morreim [76] (focusing on who should be required to disclose contract information, what information should be disclosed and how disclosure rules should be implemented); Miller and Horowitz [73] (addressing the challenge of informing without doing harm to the physician-patient relationship); Hall, Kidd and Dugan [46] (evaluating whether disclosure accomplishes the goals it sets out to achieve).

negligent behavior caused her injury. Studies that analyze the efficiency of medical malpractice damage rules are sparse. King [59] analyzes the all-or-nothing damage rule and argues that employing a loss-of-a-chance framework more fairly compensates an injured patient for losses due to negligent care. King's study, however, does not consider how physician treatment choices respond to damage rules. In adopting the loss-of-a-chance rule, some courts expound on the deterrence effects of various medical malpractice damage rules.[11] In a recent study, Fischer [36] justifies applying the loss-of-a-chance rule by arguing that it provides better deterrence than the all-or-nothing rule. The present study goes one step further be analyzing how these rules affect MCO contract choices which in turn influence physician treatment choices and patient litigation decisions. By stretching the analysis to include the MCO's contract choice, the inefficiencies of the damage rules can be characterized.

Finally, the model facilitates a formal analysis of tortfeasor rules.[12] A significant literature is devoted to the study of vicarious liability and the influence of tortfeasor rules on outcomes. For example, Kornhauser [61] and Sykes [98] consider the effects of vicarious liability under various market conditions including the presence of wealth-constrained agents, significant transaction costs, the employer's ability to condition wages on care levels, proof problems, conflicts of interest and the employer's ability to communicate incentives, screen and supervise.[13] Although these conditions are not considered in the present study, the model easily could be extended to take them into account. A handful of studies focuses on the theory of enterprise liability in health care markets.[14] These studies, however, do not analyze formally how tortfeasor rules combine with disclosure rules to affect contract, treatment and litigation decisions.

[11]See *Roberson v. Counselman*, 235 Kan. 1006, 686 P.2d 149 (1984) (concluding that the all-or-nothing rule, which awards no compensation if the chance of recovery with treatment is less than one-half, "declares open season on critically ill or injured persons."); *Shively v. Klein*, 551 A.2d 41(Del. 1988) (arguing that the physician should be held responsible for any decrease in the patient's chance of recovery).

[12]Tortfeasor rules specify the parties an injured plaintiff may sue.

[13]Also see Latin [67] (analyzing tortfeasor rules under the assumption that actors are severely restricted by cognitive constraints); Polinsky and Shavell [81] (suggesting that principal-only liability is not optimal if the principal is unable to penalize the agent an amount more than the amount of the harm his actions might cause and that the negligence rule should govern sanctions on agents but not those on principals).

[14]For example, see Sage [84] and Epstein [33].

The present study offers predictions regarding how MCO contract choices react to various tortfeasor rules.[15]

Section 3.3 provides a numerical example to illustrate some of the results' intuitions.

3.3 Numerical Examples

This section provides numerical examples of the paper's basic results regarding how contract, treatment and litigation decisions react to disclosure rules. The first example assumes patients are able to observe the contract between the MCO and the physician. The second assumes that contracts are unobservable. The purpose of this section is two-fold. First, the examples help to illuminate the intuitions behind the model's results. Second, it offers a framework to keep in mind while digesting the general results.

3.3.1 The Observable Contract Case

This example assumes that patients are able to observe the contract the MCO uses to compensate the physician for providing medical services to the MCO's insured members. Assume the following about player payoffs. The MCO pays the physician a fixed payment (possibly zero), reimburses some amount (possibly zero) of the cost of treatment when the physician treats a patient and faces exposure to damages if a patient realizes a negative outcome and sues the MCO. The physician receives a fixed payment from the MCO and, upon treating a patient, pays the cost of treatment and is reimbursed some amount by the MCO. The physician also faces exposure to damages given a negative outcome and a lawsuit. Finally, the patient, upon realizing a negative outcome, must decide whether to sue without knowing the physician's action. In other words, an injured patient is unable to observe whether she received compliant treatment. If a lawsuit is filed, the patient pays some cost to pursue the

[15] See *supra* Section 2.2.5 for a detailed explanation of the differences between the vicarious liability literature and the results presented in this Chapter.

medical malpractice claim. The court perfectly verifies the physician's action and awards damages if the physician did not treat.[16]

Imagine a population of 100 identical patients experiencing the same medical condition. The condition is such that the probability of a positive outcome given non-compliant treatment is 40%. Compliant treatment provided by the physician will increase the chance of a positive outcome to 80%. If compliant treatment is provided, the physician will incur a cost of $10,000 per patient ($1,000,000 to treat all 100 patients). No cost will be incurred for non-compliant treatment.[17] If a patient experiences a bad outcome, the cost of bringing a lawsuit is $5,000.[18]

Consider the outcome under various damage levels. First, imagine that if a patient experiences a negative outcome, files a lawsuit and wins in court (or settles), the MCO and physician collectively must pay the patient $4,000 in damages. At this damage level, the patient will not file a lawsuit because litigation costs ($5,000) exceed damages ($4,000). Knowing this, the MCO will pay the physician nothing and the physician will not compliantly treat.[19]

Consider the outcome if expected damages increase to $5,500.[20] In this case, the

[16]The model is sufficiently general such that the court can provide a variety of incentives by specifying any standard of care it wishes. For example, the court might award damages if the physician does not implement the treatment that is customary in a particular locality given the patient's condition. Alternatively, the court might award damages only if the net benefit from the physician's action is greater than the cost. Therefore, imposition of liability "if the physician did not provide compliant treatment " can be interpreted in many different ways depending on the standard of care the court specifies.

[17]The cost of non-compliant treatment is normalized to zero for ease of computation. Identical results would obtain if the model assumed a strictly positive cost of non-compliant treatment. The only necessary assumption is that the cost of compliant treatment must exceed the cost of non-compliant treatment.

[18]Note that the primitives of the model are the probability that a positive outcome results given compliant treatment, the probability that a positive outcome results given non-compliant treatment, the cost incurred by the physician to provide compliant treatment, the cost to an injured patient to file and pursue a medical malpractice claim, damages payable by a negligent physician and/or MCO, the value of health for a patient who experiences a positive outcome and the insurance premium paid by an enrollee to the MCO for health care insurance.

Note that optimal court rules are not considered in Sections 3.3 through 3.5. See *infra* Section 3.7 for the development of an optimal court rule under the conditions of the model.

[19]Note that calculations for all numerical examples are derived from the formal propositions provided in Section 3.5.

[20]To simplify the example, assume that damages must be paid jointly by the MCO and the physician. Section 3.8 will reveal that treatment and litigation decisions do not depend on which parties the patient is allowed to sue. This results from the fact that the physician will reject the

MCO knows that injured patients have some incentive to sue because expected damages exceed litigation costs. Therefore, it compares the expected cost of compliant treatment and expected damages given non-compliant treatment to decide whether to employ a fee-for-service contract (to induce compliant treatment and avoid litigation) or a capitated contract (to avoid costly compliant treatment and accept exposure to damages). If the MCO chooses a fee-for-service contract, its total expected treatment cost is roughly \$230,000 (23% of \$1,000,000) because the physician need only compliantly treat 23% of the 100 patients to deter injured patients from suing.[21] Recall that patients face litigation costs if they sue partly due to the fact that they are unable to observe the physician's action in each case. Therefore, if the physician compliantly treats a high enough number of the 100 patients, each injured patient will find litigation too risky to pursue. Although the patients are unable to observe the physician's action in each case, they are ensured that the physician compliantly treated some number of patients because contract terms are observable; therefore, they know that the physician was compensated with a fee-for-service contract and compliantly treated just enough patients such that no patient would risk filing a lawsuit.

On the other hand, if the MCO chooses a capitated contract, it expects to pay \$330,000 in damages (100 patients x \$5,500 expected damages x 60% probability of a negative outcome given non-compliant treatment). Therefore, the MCO will choose a fee-for-service contract (\$230,000 < \$330,000). The physician will compliantly treat 23 of the 100 patients and no injured patient will file a medical malpractice claim. Even though the cost of compliantly treating an individual patient exceeds expected damages if that one patient sues, the physician must compliantly treat only a few patients to avoid lawsuits because the patient's expected gain from a successful lawsuit is low (\$5,500–\$5,000=\$500).

contract unless the MCO absorbs the physician's exposure to liability. Therefore, the MCO considers total expected damages regardless of whether the patient sues the MCO. The form of the contract, however, does depend on the group of potential defendants.

[21] Studies have shown that MCOs sometimes authorize disparate treatment for similarly-situated patients. For example, Peters and Rogers [79] report a study of authorizations for bone marrow transplants to treat breast cancer. They found that MCOs approved the treatment in 77% of all cases and denied identical treatment in 23% of similarly-situated cases, claiming that the treatment was experimental in nature and not covered under the patients' health care insurance policies.

Next, imagine that the court increases expected damages to $10,000 per case. As before, the MCO compares the cost of compensating the physician using a fee-for-service contract with that of a capitated contract. The increase in damages leads to an increase in an injured patient's expected gain from suing. Knowing this, the physician must increase the number of patients he compliantly treats to keep the patients from suing. Specifically, the physician must compliantly treat 75 of the 100 patients to ensure that no injured patient risks suing. Therefore, if the MCO chooses a fee-for-service contract, expected treatment costs are $750,000. Alternatively, if the MCO chooses a capitated contract, it faces expected damages of $600,000 (100 patients x $10,000 expected damages x 60% probability of a negative outcome given non-compliant treatment). Therefore, under these conditions, the MCO will choose a capitated contract and pay the physician a fixed payment to cover his exposure to liability. The physician will never provide compliant treatment, and every injured patient will observe that the contract is capitated, deduce that the physician did not satisfy the legal standard of care and sue. Given that the physician must compliantly treat a high number of patients to keep injured patients from suing, the MCO finds it optimal to expose itself to liability rather than paying the expected cost of treatment.

Finally, imagine that the court increases damages one last time to $50,000 per case. At this level, an injured patient's expected gain from filing a claim is high. Knowing this, the physician increases the number of patients he compliantly treats to 97 out of 100. Given this treatment rate, the MCO expects to incur treatment costs of $970,000 if it employs a fee-for-service contract. It compares this cost to its expected cost from potential damages if it employs a capitated contract, encouraging the physician to avoid costly compliant treatment. Given the high damage award, this expected cost amounts to $3,000,000 (100 patients x $50,000 expected damages x 60% probability of a negative outcome given non-compliant treatment). Therefore, even though the required compliant treatment rate is high, the MCO finds it optimal to compensate the physician using a fee-for-service contract to encourage compliant treatment and avoid exposure to costly litigation. The physician will compliantly treat 97 of 100 patients and injured patients, observing the fee-for-service contract, will never sue.

This example illustrates the complexities involved in predicting how changes in damages will affect behavior by market actors when contracts are observable by patients. The next section provides an example of how actors react to changes in damages when contracts are unobservable by patients.

3.3.2 The Unobservable Contract Case

This example assumes that patients are unable to observe the contract the MCO uses to compensate the physician. Assume that we have the same 100 patients with the same medical condition. The probability of a positive outcome is 40% without compliant treatment and increases to 80% if the physician provides compliant treatment. In addition, just as in the observable contract case, assume that if compliant treatment is provided, the physician will incur a cost of $10,000 per patient and an injured patient must pay $5,000 to pursue a medical malpractice claim. The case in which litigation costs exceed expected damages results in the same outcome as the observable contract case: injured patients will never sue, the MCO pays nothing to the physician and the physician never compliantly treats.

First consider the effect of observability on the patients' strategy. In the observable contract case, patients are able to sue when suing is optimal because they can observe the contract and know that the physician is either compliantly treating some positive number of patients (i.e., fee-for-service contract) or providing no compliant treatment (i.e., capitated contract). The MCO, knowing that the patient can observe the contract and deduce the physician's strategy, is forced to choose a fee-for-service contract when expected compliant treatment costs are less than expected damages. If the MCO employed a capitated contract instead, the physician would never provide compliant treatment and all injured patients would sue. The MCO would be exposed to expected damages rather than the lower expected cost of compliant treatment. In other words, the patients' ability to observe the contract keeps the MCO from discouraging compliant treatment when expected compliant treatment costs are lower than expected damages.

Consider the effect of eliminating the patients' ability to observe the contract. Without this ability, the only way to force the MCO to encourage compliant treatment when the cost of compliant treatment is low relative to expected damages is for some number of the patients to sue with certainty upon experiencing a negative outcome. Without the threat of lawsuits, the MCO would never induce compliant treatment. Given that a certain number of injured patients will sue, the MCO has an incentive to induce some level of compliant treatment so that not every patient who brings a suit will win in court. Therefore, when contracts are unobservable some amount of litigation will occur regardless of the relationship between the cost of compliant treatment and damages.

With the patient's optimal strategy in mind, imagine that the court sets damages at $5,500 per case. Patients cannot observe the contract, so they are left to formulate their litigation strategy based on the strategy of the MCO. Given the relationship between cost of compliant treatment per patient ($10,000) and expected damages per patient given non-compliant treatment and a lawsuit ($5,500 damage award per injured patient x 60% probability of a negative outcome given non-compliant treatment=$3,300), the MCO finds it futile to encourage compliant treatment because for each patient treated the MCO pays $10,000 in treatment costs but saves only $3,300 in expected damages. Therefore, the MCO maximizes its payoff by choosing a capitated contract, which encourages the physician to avoid costly compliant treatment in all cases.[22] The patients can infer the MCO's strategy given the relationship between expected damages and the cost of compliant treatment. Therefore, knowing that the court will award damages, every patient sues with certainty. This outcome differs substantially from the observable contract case. Informing the patient about the contract terms allows the MCO to communicate the physician's level of compliant treatment, which, in turn, reduces the rate of litigation. If the MCO finds it optimal to conceal contracts for some reason (e.g., to protect their trade secret status), they

[22]Note that the MCO must pay the physician a fixed payment equal to the physician's expected damages or the physician will reject the contract.

sacrifice the ability to reveal the physician's strategy to patients.

Finally, imagine that the court increases damages to \$50,000 per case. At this damage level, the cost of compliant treatment per patient (\$10,000) is less than expected damages per case filed (\$50,000 x 60% probability of a negative outcome given non-compliant treatment=\$30,000). Therefore, the MCO finds it optimal to encourage the physician to compliantly treat some number of patients and chooses a fee-for-service contract to compensate the physician. The physician, however, will not provide compliant treatment with certainty because he knows that each patient is unable to observe his treatment choice. In fact, to encourage the physician to compliantly treat at all, some number of injured patients must commit to suing with certainty. In this particular situation, if one-third of all injured patients sue with certainty, the physician will provide compliant treatment to some number of patients to reduce the exposure to liability. Specifically, considering the tradeoff between compliant treatment costs and expected damages given that one-third of all injured patients will sue, the physician will find it optimal to compliantly treat 97 of the 100 patients.

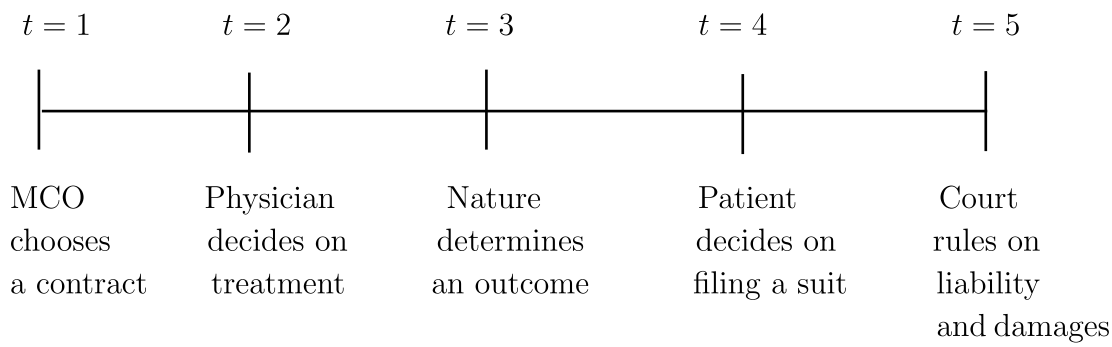
Section 3.4 develops the formal framework used to study the general effects of various legal rules on contract, treatment and litigation decisions.

3.4 The Framework

This section develops an approach to study the role of specific judicial and legislative rules in health care markets in a somewhat nonstandard agency model. The model is unusual in that it involves two simultaneous principal-agent relationships. First, the physician acts as an agent for the patient.[23] In addition, the physician acts as an agent for the MCO. Although the model assumes that the MCO can contract with the physician based on the cost of treatment, it is unable to contract directly on the effort level of the physician. The model's stages progress as follows. First, the MCO selects a contract. Second, the physician, knowing the contract terms, chooses whether to

[23]The model assumes that the physician sees one patient. Therefore, his behavior will be framed in terms of the likelihood that he compliantly treats the one patient rather than treating a certain percentage of a population of identical patients.

compliantly treat the patient. Compliant treatment reduces the probability of a bad outcome for the patient. Third, the patient either enjoys a positive outcome or suffers a negative outcome. Fourth, upon realizing a negative outcome the patient decides whether to file a medical malpractice claim.[24] Finally, the court rules on liability and awards damages to compensate the patient for her losses.[25] All players are assumed to be risk neutral and expected-utility maximizers. The following diagram presents the stages of the game.



3.4.1 MCO Contract Choice

In the first stage of the game, the MCO chooses a contract to obtain physician services for its insured patient. The contract consists of two terms: (1) a fixed payment, $f \geq 0$, which does not depend on the physician's treatment decision, and (2) an amount the MCO reimburses the physician for the cost of treatment, $r \geq 0$. The model considers all contracts (r, f) in $\Re^2_+$ (i.e., all possible combinations of reimbursement amounts and fixed payments).

Given the patient's illness, the MCO considers the cost of compliant treatment relative to expected damages and, anticipating the reactions of the physician and the

[24]Sections 3.5, 3.6 and 3.7 assume that the patient files claims against both the MCO and the physician. Section 3.8 considers various tortfeasor rules dictating to the patient which parties she may sue.

[25]The fact that the model does not consider a settlement option does not change the insights it provides. The model can be extended to account for situations in which the parties might participate in settlement negotiations. The extension, however, makes the model unnecessarily complicated given its focus.

patient, chooses a contract, $\kappa = (r, f)$, to maximize its ex ante expected payoff.[26] The contract will either induce compliant treatment or encourage the physician to forego costly compliant treatment.

It is important to note that the MCO's choice is constrained by the physician's individual rationality constraint. This means that the MCO must provide the physician with enough of an incentive to induce him to accept the contract rather than seek employment elsewhere. The MCO is also constrained by the equilibrium behavior of the other actors.

3.4.2 Physician Treatment Decision

Once the MCO chooses a contract, the physician considers the cost of compliant treatment relative to expected damages, anticipates the patient's strategy given a negative outcome and decides whether to provide compliant treatment. In effect, the physician in the model is an automaton, simply following the dictate the MCO indirectly issues through its contract choice.[27]

The model assumes that the physician's treatment decision is private. Although the patient can observe the outcome, the patient is unable to observe or monitor the physician's action due to the asymmetric nature of the information necessary to make sound medical decisions. While physicians are trained extensively in identifying symptoms, diagnosing illnesses and treating ailments, most patients have little, if any, knowledge of the intricacies of this highly technical field. Although patients might be able to obtain multiple physician opinions, they could be of limited use in alleviating asymmetries of information. Patients might not possess adequate information to identify the most efficacious from among the multiple opinions. Furthermore, if the patient is limited to receiving medical services from physicians contracting with his

[26] The process described here is akin to the current practice of utilization review. For each individual case (usually with treatment costs above a certain threshold) the MCO will decide if compensating the physician to perform the procedure that complies with the legal standard of care will result in a higher expected payoff than denying reimbursement for the cost of such treatment.

[27] Evidence exists to suggest that physicians advocate on behalf of their patients to urge MCOs to approve costly treatment. Countervailing evidence, however, indicates that physicians generally are tied to following the dictates of the MCO.

MCO, all available physicians likely are under the influence of the same financial incentives. Therefore, the patient might receive similar opinions from all physicians asked to diagnose the ailment and suggest a treatment. Finally, seeking multiple opinions simply might be too costly.[28]

Even though the patient cannot observe the physician's action, she does observe the outcome. This information alone, however, does not enable the patient to identify the action. Even if the physician does not provide compliant treatment, the patient might experience a positive outcome. Likewise, in some cases in which the physician compliantly treats, a bad outcome results. For example, imagine that the patient experiences back pain and seeks medical care. After collecting information about the patient's symptoms, the physician must decide on a treatment option. Assume that the physician considers two options: prescribing a low cost medication and prescribing a more expensive diagnostic test which could lead to a costly surgical procedure. Even though the physician knows that the low cost option does not meet the standard of care, he might prescribe it to reduce his costs. In fact, he might be forced to prescribe the low cost treatment because he is unable to pay the out-of-pocket cost for the more expensive treatment if the MCO does not reimburse for treatment costs. The model assumes that the patient is unable to judge the quality of care provided by the physician and, upon realizing a negative outcome (e.g., a serious spinal injury leading to partial paralysis), cannot be sure that the physician met the standard of care without pursuing costly verification.

The MCO faces similar hurdles in observing and monitoring the physician's action. To observe the physician's action, the MCO must evaluate every step in the physician's decision making process including symptom analysis, choice of diagnostic tests, interpretation of diagnostic tests, etc. The model assumes the MCO is unable to perform monitoring of this type in a cost effective manner. Therefore, the MCO is unable to contract based on the physician's action. The model assumes, however, that the MCO is able to contract based on cost.

Providing treatment imposes on the physician a strictly positive cost, c. If the

[28]See Green [44] for additional justifications of this assumption.

physician does not treat, he incurs no direct cost (i.e., $c = 0$).[29] Providing treatment, however, can benefit the physician as it affects the probability that the patient will realize a positive outcome and the likelihood that the physician will be liable for injuries suffered by the patient. Specifically, the relationship between the physician's action and the probability of a positive outcome is summarized in the following table:

	Positive outcome	Negative outcome
Compliant Treatment	p	$(1 - p)$
Non-compliant Treatment	q	$(1 - q)$

The parameter $p \in [0, 1]$ measures the extent to which compliant treatment affects the patient's outcome. As p increases the importance of the physician's action with respect to the outcome increases. The parameter $q \in [0, 1]$ represents the probability that the patient enjoys a positive outcome after non-compliant treatment. The model assumes that $p > q$. In other words, the patient has a better chance for a positive outcome given compliant treatment than with non-compliant treatment.[30] Once the physician decides on an action, Nature determines the outcome according to this

[29] Note that, even though the cost incurred by the physician is monetary in nature, this does not imply that the physician's action is observable by the MCO or the patient. The model considers the most severe case ($c = 0$ in the case the physician does not treat). One, however, might imagine a case in which the physician incurs a large cost when providing treatment that meets the established standard of care and a lower cost for providing a non-compliant treatment. Given the cost of treatment, the patient cannot identify whether the physician chose the appropriate treatment for the reasons previously discussed. Indeed, the physician has discretion during the diagnostic phase to lean toward diagnoses that require low cost treatments. The model could include an additional parameter for the lower cost of inappropriate treatment, but this would complicate the model without adding any insight.

[30] The relationship between the physician's action and the probability of a positive outcome clearly is much more complex than the model assumes. This assumption, however, simply gets at the notion that other factors in addition to the physician's action contribute to the patient's outcome. In addition, assuming that compliant treatment results in a higher probability of a positive outcome than that resulting from non-compliant treatment seems reasonable given that compliant treatments obtain that status because they result in positive outcomes more often than non-compliant treatments (although this assumption is questionable in a regime characterized by managed care in which standards eventually might be set by MCOs as they encourage physicians to perform low cost treatments in some cases).

particular relationship between the physician's action and the patient's outcome.

When deciding whether to treat, the physician will consider the contract terms, the cost of treatment and expected damages if compliant treatment is not provided. Studies have shown that contractual arrangements such as capitation motivate physicians to behave differently than similarly-situated physicians not facing such financial incentives. Although some argue that medical ethics protect patients from the undesirable effects of contractual incentives, substantial evidence that contract terms between MCOs and physicians significantly affect physician behavior proves otherwise. For example, Stearns et al. [95] studied the changes in treatment rates when a specific group of physicians was shifted from fee-for-service to capitation. The study found large changes in utilization in response to the shift. In a second study, Greenfield et al. [45] compared patient hospitalization rates for physicians paid under a fee-for-service arrangement and physicians of the same group paid by the same employer under capitation. The study controlled extensively for patient characteristics. They concluded that hospitalization was significantly more likely for fee-for-service patients. These studies suggest that physician behavior is motivated by factors other than medical ethics. In some situations physicians simply might find it infeasible to provide proper treatment given the compensation arrangement with the patient's MCO.[31] Furthermore, substantial evidence supports the claim that physicians consider expected damages when making treatment decisions.[32] Finally, the model as-

[31] The effect of outcomes on the physician's reputation might factor into his utility function. The model, however, assumes that the physician's utility function does not account for reputation effects. The model can be altered to include this feature. The intuitions provided by the model, however, would not change.

In addition, the model does not consider the effect of medical malpractice insurance on the physician's treatment decision. Almost all physicians carry medical malpractice insurance so that, in the event the physician is held liable for damages, the insurance carrier will cover some or all of the damages owed to the injured patient. Naturally, insurance coverage will affect the physician's treatment decision. The effect, however, is limited. For example, most insurers specify a maximum amount they will pay per incident. For comprehensive studies of how medical malpractice insurance affects health care markets and physician behavior see Bhat [11], Danzon [28] and Schlesinger [86].

[32] See White [102] (concluding that the medical malpractice system clearly communicates to physicians the risks of providing substandard care); Lawthers et al. [68] (finding that physicians respond to the risk of lawsuits by taking actions to reduce the probability of patient injury); Blendon et al. [12] (reporting that over sixty percent of physicians involved in the authors' study sometimes practiced defensive medicine). But see, Liang [69] (using survey data to show that physicians do not know the judicial standard of care for medical malpractice and are not aware of the level of damages

sumes that the physician gains no direct utility from the patient's outcome. [33]

3.4.3 Patient's Litigation Decision

If the patient realizes a positive outcome after the physician administers treatment, she receives a payoff of H,[34] her value of health, and the game ends. On the other hand, if the patient realizes a negative outcome, she must decide whether to file a claim for medical malpractice. Although the patient knows the outcome, she is unable to observe the physician's action. Based on the outcome the patient must form beliefs represented by a probability that the physician compliantly treated. In addition, the patient considers expected damages and the expected cost of litigation, L, when deciding whether to sue.[35]

3.4.4 Damages and Disclosure Laws

If the patient experiences a negative outcome and decides to file a claim, the court hears the case and decides on the issue of liability. The model assumes that the court uses a negligence standard with customary treatment as the standard of care.[36] In

assessed against liable physicians).

[33]This assumption leads to predictions for the most extreme case. Other models assume that physicians are imperfect agents, but derive some utility from patient outcomes. For example, see Blumstein [15], Havighurst [49], Danzon [26], Pauly [78], Farley [35], Ellis and McGuire [32] and Arlen and MacLeod [3]. Weakening the assumption that physicians are self-interested does not affect the general intuitions the present model offers in terms of how legal rules affect behavior.

[34]The complications associated with measuring the value of a positive outcome to the patient are outside the scope of this paper. The model assumes that the value of health, H, is measurable. For interesting views on measuring the value of health, see Bloche [13], Korobkin [62] and Dolan [30]. Bhat [11] discusses how courts calculate damages to compensate an injured patient for the value of lost health.

[35]The parameter, L, can be thought to capture all expected costs to be incurred by the patient to bring a lawsuit against any number of defendants. In addition, the model does not include decisions made by attorneys who work on a contingency fee basis. Danzon [26] claims that medical malpractice attorneys accept cases on a contingency fee basis, typically charging one-third of the total award won. Adding the attorney's decision to the model, however, would complicate it without adding additional insight. See Farber et al. [34] for an interesting analysis of the medical malpractice litigation process.

[36]To succeed in a medical malpractice lawsuit, the plaintiff must prove four elements: (1) the defendant's duty to the plaintiff to protect the plaintiff from injury; (2) the defendant's failure to exercise or perform that duty properly; (3) a legally sufficient causal relationship between the defendant's failure and the plaintiff's injury; and (4) recoverable damages. See *McKellips v. Saint Francis Hosp., Inc.*, 741 P.2d 467, 470 (Okla. 1987). The element of causation is not addressed in

addition, the model assumes that the court can verify perfectly whether the physician provided compliant treatment.[37] If the patient wins in court against the MCO, the MCO must pay expected money damages, D_m, to the patient. Likewise, if the patient wins in court against the physician, the physician must pay expected money damages, D_p, to the patient. Recall that the patient incurs an expected cost, L, to file and pursue a medical malpractice lawsuit. If litigation costs (L) exceed the total damage award ($D_m + D_p$) then the patient will never sue. Knowing that the patient will not sue, the physician does not provide compliant treatment and the MCO pays nothing for physician services. When the total damage award exceeds litigation costs, predicting behavior becomes more complicated. This case is the main focus of the paper and is presented in Section 3.5.

Note that the analysis in Section 3.5 is performed assuming court-determined damages are held constant. Section 3.6 considers how damage levels affect treatment and litigation decisions. Section 3.7 evaluates the inefficiencies of commonly-used damage rules as compared to efficient negligence and damage rules.

As mentioned, the model considers two cases. The first case assumes that the patient can observe the contract terms before deciding whether to sue. The second case assumes that the contract is unobservable. These cases correspond to state legislative rules mandating MCOs to disclose to insured patients the terms of their

this analysis. The model implicitly assumes that if the physician did not meet the standard of care, his action caused the patient's injury.

The physician fails to perform his duty properly if his effort level falls below the standard of care. The majority rule for the standard of care used by courts to determine liability is a locality rule. Specifically, if a physician-defendant's behavior conformed to established medical custom practiced by minimally competent physicians in a given area (local or national), the court will not hold the physician liable for damages suffered by the patient. See Furrow [38] for a detailed discussion of the standard of care for medical malpractice. Also, Keeton et al. [58] provides a general discussion of the theory of negligence as it relates to medical malpractice suits. The damage rule can be formulated to adjust for the portion of the injury unrelated to the physician's action. This is discussed *infra* in Section 3.7.

[37]This assumption is not critical for the results provided in Sections 3.5 and 3.6. If the model assumed imperfect verification, then sometimes physicians and MCOs would face liability after meeting the standard of care or escape liability when in fact it should be imposed. From an ex ante perspective, assuming perfect verification merely results in a variance of expected damages different than the variance under the assumption of imperfect verification. This has little effect on the comparative statics regarding contract, treatment and litigation decisions. The assumption, however, will affect the structure of the efficient damage rule. This is discussed further *infra* in Section 3.7.

contracts with physicians. Some states require disclosure, while others do not.[38] Therefore, the analysis is performed under both conditions to gain insight into the effects of disclosure laws on behavior in health care markets.

3.4.5 The Payoffs

Recall that the MCO moves in the first stage, choosing a contract for the provision of medical services to the patient. In the second stage, the physician decides whether to provide compliant treatment. Next, Nature determines whether the patient experiences a positive or negative outcome. If a positive outcome is realized, the game ends. If the physician provided compliant treatment, the MCO receives a payoff of $I - f - r$, the physician receives a payoff of $f + r - c$ and the patient receives a payoff of $H - I$, where I represents an insurance premium paid by the patient to the MCO to obtain medical insurance prior to stage one of the game.[39] If the physician did not provide compliant treatment, then the payoffs to the MCO, physician and patient are $I - f$, f and $H - I$, respectively.

[38] Note that states vary with respect to the specific information that must be disclosed and the method that MCOs must use to disclose the information (Hellinger [50]). The model assumes that the patient is able to observe the contract terms of her particular physician. This assumption, however, might not hold true for all states requiring disclosure. For example, some states merely require the MCO to provide general information about incentive arrangements, but do not force MCOs to disclose the actual contract terms of the patient's physician. Knowing some information about the types of contracts employed generally, however, aids an injured patient in forming beliefs about whether the physician met the standard of care.

Courts also have had a hand in formulating disclosure laws. Courts in some jurisdictions have ruled that failure to disclose contract terms is a breach of fiduciary duty imposed by the Employee Retirement Income Security Act of 1974 (29 U.S.C. §§1001–1461 (1994)), the federal statute regulating employee benefits (e.g., see *Shea v. Esensten*, 107 F.3d 625 (8th Cir. 1997)).

[39] Although, in this model, I is merely a transfer between the patient and the MCO and does not affect efficiency, the transfer is important to note when considering the efficiencies related to health care insurance, a topic not considered here. The model assumes that the expected benefits of purchasing health insurance always outweigh the costs. The paper does not address the inefficiencies created when the tort system sets damages such that the patient's cost of purchasing health insurance exceeds expected benefits. Inefficiencies of this sort are discussed in length in Sykes [98].

The results provided here, however, indirectly show that changes in expected damages will alter the patient's expected utility in the form of a change in premiums necessary to satisfy the MCO's individual rationality constraint. A model including efficiency gained from providing health care insurance to risk averse patients would reveal a trade-off between the level of care provided and the reduction of risk through health care insurance. Specifically, if the standard of care requires more costly treatment, health care insurance costs increase, pricing some patients out of health care insurance markets.

If a negative outcome occurs, the patient chooses whether to file a claim against the physician and/or the MCO. If the patient decides not to sue, the game ends. The payoffs are the same as above with $H = 0$. If the patient decides to sue, the court decides on the issue of liability and sets the damage award. Recall that the patient incurs a strictly positive cost, L, to pursue litigation.

If the physician compliantly treated, the patient loses in court against both the physician and the MCO. Payoffs to the MCO, physician and patient are $I - f - r$, $f + r - c$ and $-L - I$, respectively. Conversely, if the physician did not compliantly treat, the patient wins against both the physician and the MCO, given that each is named as a defendant. Damage awards of D_p and D_m are paid to the patient by the physician and MCO, respectively. The patient will sue only if the expected damage award covers the cost of filing and pursuing litigation. If the court finds that the physician did not compliantly treat, payoffs are $I - f - D_m$, $f - D_p$, and $D_m + D_p - L - I$ for the MCO, physician and patient, respectively.

Section 3.5 provides results for the case in which contracts are observable and the case in which they are not. The effects of observability on contract, treatment and litigation decisions are analyzed.

3.5 Analysis of Equilibrium Behavior

Given the framework of the game, it is possible to search for an equilibrium arising from non-cooperative play when contracts are observable and when they are not. The analysis uses the perfect Bayesian equilibrium concept.[40] Denote the probability that the patient sues given a negative outcome by γ and the probability that the physician compliantly treats by β.

The propositions stated in Sections 3.5.1 and 3.5.2 assume that damages exceed

[40] For those not familiar with game theory, this equilibrium concept is used to analyze dynamic games of incomplete information. It requires that (1) no player has an incentive to deviate from the equilibrium strategy given his beliefs and the other players' subsequent strategies, and (2) players update their beliefs by considering equilibrium strategies and using a specific method called Bayes' rule. See Fundenberg and Tirole [37] for a formal definition of perfect Bayesian equilibrium for a broad class of dynamic games of incomplete information. Gibbons [40] provides an intuitive definition of the equilibrium concept along with straightforward examples.

litigation costs. The analysis of the case in which litigation costs exceed damages is straightforward. In that case, patients have no incentive to sue. Knowing this, the MCO will pay nothing to the physician in the form of reimbursement for costs or a fixed payment and the physician will not provide compliant treatment. In addition, all results and discussions assume that, given a negative outcome, patients are able to sue both the physician and the MCO for medical malpractice. Variations of the results under different tortfeasor rules are given in Section 3.8. All proofs appear in the Appendix.

3.5.1 Equilibrium when Contracts Are Observable by the Patient

This section presents the equilibrium behavior of the MCO, physician and patient assuming the patient is able to observe the contract terms.

Proposition 1 *Fix treatment costs, probability of a positive outcome given compliant treatment, probability of a positive outcome given non-compliant treatment, expected litigation costs and expected damages. Let m^* equal the minimum probability of compliant treatment that guarantees that the patient will never sue. Assume that total expected damages exceed expected litigation costs (i.e., $D_m + D_p > L$). The following specifies the equilibrium contracts and resulting equilibrium behavior of the patient and the physician:*

(1) If the ex ante expected cost of compliant treatment is low relative to expected damages (i.e., $m^*c < (1 - q)(D_m + D_p)$,[41] then the MCO chooses a fee-for-service contract with full reimbursement for cost and no fixed payment. The physician compliantly treats with a probability (m^*) high enough such that the patient never sues, and the patient never sues.

(2) If the ex ante expected cost of compliant treatment is high relative to expected

[41] Note that m^* represents the equilibrium probability of compliant treatment. Therefore, although this condition is quite intuitive, it is not stated in terms of the model's exogenous variables. The discussion following the proposition analyzes the MCO's decision in terms of the model's exogenous variables.

damages (i.e., $m^*c > (1-q)(D_m + D_p)$), then the MCO chooses a capitated contract with a fixed payment equal to the physician's expected damages. The physician never provides compliant treatment, and the patient sues with certainty.

The following discussion provides some intuition behind the results stated in Proposition 1.

First, note that the MCO takes into account both its expected damages from a suit against itself and the physician's expected damages from a suit against the physician. This results from the fact that the MCO must design a contract that the physician will accept rather than seeking employment elsewhere. If the MCO finds it in its best interest to induce the physician to avoid costly compliant treatment, then the physician will be exposed to liability. If the contract does not compensate the physician for his exposure to liability, he will reject it. Therefore, in the end, the MCO ultimately will bear the expected damages it faces directly and those faced by the physician.

Also, it is important to note that the physician never provides compliant treatment with certainty in equilibrium (i.e., $m^* < 1$).[42] The only way to achieve certain compliant treatment is for the MCO to reimburse the physician more than the cost of compliant treatment. The MCO, however, would never do this in equilibrium because it can set the reimbursement level equal to cost and ensure that the physician compliantly treats with a high enough probability such that the patient will never sue. Furthermore, the physician does not have an incentive of his own to compliantly treat with certainty because he knows that the patient must pay litigation costs to file a suit and that the patient is uncertain about the physician's action. Suing is risky for the patient because if the court verifies that the physician met the standard of care, the patient's investment in the costly verification process becomes fruitless. It follows that the less the patient stands to gain from winning a lawsuit (i.e., damages less litigation costs), the less effort the physician must exert to ensure that the patient will not sue. Finally, note that the patient does not have to threaten to sue to compel

[42] This result is consistent with results obtained by others. For example, see Ordover [77] and Hylton [52].

the physician to compliantly treat with some positive probability. This follows directly from the assumption that the patient is able to observe the contract. If the patient observes a fee-for-service contract, she can be sure that it was optimal for the MCO to encourage the physician to compliantly treat and that he will provide compliant treatment with a probability high enough such that the patient will never sue. If she observes a capitated contract, she sues for certain, knowing that the physician did not meet the standard of care.

Next, consider the MCO's contract choice. Its decision hinges on the level of ex ante expected compliant treatment costs (m^*c) relative to expected damages given non-compliant treatment ($(1-q)(D_m+D_p)$). Substituting $m^* = \frac{(1-q)(D_m+D_p-L)}{(1-q)(D_m+D_p-L)+(1-p)L}$ into the condition, $m^*c < (1-q)(D_m+D_p)$, reveals that the MCO should employ a fee-for-service contract if $c < (D_m+D_p)(1-q) + \frac{L(1-p)}{1-\frac{L}{D_m+D_p}}$. Figure 3.1 provides an example of a typical outcome when contracts are observable, the probability of a positive outcome given compliant treatment is 60%, the probability of a positive outcome given non-compliant treatment is 40% and litigation costs are $100.

As stated previously, when litigation costs ($100 in this example) exceed damages, the patient will never sue. Therefore, the MCO will choose a capitated contract with no fixed payment (i.e., the MCO will pay nothing to the physician) and the physician will never compliantly treat. If damages exceed litigation costs, then the MCO must compare the ex ante expected compliant treatment cost to total expected damages in order to choose the optimal contract. The following discussion provides the intuition for outcomes when damages exceed litigation costs.

If compliant treatment costs are sufficiently low (i.e., $c < \hat{c}$),[43] the MCO maximizes its payoff by choosing a fee-for-service contract to induce compliant treatment and avoid exposure to liability. The MCO will reimburse the physician at least the full cost of treatment so that the physician will compliantly treat with an adequately high probability so that the patient never sues. This stems from the fact that the patient can observe the contract terms and, from the terms, infer the physician's strategy. The

[43] $\hat{c}$ represents the value of c corresponding to the level of total expected damages that minimizes the function used to find the MCO's cutoff point (i.e., $m^*c = (1-q)(D_m+D_p)$).

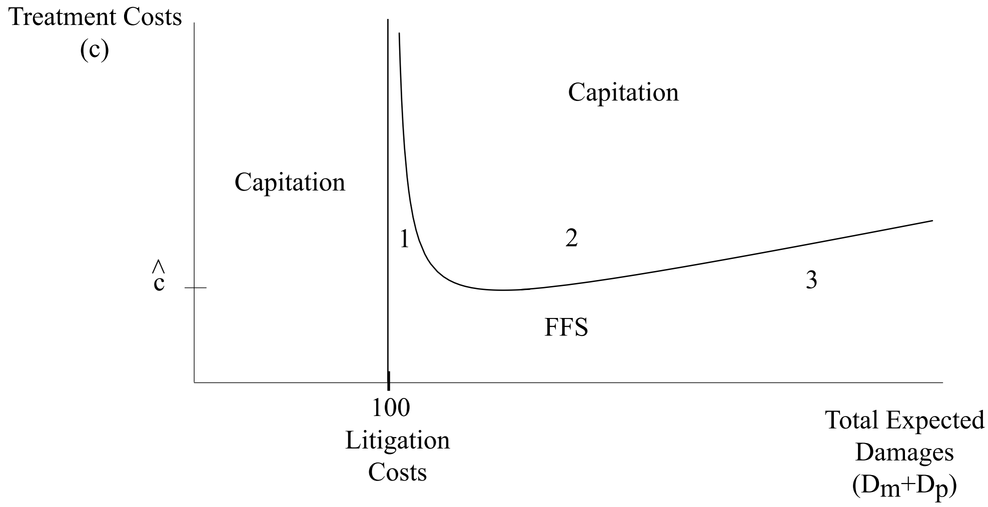


Figure 3.1: This graph illustrates MCO contract choices given observable contracts. The example assumes that the probability of a positive outcome given compliant treatment is 60%, the probability of a positive outcome given non-compliant treatment is 40% and litigation costs are $100. The graph presents the model's prediction of the MCO's contract choice for all (total expected damages, treatment costs) pairs in the displayed range.

MCO, however, enjoys a higher payoff the lower the reimbursement amount; therefore, the MCO will set reimbursement equal to the cost of treatment. Any amount over cost that the MCO reimburses reduces its payoff because the physician will treat with a higher probability even though the patient will never sue. In equilibrium the MCO will employ a standard fee-for-service contract (i.e., reimbursement of full cost with no fixed payment) and the physician will compliantly treat with a probability high enough so that the patient never sues. As compliant treatment costs increase beyond $\hat{c}$, the MCO will compare expected compliant treatment costs (m^*c) with expected total damages given non-compliant treatment ($(1-q)(D_m+D_p)$) when choosing a contract.

When compliant treatment costs exceed $\hat{c}$ and the patient's expected gain from winning a lawsuit (i.e., damages less litigation costs) is low (i.e., points in the region of the graph near "1"), the physician is able to shield himself from damages by providing a low level of compliant treatment. For this reason, ex ante expected compliant treatment costs are less than expected total damages and so the MCO will choose a fee-for-service contract, the physician will provide compliant treatment with a probability high enough such that the patient will not sue, and the patient will never sue.

As damages increase (moving the (total expected damages, compliant treatment costs) pair into the region labelled “2”), the MCO will find it optimal to face exposure to liability rather than encourage the physician to compliantly treat and so will choose a capitated contract. Even though damages increase, expected treatment costs also rise as the physician finds it necessary to increase the probability of compliant treatment given that patients have more to gain from suing. In other words, the physician is forced to compliantly treat with a higher probability to ensure that the patient never sues. This increase in probability of treatment will drive expected treatment costs higher than expected damages given no treatment. Therefore, the MCO will choose a contract such that the physician will not provide costly treatment despite the fact that the patient will sue with certainty. The MCO simply sets the reimbursement policy low enough so that the physician has no incentive to meet the standard of care. In particular, the MCO is indifferent between any contract specifying a relatively low reimbursement level (i.e., $r \leq c - (1-q)D_p$), which ensures that the physician will not provide compliant treatment. While any of these reimbursement policies will satisfy the equilibrium conditions, it is natural to assume that the MCO will employ a standard capitated contract with no reimbursement for cost and a positive fixed payment equal to the physician’s expected damages.

If damages continue to increase relative to compliant treatment costs, then eventually expected damages will once again exceed the expected cost of compliant treatment (indicated in the graph by region “3”) despite the fact that the physician must provide compliant treatment with a higher probability to keep the patient from suing. The MCO will revert back to choosing a fee-for-service contract to encourage the physician to provide compliant treatment with a probability high enough so that the patient never sues, and the patient never sues.

This result clearly illustrates why policymakers must take care when they contemplate changes to damage rules, such as setting maximum damage awards.[44] Not only will litigation decisions adjust, but also MCOs and physicians will adjust their behavior to take into account changes in expected damages. For these reasons, expected changes in litigation rates might not obtain.

The following section presents results for the case in which the patient cannot observe the contract terms.

3.5.2 Equilibrium when Contracts Are not Observable by the Patient

This section presents the equilibrium behavior of the MCO, physician and patient assuming the patient is *not* able to observe the contract terms. Proposition 2 reveals that observability of the contract terms matters. The critical difference in the structure of the game with observable contracts and this case is that, here, the patient's decision to sue is made without knowledge of how the MCO compensated the physician. Therefore, the patient must resort to equilibrium reasoning to infer the physician's action. On the other hand, when the patient can observe the contract, the patient's decision to sue hinges on observation of the contract terms and the ability to infer directly the physician's strategy. Knowing this, the MCO is unable to deviate and change contracts because the patient would observe the deviation and change her behavior in response. Proposition 2 states the equilibrium of the model when the patient cannot observe the contract terms.

Proposition 2 *Fix treatment costs, probability of a positive outcome given compliant treatment, probability of a positive outcome given non-compliant treatment, expected litigation costs and expected damages as given. Assume that total expected damages*

[44]The medical malpractice insurance crisis led most states to set caps on damages allowable in medical malpractice lawsuits (Kinney [60]). The theory presented in this study provides one possible explanation as to why some states did not experience an expected decrease in claim rates. See Kinney [60] for a critique of malpractice reforms attempted in the 1970s and 80s.

exceed expected litigation costs (i.e., $D_m + D_p > L$). The following specifies the equilibrium contracts and resulting equilibrium behavior of the patient and the physician:

(1) If the cost of compliant treatment is low relative to expected damages (i.e., $c < (1-q)(D_m + D_p)$), then the MCO chooses a fee-for-service contract with partial reimbursement for cost and a positive fixed payment. The physician compliantly treats with a probability high enough such that the patient will not always sue, and the patient sues with some positive probability.

(2) If the cost of compliant treatment is high relative to expected damages (i.e., $c > (1-q)(D_m + D_p)$), then the MCO chooses a capitated contract with a fixed payment equal to the physician's expected damages. The physician does not provide compliant treatment, and the patient sues with certainty.

The formal proof appears in the Appendix. Also, the effects of the tortfeasor rule on contract terms are specified in Section 3.8. The following discussion assumes that the patient is allowed to sue both the MCO and the physician.

Notice that the results here substantially differ from the results given in the case of observable contracts. First consider the MCO's contract choice. Figure 3.2 provides an example of a typical outcome when contracts are unobservable given the same parameter values used in Figure 3.1 (i.e., the probability of a positive outcome given compliant treatment is 60%, the probability of a positive outcome given non-compliant treatment is 40% and litigation costs are $100).

As in the observable contract case, when litigation costs exceed damages, the patient has no incentive to sue no matter how trivial the cost of compliant treatment. Knowing this, regardless of the cost of compliant treatment the MCO employs a capitated contract and the physician never provides compliant treatment. When damages exceed litigation costs the MCO will choose a fee-for-service contract if expected total damages given non-compliant treatment ($(1-q)(D_m + D_p)$) exceed the cost of compliant treatment (c). The physician will compliantly treat with a high enough probability such that the patient does not sue with certainty and the patient will sue with a high enough probability such that, when the cost of compliant treatment is

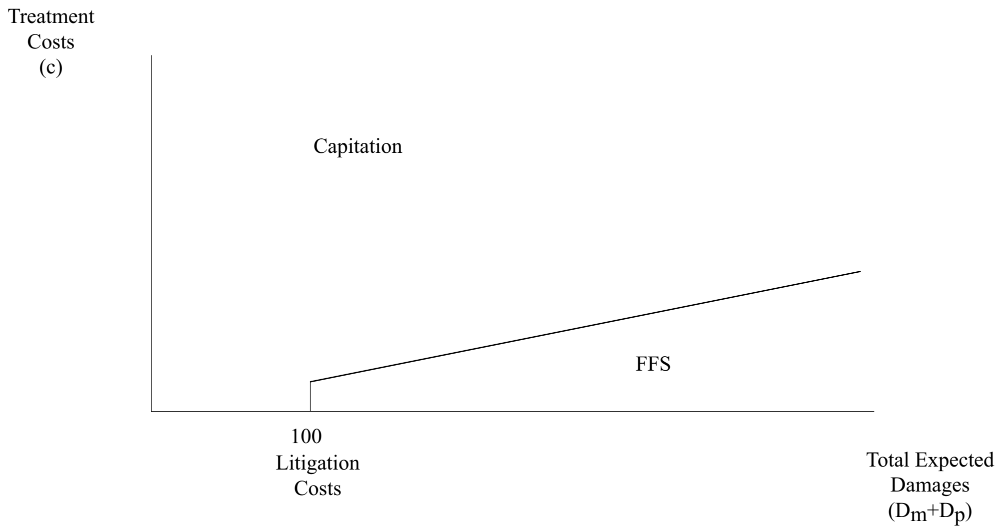


Figure 3.2: This graph illustrates outcomes given unobservable contracts. The example assumes that the probability of a positive outcome given compliant treatment is 60%, the probability of a positive outcome given non-compliant treatment is 40% and litigation costs are $100. The graph presents the model's prediction of the MCO's contract choice for all (total expected damages, compliant treatment costs) pairs in the displayed range.

low compared to expected damages given non-compliant treatment, the MCO will induce compliant treatment. Alternatively, if the cost of compliant treatment exceeds expected total damages given non-compliant treatment, then the MCO choose a capitated contract, the physician never compliantly treats and the patient sues with certainty.

Note that no equilibrium exists such that the patient never sues. This result directly relates to the unobservability of the contract terms. As stated previously, when the patient is unable to observe the contract terms, she must threaten to sue with some positive probability to provide an incentive for the MCO to encourage compliant treatment with some positive probability when the cost of such treatment is less than expected damages given no treatment. The equilibrium probability of suing lies somewhere between suing with certainty and never suing. If the patient always sued, the physician would always compliantly treat, which implies that the patient would never choose to sue, a contradiction. Conversely, if the patient never sued, the physician would never compliantly treat, which implies that the patient would always choose to sue, a contradiction. Therefore, the equilibrium probability of suing must lie somewhere between these two extremes. When contracts are observable, on the other hand, the patient need not threaten to sue because she is able to infer perfectly the physician's behavior from the contract terms. Knowing this, the MCO is unable to deviate by switching to a contract inducing less compliant treatment.

Second, note that when deciding on a contract, the MCO compares expected damages given non-compliant treatment to the full cost of compliant treatment (c) rather than the expected cost of compliant treatment (m^*c). The fact that the patient is unable to observe the contract produces this result. As discussed previously, when the patient is unable to observe the contract, she must sue with some positive probability to encourage the MCO to induce compliant treatment. In an observable contract regime, the cost of compliant treatment is merely the expected cost of compliant treatment given the physician's equilibrium probability of compliantly treating (m^*c). In an unobservable contract regime, however, if the MCO induces compliant treatment it incurs costs for actual treatment given the physician compliantly treats (m^*c) plus expected damages from litigation given the physician does not compliantly treat ($(1-m^*)\gamma^*(1-q)(D_m+D_p)$). The patient's equilibrium probability of suing (γ^*) ensures that these costs equate exactly to the cost of compliant treatment (c).[45] By employing this strategy when contracts are unobservable, the patient is able to ensure the highest level of compliant treatment possible when the cost of compliant treatment is relatively low.

Third, given that the MCO wishes to induce complaint treatment and reimburses some portion of the treatment cost, the likelihood that the physician will treat is the same under both disclosure rules.[46] The equilibrium probability of compliant treatment adjusts for the assumptions that litigation is costly and that the patient is

[45] When the cost of compliant treatment is relatively low, the patient's equilibrium probability of suing is $\frac{c}{(1-q)(D_m+D_p)}$. Therefore, if the MCO chooses a fee-for-service contract its total expected cost is equal to $m^*c+(1-m^*)\frac{c}{(1-q)(D_m+D_p)}(1-q)(D_m+D_p)=c$.

[46] Propositions 1 and 2 reveal that, if reimbursed for some portion of the treatment cost, the physician will compliantly treat with a probability high enough such that the patient will not sue with certainty.

unable to observe the physician's action. These assumptions remain unchanged regardless of the observability of the contract. If the MCO induces compliant treatment, the physician will always compliantly treat just often enough so that the patient does not sue with certainty.

Finally, notice that when compliant treatment costs are relatively low, the MCO employs a fee-for-service contract with partial reimbursement and some positive fixed payment, whereas, when contracts are observable, the MCO fully reimburses for the full cost of treatment and provides no fixed payment. This is expected given the role of the contract and the patient's behavior under both disclosure regimes. Consider the MCO's reasons for employing a reimbursement policy versus a fixed payment. The MCO reimburses a portion of the treatment cost to encourage the physician to compliantly treat with some positive probability. On the other hand, the MCO will provide a fixed payment only when the physician is exposed to liability. If the MCO does not compensate the physician for his exposure to liability, the physician has no incentive to accept the contract. Next, consider the patient's behavior under both regimes. When patients are able to observe the contract and compliant treatment costs are relatively low, no lawsuits occur. This implies that the MCO need not provide any fixed payment to satisfy the physician's individual rationality constraint because the physician is never exposed to potential liability. On the other hand, when patients are unable to observe the contract, litigation occurs with some positive probability. Therefore, the MCO must pay the physician some fixed payment to compensate for the fact that he always faces potential liability.

With respect to reimbursement for the cost of treatment, the MCO must reimburse the physician for the full cost of treatment when contracts are observable and compliant treatment costs are relatively low. This result obtains because the patient will never sue under these conditions. Therefore, the physician has no incentive of his own (i.e., exposure to liability) that drives his willingness to satisfy the legal standard of care. Knowing this, the MCO must fully compensate the physician for the cost of treatment to encourage the physician to compliantly treat with a probability high enough such that an injured patient will never sue. When contracts are unobservable, however, the physician faces potential liability of his own because an injured patient will always sue with some positive probability. Thus, the MCO can partially reimburse the physician for treatment costs and still be sure that the physician will compliantly treat with a sufficiently high probability because he is partially encouraged to provide compliant treatment when he considers his personal exposure to liability.

By comparing Propositions 1 and 2 one might conclude that, under the assumptions of the model, MCOs receive a higher payoff in a regime in which contracts are observable.[47] Therefore, the model suggests that MCOs are better off if they voluntarily disclosure contract terms to insured members. Legislation forcing MCOs to disclose, however, indicates that, in practice, MCOs are reluctant to disclosure voluntarily. Features of health care markets not taken into account by the model help to explain this phenomenon. For example, contracts with physicians have a major influence on costs incurred by MCOs to insure its members. Therefore, an MCO might keep contract terms private to remain competitive in health care insurance markets. Moreover, by avoiding disclosure, an MCO might limit its liability in cases in which injured plaintiffs argue that the contract terms, themselves, led to substandard care which, in turn, caused injury to the plaintiff.[48]

[47]If $c < (1-q)(D_m + D_p)$, then the MCO induces compliant treatment regardless of observability. If contracts are observable, the MCO's payoff is $I - mc$. If contracts are not observable, the MCO's payoff is $I - c < I - mc$. If $(1-q)(D_m + D_p) < c < \frac{(1-q)(D_m+D_p)}{m}$, then if contracts are observable, the MCO induces compliant treatment and earns a payoff of $I - mc$. If contracts are unobservable, the MCO does not induce compliant treatment and earns a payoff of $I - (1-q)(D_m + D_p) < I - mc$. Finally, if $c > \frac{(1-q)(D_m+D_p)}{m}$, the MCO does not induce compliant treatment regardless of observability and earns a payoff of $I - (1-q)(D_m + D_p)$.

[48]For example, see *Bush v. Dake* No. 86-2576NM-2, slip op. (Mich. Cir. Ct. Apr. 27, 1989) (holding that whether the MCO's incentive structure had proximately contributed to the injury was a genuine issue of material fact) and *Ching v. Gaines* No. CV-137656 (Ventura County Super. Ct. Nov. 15, 1995) (awarding $2.9 million for failure to refer for diagnosis of colon cancer based in part on evidence of financial incentives to deny care).

3.5.3 Effect of the Disclosure Rule on the Likelihood of Lawsuits

Propositions 1 and 2, taken together, predict the likelihood of lawsuits under different disclosure laws. The following proposition specifies the relationship between disclosure laws and the likelihood that the patient will file a lawsuit following a negative outcome. The proof appears in the Appendix.

Proposition 3 *For any feasible set of treatment costs (c), probability of a positive outcome given compliant treatment (p), probability of a positive outcome given non-compliant treatment (q), expected litigation costs (L) and expected damages (D_m+D_p), the probability that an injured patient will file a medical malpractice lawsuit in a regime with observable contracts is less than or equal to the probability under a regime with unobservable contracts.*

The intuition for this result is as follows. When expected litigation costs exceed expected damages, the comparison is simple. Regardless of the disclosure rule, the patient will not sue. Therefore, it must be that, when expected damages exceed expected litigation costs, the probability of suing is lower (in some cases) under a mandatory disclosure rule. Figure 3.3 illustrates the differences in litigation rates caused by different disclosure rules.

The increase in expected litigation rates that results from shifting from an observable contract regime to an unobservable contract regime arises from two sources. First, unobservability of the contract forces patients to sue to encourage MCOs to induce compliant treatment when treatment costs are relatively low. Therefore, even if compliant treatment costs and damage levels are such that the MCO chooses a fee-for-service contract in both regimes (represented by the lower portion of the graph), more lawsuits occur when the contract is unobservable.

Second, as discussed previously, the total cost of treatment is higher in an unobservable regime because the MCO must pay not only the expected cost of treatment but also expected damages. Therefore, the MCO finds it optimal to induce compliant

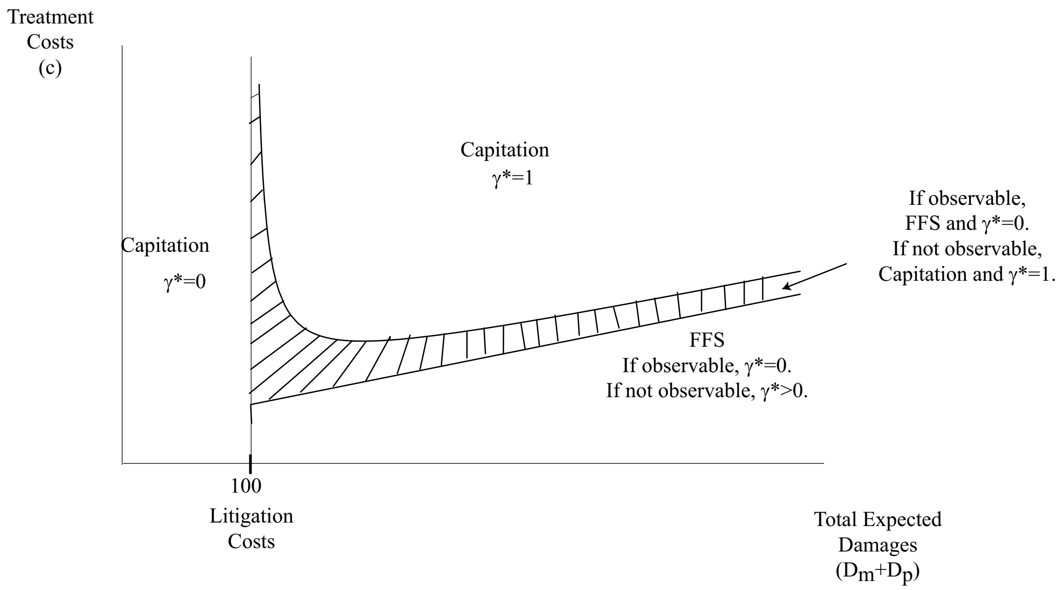


Figure 3.3: This graph illustrates the differences in claim rates caused by different disclosure rules. This figure simply combines Figures 3.1 and 3.2 using the same parameters (i.e., the probability of a positive outcome given compliant treatment is 60%, the probability of a positive outcome given non-compliant treatment is 40% and litigation costs are $100). Recall that the patient's equilibrium probability of suing is represented by γ^*.

treatment less often when patients are unable to observe the contract. The hatched area of Figure 3.3 represents the set of (expected total damages, compliant treatment costs) pairs for which the MCO will induce compliant treatment only in an observable regime. For these pairs, patients will never sue if they are able to observe the contract, but will always sue if they cannot observe the contract. This results in higher claim rates in unobservable contract regimes.

The following section performs a similar analysis for the rate of compliant treatment under each legal regime.

3.5.4 Effect of the Disclosure Rule on the Likelihood of Compliant Treatment

Propositions 1 and 2 also jointly lead to a prediction regarding the likelihood of compliant treatment under different disclosure laws. The following proposition specifies the relationship between disclosure laws and the likelihood that the physician's treatment choice will satisfy the legal standard of care. The proof appears in the Appendix.

Proposition 4 *For any feasible set of compliant treatment costs (c), probability of a positive outcome given compliant treatment (p), probability of a positive outcome given non-compliant treatment (q), expected litigation costs (L) and expected damages* ($D_m + D_p$)*, the probability that a physician will compliantly treat an injured patient is higher under a regime in which the patient can observe contract terms between the MCO and physician relative to a regime in which the patient cannot observe the contract terms.*

The intuition behind this result is very similar to that provided for the result regarding the effect of disclosure rules on the likelihood of litigation. Note first that, as explained *supra* in Section 3.5.2, the physician's probability of compliantly treating given reimbursement does not depend on observability of the contract terms. Indeed, the result here is linked solely to the MCO's contract choice under each disclosure regime. Figure 3.4 illustrates the differences in compliant treatment rates caused by different disclosure rules.

Unlike the comparison of litigation rates, the difference in compliant treatment rates emerges from just one source. That is, for the set of (total expected damages, compliant treatment costs) pairs for which the MCO will employ a fee-for-service contract regardless of the observability of the contract (represented by the lower portion of the graph), compliant treatment levels are identical in each legal regime. The physician will compliantly treat just often enough so that the patient will not sue with certainty. This probability does not depend on the observability of the contract. Compliant treatment rates, however, do differ in the region representing the set of (expected total damages, compliant treatment costs) pairs for which the MCO will induce compliant treatment only in an observable regime (represented by the hatched region of Figure 3.4). When the contract is observable, the costs of compliantly treating the patient are lower than in an unobservable contract regime.

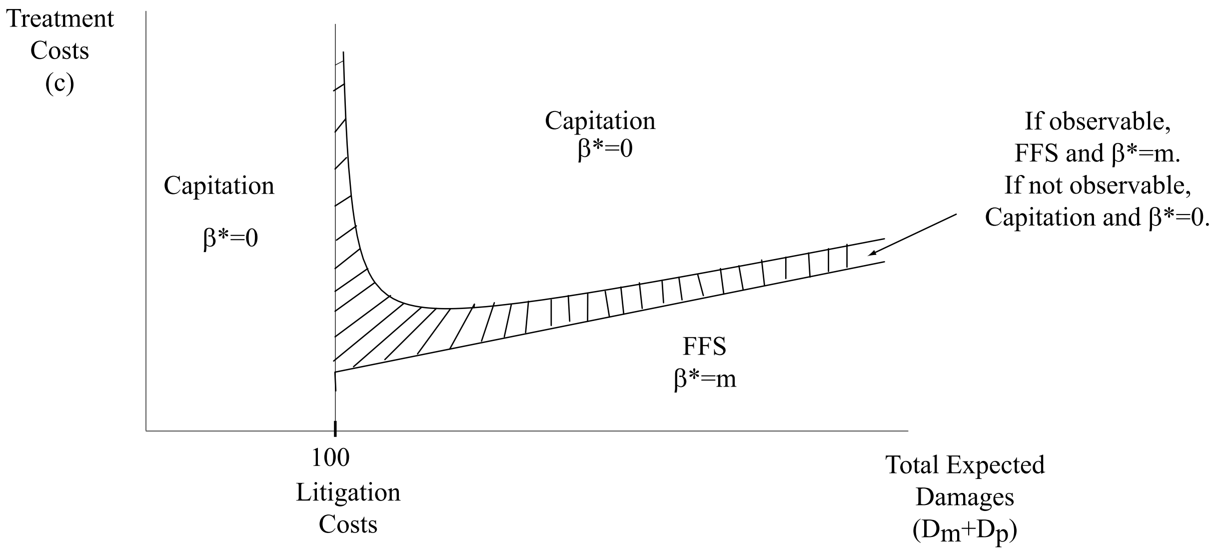


Figure 3.4: This graph illustrates the differences in compliant treatment rates caused by different disclosure rules by combining Figures 3.1 and 3.2 using the same parameters (i.e., the probability of a positive outcome given compliant treatment is 60%, the probability of a positive outcome given non-compliant treatment is 40% and litigation costs are $100). Recall that the physician's equilibrium probability of compliantly treating is represented by β^*.

The MCO is more likely, therefore, to employ a capitated contract to discourage compliant treatment when contracts are unobservable. This leads to the result that compliant treatment rates are higher in observable contract regimes.

The next section characterizes how physician treatment decisions and patient litigation decisions vary with changes in damages.

3.6 Effect of Damages on the Likelihood of Treatment and Litigation

Propositions 1 and 2 predict treatment and litigation decisions when total damages exceed litigation costs. From this analysis we can characterize the relationship between damages and physician treatment choices and between damages and patient litigation decisions. Analyses are provided for the case in which contracts are observable and for the case in which they are not.

3.6.1 Damages and Litigation

First consider how the patient's litigation decision reacts to a change in total expected damages. The relationship between damages and litigation depends on observability of the contract. Recall that the patient will never sue if total expected damages are less than the patient's litigation costs. The following discussion considers patient behavior when damages exceed litigation costs.

Observable Contract Regime

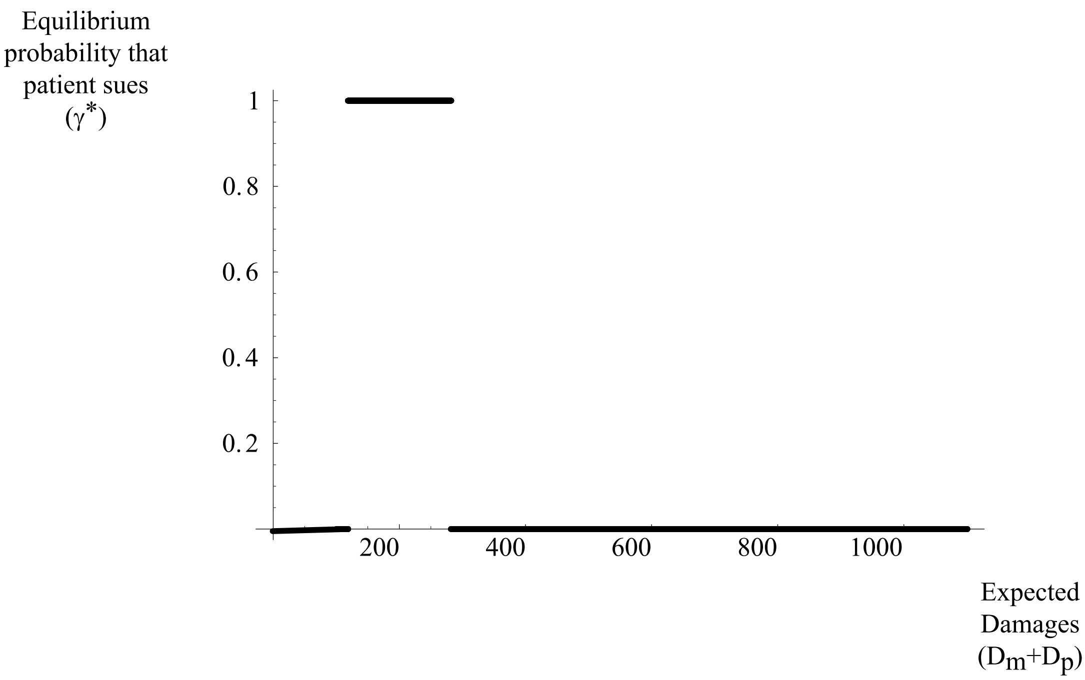


Figure 3.5: This graph illustrates how the patient's litigation decision varies with changes in the damage level when contracts are observable and compliant treatment costs exceed $\hat{c}$. The graph assumes that the probability of a positive outcome given compliant treatment is 80%, the probability of a positive outcome given non-compliant treatment is 40%, litigation costs are \$100 and the cost of compliant treatment is \$200.

When contracts are observable (see Figure 3.1), the patient's behavior will depend on whether the cost of compliant treatment is high (i.e., $c > \hat{c}$) or low (i.e., $c < \hat{c}$).

Figure 3.5 illustrates the relationship between damages and the probability that the patient sues when compliant treatment costs exceed $\hat{c}$. The patient will never sue if the physician provides compliant treatment with some positive probability. This occurs when total expected damages are just above litigation costs and when they are sufficiently high such that expected damages given non-compliant treatment exceed the cost of compliant treatment. When total expected damages lie somewhere between these two regions, the MCO chooses a capitated contract, the physician never provides compliant treatment and the patient sues with certainty.

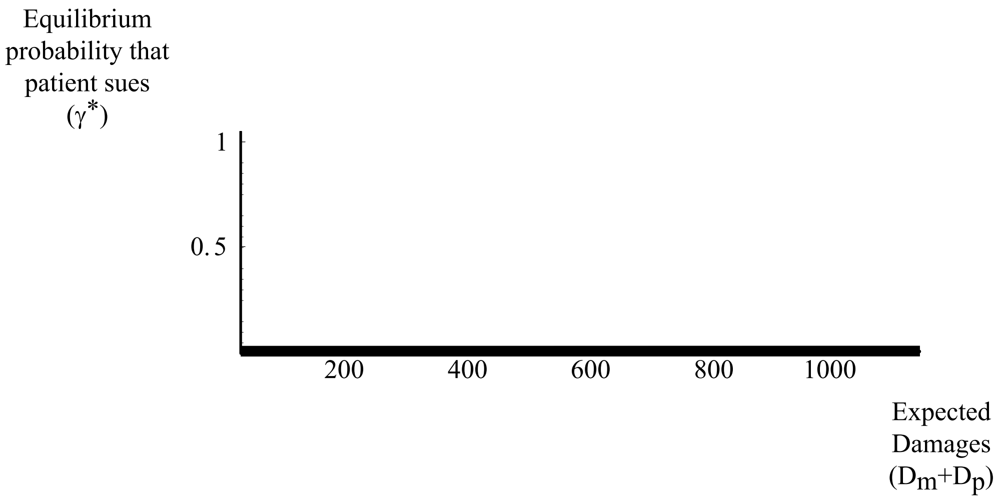


Figure 3.6: This graph illustrates how the patient's litigation decision varies with changes in the damage level when contracts are observable and compliant treatment costs are less than $\hat{c}$. The graph assumes that the probability of a positive outcome given compliant treatment is 80%, the probability of a positive outcome given non-compliant treatment is 40%, litigation costs are \$100 and the cost of compliant treatment is \$100.

Figure 3.6 illustrates the relationship between damages and the probability that the patient sues when compliant treatment costs are less than $\hat{c}$. Recall that when compliant treatment costs are less than $\hat{c}$, the MCO finds inducing compliant treatment to be optimal in all cases. Therefore, the physician always provides compliant treatment often enough such that the patient never sues, and the patient never sues. Under these conditions, no litigation occurs.

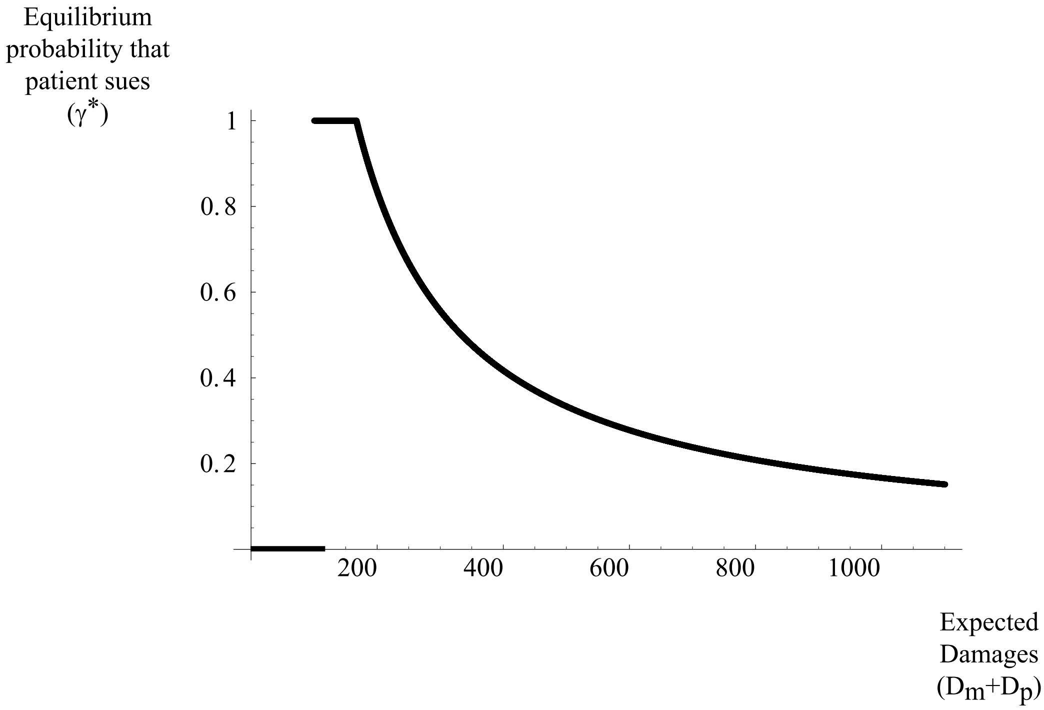


Figure 3.7: This graph illustrates how the patient's filing decision varies with changes in the damage level when contracts are unobservable. The graph assumes that the probability of a positive outcome given compliant treatment is 80%, the probability of a positive outcome given non-compliant treatment is 40%, litigation costs are \$100 and the cost of compliant treatment is \$100.

Unobservable Contract Regime

Figure 3.7 illustrates the relationship between damages and the probability that the patient sues when contracts are unobservable. In this case, the MCO will not induce compliant treatment until expected damages given non-compliant treatment, $(1 - q)(D_m + D_p)$, exceed the cost of compliant treatment, c. Once this condition is met, the MCO will induce compliant treatment and the physician will compliantly treat with some positive probability. The patient will sue with certainty when the MCO chooses not to induce compliant treatment. Once the physician begins compliantly treating with an increasing probability, the patient sues with some probability less than one. As damages increase, the probability of compliant treatment increases; therefore, the patient finds it optimal to decrease the probability of filing suit until the probability of filing nears zero.

3.6.2 Damages and Treatment

Next consider how the physician's treatment decision reacts to a change in total expected damages. Just as in the case of litigation levels, the relationship between treatment and damages depends on whether patients are able to observe the contract. Recall that the physician will never compliantly treat if total expected damages are less than the patient's litigation costs. The following discussion considers physician behavior when damages exceed litigation costs.

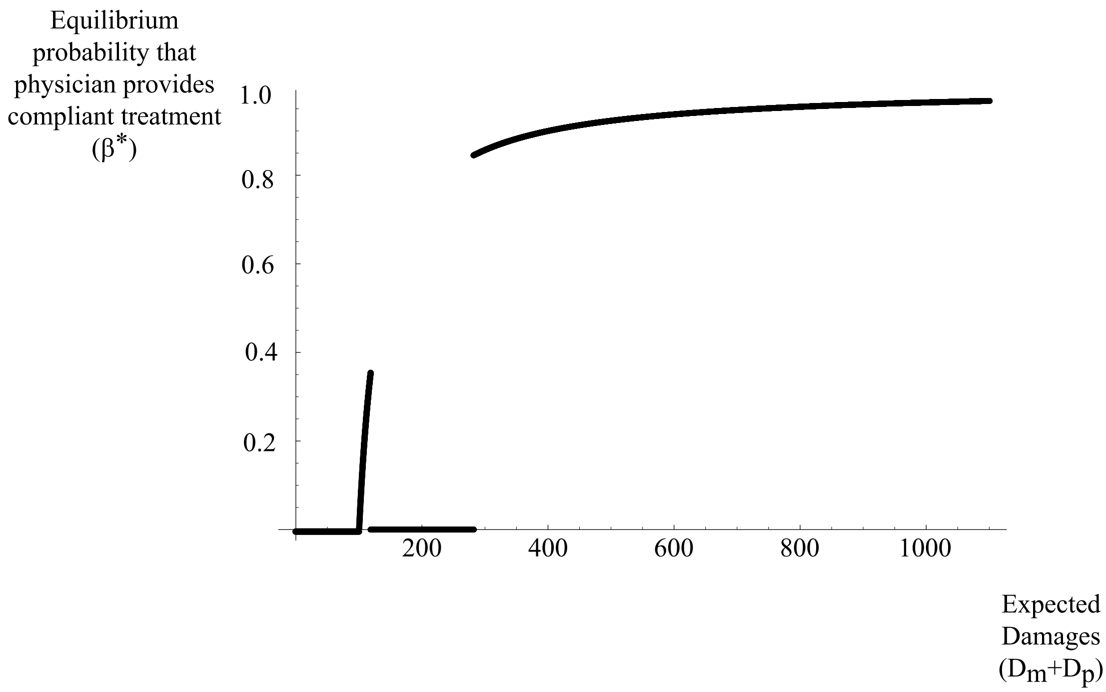


Figure 3.8: This graph illustrates how the physician's treatment decision varies with changes in the damage level when contracts are observable and compliant treatment costs exceed $\hat{c}$. The graph assumes that the probability of a positive outcome given compliant treatment is 80%, the probability of a positive outcome given non-compliant treatment is 40%, litigation costs are \$100 and the cost of compliant treatment is \$200.

Observable Contract Regime

When contracts are observable (see Figure 3.1), the physician's behavior will depend on whether the cost of compliant treatment is high (i.e., $c > \hat{c}$) or low (i.e., $c < \hat{c}$). Figure 3.8 illustrates the relationship between damages and the probability that the physician compliantly treats when compliant treatment costs exceed $\hat{c}$. The physician will never compliantly treat when litigation costs exceed damages. Once the patient expects a positive gain from winning a lawsuit, then the MCO induces compliant treatment which is provided with an increasing probability until damages increase to the point at which expected compliant treatment costs, m^*c, exceed expected damages given non-compliant treatment, $(1-q)(D_m + D_p)$. At this point, the MCO chooses a capitated contract and the physician never provides compliant treatment. This continues until damages increase enough such that the expected damages given non-compliant treatment exceed the expected cost of compliant treatment. At this point, damages are relatively high and so the patient will gain significantly from a successful lawsuit. This results in a high level of compliant treatment which continues to increase as damages increase until the probability of compliant treatment is nearly certain.

Figure 3.9 illustrates the relationship between damages and the probability that the physician compliantly treats when compliant treatment costs are less than $\hat{c}$. Note from Figure 3.1 that when compliant treatment costs are less than $\hat{c}$, the MCO finds inducing compliant treatment to be optimal in all cases. Even when the patient's expected gain from a successful lawsuit is relatively low, the expected cost of compliant treatment is low enough such that compliant treatment at some level is always optimal. This results in a positive level of compliant treatment once expected damages exceed litigation costs, which continues to increase as damages increase until the probability of compliant treatment is nearly certain.

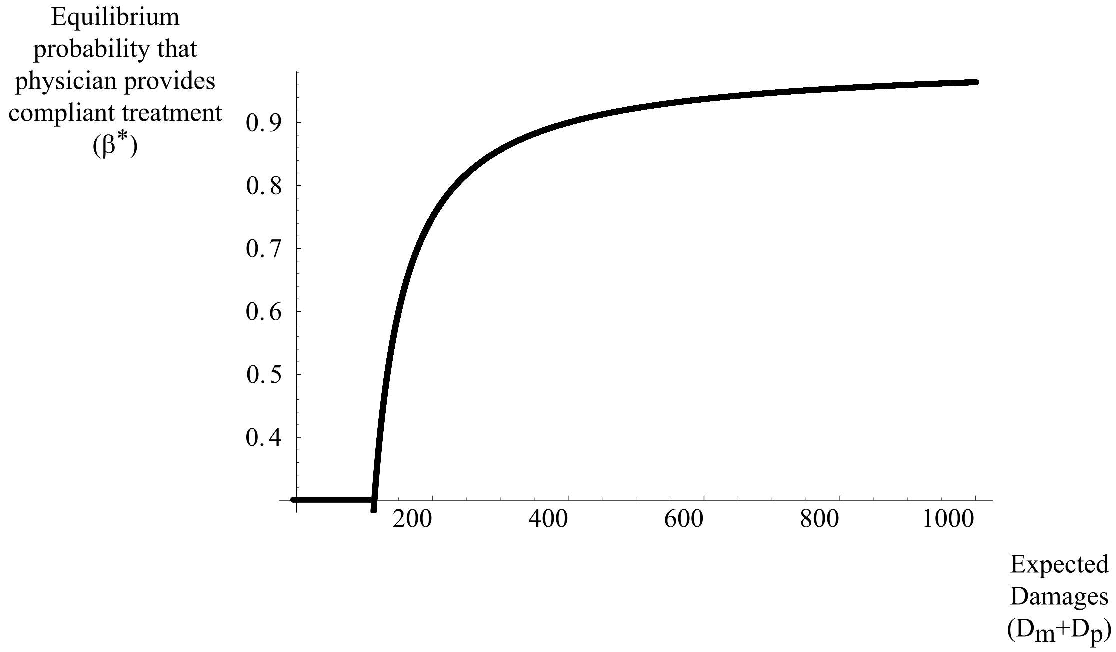


Figure 3.9: This graph illustrates how the physician's treatment decision varies with changes in the damage level when contracts are observable and compliant treatment costs are less than $\hat{c}$. The graph assumes that the probability of a positive outcome given compliant treatment is 80%, the probability of a positive outcome given non-compliant treatment is 40%, litigation costs are \$100 and the cost of compliant treatment is \$100.

Unobservable Contract Regime

Figure 3.10 illustrates the relationship between damages and the probability that the physician compliantly treats when contracts are unobservable (see Figure 3.2). In this case, the MCO will not induce compliant treatment until expected damages given non-compliant treatment, $(1 - q)(D_m + D_p)$, exceed the cost of compliant treatment, c. Once this condition is met, the MCO will induce compliant treatment and the physician will provide compliant treatment with some positive probability. As damages increase, this probability increases until the physician is compliantly treating with near certainty.

Section 3.7 constructs an efficient damage rule to analyze the inefficiencies of two damage rules courts use to compensate injured patients for their losses.

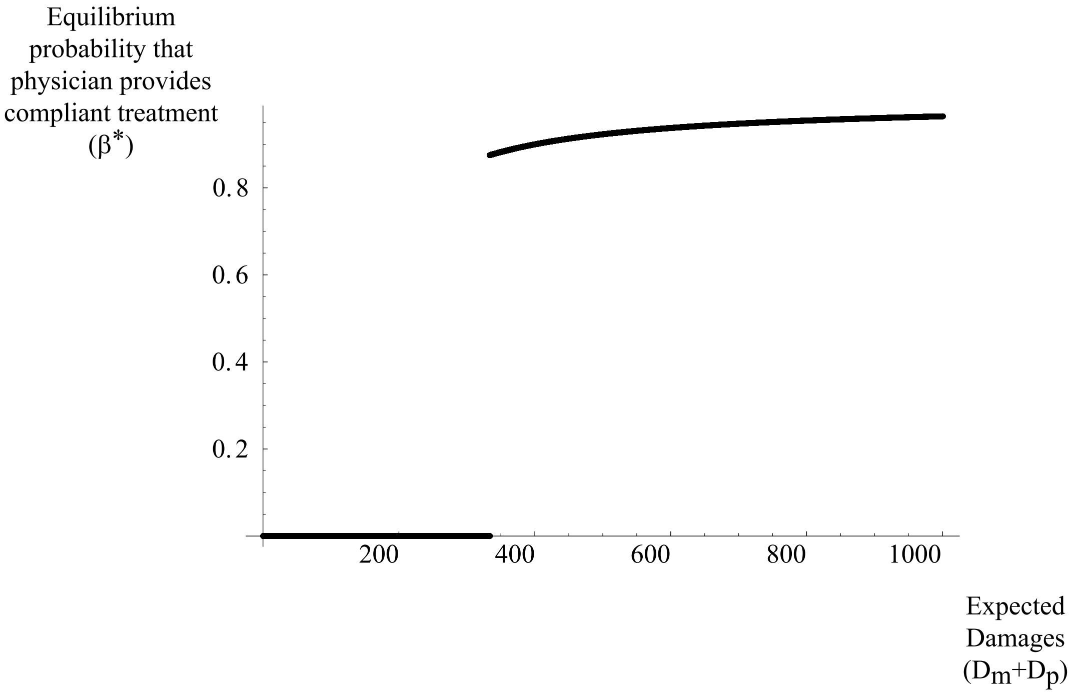


Figure 3.10: This graph illustrates how the physician's treatment decision varies with changes in the damage level when contracts are unobservable. The graph assumes that the probability of a positive outcome given compliant treatment is 80%, the probability of a positive outcome given non-compliant treatment is 40%, litigation costs are \$100 and the cost of compliant treatment is \$200.

3.7 Analysis of Damage Rule Efficiency

The purpose of this section is to identify the inefficiencies of damage rules courts use to compensate negligently injured patients. The inefficiencies depend on the disclosure rule. Section 3.7.1 begins by suggesting an efficient damage rule based on the results of Section 3.5. Section 3.7.2 analyzes the efficiency of two commonly used damage rules: the all-or-nothing rule and the loss-of-a-chance rule.

3.7.1 An Efficient Damage Rule

The analysis begins with a calculation of the first-best solution. Given perfect information, a social planner would compare total social welfare if the physician provides treatment,[49] $pH - c$, with the total social welfare given the physician does not treat, qH. If the net benefit from treatment is greater than the cost of such treatment ($(p-q)H > c$), the social planner would dictate that the physician treat the patient's ailment. On the other hand, if the net benefit from treatment is less than the cost, the social planner would require that no treatment be provided.[50]

This first-best solution is attainable with perfect information. In health care markets, however, information is not perfect. Neither the patient nor the MCO can observe whether the physician treated. To mitigate the negative effects of incomplete information, efficiency-minded courts can set damages to create incentives for industry actors that lead to (or at least approximate) first-best outcomes despite market imperfections. To achieve an efficient outcome, the court must set damages such that the actors are faced with the proper ex ante incentives. The following proposition provides the efficient damage rule and resulting equilibrium behavior.

Proposition 5 *Regardless of the observability of the contract terms, the following specifies the efficient damage rule:*

If the net benefit from treatment is greater than the cost, the court can approximate arbitrarily the first-best solution by increasing damages. This results in the MCO employing a fee-for-service contract with almost full reimbursement for cost, the physician treating with near certainty and the patient almost never suing.

If the net benefit from treatment is less than the cost, the court can achieve the first-best solution by setting damages equal to zero. This results in the MCO paying nothing to the physician, the physician never treating and the patient never suing.

The Appendix provides a proof for this proposition. The intuition for this result is as follows.[51]

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[49]For purposes of this section, read "treatment" as the treatment choice that the social planner would prefer (i.e., the efficient treatment choice).

[50]This cost/benefit framework is akin to that articulated by Judge Learned Hand in *United States v. Carroll Towing Co.*, 159 F.2d 169 (2d Cir. 1947) and years earlier by Terry [99].

[51]Grady [43] argues for a cost-benefit standard of care to replace the threshold level of care standard. He also claims that "this new negligence rule is more consistent with the actual decision rules used by courts than the formal rules posited by the conventional theory." The present study takes no stand regarding the superiority of the cost-benefit standard, but merely employs it to

Consider the case in which the patient can observe the contract terms (see Proposition 1). Recall that the patient will not sue if the physician treats with a sufficiently high probability (m^*). If treatment is socially desirable, setting damages high[52] forces the physician to treat with near certainty to ensure no litigation. Therefore, the physician maximizes his expected payoff by treating with near certainty. In addition, Proposition 1 reveals that the MCO uses a fee-for-service contract when expected damages given no treatment are high relative to the expected cost of treatment. By setting damages high, the court provides an incentive for the MCO to fully reimburse the physician for the cost of treatment. Knowing that the physician (almost) always treats, the patient (almost) never sues.[53]

When the patient cannot observe the contract terms, the reasoning works in much the same way (see Proposition 2). Just as in the previous case, when damages are high the physician maximizes his payoff by treating with near certainty. In addition,

construct a simple and efficient damage rule.

It is important to note that constructing the efficient damage rule is not meant for normative purposes. Clearly important considerations in addition to efficiency drive our search for the "perfect" damage rule. In addition, the model assumes perfect verification by the court. Assuming otherwise significantly changes the construction of the efficient damage rule. The purpose for articulating an efficient damage rule in this section merely is to create a benchmark against which commonly used damage rules can be compared to study their effects on efficiency. Polinsky and Shavell [82], Hylton [53] and Calfee and Craswell [21] study the effects of legal error on incentives.

[52] Even though the efficient rule technically requires infinitely high damages to achieve approximate efficiency, the level of damages necessary to obtain a reasonable outcome is significantly lower. Consider the following example. Assume that treatment is efficient. This implies that the court wishes to set damages such that treatment occurs. If the probability of a positive outcome given treatment is 60%, the probability of a positive outcome given no treatment is 40%, litigation costs equal $10,000 and the cost of treatment is $4,000, then, by setting damages at $5,000,000, the court can ensure (under the assumptions of the model) that the physician will treat in nearly 999 out of 1000 cases and injured patients will sue in approximately 1.3 out of 1000 cases.

[53] Becker [9] shows that, in criminal cases, an optimal level of punishment exists to balance the goals of maintaining low crime levels and minimizing enforcement costs (e.g., costs necessary to investigate crimes and punish offenders). Becker's analysis differs substantially from the analysis of the efficient damage rule in the case of medical malpractice. Tort law, in effect, is "enforced" by injured parties who internalize the costs of suing. The administrative costs of the court system are ignored in this study.

In medical malpractice cases, one must be concerned with balancing good outcomes with the cost to physicians of taking care. These costs imposed on physicians include not only the cost of treatment in each particular case, but also costs incurred to become a specialist in a particular area, to fulfill continuing education requirements, etc. The efficient rule constructed in Proposition 5, however, is designed to take these costs into account. To be efficient, the rule must specify that the cost of treatment, c, accounts for *all* costs necessary to perform a particular treatment, including training, research, etc.

even though the patient will always sue with some positive probability, when damages are set high, the probability that the patient sues is approximately zero because the probability of winning a lawsuit is approximately zero. Finally, when damages are high relative to treatment costs, the MCO will employ a fee-for-service arrangement with partial (but almost full) reimbursement for cost.[54] Therefore, in terms of physician and patient behavior, the same results obtain (approximately) regardless of the observability of the contract terms.

When the cost of treatment exceeds the net benefits it provides, an efficiency-minded court discourages treatment by setting damages equal to zero. When damages are zero, litigation costs exceed expected damages. Therefore, the patient never sues. Knowing the patient will never sue, the physician never treats and the MCO pays the physician nothing. The court achieves the first best outcome. This result is independent of the observability of the contract.

Many studies investigate the effects of defensive medicine: precautions taken by physicians that surpass the standard of care set by custom in order to avoid liability for medical malpractice.[55] The efficient rule proposed might not help to prevent the practice of defensive medicine unless the costs and benefits of treatment are known with certainty. If physicians are uncertain about how costs relate to net benefits, they might provide treatment in cases in which the costs of treatment exceed its net benefits. In addition, if the court is unable to perfectly verify the physician's action, physicians might find it optimal to practice defensive medicine.

3.7.2 Analysis of Commonly Used Damage Rules

Courts in different jurisdictions use different rules to calculate damages when the court determines that the physician acted negligently (i.e., did not provide customary treatment, according to this model). Most states use one of two calculations: (1) the

[54]See the discussion in the appendix for a more detailed explanation of the contract terms under these circumstances.

[55]For a review of studies related to the practice of defensive medicine, see McGuire [72].

all-or-nothing rule or (2) the loss-of-a-chance rule.[56] The *all-or-nothing rule* allows full compensation (i.e., H) for an injury only if the patient would have had a better than fifty percent chance of recovery given treatment (i.e., $p > .5$). Some states that have adopted the *loss-of-a-chance rule* determine damages using a single outcome approach suggested by King [59]. Under this approach, the plaintiff is awarded damages equal to a portion of the full value of lost health. The portion is the percentage by which the defendant's tortious conduct reduced the plaintiff's chance of obtaining a more favorable outcome given treatment. For example, assume that given treatment, the patient would have had a percent chance, p, of recovery (with a value of H). Without treatment, however, the patient has a percent chance, q, of recovery with q strictly less than p. Under this scenario, the plaintiff would be awarded damages of $(p-q)H$, the portion of recovery lost due to the physician's failure to provide proper treatment.

The All-or-Nothing Damage Rule

The purpose of this section is to analyze the effect of imposing the all-or-nothing damage rule on physicians and MCOs that are found liable for medical malpractice.

First consider the case in which litigation costs exceed damages. In this case, the patient will never sue. Knowing that the patient will not sue, the physician never treats. If the net expected benefit of treatment exceeds its cost, inefficiency arises in the form of undertreatment. The same result obtains when damages exceed litigation costs but the probability of a positive outcome given treatment, p, is at most one-half.

If damages exceed litigation costs and the probability of a positive outcome given treatment is more than one-half, then inefficiencies resulting from the all-or-nothing damage rule depend on whether the patient can observe the contract terms. Under these conditions, the all-or-nothing damage rule requires the court to set damages equal to the value of health (i.e., $D_m + D_p = H$).

First consider the case in which the patient can observe the contract terms. In this

[56] Note that some jurisdictions apply a hybrid, using the all-or-nothing rule when the patient's chance of recovery with treatment exceeds one-half and the loss-of-a-chance rule otherwise. E.g., see *Donnini v. Ouano*, 810 P.2d 1163 (Kan. Ct. App. 1991). Variations of the two main damage rules are not studied here.

case inefficiencies of some sort result regardless of the relationship between costs and the expected net benefit of treatment. Table 3.1 lists all cases that could arise under the all-or-nothing damage rule and the resulting inefficiencies given that contracts are observable by the patient, the probability of a positive outcome given treatment is more than one-half and total damages exceed litigation costs. Note that the expected cost of treatment under the all-or-nothing rule ($m_a^* c$) is always less than or equal to the cost of treatment (c). Also, the net benefit of treatment ($(p-q)H$) is always less than or equal to expected damages given no treatment and a lawsuit ($(1-q)H$). Following is a summary of all possible cases assuming that damages exceed litigation costs.

		Efficient Damage Rule Outcomes	
		Treatment is efficient ($c < (p-q)H$)	Treatment is inefficient ($c > (p-q)H$)
All-or-Nothing Damage Rule Outcomes	Treatment cost relatively low ($m_a^* c < (1-q)H$)	undertreatment	overtreatment
	Treatment cost relatively high ($m_a^* c > (1-q)H$)	inconsistent conditions	litigation costs

Table 3.1: Inefficiencies resulting from the all-or-nothing damage rule as compared to the efficient damage rule when contracts are observable by the patient, the probability of a positive outcome given treatment is greater than one-half and total damages exceed litigation costs.

If the expected cost of treatment ($m_a^* c$) is low relative to total expected damages under the all-or-nothing rule ($(1-q)H$) and the level of treatment is efficient, then the physician will treat with a lower probability than that resulting under the efficient rule. Under these conditions, the efficient damage rule results in (near) certain treatment, whereas the all-or-nothing rule leads to treatment less often. On the other hand, if treatment is not efficient, then the efficient damage rule calls for no treatment while the all-or-nothing rule leads to treatment with some positive probability. Therefore, overtreatment occurs. Note that litigation occurs neither under the efficient rule nor under the all-or-nothing damage rule when treatment cost is low relative to total expected damages.

If the expected cost of treatment is high relative to total expected damages under the all-or-nothing rule, then treatment must be inefficient.[57] Treatment does not occur under either rule. The efficient outcome, however, calls for no lawsuits while the actual outcome under the all-or-nothing damage rule results in the patient suing with certainty. Therefore, inefficiencies arise due to litigation costs.

When contracts are not observable by the patient, the same inefficiencies obtain. The MCO's decision rule, however, differs from the observable contract case.[58] Table 3.2 lists all cases that could arise under the all-or-nothing damage rule and the resulting inefficiencies given that contracts are not observable by the patient, the probability of a positive outcome given treatment is more than one-half and total damages exceed litigation costs.

If the cost of treatment (c) is low relative to total expected damages ($(1-q)H$) and treatment is efficient, the efficient rule calls for certain treatment and no lawsuit. The all-or-nothing rule, on the other hand, results in treatment less often and a positive probability of litigation. Therefore, the physician undertreats and the patient will incur inefficient litigation costs. If treatment is inefficient, then the efficient rule calls for no treatment and no lawsuit. The all-or-nothing rule results in some positive probability of treatment and some positive probability of a lawsuit. Therefore, the patient incurs inefficient litigation costs and the physician overtreats.

If the cost of treatment exceeds total expected damages, then treatment is inefficient for the same reason given in the observable contract case. Neither the all-or-

[57] If $m_a^* c > (1-q)H \Rightarrow c > (1-q)H \Rightarrow c > (p-q)H$.

[58] Specifically, the MCO compares the cost of treatment (rather than the expected cost of treatment) to total expected damages when deciding on a contract type.

		Efficient Damage Rule Outcomes	
		Treatment is efficient ($c < (p - q)H$)	Treatment is inefficient ($c > (p - q)H$)
All-or-Nothing Damage Rule Outcomes	Treatment cost relatively low ($c < (1 - q)H$)	undertreatment; litigation costs	overtreatment; litigation costs
	Treatment cost relatively high ($c > (1 - q)H$)	inconsistent conditions	litigation costs

Table 3.2: Inefficiencies resulting from the all-or-nothing damage rule as compared to the efficient damage rule when contracts are *not* observable by the patient, the probability of a positive outcome given treatment is greater than one-half and total damages exceed litigation costs.

nothing rule nor the efficient rule results in treatment. The efficient outcome, however, calls for no lawsuits while the actual outcome under this damage rule results in the patient suing with certainty. Therefore, inefficiencies arise due to litigation costs.

The next section discusses inefficiencies that arise when courts use the loss-of-a-chance rule to compensate injured patients for their losses.

The Loss-of-a-Chance Damage Rule

The purpose of this section is to analyze the effect of imposing the loss-of-a-chance damage rule on physicians and MCOs that are found liable for medical malpractice. Recall that, under this damage rule, if the injured patient proves medical malpractice, the court awards the patient the value of the lost chance of recovery attributable to the physician's action (i.e., $(p - q)H$). Just as under the all-or-nothing damage rule, if litigation costs exceed damages and the net expected benefit of treatment exceeds its cost, inefficiency in the form of undertreatment occurs.

When damages exceed litigation costs, regardless of whether the patient is able to observe the contract, inefficiencies arise under all possible circumstances when courts use the loss-of-a-chance rule to compensate the injured patient. First consider the case in which the patient is able to observe the contract. Table 3.3 lists all cases that could arise under the loss-of-a-chance damage rule and the resulting inefficiencies given that contracts are observable by the patient and damages exceed litigation costs. Let $m_l^* c$ represent the expected cost of treatment under the loss-of-a-chance damage rule.

If the expected cost of treatment ($m_l^* c$) is less than the MCO's expected damages ($(1-q)(p-q)H$) and treatment is efficient, the loss-of-a-chance rule results in a lower probability of treatment than that resulting under the efficient damage rule. Conversely, if treatment is inefficient, then the loss-of-a-chance rule results in a higher probability of treatment than the efficient damage rule produces. Note that these results are similar to those in an observable contract regime. The unobservability of contracts and the loss-of-a-chance damage rule, however, change the MCO's contract choice and the equilibrium probability of treatment. Specifically, decreasing damages lowers the likelihood that the MCO will employ a fee-for-service contract and, therefore, lowers the probability of treatment.

Next, consider the case in which the expected cost of treatment is high relative to total expected damages. Unlike the observable contract case, it is possible for treatment to be efficient. The efficient treatment rule calls for certain treatment and no lawsuit. The loss-of-a-chance rule, on the other hand, results in no treatment and a certain lawsuit. Therefore, the physician undertreats and the patient incurs inefficient litigation costs. If treatment is inefficient, then the efficient outcome calls for no lawsuits while the actual outcome under this damage rule results in the patient suing with certainty. Therefore, inefficiencies arise due to litigation costs. Neither rule results in treatment; therefore, no inefficiencies due to treatment emerge.

When contracts are not observable by the patient, the same inefficiencies obtain. The MCO's decision rule, however, differs from the cases considered previously. Table 3.4 lists all cases that could arise under the loss-of-a-chance damage rule and the resulting inefficiencies given that contracts are not observable by the patient and

		Efficient Damage Rule Outcomes	
		Treatment is efficient $(c < (p-q)H)$	Treatment is inefficient $(c > (p-q)H)$
Loss-of-a-Chance Damage Rule Outcomes	Treatment cost relatively low $(m_l^* c < (1-q)(p-q)H)$	undertreatment	overtreatment
	Treatment cost relatively high $(m_l^* c > (1-q)(p-q)H)$	undertreatment; litigation costs	litigation costs

Table 3.3: Inefficiencies resulting from the loss-of-a-chance damage rule as compared to the efficient damage rule when contracts are observable by the patient and total damages exceed litigation costs.

damages exceed litigation costs.

If the cost of treatment (c) is less than the MCO's expected damages ($(1-q)(p-q)H$), it must be that treatment is efficient.[59] The efficient rule calls for treatment with certainty and no lawsuit. The loss-of-a-chance rule, however, leads to a lower probability of treatment and a positive probability of a lawsuit. Therefore, inefficiencies in the form of undertreatment and litigation costs occur.

If the cost of treatment exceeds total expected damages and treatment is efficient, then inefficiencies arise from both litigation and treatment choices. The efficient rule leads to certain treatment and no lawsuit. The loss-of-a-chance rule, however, results in no treatment and a certain lawsuit. Finally, if treatment is inefficient, the efficient outcome calls for no treatment and no lawsuits. While under the loss-of-a-chance rule no treatment results, the patient sues with certainty. Therefore, inefficiencies arise due to litigation costs.

The next section presents an analysis of how outcomes are affected when the court specifies which parties an injured patient is allowed to sue for medical malpractice.

[59] $c < (1-q)(p-q)H \Rightarrow c < (p-q)H$

		Efficient Damage Rule Outcomes	
		Treatment is efficient ($c < (p-q)H$)	Treatment is inefficient ($c > (p-q)H$)
Loss-of-a-Chance Damage Rule Outcomes	Treatment cost relatively low ($c < (1-q)(p-q)H$)	undertreatment; litigation costs	inconsistent conditions
	Treatment cost relatively high ($c > (1-q)(p-q)H$)	undertreatment; litigation costs	litigation costs

Table 3.4: Inefficiencies resulting from the loss-of-a-chance damage rule as compared to the efficient damage rule when contracts are *not* observable by the patient and total damages exceed litigation costs.

3.8 Analysis of Tortfeasor Rules

Tortfeasor rules specify the parties that an injured patient can sue to recover for damages resulting from non-compliant treatment. If the court allows the patient to bring a claim against both the physician and the MCO, the patient may sue both. On the other hand, if the court allows suits against only the physician or only the MCO, the patient is restricted to filing a suit against only one party.[60]

The following proposition states the relationship between tortfeasor rules and treatment and litigation decisions.

[60]Traditionally, patients were allowed to bring medical malpractice lawsuits against physicians only. MCOs, upon being sued, would use the "corporate practice of medicine" doctrine as an affirmative defense against claims of medical malpractice. States such as Texas, however, have eliminated the corporate practice of medicine law as a defense for plans. See TEX. CIV. PRAC. & REM. CODE ANN. § 88.002(h). Therefore, in recent years, patients have successfully sued both physicians and MCOs for medical malpractice (e.g., *Wilson v. Blue Cross of S. Cal.*, 222 Cal. App. 3d 660 (1990)). An "MCO only" tortfeasor rule has not been used by any court, but has been analyzed in the literature. See, for example, Polinsky and Shavell [81].

Proposition 6 *Neutrality Result: Given any damage rule and any disclosure rule, the probability that the physician will provide compliant treatment and the probability that an injured patient will sue do not depend on the tortfeasor rule.*

The proof of this neutrality result follows directly from Propositions 1 and 2.[61] The result stems from the fact that, regardless of which parties face actual liability, the MCO must absorb total expected damages to satisfy the physician's individual rationality constraint. The model also implicitly assumes that both the MCO and physician are risk neutral and face no wealth constraints. If these assumptions are relaxed, however, the result will not hold. For example, if damages imposed on the physician exceed his total wealth, then the deterrence effects of a negligence regime are reduced because the physician will not find it in his best interest to treat at the socially optimal level.[62]

Contracts between MCOs and physicians might contain agreements that grant indemnification to the MCO, holding it harmless for liability related to patient treatment decisions.[63] These clauses, however, do not affect the neutrality result. Even if an MCO secures indemnification protection, ex ante it must compensate the physician for expected damages to satisfy the physician's individual rationality constraint. As the following proposition shows, however, these clauses might affect the MCO's contract choice.

The final result states the relationship between the tortfeasor rule and the types of physician contracts employed by MCOs to obtain medical services for their enrollees.

Proposition 7 *Given any damage rule, the MCO's choice over contracts depends on the disclosure rule and the tortfeasor rule in the following way:*

If contracts are observable and the expected cost of treatment is less than total expected damages, the MCO will employ a fee-for-service contract with full reim-

[61] This result is consistent with the neutrality results formulated by Kornhauser [61] and Sykes [98]. The result here, however, generalizes Kornhauser's claim that neutrality will result only if certain instruments are available to the MCO (i.e., indemnification and/or insurance).

[62] See Kornhauser [61] and Sykes [98] for detailed discussions of circumstances under which the neutrality result does not hold.

[63] Morgan and Levy [75] summarize legislative rules regarding "hold harmless" clauses on a state-by-state basis.

bursement for cost regardless of the tortfeasor rule. If the expected cost of treatment exceeds total expected damages, then the MCO will employ a capitated contract. The fixed payment, however, will depend on the tortfeasor rule. If the patient is allowed to sue the physician, then the MCO will pay the physician a strictly positive fixed payment. Under an MCO-only tortfeasor rule, however, the physician receives no fixed payment.

If contracts are unobservable and the cost of treatment is less than total expected damages, the tortfeasor rule affects contract types as follows. If the patient is able to sue both the physician and the MCO, the MCO will employ a fee-for-service contract with partial reimbursement and a strictly positive fixed payment. If the patient is able to sue the physician only, the MCO will employ a capitated contract with a positive fixed payment equal to the cost of treatment. If the patient is able to sue the MCO only, the MCO will employ a fee-for-service contract with full reimbursement and no fixed payment. If the cost of treatment exceeds total expected damages, the result is identical to the observable contract case. That is, the MCO will employ a capitated contract with the fixed payment depending on the tortfeasor rule. If the patient is allowed to sue the physician, then the MCO must pay a strictly positive fixed payment to the physician. Under an MCO-only tortfeasor rule, however, the physician receives no fixed payment.

This result also follows directly from Propositions 1 and 2. It shows that, even though the tortfeasor rule does not affect treatment and litigation outcomes, it will affect how the MCO structures its contract with the physician to influence treatment decisions and maximize its payoff.

The intuition behind the case in which contracts are observable is fairly straightforward. When treatment costs are relatively low, the MCO will employ a fee-for-service contract with full reimbursement for cost regardless of the tortfeasor rule. This is the case because lawsuits never occur. Therefore, the physician is not exposed to damages, and the MCO must pay him the full cost of treatment to guarantee treatment at a level such that the patient never sues. When treatment costs are relatively high, the MCO employs a capitated contract with a fixed payment to cover the physician's exposure to liability. If the tortfeasor rule exposes the physician to potential liability, then the fixed payment will be strictly positive. On the other hand, if the tortfeasor rule allows suits against only the MCO, the fixed payment to the physician will be zero.

Next, consider the case in which contracts are not observable. If the cost of treatment is relatively low and the tortfeasor rule allows suits against both the MCO and the physician, the MCO employs a fee-for-service contract with partial reimbursement for treatment costs and a fixed payment to cover the physician's exposure to liability given no treatment. Recall that the MCO can reduce the reimbursement amount because the physician has some incentive to treat resulting from his exposure to liability. The MCO, however, will partially reimburse for treatment costs to encourage the optimal level of care (from the MCO's perspective) to reduce its exposure to liability. If an injured patient is allowed to sue the physician only, the MCO will not reimburse for treatment, but will pay a fixed payment equal to the cost of treatment, which, in this case, is exactly equal to the physician's liability exposure given no treatment. If, on the other hand, an injured patient is allowed to sue only the MCO, the physician has no incentive to treat based on liability exposure. The MCO must fully reimburse treatment costs but is not required to pay any fixed payment. If the cost of treatment is relatively high, contracts under an unobservable contract regime look identical to those under an observable contract regime.

3.9 Conclusion and Extensions

The model and its results provide insights with respect to policy surrounding medical malpractice. First, the observability of contracts matters. Although the motivation for forcing disclosure of contracts to potential or present MCO enrollees is to provide information during the MCO selection process, policy makers should weigh the potential effects of disclosure on contract, treatment and litigation decisions. In addition, judges and legislators should consider carefully the deterrence effects of medical malpractice damage rules and judiciously contemplate how changes in these rules affect behavior in health care markets. Finally, market conditions influence the effects of tortfeasor rules on behavior. These rules might help to explain the configuration of contracts used in the market and the variations across jurisdictions.

The model leads to several testable predictions. First, given that reliable measurements of physician treatment choices and patient filing rates are available, empirical tests of the effects of disclosure and damage rules on contracts, treatment and litigation decisions are possible.[64] In addition, testing whether treatment and litigation decisions are affected by tortfeasor rules might lead to the discovery of other market conditions that give tortfeasor rules some bite. Finally, one could test whether variations in tortfeasor rules explain variations in the portfolio of contracts employed in different jurisdictions.

Strong caveats apply. The practical use of the model's results to create policy is severely limited by many of its assumptions. First, relaxing the assumption that courts can verify perfectly the physician's action will change the construction of the efficient damage rule. If courts sometimes err, imposing heavy penalties on physicians and MCOs might encourage injured patients to sue when a lawsuit is not socially optimal. Even if damages are set high so that the physician treats with near certainty, the patient might sue to take advantage of the small chance that the court mistakenly finds the physician liable. Extending the model to account for the effect of court error on the efficient damage rule might be a useful exercise.

Second, the model does not account for the effects of competition among MCOs for enrollees. In addition, the fact that enrollees might voluntarily separate themselves into various types of plans is not considered here.[65] Although these assumptions do not affect the general intuitions of the model, considering competition and enrollee choice could offer additional insights.

Finally, the model focuses on behavior given that one patient in need of treatment

[64] See *infra* Chapter 4 for an empirical investigation of how disclosure laws and damage caps affect expected damages due to medical malpractice.

[65] See, e.g., Jackson-Beeck and Kleinman [54], Lairson and Herd [65] and Scotti et al. [89], all analyzing how patients separate themselves among types of managed care plans.

seeks medical care. Therefore, the use of contracts by MCOs to share risk with physicians is not considered here. MCO-physician contracts, however, do play a role in the sharing of risk among actors in health care markets. The explanation behind contract composition within a particular jurisdiction must take this motivation into account.

In sum, policy makers should be wary about using the results provided here to construct remedies for the imperfections of health care markets. The analysis is just one step toward understanding the very complex nature of health care markets. Until the basic elements of behavior are well understood, however, we run the risk of designing policies leading to perverse behavior by market actors.

Chapter 4 Some Empirical Tests

4.1 Introduction

Almost every state in the U.S. has implemented some sort of tort reform geared directly toward medical malpractice litigation.[1] Many state legislatures were driven to act by perceived medical malpractice insurance crises during the 1970s and 80s.[2] Conventional theories regarding tort reform suggest that reducing the spoils from litigation will reduce the tendency of injured patients to file claims against health care providers. This, in turn, will reduce the amount insurance companies pay out to cover claims, leading to a reduction in medical malpractice insurance premiums.

The theoretical model presented in Chapter 3 suggests that conventional theories might not account fully for how tort reforms influence behavior in health care markets. For example, statutory damage caps[3] affect not only injured patients' filing decisions but also physician treatment decisions. When deciding whether to provide compliant treatment, physicians consider the cost of compliant treatment versus ex ante expected damages given non-compliant treatment. Under certain conditions, when damages are reduced the level of compliant treatment provided decreases. When physicians (or MCOs) lower the level of care, the number of injuries resulting from negligent medical care will likely increase. In addition, injured patients will consider the physicians' incentives when deciding whether to expend resources to file a claim. An injured patient's decision to file depends, in part, on her belief that the physician was negligent. Although the patient is unable to observe the physician's action, she

[1] See Kinney [60] for a summary of state statutes addressing medical malpractice litigation.

[2] Many argue that the country was, indeed, experiencing true medical malpractice insurance crises. Others argued that the changes were merely adjustments toward an equilibrium arising from the changing characteristics of health care markets. See Bhat [11] for a discussion of the debate over whether actual crises occurred.

[3] Statutory damage caps limit the total damages an injured patient can recover by filing a claim against a health care provider.

forms beliefs about "guilt" by considering the physician's incentives. Knowing that the physician expects to pay less in damages if found liable by the court, an injured patient is more likely to believe that the physician failed to meet the standard of care. For these reasons, the model predicts that, under certain conditions, damage caps will cause an increase in claim rates and, in some cases, ex ante expected damages.

The theoretical model also considers the effects of another, quite different, legal rule designed not to address medical malpractice, but to provide information to prospective enrollees during the health care insurance plan selection process. Currently, roughly 20 states require MCOs to disclose to current (and/or prospective) enrollees the types of contracts they use to obtain medical services from health care providers.[4] Nothing indicates that legislators considered the effects of mandatory disclosure laws on litigation and treatment decisions. The theoretical model presented in Chapter 3 suggests that disclosure laws, indeed, do affect the behavior of health care providers and injured patients. In particular, the model predicts that states forcing the disclosure of contract terms will experience fewer claims filed against health care providers and more compliant treatment. When contracts are unobservable, injured patients must file claims to encourage MCOs/physicians to compliantly treat. On the other hand, when contracts are observable, injured patients can infer from the contract terms whether the physician provided negligent care; thus, lawsuits become unnecessary in some cases and the filing rate decreases. With respect to treatment, when contracts are unobservable the cost of compliant treatment always includes damages (i.e., some injured patients will sue in all cases). More compliant care is provided when contracts are observable because it is less costly for the MCO than when contracts are unobservable. When injured patients are able to observe the contract they never sue when the contract encourages compliant treatment. Therefore, the cost of compliant treatment includes only the costs related to the treatment.[5]

The purpose of this empirical study is to test the model's predictions regarding the effects of damage caps and disclosure laws on total ex ante expected damages result-

[4]See *infra* Section 4.2.

[5]See *supra* Chapter 3, Section 5 for a more detailed explanation of the intuitions behind these results.

ing from medical malpractice lawsuit verdicts and settlements. Data on aggregated medical malpractice premiums and incurred losses were collected for all 50 states for the years 1991–2001. These measures are used as proxies for ex ante expected damages.

It is important to keep in mind that this study does not tackle the issue of whether these legal rules are socially desirable. An evaluation of this magnitude would require a much broader study of the impacts of each legal rule and the costs and benefits of changes in legal environments. For example, mandatory disclosure laws provide benefits to enrollees in the form of increased information during the managed care plan selection process. In addition, disclosure rules might interfere with the patient/physician relationship in a negative way. The formal model does not account for these benefits and costs. Without considering these effects (and others), normative judgments regarding changes in legal rules are limited.

This chapter is organized as follows. Section 4.2 provides background information regarding the origination and implementation of mandatory disclosure law and damage caps. Section 4.3 uses the theoretical results from Chapter 3 to formulate predictions about how changes in legal rules (i.e., mandatory disclosure laws and damage caps) affect ex ante expected damages. First, the model predicts that states forcing disclosure of contract terms will experience (weakly) lower ex ante expected damages than states without disclosure laws in effect. Second, the model shows that the effect of damage caps on ex ante expected damages depends on several parameters. It is possible that a cap could increase or decrease ex ante expected damages. The effect also depends on whether contracts are observable by injured patients. These results differ from conventional theory, which predicts that damage caps will lead to a decrease in ex ante expected damages. Therefore, the theoretical model presented in Chapter 3 offers an explanation in the case that the empirical results do not support conventional theory.

Section 4.4 provides the empirical analysis with details regarding the data employed, model specification and empirical estimations. The empirical results support the prediction that disclosure laws (weakly) decrease ex ante expected damages. The results are mixed when it comes to the implementation of damage caps. Section 4.5 offers conclusions and discussion.

4.2 Background

This section provides some background into the genesis of mandatory disclosure laws and damage caps.

4.2.1 Mandatory Disclosure Laws

As of 2001, 21 states require MCOs to disclose information regarding physician compensation methods to enrollees.[6] In 1996, Arizona became the first to implement a mandatory disclosure law and, in that year, Vermont, Virginia and Washington followed Arizona's lead. In 1997, four additional states (Maine, New York, North Carolina and Rhode Island) implemented similar rules. Connecticut, Kentucky and New Jersey followed suit in 1998. Several states (Georgia, Hawaii, Iowa, Minnesota, Pennsylvania and South Dakota) jumped on the band wagon in 1999. California, Illinois and New Hampshire passed mandatory disclosure laws that went into effect in 2000. Finally, Massachusetts most recently passed a mandatory disclosure law, which went into effect in 2001.

Disclosure rules vary by content and timing requirements. In terms of content, some states require very little detail. For example, Iowa's statute mandates disclosure of "methodologies used to compensate physicians." Hawaii mandates that "managed care plan[s] shall provide generic participating provider contracts to enrollees...." Connecticut requires MCOs to issue a "written statement of the types of financial arrangements or contractual provisions that the managed care organization has with...physicians...including, but not limited to, compensation based on a fee-for-service arrangement, a risk-sharing arrangement or a capitated risk arrangement." These statutes do not provide any other detail regarding content of the disclosure.

[6] See Table A.1 in the Appendix for cites to each state's statute.

Other states require substantial detail. For instance, Illinois requires MCOs to disclose "the percentage of copayments, deductibles, and total premiums spent on health care related expenses and the percentage of copayments, deductibles, and total premiums spent on other expenses, including administrative expenses...." Maine requires MCOs to disclose "a general description of the methods used to compensate providers, including capitation and methods in which providers receive compensation based upon referrals, utilization or cost criteria."

A small number of states require disclosure of information regarding the contracts of particular physicians or physician groups, or for the provision of particular medical services (e.g., referrals). For instance, New York requires MCOs to disclose "a description prepared annually of the types of methodologies the insurer uses to reimburse providers specifying the type of methodology that is used to reimburse particular types of providers or reimburse for the provision of particular types of services...." California requires disclosure of a "description regarding whether, and in what manner, the bonuses and any other incentives are related to a provider's use of referral services." Georgia mandates the disclosure of a "summary of any agreements or contracts between the managed care plan and any health care provider or hospital." Georgia's statute, however, does not require the summary to include financial agreements as to actual rates, reimbursements, charges or fees negotiated by the managed care plan and any health care provider or hospital. Illinois requires health care plans to "provide to enrollees a description of the financial relationships between the health care plan and any health care provider...." Similar to Georgia, however, MCOs do not have to disclose specific provider reimbursement.

The disclosure statutes also vary according to the timing of disclosure. New Hampshire health carriers must provide information regarding provider contracts to covered persons in the evidence of coverage (i.e., in the contract between the MCO and the enrollee). Some states (e.g., Arizona) require disclosure to be made prior to the execution of a contract between the MCO and an enrollee. Other states, including Connecticut, also require disclosure during open enrollment periods. Minnesota requires disclosure "during open enrollment, upon enrollment, and annually thereafter...." Vermont requires disclosure only to members (presumably after they contract with the carrier for health coverage).

Other states mandate enrollment in some cases only upon request. Hawaii and Illinois mandate disclosure to enrollees upon request. Georgia and Pennsylvania require disclosure to both enrollees and prospective enrollees upon request. Massachusetts requires disclosure to "at least one adult insured in each household upon enrollment, and to a prospective insured upon request...." New York and North Carolina also require disclosure to each enrollee and, upon request, to each prospective enrollee prior to enrollment.

Although timing and content of disclosures vary by state, the reasons for passing disclosure laws are similar. Rather than actually regulating the types of contracts MCOs may use to obtain medical services for their enrollees, states use disclosure laws to force MCOs to provide information to enrollees (or prospective enrollees) so that they can make informed decisions during the plan selection process (Hellinger [50]). If a consumer does not favor the general structure of provider contracts an MCO employs, the consumer can either choose not to enroll in the plan. In addition, disclosure serves important policy goals. Miller and Horowitz [73] point out that "[d]isclosure of a conflict of interest between physicians and their patients could satisfy the fiduciary duty owed by physicians, promote patient autonomy and preserve the integrity of the physician/patient relationship."

Although mandatory contract disclosure is intended to provide prospective enrollees with information when choosing health plans (among other reasons), it also affects MCO contract choices, physician treatment decisions and litigation decisions by injured patients. Section 4.3 outlines the theory behind these claims.

4.2.2 Damage Caps

During the 1970s and 80s many states were experiencing medical malpractice insurance crises. Several insurers pulled out of the medical malpractice insurance business, resulting in a shortage of medical malpractice insurance. In addition, many physicians stopped practicing in high risk fields such as obstetrics because the cost of practicing in such areas was prohibitively expensive as medical malpractice insurance rates skyrocketed.

This led state legislators to implement tort reforms related to medical malpractice litigation. The idea was that if the spoils from litigation were reduced, injured patients would find it less rewarding to file claims against physicians. This would result in fewer claims and a resulting decrease in medical malpractice insurance premiums.

In 1975, California legislators passed the Medical Injury Compensation Reform Act (commonly known as "MIRCA") to address the medical malpractice insurance crisis in their state.[7] In addition to other sorts of tort reforms, MICRA includes a $250,000 cap on non-economic damages.[8]

MICRA became a model law that several states implemented thereafter. In addition to limiting recovery of non-economic damages, some state legislators capped the amount of economic and punitive damages an injured patient could recover by filing a claim against a physician or MCO. Table A.2 in the Appendix provides information regarding the implementation of damage caps by state.

The following section fleshes out a theory that challenges the conventional conjecture that damage caps necessarily lead to a decrease in ex ante expected damages.

4.3 Theory and Predictions

This section summarizes the theoretical results from Chapter 3 regarding how mandatory disclosure laws and damage caps affect claim rates and compliant treatment rates.

[7]Medical Injury Compensation Reform Act, ch. 1, 1975 Cal. Stat. 3949 (codified as amended in scattered sections of Cal. Bus. & Prof. Code, Cal. Civ. Code, Cal. Civ. Proc. Code, Cal. Ins. Code).

[8]Cal. Civ. Code §3333.2(b) (West 1997). Non-economic damages include losses from pain and suffering.

4.3.1 Mandatory Disclosure Laws

Recall from Chapter 3 that mandatory disclosure laws directly impact claim rates (i.e., the likelihood that an injured patient will file a claim with a court to recover damages) and compliant treatment rates. Figures 4.1 and 4.2 summarize exactly how mandatory disclosure laws affect these actions given particular treatment costs and total damages.

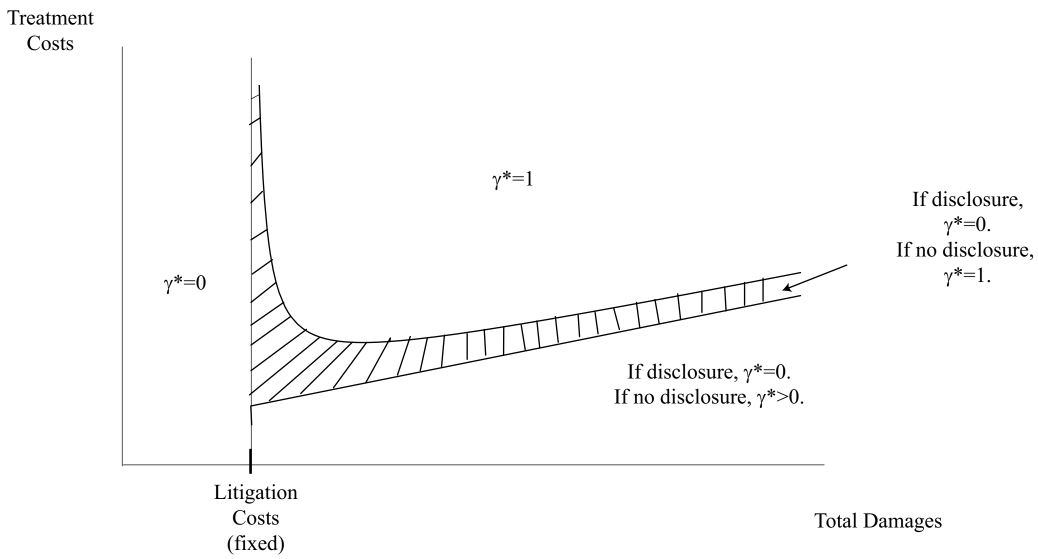

Figure 4.1: This graph illustrates the differences in claim rates related to different disclosure rules. It employs the same parameters as Figure 3.3. Recall that the patient's equilibrium probability of suing is represented by γ^*.

This chapter focuses on the claim rate prediction. Proposition 3 of Chapter 3 states that, given (1) the cost of compliant treatment, (2) the probability of a positive outcome given compliant treatment, (3) the probability of a positive outcome given non-compliant treatment, (4) expected litigation costs and (5) expected damages, claim rates in a regime with observable contracts (i.e., mandatory disclosure regimes) will be less than (or equal to) claim rates in regimes with unobservable contracts (i.e., regimes not requiring disclosure). This result can be extended to reveal predictions regarding how ex ante expected damages react to changes in total damages.

The empirical analysis presented in the following section attempts to study the

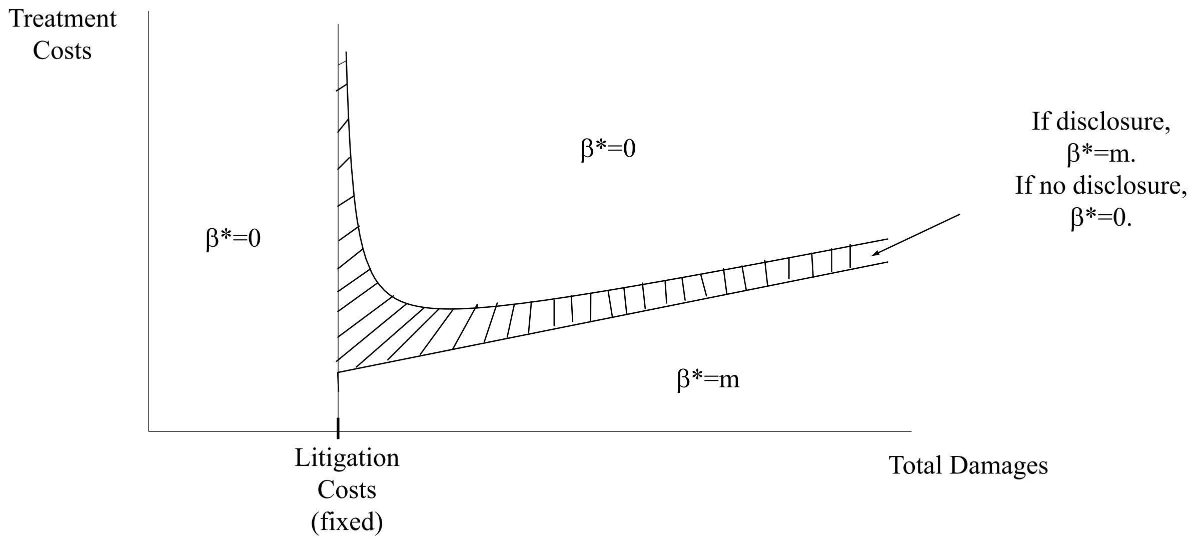

Figure 4.2: This graph illustrates the differences in compliant treatment rates related to different disclosure rules. It employs the same parameters as Figure 3.4. Recall that β^* represents the physician's equilibrium probability of compliantly treating and m represents the physician's cut-off point (i.e., the probability of compliantly treating such that the patient is indifferent between suing and not suing). See *supra* Section 3.5 for details regarding the equilibrium of the model.

relationship between disclosure laws and ex ante expected damages. The study uses average medical malpractice insurance premiums per non-federal physician as a proxy for ex ante expected damages (assuming that other factors influencing premiums are held constant). Premiums are, in large part, determined by ex ante expected damages calculated using both the likelihood of claims filed by injured patients and total damages incurred from settlements and lost court cases (Bhat [11]). Therefore, the study, in effect, tests for whether disclosure laws reduce ex ante expected damages. According to the model presented in Chapter 3, ex ante expected damages (represented here by A) are equal to the probability that the physician negligently treated $(1-\beta^*)$ multiplied by the probability of a negative outcome given negligent treatment $(1-q)$ multiplied by the probability the injured patient files a claim given an injury (γ^*) multiplied by the damage award received during settlement or awarded by the court (D). In other words, $A = (1-\beta^*)(1-q)\gamma^* D$.

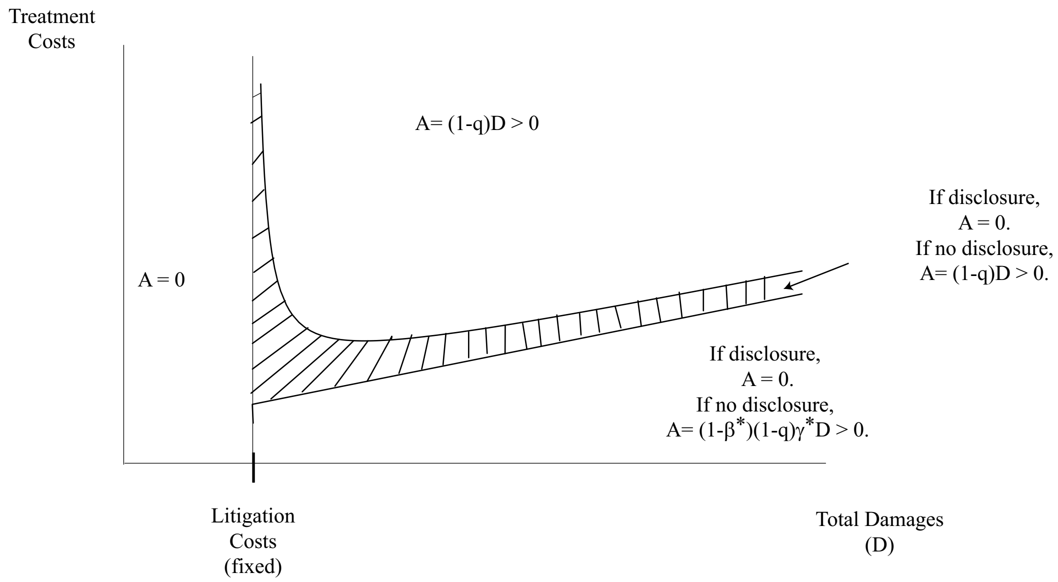

Figure 4.3: This graph illustrates the differences in ex ante expected damages caused by different disclosure rules. The figure combines Figures 4.1 and 4.2. The patient's equilibrium probability of filing a claim is represented by γ^* and the physician's equilibrium probability of providing treatment that complies with the legal standard of care is represented by β^*. According to the theoretical model, ex ante expected damages generally are given by $A = (1 - \beta^*)(1 - q)\gamma^* D$.

The theory presented in Chapter 3 supports the claim that regimes requiring disclosure will experience not only lower claim rates, but also lower ex ante expected damages. The claim that disclosure regimes observe lower ex ante expected damages is shown by examining Figures 4.1 and 4.2 simultaneously. Figure 4.3 provides predictions regarding ex ante expected damages (A) for each region of the graph by considering the patient's equilibrium probability of filing a claim and the physician's equilibrium probability of providing compliant treatment.

Consider each region of the graph.[9] When litigation costs (L) exceed total damages (D), the patient will never sue, regardless of the disclosure rule. In addition, if the (total damages, treatment costs) pair lies in the region above the shaded region, then the physician will not provide compliant treatment (i.e., $\beta^* = 0$). In this case, the patient sues with certainty (i.e., $\gamma^* = 1$), regardless of the disclosure law. Therefore, for (total damages, treatment costs) pairs in these regions, ex ante expected damages

[9]See Chapter 3 for detailed explanations of the model's theoretical predictions.

given observable contracts are equal to ex ante expected damages given unobservable contracts.

Next, consider (total damages, treatment costs) pairs lying in the shaded region. In regimes mandating disclosure, the physician will provide compliant treatment at a level such that injured patients will never sue. Therefore, if disclosure is required, ex ante expected damages are equal to zero. If, on the other hand, disclosure is not required, then the physician will not provide compliant care (i.e., $\beta^* = 0$) and the patient will sue with certainty (i.e., $\gamma^* = 1$). Thus, in regimes without disclosure laws, ex ante expected damages are equal to $(1-q)D$, which is greater than zero. So, for all (total damages, treatment costs) pairs in the shaded region, ex ante expected damages in regimes that force disclosure are less than ex ante expected damages in regime that do not.

Finally, consider (total damages, treatment costs) pairs lying below the shaded region. Again, ex ante expected damages will be greater if contract disclosure is not required. In regimes mandating disclosure, the physician will provide compliant treatment at a level such that injured patients never sue. Therefore, when contracts are observable, ex ante expected damages are equal to zero. On the other hand, in regimes without mandatory disclosure laws, injured patients will sue with some positive probability and physicians will treat with some probability. Therefore, in these regimes, ex ante expected damages are equal to $(1-\beta^*)(1-q)\gamma^* D$, which is strictly greater than zero.

Individual analysis of each region of the graph demonstrates that regimes requiring disclosure will experience lower ex ante expected damages than regimes not requiring disclosure. Therefore, the model presented in Chapter 3 predicts that medical malpractice insurance premiums should be lower in regimes requiring disclosure.[10]

Recall from the previous section that disclosure laws vary substantially in terms of timing and content requirements. These differences, however, do not alter the predictions of the model with respect to ex ante expected damages. First, differences in timing requirements are irrelevant as long as the injured patient is able to obtain

[10]Note that this prediction is true regardless of whether a damage cap is in effect.

information about contracts at the time she is considering filing a claim. In all states mandating disclosure, enrollees are able to obtain this information after an injury has occurred. Second, differences in content requirements will not alter the prediction because even states with very limited content requirements force general disclosure of the types of provider contracts used by MCOs. Any information regarding the types of provider contracts employed will alter injured patients' beliefs about whether the MCO encouraged, and the physician provided, compliant medical care.[11]

4.3.2 Damage Caps

The effect of damage caps on ex ante expected damages can be analyzed similarly. The results, however, are not as clear-cut. Examining Figures 4.1 and 4.2 simultaneously leads to the conclusion that imposing damage caps might lead to an increase or decrease in ex ante expected damages. In addition, the prediction will differ depending on whether a disclosure rule is in effect.

Consider the case in which contracts are observable. Two cases must be analyzed separately. First, assume that the cost of treatment (c) is less than the cost of treatment ($\hat{c}$) corresponding to the level of total expected damages that minimizes the function used to find the MCO's cutoff point (i.e., the point at which the MCO is indifferent between encouraging compliant treatment and encouraging no treatment).[12] Figure 3.6 shows that under this condition, the patient never sues. Therefore, a change in damages will not affect ex ante expected damages.

Second, assume that $c > \hat{c}$. Recall Figure 3.5, which demonstrates how an injured patient's probability of suing responds to changes in total damages. Figure 4.4 demonstrates how ex ante expected damages react to changes in total damages when $c > \hat{c}$. The figure reveals that ex ante expected damages could increase, decrease or remain unchanged after the imposition of a damage cap. When total damages are low relative to treatment costs, injured patients never sue. Therefore, ex ante

[11] Note also that the theoretical model assumes that (total damages, treatment costs) pairs are similarly distributed in regimes that force disclosure and in those that do not. There is no reason to believe that this is not the case.

[12] See Section 3.5.1 for a derivation and discussion of $\hat{c}$.

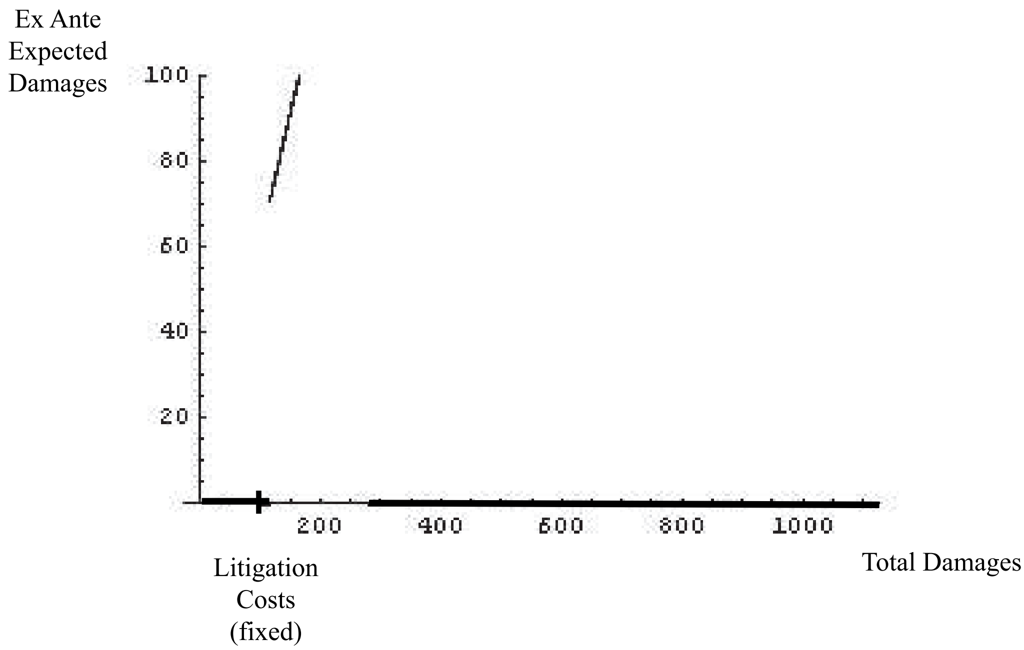

Figure 4.4: This graph illustrates how ex ante expected damages adjust to changes in damage levels in regimes mandating disclosure of physician contracts. The graph assumes that the probability of a positive outcome given compliant treatment is 80%, the probability of a positive outcome given non-compliant treatment is 40%, litigation costs are \$100 and the cost of compliant treatment is \$200.

expected damages are equal to zero. As total damages increase, the MCO switches to a capitated contract and the physician never treats. In equilibrium, injured patients always sue, and ex ante expected damages are equal to the probability of a negative outcome given non-compliant treatment $(1-q)$ times total damages (D). As total damages increase in this range, ex ante expected damages increase linearly. When total damages increase so much that the MCO finds it in its best interest to encourage treatment, then physicians compliantly treat at a high enough rate such that injured patients never sue. Therefore, ex ante expected damages drop to, and remain at, zero.

Similar conclusions are drawn with respect to changes in ex ante expected damages given the imposition of a damage cap when contracts are *unobservable*. Figure 4.5 demonstrates specifically how ex ante expected damages react to changes in damages in regimes that do not force disclosure of physician contracts. The figure illustrates the ambiguity of the theoretical prediction. When total damages are low, the patient never sues; therefore, ex ante expected damages are equal to zero. As total damages increase, the MCO finds it optimal to discourage the physician from treating. In equilibrium, the patient will sue with certainty, and ex ante expected damages are equal to $(1-q)D$, which will increase linearly as total damages increase. This continues until damages reach a high enough level such that the MCO finds it optimal to encourage some level of compliant treatment. Unlike the observable contract case, however, ex ante expected damages do not drop to zero. When contracts are unobservable, injured patients will sue with some positive probability less than certainty. Therefore, ex ante expected damages will fall and will decrease as total damages increase.

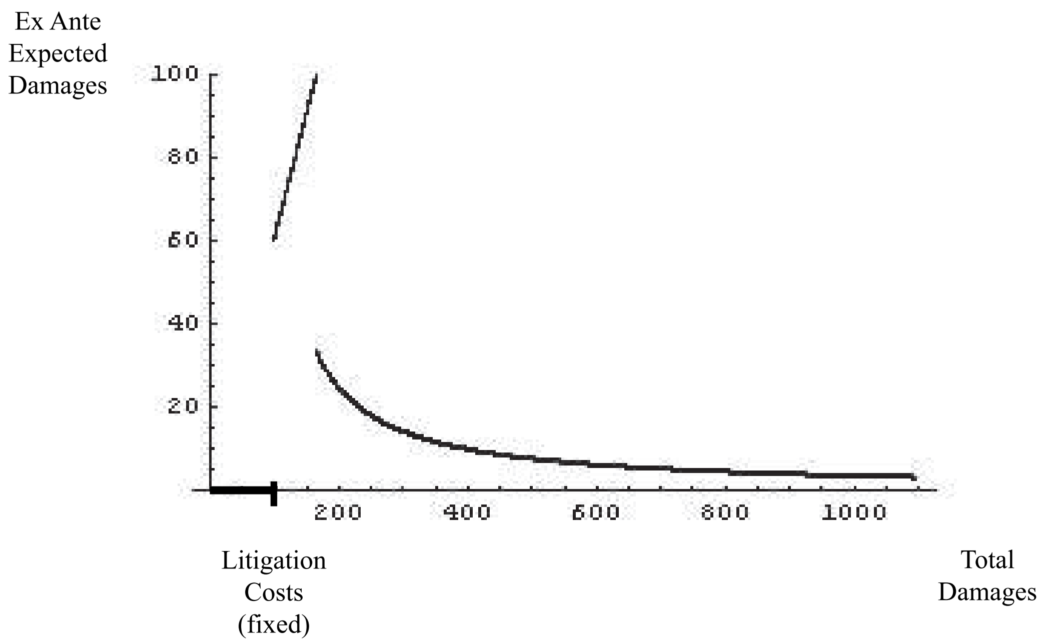

Figure 4.5: This graph illustrates how ex ante expected damages adjust to changes in damage levels in regimes that do not mandate disclosure of physician contracts. The graph assumes that the probability of a positive outcome given compliant treatment is 80%, the probability of a positive outcome given non-compliant treatment is 40%, litigation costs are \$100 and the cost of compliant treatment is \$100.

Given these results, it is impossible to make a clear prediction regarding how ex ante expected damages will shift as total damages are reduced. It could be that ex ante expected damages decrease. It is also possible that ex ante expected damages might increase. Given the relationship between total damages and ex ante expected damages illustrated in Figures 4.4 and 4.5, the imposition of a damage cap is most likely to result in an increase (or no change) in ex ante expected damages because caps most likely affect only cases that would have resulted in higher total damages than the amount specified by the cap. Therefore, unless the cap is so restrictive that total damages fall below litigation costs, caps most likely will cause an increase in ex ante expected damages.

In addition, while it is impossible to make a definite prediction regarding the effect of damage caps, the empirical results are still of interest. Previous conjectures suggest that damage caps lead to a decrease in ex ante expected damages.[13] These conjectures consider only part of the story, however. Therefore, if the empirical results reveal that ex ante expected damages actually increase (or remain the same) with the implementation of a damage cap, then the theory presented in Chapter 3 would offer an explanation for such a result.

4.4 Empirical Analysis

This section describes the data used to calculate empirical estimates and the specification of the empirical model. In addition, empirical estimations of the test equation are provided. Finally, empirical estimations of alternative specifications are presented.

4.4.1 Data Description

The goal of this empirical analysis is to test whether disclosure laws and damage caps are significantly related to ex ante expected damages. The analysis uses a data set containing information from all 50 states for each year during the period 1991–2001. Medical malpractice insurance premiums aggregated by state and normalized by the number of non-federal physicians in patient care are used as a proxy for ex ante

[13]See, e.g., Danzon [29], Sloan [94] and Zuckerman et al. [103] (discussing conjectures that capping damages will lead to a decrease in the number of lawsuits).

expected damages.[14] Presumably, if total ex ante expected damages increase, then medical malpractice insurance premiums likely will increase to cover the increase in claims (all else held constant).

Using premiums as a proxy for ex ante expected damages has some limitations. First, the average lag from the filing of a claim to disposition ranges from 3.5 years to 6.5 years depending on the type of claim (Bhat [11]). The procedure for setting premiums might account for this lag. Sloan [94] reports, however, that around 90 percent of the response of premiums to a change in a particular legal rule takes place in the year following the change.

Second, it is likely that losses paid by medical malpractice insurers to cover damages won by injured patients through litigation or settlement would be a better proxy for ex ante expected damages than premiums. Data on this variable by state, however, are not available.[15]

Finally, the theory developed in Chapter 3 applies only to those insured by managed care plans. In 1991, roughly 36% of the U.S. population was enrolled in some form of managed care plan. By 2001, managed care plans insured approximately 67% of the U.S. population.[16] The vast majority not covered by managed care plans are enrolled in traditional indemnity plans, under which the health insurer has virtually no control over the physician's treatment choices. The incentives of physicians treating patients covered by indemnity insurance plans most likely are more aligned with the patient's interests than those of physicians treating patients covered by managed care plans because the physician does not bear the cost of treatment when the patient is covered by indemnity insurance. Therefore, treatment and litigation decisions differ greatly from those made when the patient is enrolled in a managed care plan. For purposes of the empirical study, data on medical malpractice insurance premiums

[14] Bhat [11] states that "premiums are calculated using the probabilities of claims and payment amounts and attorney fees." See also Sloan [94].

[15] Results are provided using losses incurred as a proxy for ex ante expected damages. Losses are a measure of the amount paid out by insurance companies for claims against insured physicians won by injured patients though settlements or judgments. See *infra* Section 4.4.3.

[16] These figures were calculated using annual MCO enrollment data published by the American Association of Health Plans and annual U.S. population data published by the U.S. Census Bureau.

will capture changes to behavior related to both types of health insurance. As more of the U.S. population participates in managed care, however, the empirical results should gravitate toward the theoretical predictions.

Aggregated medical malpractice premiums were obtained from the National Association of Insurance Commissioners ("NAIC"). The data were taken from the NAIC's "Report on Profitability by Line and by State" for each year during the period 1991 through 2001. The NAIC obtains the data from annual statements filed with the organization by a large portion of the property/casualty insurers in the U.S. The NAIC reports that the data comprise well in excess of 95 percent of the premiums written in the U.S.[17] The insurers not filing with the NAIC tend to be small, single-state companies. Data from joint underwriting associations, state funds and nonadmitted insurers are included in the report only if they file with the NAIC.[18]

Information on disclosure laws and damage caps was collected using actual state statutes. Tables A.1 and A.2 in the Appendix contain details on the statutes by state, including the year each statute went into effect and cites to individual state mandatory disclosure statutes. The legal rules are coded as dummy variables, taking on a value of 1 if the legal rule was in effect in state i and in year t, and 0 otherwise.

The variables are summarized in Table 4.1. All dollar-dependent variables have been deflated to 1990 dollars.

It should be noted that the theoretical model makes predictions regarding ex ante expected damages based on total damages paid by MCOs and physicians. The data, however, capture only claims paid by physicians. Regardless, this measure closely approximates total damages given that only seven states allowed medical malpractice suits against MCOs during the period under consideration.[19] In addition, most of

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[17] Physician-owned and directed professional liability companies insure a large portion of physicians against medical malpractice claims (Johnson, [56]). These insurers report to the NAIC; therefore, premiums written by these insurers are included in the data analyzed here.

[18] In 1996, less than 10 percent of medical malpractice insurance was written by joint underwriting associations (Maxwell [71]).

[19] Tex. Civ. Prac. & Rem. Code Ann. §88 (West 1997) (effective September 1, 1997); Ga. Code Ann. §51-1-48 (effective July 1, 1999); Okla. Stat. Ann. tit. 36, §6593 (West 2002) (effective July 1, 2000); Ariz.Rev. Stat. Ann. §20-3153 (West 2002) (effective January 1, 2001); Cal. Civ. Code §3428 (West 2003) (effective January 1, 2001); Me. Rev. Stat. Ann. tit. 24-A, §4313 (West 2002) (effective January 1, 2001); Wash. Rev. Code Ann. §48.43.545 (West

Variable Descriptions					
Variable	Mnemonic	Mean	Standard Deviation	Definition	Source
Dependent Variables:					
Medical Malpractice Premiums Earned	PREM	\$8,472	\$3,060	Medical malpractice insurance premiums per non-federal physician in patient care	National Association of Insurance Commissioners
Medical Malpractice Losses Incurred	LOSS	\$5,428	\$3,987	Medical Malpractice insurance losses per non-federal physician in patient care	National Association of Insurance Commissioners
Independent Variables:					
Disclosure Law	DISCL	0.15	0.35	Disclosure Law dummy variables	Statutes
Damage Cap	CAP	0.68	0.47	Damage Cap dummy variables	Statutes

Table 4.1: This table provides a summary of the variables employed in the empirical analysis along with summary statistics, descriptions and the source of each variable.

these states did not allow suits against MCOs until late in the period.

Table 4.2 reports descriptive statistics on trends of normalized medical malpractice insurance premiums by year. The unit of observation is aggregated premiums normalized by the number of non-federal physicians in patient care.[20] All dollar values are adjusted to 1990 dollars.

4.4.2 Model Specification

To test whether disclosure laws and damage caps are significantly related to ex ante expected damages, the following random effects linear model with an AR(1) disturbance was estimated:

$$ln(PREM_{it}) = \alpha + \phi_1 DISCL_{it} + \phi_2 CAP_{it} + \phi_3 (DISCL_{it} * CAP_{it}) + \lambda YEARit + \nu_i + \epsilon_{it}$$

$i = 1, ..., N; t = 1, ..., T_i$

where

2003) (effective July 1, 2001)

[20]Data on the number of physicians in patient care by state and by year were collected from the American Medical Association [2]. Data from 1991 were not available, however. An estimate for each state was formed by taking the average of the number of physicians in patient care in 1990 and the number of physicians in patient care in 1992.

Trends in Insurance Premiums				
	Mean	Median	Minimum	Maximum
1991	$9,503	$9,471	$1,513	$18,918
1992	$9,314	$9,610	$1,567	$17,708
1993	$9,018	$8,636	$1,329	$17,295
1994	$9,462	$9,089	$2,429	$15,904
1995	$9,075	$8,659	$1,391	$15,580
1996	$8,489	$7,938	$1,294	$15,194
1997	$7,785	$7,274	$1,304	$13,786
1998	$7,941	$7,868	$1,524	$13,284
1999	$7,651	$7,549	$1,733	$12,924
2000	$7,360	$7,116	$1,840	$13,519
2001	$7,595	$7,316	$2,142	$15,727

Table 4.2: This table provides descriptive statistics on trends for medical malpractice insurance premiums per non-federal physician in patient care. Premiums are reported in 1990 dollars.

$PREM_{it}$ = aggregated medical malpractice insurance premiums earned (in 1990 dollars) normalized by the number of non-federal physicians in patient care in state i during year t,

α = the intercept,

ϕ_1, ϕ_2, ϕ_3 and λ represent estimated coefficients of the model,

$DISCL_{it}$ = 1 if state i had a disclosure law in effect during year t and 0 otherwise,

CAP_{it} = 1 if state i had a damage cap of any sort in effect during year t and 0 otherwise,

YEAR_{it} represents each observation's year (i.e., $\text{YEAR}_{it} = 1$ for 1991 observations, 2 for 1992 observations, etc.),

ν_i = state-specific disturbances,[21]

$\epsilon_{it} = \rho\epsilon_{i,t-1} + \eta_{it}$ = non-state-specific disturbances, where ρ = the autocorrelation

[21]The random-effects model assumes that ν_i are realizations of an independent and identically distributed process with mean 0 and variance σ_ν^2.

parameter[22] and η_{it} is distributed as $N(0, \sigma_\eta^2)$ and is independent of other errors over time (as well as being independent of ϵ).

Functional Form. Logarithmic transformations of the dollar-dependent variables, PREM and LOSS, are used to correct for their skewed distributions. This transformation also decreases the effect that outliers might have on the estimation results and accounts for the fact that the distribution of premiums is naturally truncated (i.e., all observations on premiums are strictly positive).

Dynamic Nature of Premiums. A particular state's prior year premiums per physician is likely a good predictor of the current year's premiums per physician. Events affecting premiums, such as changes in the law and the competitive environment of the insurance industry, tend to occur slowly over time. Therefore, the set of conditions in a particular state affecting premiums are likely to be very similar from one year to the next. Typically a lagged dependent variable is used to control for this feature when time-series data are used. With panel-data sets, however, the inclusion of a lagged dependent variable can be quite problematic.[23] Therefore, to account for the dynamic nature of premiums, a variable for the year, YEAR_{it}, is included as an independent variable. The coefficient on this variable (λ) represents the general time trend in the data. Specifically it will capture the average percentage change in premiums from year to year.

Heterogeneity Across States. When using panel data, it is possible that the disturbances include a component common to all states (which is time-invariant and orthogonal to the regressors). Using a random effects estimator controls for these effects.[24]

[22]This parameter measure the correlation between ϵ_{it} and $\epsilon_{i,t-1}$.

[23]See Hsiao [51] for a discussion of dynamic models with variable intercepts (describing why estimates are bias under these conditions). The bias of coefficients worsens as the number of time periods decreases. Note that Gius [41] employs a random effects specification with a lagged dependent variable, but does not account for the issues described here. His coefficients are possibly biased due to the specification of his model. His data set, however, includes 15 time periods; thus, the bias might be minimal.

[24]Virtually identical results were obtained when estimates were computed using a fixed effects estimator. A Hausman specification test (Hausman [47]) indicated that the difference in coefficients estimated using a random-effects model are not systematically different from the coefficients estimated using a fixed-effects model (i.e., the state-specific disturbances are not correlated with the regressors). Therefore, the random-effects specification seems appropriate. In addition, the Breusch and Pagan [17] lagrangian multiplier test results indicate the presence of random effects.

Most other empirical studies of medical malpractice insurance premiums account for differences between states by adding several control variables to the empirical model (e.g., differences in tort reforms, insurance regulations, access to lawyers, age distribution of the population, etc.). The theories regarding how these variables interact with one another and how they should enter the empirical model, however, are not well developed. When using a relatively small number of observations, including a large number of independent variables calls into question the model's results. Therefore, rather than specifying a model with several independent variables, the present study employs a random-effects model to account more generally for variations across states.

Serial Correlation of the Disturbances. Given the nature of data on premiums, serial correlation of the disturbances is expected.[25] First, the lag in closing claims might induce strong correlation across years. Also, insurers might not be able to set premiums freely in any given year. Insurance regulations in some states might restrict changes to premiums from year to year. That insurance regulations are not included in the empirical model might cause serial correlation of the disturbances.[26] To account for this feature of the data, a linear model with an AR(1) disturbance was used.[27]

It should be noted that estimation from first differences was attempted but unsuccessful. The minimal variation in independent variables during the time period under consideration probably led to this result (e.g., of 550 observations on change in disclosure law, only 21 observations indicate a change).

Interaction Term. The interaction term, $\text{DISCL}_{it}{*}\text{CAP}_{it}$, captures the fact that caps might affect premiums differently for states with disclosure laws in place than

[25] In fact, a Breusch [18] – Godfrey [42] test indicates significant autocorrelation in the disturbances when premiums are regressed on the independent variables.

[26] Other studies correct for autocorrelation in the presence of controls for random effects. See, e.g., Baltagi and Griffin [6], Jalan and Ravallion [55] and Egger [31].

[27] An AR(1) disturbance specification assumes that the disturbance term is first-order autoregressive. Under this specification, each disturbance embodies the entire past history of the η's with the most recent observations receiving greater weight than those in the distant past. This is the most widely used assumption for serial correlation. See Baltagi and Li [7] for a description of the transformation that circumvents the problem of autocorrelation in an error component model.

for states not mandating disclosure. The interaction term allows for estimation of this effect. For example, the percentage change in premiums caused by implementing a damage cap along with a disclosure law can be calculated as follows:

$$\frac{\partial ln(PREM_{it})}{\partial CAP_{it}} = \phi_2 + \phi_3$$

Similarly, the interaction term can be used to estimate the percentage change in premiums caused by implementing a disclosure law in the presence of a damage cap by considering $\phi_1 + \phi_3$.

4.4.3 Empirical Estimation of the Test Equation

The hypothesis that disclosure laws (weakly) decrease ex ante expected damages is supported by the data if the coefficient on disclosure laws is significantly less than (or equal to) zero (i.e., $\phi_1 \leq 0$). This test determines the effect of disclosure laws in regimes without damage caps in place. To test whether disclosure laws in the presence of damage caps also (weakly) decrease ex ante expected damages, the sum of the coefficients on DISCL and (DISCL*CAP) is considered. If $\phi_1 + \phi_3 \leq 0$, then the data further support this hypothesis.

Recall that the theoretical model does not make a clear prediction about the relationship between damage caps and ex ante expected damages. Several previous studies, however, suggest that damage caps in any environment will lead to a decrease in ex ante expected damages.[28] Therefore, the inquiry is slightly different in this case. If the coefficient on damages turns out to be greater than or equal to zero (i.e., $\phi_2 \geq 0$), then the theoretical model presented in Chapter 3 can be viewed as a explanation for the result. On the other hand, if $\phi_2 < 0$, then the data here support the conventional conjecture regarding how damage caps relate to ex ante expected damages. Likewise, if the sum of the coefficients on damage caps and the interaction term is significantly less than (or equal to) zero (i.e., $\phi_2 + \phi_3 \leq 0$), then the model in Chapter 3 can be viewed as an explanation for this result. Recall that the interaction term indicates

[28] See the studies discussed in the literature review *supra* in Chapter 2.

whether the marginal effect of a damage cap on ex ante expected damages is increased or decreased when a disclosure law is in effect. Thus, the sum $\phi_2 + \phi_3$ indicates the relationship between damage caps in the presence of a disclosure law and ex ante expected damages.

Table 4.3 presents the estimation results for the log premium regression equations. The first set of results assumes no autocorrelation and the second set assumes significant autocorrelation (i.e., AR(1)). The coefficient on YEAR indicates that, on average, premiums decreased by roughly 2% per year during the period 1991–2001.

The results show that the coefficient on the first variable of interest, DISCL, is negative and significantly different from zero. This indicates that disclosure laws significantly decrease premiums. On average, mandatory disclosure laws decrease premiums by 11.5% on average (8.2% under AR(1)). This result supports the model's prediction related to disclosure laws. In addition, an F-test on $H_o : \phi_1 + \phi_3 = 0$, reveals that the effect of a disclosure law in the presence of a damage cap is not statistically significant at the 10% level.[29] This result further supports the prediction regarding the relationship between disclosure laws and ex ante expected damages.

The empirical results pertaining to the implementation of damage caps are mixed. An F-test on $H_o : \phi_2 + \phi_3 = 0$ reveals that the effect of damage caps in the presence of a disclosure law is not statistically significant at the 10% level.[30] Therefore, the conventional theory is not supported by the data. The model presented in this study offers an explanation as to why damage caps in the presence of a disclosure law do not have a significant effect on ex ante expected damages.

With respect to damages caps in the absence of a disclosure law, the results show that damage caps alone decrease premiums by 8.2% on average (under the assumption of no autocorrelation). The coefficient is statistically significant at the 5% level. This result supports the conventional theory. When autocorrelation of the non-state-specific disturbances is assumed, however, the coefficient on damage

[29] The test resulted in a χ^2 statistic of 0.13 with a p-value of 0.71. Similar results obtain under AR(1).

[30] The test resulted in a χ^2 statistic of 0.60 with a p-value of 0.44. Similar results obtain under AR(1).

Log Premiums Regression Results, 1991–2001				
	Random-Effects Linear Model			
	No Autocorrelation		AR(1) Assumed	
Variable	Coefficient	S.E. (p value)	Coefficient	S.E. (p value)
Intercept	51.32***	5.513 (0.000)	9.12***	0.066 (0.000)
Disclosure Law	−0.115***	0.039 (0.003)	−0.082*	0.044 (0.064)
Damage Cap	−0.082**	0.042 (0.048)	−0.050	0.046 (0.277)
Interaction Term	0.129**	0.051 (0.011)	0.089	0.058 (0.124)
Year	−0.021***	0.003 (0.000)	−0.020***	0.004 (0.000)
R^2	0.05		0.04	
Wald χ^2	117.05***	(0.000)	40.35***	(0.000)
N	550		550	

Table 4.3: This table provides the random-effects linear model results for medical malpractice insurance premiums assuming no autocorrelation. Results are also presented for the model assuming AR(1) disturbances.

S.E. = standard errors.

∗ Statistically significant at the 90% confidence level, two-tailed test

∗∗ Statistically significant at the 95% confidence level, two-tailed test

∗ ∗ ∗ Statistically significant at the 99% confidence level, two-tailed test

caps is not statistically different from zero. The result supports the present model's prediction.

Losses Incurred. Previous studies use data on insurance company losses incurred as a proxy for ex ante expected damages.[31] Losses are a measure of the amount paid out by insurance companies for claims against insured physicians won by injured patients though settlements or judgments. As mentioned, data on actual losses paid are not available by state. Data on losses incurred, however, are available.

It should be noted that using incurred losses as a proxy for ex ante expected damages has limitations. Losses incurred might not be a good measure of actual losses paid because accruals greatly affect this variable. Accruals are made to create reserves for future losses and are not related to actual losses paid out in the particular year they are recorded. In fact, 13 of the 550 observations on losses incurred during the period of interest indicate a negative amount, demonstrating that accruals significantly affect reported losses incurred in a given year.

Table 4.4 provides estimates of the effects of the legal rules on ex ante expected damages using the log of losses incurred as a proxy for ex ante expected damages. A Breusch [17] – Godfrey [42] test revealed no serial correlation of the disturbances; therefore, the model does not adjust for autocorrelation. In addition, a Breusch/Pagan Lagrangian multiplier test indicates the presence of random effects. A Hausman test, however, indicates that the differences in coefficients under random effects and fixed effects are not systematic. Therefore, Table 4.4 provides results for both random effects and fixed effects. The reported results are virtually identical.

The results for incurred losses are similar to the results obtained using premiums. The coefficient on DISCL is not significantly different from zero. In addition, an F-test on $H_o : \phi_1 + \phi_3 = 0$, reveals that DISCL + (DISCL*CAP) is not statistically different from zero.[32] These results support the prediction that disclosure laws (weakly) decrease ex ante expected damages.

An F-test on $H_o : \phi_2 + \phi_3 = 0$ reveals that the sum of $CAP + (DISCL * CAP)$ is

[31] See, e.g., Viscusi et al. [100] and Viscusi et al. [101].

[32] The test resulted in a χ^2 statistic of 0.06 with a p-value of 0.81.

Log Losses Incurred Regression Results, 1991–2001				
	Random-Effects Linear Model		Fixed-Effects Linear Model	
	No Autocorrelation		No Autocorrelation	
Variable	Coefficient	S.E. (p value)	Coefficient	S.E. (p value)
Intercept	8.31***	0.124	8.32***	0.112
		(0.000)		(0.000)
Disclosure Law	−0.078	0.133	−0.054	0.137
		(0.560)		(0.695)
Damage Cap	−0.297**	0.122	−0.303**	0.153
		(0.015)		(0.049)
Interaction Term	0.109	0.175	0.072	0.179
		(0.532)		(0.686)
Year	0.048***	0.010	0.048***	0.010
		(0.000)		(0.000)
R^2	0.05		0.05	
Wald χ^2	33.75***	(0.000)	7.91***	(0.000)
N	537		537	

Table 4.4: This table provides the random-effects linear model results for medical malpractice insurance losses incurred assuming no autocorrelation. In addition, the results from a fixed effects specification are provided.

S.E. = standard errors.

∗ Statistically significant at the 90% confidence level, two-tailed test

∗∗ Statistically significant at the 95% confidence level, two-tailed test

∗ ∗ ∗ Statistically significant at the 99% confidence level, two-tailed test

Simple Averages and Medians of Premiums per Physician by Legal Rule						
	With Rule			Without Rule		
Legal Rule	#	Mean	Median	#	Mean	Median
Disclosure Law	80	$7,487	$7,128	470	$8,640	$8,034
Damage Cap	372	$8,277	$7,672	178	$8,880	$8,432

Table 4.5: This table provides simple averages and medians for premiums per physician by legal rule. # indicates the number of observations.

not statistically different from zero.[33] This result does not support the conventional theory regarding damage caps. The present model offers an explanation for the empirical result.

Finally, the results show that damage caps alone decrease losses incurred by approximately 30% on average. The coefficient is statistically significant at the 5% level. This result offers support for the conventional conjecture regarding the relationship between damage caps and ex ante expected damages. That the empirical result does not support the model's prediction (i.e., that damage caps will lead to an increase in ex ante expected damages) might be due to the specification of the model. The empirical model does not account for the fact that legal rules directly affect physician behavior. Using a simultaneous equations model might help in incorporating this feature of the theoretical model.

Simple Averages. Table 4.5 provides simple averages and medians of medical malpractice insurance premiums for states with mandatory disclosure laws and damage caps and for states without these particular legal rules.

The results are fairly consistent with those presented in Tables 4.3 and 4.4. States with disclosure laws in place observe medical malpractice premiums that are, on average, lower (at the 1% level) than premiums in those states without mandatory disclosure laws in effect.[34] In addition, average premiums in states that have implemented damage caps are lower (at the 5% level) than average premiums in states that

[33]The test resulted in a χ^2 statistic of 0.97 with a p-value of 0.33.
[34]F statistic = 9.85; p-value = 0.0018.

do not cap damages.[35]

Alternative Specification. Zuckerman et al. [103] also studied the effects of damage caps on premiums. They observed that premiums for a particular year are announced at the beginning of the year. Therefore, premiums can be influenced only by the legislation in effect during the prior year. To account for this fact, they regressed premiums in year t on the legal rules in effect during the year t–1.

Using the present study's data, the following model was estimated:

$$ln(PREM_{it}) = \alpha + \phi_1 DISCL_{it-1} + \phi_2 CAP_{it-1} + \phi_3 (DISCL_{it-1} * CAP_{it-1}) + \lambda YEAR_{it} + \nu_i + \epsilon_{it}$$

Table 4.6 presents the estimation results for this alternative specification of the model. The results do not differ substantially from the original specification.

4.5 Conclusion and Discussion

The empirical tests presented in this chapter were performed to test specific predictions of the theoretical model developed in Chapter 3. First, the model predicts that states forcing MCOs to disclose information regarding physician contracts to enrollees should experience (weakly) lower ex ante expected damages than states not requiring contract disclosure. The empirical results support this prediction. The results show that medical malpractice premiums and incurred losses (proxies for ex ante expected damages) in states mandating disclosure will be (weakly) lower than premiums and incurred losses in states not forcing disclosure.

Second, conventional theory suggests that damage caps will decrease ex ante expected damages because injured patients will have less of an incentive to file a claim. The theoretical model presented here shows that caps will not necessarily decrease ex ante expected damages in states that do not force contract disclosure. The empirical results are mixed. The results indicate that caps significantly decrease ex ante expected damages in states not forcing disclosure (in all specifications except one). The results, however, also indicate that damage caps in states forcing disclosure do

[35] F statistic = 4.70; p-value = 0.03.

Log Premiums Regressed on Prior Year Legal Rules				
	Random-Effects Linear Model			
	No Autocorrelation		AR(1) Assumed	
Variable	Coefficient	S.E. (p value)	Coefficient	S.E. (p value)
Intercept	9.17***	0.064 (0.000)	9.14***	0.066 (0.000)
Disclosure Law$_{(t-1)}$	−0.097**	0.040 (0.015)	−0.069	0.047 (0.137)
Damage Cap$_{(t-1)}$	−0.095**	0.041 (0.021)	−0.076	0.047 (0.103)
Interaction Term$_{(t-1)}$	0.108*	0.055 (0.050)	0.073	0.062 (0.238)
Year	−0.023***	0.003 (0.000)	−0.020***	0.004 (0.000)
R^2	0.04		0.04	
Wald χ^2	109.18***	(0.000)	39.82***	(0.000)
N	500		500	

Table 4.6: This table provides the random-effects linear model results assuming no autocorrelation when log premiums are regressed on legal rules in effect during the prior year. Results are also presented for the model assuming AR(1) disturbances.

S.E. = standard errors.

∗ Statistically significant at the 90% confidence level, two-tailed test

∗∗ Statistically significant at the 95% confidence level, two-tailed test

∗ ∗ ∗ Statistically significant at the 99% confidence level, two-tailed test

not significantly affect premiums earned or losses incurred.

The fact that the results indicate that damage caps will decrease ex ante expected damages (in the incurred losses regressions) might be due to the specification of the empirical model as compared to the theoretical model described in Chapter 3. The intuition behind the theoretical results suggests that legal rules affect not only litigation decisions but also treatment decisions. The empirical model does not directly account for this feature of the theoretical model. To investigate this hypothesis, the empirical model should be modified to account for this discrepancy. One possibility would be to employ a simultaneous equations model to first estimate physician behavior given a set of legal rules and then to estimate premiums given physician behavior and the same set of legal rules. Additional data would be required to run this particular specification.

It should be noted that the empirical model does not control for selection effects. For example, the model does not take into account the fact that states with higher premiums might implement particular sorts of tort reform (e.g., damage caps) with a higher probability than states with lower premiums. This probably will not affect the results of the empirical model for two reasons, however. First, disclosure rules seem to be exogenous to the system given that states implement them to provide consumers with more information about health insurance plans during the plan selection process. Second, if selection effects were at work with respect to damage caps, one might be worried that states with higher premiums would be more likely to implement damage caps. The results, though, show the opposite effect: states with damage caps observe lower premiums, on average, than state without damage caps. Therefore, selection effects probably do not play a significant role in the results produced by the empirical analysis.

Chapter 5 Conclusion

Together, the theoretical model and empirical results show that legal rules do, indeed, affect the behavior of market actors in systematic ways. The results suggest that mandatory disclosure laws influence the mix of MCO-physician contracts, increase the rate of compliant treatment and decrease claim rates. In addition, medical malpractice damage rules and tortfeasor rules provide certain incentives that influence medical care provider treatment decisions and injured patient litigation decisions.

As mentioned, the methodologies used to study the potential consequences of legal rules are not without their limitations. The benefits of formal modelling are tied inextricably to the methodology's weaknesses. While game theory allows us to capture essential features of complex situations involving asymmetric information, it forces us to simplify down to a necessary level of abstraction. Some worry that this process of simplification renders dubious the predictions of game theoretic models. These concerns, though, suggest a misunderstanding of what game theory purports to deliver. Kreps [64] succinctly states the main advantages of game theory: to give "clear and precise language for communicating insights and notions," "to subject particular insights and intuitions to the test of logical consistency," and "to see what assumptions are really at the heart of particular conclusions." In short, game theory is simply an aid in understanding what will happen in various social contexts, and its results must be viewed in light of its advantages and limitations.

The use of game theory to study health care regulations demonstrates the complex ways in which the law affects the behavior of market actors. Without a clear understanding of the complex interactions influenced by changes in the law, legal rules likely will result in unintended consequences. Concrete steps can be taken to avoid unintentional effects, though. Policy makers should take full advantage of the tools of economics, including theoretical models, empirical analysis and economics experiments, to analyze potential consequences of proposed laws before enacting them.

Formal analysis and testing can lead to a significant reduction in unintended consequences caused by changes in the law.

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Appendix A Appendix

A.1 Notation

p represents the probability that a positive outcome results given that the physician provides compliant treatment.

q represents the probability that a positive outcome results given that the physician provides non-compliant treatment.

$\beta \in [0, 1]$ represents the probability that the physician provides compliant treatment.

$\gamma \in [0, 1]$ represents the probability that the patient decides to file a medical malpractice claim given a negative outcome.

$\alpha \in [0, 1]$ represents the patient's belief that the physician provided compliant treatment given a negative outcome.

f represents the fixed wage paid by the MCO to the physician. Assume $f \geq 0$.

r represents the amount paid by the MCO to reimburse the physician for treatment costs. Assume $r \geq 0$.

$\kappa = (r, f)$ represents a contract chosen by the MCO.

c represents the cost incurred by the physician to provide compliant treatment. Assume $c > 0$ if physician provides compliant treatment and $c = 0$ if not.

L represents the fees incurred by the patient to file and pursue a claim. Assume $L > 0$.

D_m represents the damages awarded by the court to be paid by the MCO to the patient. Assume $D_m \geq 0$.

D_p represents the damages awarded by the court to be paid by the physician to the patient. Assume $D_p \geq 0$. Let $D = D_m + D_p$.

H represents the value of health to the patient if a positive outcome is realized. Assume $H > 0$.

I represents the insurance premium paid by the patient to the MCO to insure against uncertain health care costs.

A represents ex ante expected damages.

u_m represents the ex ante expected payout to the MCO.

u_p represents the ex ante expected payout to the physician.

u_i represents the ex ante expected payout to the patient.

A.2 Equilibrium when Contracts Are Observable by the Patient

This section provides proofs for claims made in the case when the contract formed between the MCO and the physician is observable by the patient. Proofs are given for the case in which patients are allowed to sue both the MCO and the physician for medical malpractice. The proofs, however, are general and can be modified easily to develop claims for the other tortfeasor rules: (1) patient can sue physician only (set $D_m = 0$ in all cases), and (2) patient can sue MCO only (set $D_p = 0$ in all cases). Also, results are given for the case in which total damages exceed litigation costs. When they do not, the patient will never sue, MCOs will pay nothing to the physician and the physician will never compliantly treat.[1] The first step in solving for the equilibrium is to analyze the strategies of the patient and physician.

A.2.1 Best Response of Patient to Physician Action

Claim 1 *Taking β, q, D_m, D_p, and L as given, the patient's best response to the physician's strategy is as follows:*

If $\beta < m$, then the patient sues ($\gamma^* = 1$) .

If $\beta = m$, then the patient is indifferent ($\gamma^* \in [0, 1]$).

If $\beta > m$, then the patient does not sue ($\gamma^* = 0$),

where $m = \frac{(1-q)(D_m+D_p-L)}{(1-q)(D_m+D_p-L)+(1-p)L}$.

Proof: Let α represent the patient's belief that the physician compliantly treated given a negative outcome. Specifically, $\alpha = \frac{\beta(1-p)}{\beta(1-p)+(1-\beta)(1-q)}$. If the patient chooses not to file a claim, her payoff is simply zero. On the other hand, if the patient files and pursues a claim, her expected payoff is $(1 - \alpha)(D_m + D_p) - L$. Therefore, the patient will sue if and only if $(1 - \alpha)(D_m + D_p) > L$. Substituting for α gives sue if and only if $\beta < \frac{(1-q)(D_m+D_p-L)}{(1-q)(D_m+D_p-L)+)(1-p)L}$. ■

[1] The case in which damages equal litigation costs is similarly uninteresting and is not considered here.

A.2.2 Best Response of Physician to Patient Action

Claim 2 *Taking γ, r, f, c, q and D_p as given, the physician's best response to the patient's strategy is as follows:*

If $\gamma > \frac{c-r}{(1-q)D_p}$, then the physician provides compliant treatment ($\beta^* = 1$).

If $\gamma = \frac{c-r}{(1-q)D_p}$, then the physician is indifferent ($\beta^* \in [0,1]$).

If $\gamma < \frac{c-r}{(1-q)D_p}$, then the physician does not provide compliant treatment ($\beta^* = 0$).

Proof: If the physician decides to provide compliant treatment, his payoff will be $f+r-c$. In the event the physician does not, his expected payoff will be $f-(1-q)\gamma D_p$. Therefore, the physician will provide compliant treatment if and only if $r - c > -(1-q)\gamma D_p$. Therefore, $\gamma > \frac{c-r}{(1-q)D_p} \Leftrightarrow \beta = 1$. ■

A.2.3 Equilibrium of Patient and Physician Behavior

Claim 3 *Taking r, f, c, q, D_m, D_p, and L as given, the equilibrium of patient and physician behavior and best responses to the MCO's reimbursement terms are as follows:*

If $r > c$, then $\beta^* = 1$ and $\gamma^* = 0$.

If $r = c - \gamma(1-q)D_p$, then (a) $\beta^* \in (m, 1]$ and $\gamma^* = 0$, or

(b) $\beta^* = m$ and $\gamma^* = \frac{c-r}{(1-q)D_p}$, or

(c) $\beta^* \in [0, m)$ and $\gamma^* = 1$.

If $r < c - (1-q)D_p$, then $\beta^* = 0$ and $\gamma^* = 1$,

where $m = \frac{(1-q)(D_m+D_p-L)}{(1-q)(D_m+D_p-L)+(1-p)L}$.

Proof: Given patient and physician best responses, consider the possible cases:

(1) $\beta = 1$ and $\gamma = 1$. $\beta = 1 \Rightarrow \alpha = 1$. Therefore, $\gamma = 1$ implies $L < 0$, a contradiction.

(2) $\beta = 1$ and $\gamma \in [0,1]$. $\beta = 1 \Rightarrow \alpha = 1$. Therefore, $\gamma \in [0,1]$ implies $L = 0$, a contradiction.

(3) $\beta = 1$ and $\gamma = 0$. $\beta = 1 \Rightarrow \alpha = 1$. Therefore, $\gamma = 0$ implies $L > 0$, an assumption of the model. Note that $\gamma = 0$ implies $\frac{c-r}{(1-q)D_p} < 0 \Rightarrow r > c$.

(4) $\beta \in [0,1]$ and $\gamma = 0$. These conditions imply $r = c$ and $\alpha > \frac{D_m+D_p-L}{D_m+D_p}$. It is possible to meet both conditions. Substituting for α gives $\beta > \frac{(1-q)(D_m+D_p-L)}{(1-q)(D_m+D_p-L)+(1-p)L}$.

(5) $\beta \in [0,1]$ and $\gamma \in [0,1]$. These conditions imply $\gamma = \frac{c-r}{(1-q)D_p}$ and $\alpha = \frac{D_m+D_p-L}{D_m+D_p}$. It is possible to meet both conditions. Substituting for α gives $\beta = \frac{(1-q)(D_m+D_p-L)}{(1-q)(D_m+D_p-L)+(1-p)L}$.

(6) $\beta \in [0,1]$ and $\gamma = 1$. These conditions imply $r = c-(1-q)D_p$ and $\alpha < \frac{D_m+D_p-L}{D_m+D_p}$. It is possible to meet both conditions. Substituting for α gives $\beta < \frac{(1-q)(D_m+D_p-L)}{(1-q)(D_m+D_p-L)+(1-p)L}$.

(7) $\beta = 0$ and $\gamma = 1$. These conditions imply $r < c-(1-q)D_p$ and $\alpha < \frac{D_m+D_p-L}{D_m+D_p}$. It is possible to meet both conditions.

(8) $\beta = 0$ and $\gamma \in [0,1]$. $\beta = 0 \Rightarrow \alpha = 0$. This condition implies $\frac{D_m+D_p-L}{D_m+D_p} = 0$, a contradiction.

(9) $\beta = 0$ and $\gamma = 0$. $\beta = 0 \Rightarrow \alpha = 0$. This condition implies $\frac{D_m+D_p-L}{D_m+D_p} < 0$, a contradiction. ■

A.2.4 MCO's Best Response to Physician and Patient Behavior and Resulting Equilibrium Contracts

Proposition 1 *Taking c, q, L, D_m and D_p as given, the equilibrium contracts, resulting equilibrium behavior of the patient and the physician and expected payouts are as follows:*

(1) If $mc < (1-q)(D_m+D_p)$, then $\kappa^* = (c,0)$ with $\beta^* = m$, $\gamma^* = 0$, $u_m = I-mc$, $u_p = 0$ and $u_i = mpH + (1-m)qH - I$.

(2) If $mc > (1-q)(D_p+D_m)$, then $\kappa^* = (r^* \leq c-(1-q)D_p, (1-q)D_p)$ with $\beta^* = 0$ and $\gamma^* = 1$, $u_m = I-(1-q)(D_m+D_p)$, $u_p = 0$ and $u_i = qH+(1-q)(D_m+D_p-L)-I$.

Proof: The MCO will solve the following maximization problem.

$$\max_{(f,r)} I - f - \beta^* r - (1-\beta^*)(1-q)\gamma^* D_m$$

$$\text{subject to (1) } f + \beta^*(r - c) - (1 - \beta^*)(1 - q)\gamma^* D_p \geq 0$$ [2]

$$(2)\ \beta^* = \arg\max_{\beta} f^* + \beta(r^* - c) - (1 - \beta)(1 - q)\gamma^* D_p$$

$$(3)\ \gamma^* = \arg\max_{\gamma} \beta^*\gamma(-L) + (1 - \beta^*)\gamma(D_m + D_p - L)$$

Consider each case presented in Claim 3:

(1) If the MCO sets $r > c$, then $\beta^* = 1$ and $\gamma^* = 0$. To meet the physician's IR constraint, however, the MCO must set $f = c - r < 0$, which violates the assumption that $f \geq 0$. Therefore, this contract is unfeasible.

(2) If the MCO sets $r = c - (1 - q)\gamma D_p$, consider the following:

(a) $\beta^* > m$ and $\gamma^* = 0$

Given that the patient does not sue, $r^* = c$. To meet the physician's IR constraint, the MCO must set $f^* = \beta(c - r) = 0$. Because the physician is indifferent between all effort levels above m, the effort level is set to optimize the MCO's payoff. Specifically, the MCO will solve the following problem: $\max_{\beta > m} I - \beta c$. The MCO prefers the lowest feasible β. Therefore, the contract specifies $r^* = c$ and $f^* = 0$. In equilibrium, $\beta = m + \varepsilon$ (ε small) $\Rightarrow u_m \to I - mc$ (from below).

(b) $\beta^* = m$ and $\gamma^* = \frac{c-r}{(1-q)D_p}$

In this case the MCO sets $r^* = c - (1 - q)\gamma D_p$ and $f^* = m(c - r) + (1 - m)(c - r) = c - r$. This contract provides

$$u_m = I - (c - r) - mr - (1 - m)\frac{(c - r)D_m}{D_p}$$

$$= I - c + r - mr - (1 - m)c\frac{D_m}{D_p} + (1 - m)r\frac{D_m}{D_p}$$

$$= I - c - (1 - m)c\frac{D_m}{D_p} + r(1 - m + (1 - m)\frac{D_m}{D_p})$$

[2] Note that, in equilibrium, the MCO will set the fixed payment, f, and the reimbursement amount, r, so that $u_p = 0$. Therefore, the maximization problem is solved assuming that the constraint is binding.

u_m is increasing in r. Therefore, the MCO prefers to set r as high as possible given that $\gamma = \frac{c-r}{(1-q)D_p}$ and $\gamma \geq 0$. Therefore, the MCO will set $r^* = c$ and $f^* = 0$. In equilibrium, $\beta^* = m$ and $\gamma^* = 0$ resulting in $u_m = I - mc$.

(c) $\beta^* < m$ and $\gamma^* = 1$

Under these conditions, $r^* = c - (1-q)D_p$ and $f^* = (1-q)D_p$. Because the physician is indifferent between all effort levels below m, the effort level is set to optimize the MCO's payoff. Specifically, it will solve the following problem:

$$\max_{\beta<m} I - (1-q)D_p - \beta(c - (1-q)D_p) - (1-\beta)(1-q)D_m =$$

$$I - (1-q)(D_m + D_p) + \beta((1-q)(D_m + D_p) - c)$$

Therefore, the MCO's preferred probability of treatment depends on the relationship between c and $(1-q)(D_m + D_p)$:

(i) If $c < (1-q)(D_m+D_p) \Rightarrow$ the MCO prefers $\beta = m-\varepsilon$ and $u_m = I-(1-q)D_p-(m-\varepsilon)(c-(1-q)D_p)-(1-(m-\varepsilon))(1-q)D_m \rightarrow I-mc-(1-m)(1-q)(D_m+D_p)$.

(ii) If $c = (1-q)(D_m + D_p) \Rightarrow$ MCO is indifferent between all $\beta < m$ (say $\beta = l$) and $u_m = I - lc - (1-l)(1-q)(D_m + D_p) = I - c$.

(iii) If $c > (1-q)(D_m+D_p) \Rightarrow$ the MCO prefers $\beta = 0$ and $u_m = I-(1-q)(D_m+D_p)$.

(3) If the MCO sets $r < c - (1-q)D_p$, then $\beta^* = 0$ and $\gamma^* = 1$. To satisfy the physician's IR constraint, the MCO must set $f^* = (1-q)D_p$. This results in $u_m = I - (1-q)(D_m + D_p)$.

To summarize:

When $c < (1-q)(D_m + D_p)$:

- If $\kappa = (c, 0)$, then $u_m = I - mc$.
- If $\kappa = (c-(1-q)D_p, (1-q)D_p)$, then $u_m \rightarrow I - mc - (1-m)(1-q)(D_m + D_p)$.
- If $\kappa = (r < c-(1-q)D_p, (1-q)D_p)$, then $u_m = I - (1-q)(D_p + D_m)$.

Therefore, the MCO will maximize its payoff by employing $\kappa = (c, 0)$.

When $c = (1-q)(D_m + D_p)$:

- If $\kappa = (c, 0)$, then $u_m = I - mc$.

- If $\kappa = (c - (1-q)D_p, (1-q)D_p)$, then $u_m = I - c$.
- If $\kappa = (r < c - (1-q)D_p, (1-q)D_p)$, then $u_m = I - (1-q)(D_p + D_m)$.

Therefore, the MCO will maximize its payoff by employing $\kappa = (c, 0)$.

When $c > (1-q)(D_m + D_p)$:

- If $\kappa = (c, 0)$, then $u_m = I - mc$.
- If $\kappa = (c - (1-q)D_p, (1-q)D_p)$, then $u_m = I - (1-q)(D_p + D_m)$.
- If $\kappa = (r < c - (1-q)D_p, (1-q)D_p)$, then $u_m = I - (1-q)(D_p + D_m)$.

Therefore, if $mc < (1-q)(D_p + D_m)$, then the MCO will maximize its payoff by employing $\kappa = (c, 0)$. On the other hand, if $mc > (1-q)(D_p + D_m)$, then the MCO will maximize its payoff by employing $\kappa = (r \leq c - (1-q)D_p, (1-q)D_p)$. ■

A.3 Equilibrium when Contracts Are not Observable by the Patient

This section provides proofs for claims made in the case when the contract formed between the MCO and the physician is *not* observable by the patient. Just as in the observable contract case, the following proofs apply to the case in which the patient is allowed to sue both the physician and the MCO for medical malpractice. The claims and proofs can be modified, however, to analyze the remaining tortfeasor rules: (1) patient can sue physician only (set $D_m = 0$ in all cases) and (2) patient can sue MCO only (set $D_p = 0$ in all cases).

Solving this case for the equilibrium proceeds in much the same way as in the case with observable contracts. The patient, however, cannot observe the contract terms. Therefore, the MCO best responds only to the physician's strategy.

A.3.1 MCO's Best Response to the Physician's Strategy

Claim 4 *Taking c, p, q, D_m, D_p, L and γ as given, the MCO's best response to the physician's strategy is as follows:*

If $\gamma > \frac{c}{(1-q)(D_m+D_p)}$*, then the MCO sets* (r, f) *such that* $\gamma = \frac{c-r}{(1-q)D_p}$*, namely* $\kappa = (c-(1-q)\gamma D_p, (1-q)\gamma D_p)$ *with* $\beta = 1$ *resulting in* $u_m = I - c$*.*

If $\gamma = \frac{c}{(1-q)(D_m+D_p)}$*, then the MCO is indifferent between: (1) setting* (r, f) *such that* $\gamma = \frac{c-r}{(1-q)D_p}$*, namely* $\kappa = (\frac{cDm}{D_m+D_p}, \frac{cDp}{D_m+D_p})$ *with* $\beta \in [0, 1]$ *and (2) setting* (r, f) *such that* $\gamma < \frac{c-r}{(1-q)D_p}$*, namely* $\kappa = (r < \frac{cDm}{D_m+D_p}, \frac{cDp}{D_m+D_p})$ *with* $\beta = 0$*. Both contracts result in* $u_m = I - c = I - (1-q)\gamma(D_m + D_p)$*.*

If $\gamma < \frac{c}{(1-q)(D_m+D_p)}$*, then the MCO is indifferent between: (1) setting* (r, f) *such that* $\gamma = \frac{c-r}{(1-q)D_p}$*, namely* $\kappa = (c-(1-q)\gamma D_p, (1-q)\gamma D_p)$ *with* $\beta = 0$ *and (2) setting* (r, f) *such that* $\gamma < \frac{c-r}{(1-q)D_p}$*, namely* $\kappa = (r < c-(1-q)\gamma D_p, (1-q)\gamma D_p)$ *with* $\beta = 0$*. Both contracts result in* $u_m = I - (1-q)\gamma(D_m + D_p)$*.*

Proof: Consider the MCO's decision regarding which contract to utilize to obtain physician services given a fixed probability γ that the patient will sue if a negative outcome occurs. Taking c, p, q, D_m, D_p, L and γ as given, the MCO will solve the following problem:

$$\max_{(r,f)} I - f - \beta^* r - (1-\beta^*)(1-q)\gamma D_m$$

$$\text{subject to (1) } f + \beta^*(r-c) - (1-\beta^*)(1-q)\gamma D_p \geq 0$$

$$(2)\ \beta^* = \arg\max_{\beta} f^* + \beta(r^* - c) - (1-\beta)(1-q)\gamma D_p$$

Recall from Claim 2 that the cutoff point for physician action is $\gamma = \frac{c-r}{(1-q)D_p}$. That is, if the probability that the patient will sue given a negative outcome is greater than this cutoff point, the physician will provide compliant treatment. This cutoff point is a choice variable for the MCO: when it selects an amount to reimburse the physician, it fixes the cutoff point. Consider the following cases based on the physician's strategy in Claim 2 given a fixed γ:

(1) If the MCO sets (r, f) such that $\gamma > \frac{c-r}{(1-q)D_p} \Rightarrow \beta^* = 1$. In other words, if the MCO sets $r > c - (1-q)\gamma D_p$, the physician will provide compliant treatment with

certainty. The MCO's maximization problem becomes $\max_{(f,r)} I - f - r$ subject to $f + r = c$. To meet the physician's IR constraint, the MCO must provide $f = c - r < 0$, which violates an assumption of the model. Therefore, this contract is unfeasible.

(2) If the MCO sets (r, f) such that $\gamma = \frac{c-r}{(1-q)D_p} \Rightarrow \beta^* \in [0, 1]$. In other words, if the MCO sets $r = c - (1-q)\gamma D_p$, the physician will be indifferent between all effort levels. Therefore, the effort level is set to maximize the MCO's payoff. Substituting for r, the maximization problem becomes

$$\max_{(f,\beta)} I - f - \beta(c - (1-q)\gamma D_p) - (1-\beta)(1-q)\gamma D_m$$

$$\text{subject to } f = (1-q)\gamma D_p$$

Substituting for f gives

$$\max_{\beta} I - \beta c - (1-\beta)(1-q)\gamma(D_m + D_p)$$

$$\max_{\beta} \beta((1-q)\gamma(D_m + D_p) - c).$$

The MCO's decision will depend on how the cost of compliant treatment relates to ex ante expected total damages given non-compliant treatment:

(a) If $c < (1-q)\gamma(D_m + D_p)$ (or $\gamma > \frac{c}{(1-q)(D_m+D_p)}$), then $\beta = 1$ maximizes the MCO's payoff. Therefore, the contract will specify $r = c - (1-q)\gamma D_p$ and $f = (1-q)\gamma D_p$. $\beta = 1 \Rightarrow u_m = I - c$.

(b) If $c = (1-q)\gamma(D_m + D_p)$ (or $\gamma = \frac{c}{(1-q)(D_m+D_p)}$), then the MCO is indifferent between all values of β. Therefore, the contract will specify $r = c - (1-q)\gamma D_p = \frac{cD_m}{D_m+D_p}$ and $f = (1-q)\gamma D_p = \frac{cD_p}{D_m+D_p}$ and

$$u_m = I - f - \beta r - (1-\beta)(1-q)\gamma D_m$$

$$= I - \frac{cD_p}{D_m + D_p} - \beta(\frac{cD_m}{D_m + D_p}) - (1-\beta)(1-q)(\frac{c}{(1-q)(D_m + D_p)})D_m$$

$$= I - \frac{cD_p}{D_m + D_p} - \beta(\frac{cD_m}{D_m + D_p}) - (1-\beta)\frac{cD_m}{D_m + D_p}$$

$$= I - c = I - (1-q)\gamma(D_m + D_p)$$

(c) If $c > (1-q)\gamma(D_m + D_p)$ (or $\gamma < \frac{c}{(1-q)(D_m+D_p)}$), then $\beta = 0$ maximizes the MCO's payoff. Therefore, the contract will specify $r = c - (1-q)\gamma D_p$ and $f = (1-q)\gamma D_p$. $\beta = 0 \Rightarrow u_m = I - (1-q)\gamma(D_m + D_p)$.

(3) If the MCO sets (r, f) such that $\gamma < \frac{c-r}{(1-q)D_p} \Rightarrow \beta = 0$. In other words, if the MCO sets $r < c - (1-q)\gamma D_p$, the physician will not compliantly treat. The MCO's maximization problem becomes $\max_f I - f - (1-q)\gamma D_m$ subject to $f = (1-q)\gamma D_p$. Therefore, the contract will specify any $r < c - (1-q)\gamma D_p$ and $f = (1-q)\gamma D_p$. This implies $u_m = I - (1-q)\gamma(D_m + D_p)$.

To summarize:

When $c < (1-q)\gamma(D_m + D_p)$ **(or** $\gamma > \frac{c}{(1-q)(D_m+D_p)}$**):**

- If the MCO sets (r, f) such that $\gamma = \frac{c-r}{(1-q)D_p}$, namely $\kappa = (c-(1-q)\gamma D_p, (1-q)\gamma D_p)$, then $u_m = I - c$ with $\beta = 1$.
- If the MCO sets (r, f) such that $\gamma < \frac{c-r}{(1-q)D_p}$, namely $\kappa = (r < c - (1-q)\gamma D_p, (1-q)\gamma D_p)$, then $u_m = I - (1-q)\gamma(D_m + D_p)$ with $\beta = 0$.

Therefore, the MCO will maximize its payoff by setting (r, f) such that $\gamma = \frac{c-r}{(1-q)D_p}$ and employing $\kappa = (c - (1-q)\gamma D_p, (1-q)\gamma D_p)$ with $\beta = 1$.

When $c = (1-q)\gamma(D_m + D_p)$ **(or** $\gamma = \frac{c}{(1-q)(D_m+D_p)}$**):**

- If the MCO sets (r, f) such that $\gamma = \frac{c-r}{(1-q)D_p}$, namely $\kappa = (\frac{cD_m}{D_m+D_p}, \frac{cD_p}{D_m+D_p})$, then $u_m = I - c = I - (1-q)\gamma(D_m + D_p)$ with $\beta \in [0, 1]$.
- If the MCO sets (r, f) such that $\gamma < \frac{c-r}{(1-q)D_p}$, namely $\kappa = (r < \frac{cD_m}{D_m+D_p}, \frac{cD_p}{D_m+D_p})$, then $u_m = I - c = I - (1-q)\gamma(D_m + D_p)$ with $\beta = 0$.

Therefore, the MCO is indifferent between the two contracts.

When $c > (1-q)\gamma(D_m + D_p)$ **(or** $\gamma < \frac{c}{(1-q)(D_m+D_p)}$**):**

- If the MCO sets (r, f) such that $\gamma = \frac{c-r}{(1-q)D_p}$, namely $\kappa = (c-(1-q)\gamma D_p, (1-q)\gamma D_p)$, then $u_m = I - (1-q)\gamma(D_m + D_p)$ with $\beta = 0$.
- If the MCO sets (r, f) such that $\gamma < \frac{c-r}{(1-q)D_p}$, namely $\kappa = (r < c - (1-q)\gamma D_p, (1-q)\gamma D_p)$, then $u_m = I - (1-q)\gamma(D_m + D_p)$ with $\beta = 0$.

Therefore, the MCO is indifferent between the two contracts. ■

A.3.2 Equilibrium Contracts

Proposition 2 *Taking c, p, q, D_m, D_p and L as given, the equilibrium contracts, resulting equilibrium behavior of the patient and the physician and payoffs are as follows:*

(1) If $c < (1-q)(D_m + D_p)$, then the MCO will employ $\kappa^* = (\frac{cD_m}{D_m+D_p}, \frac{cD_p}{D_m+D_p})$ with $\beta^* = m$ and $\gamma^* = \frac{c}{(1-q)(D_m+D_p)}$ resulting in $u_m = I - c$, $u_p = 0$ and $u_i = mpH + (1-m)qH + m(1-p)\frac{c}{(1-q)(D_m+D_p)}(-L) + (1-m)\frac{c(D_m+D_p-L)}{(D_m+D_p)} - I$.

(2) If $c > (1-q)(D_m + D_p)$, then the MCO will employ $\kappa^* = (r^* < c - (1-q)D_p, (1-q)D_p)$ with $\beta^* = 0$ and $\gamma^* = 1$ resulting in $u_m = I - (1-q)(D_m + D_p)$, $u_p = 0$ and $u_i = qH + (1-q)(D_m + D_p - L) - I$.

Proof: Equilibrium contracts are found by considering the patient's best response to resulting physician behavior given the contract chosen by the MCO. Take c, p, q, D_m, D_p and L as given. Consider each scenario listed in Claim 4:

(1) If $\gamma > \frac{c}{(1-q)(D_m+D_p)}$, then $\kappa = (c - (1-q)\gamma D_p, (1-q)\gamma D_p)$ with $\beta = 1$.

$\beta = 1$ implies $\gamma = 0$ (see Claim 3). Substituting $\gamma = 0$ into $\gamma > \frac{c}{(1-q)(D_m+D_p)}$ gives $0 > \frac{c}{(1-q)(D_m+D_p)}$, a violation of the assumptions of the model. Therefore, this contract is not possible in equilibrium.

(2) If $\gamma = \frac{c}{(1-q)(D_m+D_p)}$, consider the two contracts specified in Claim 4:

(a) The MCO sets (r, f) such that $\gamma = \frac{c-r}{(1-q)D_p}$, namely $\kappa = (\frac{cD_m}{D_m+D_p}, \frac{cD_p}{D_m+D_p})$ with $\beta \in [0, 1]$. When $\gamma = \frac{c-r}{(1-q)D_p}$, however, in equilibrium $\beta = m$, where $m = \frac{(1-q)(D_m+D_p-L)}{(1-q)(D_m+D_p-L)+(1-p)L}$ (see Claim 3). This constitutes an equilibrium contract with $u_m = I - c$.

(b) The MCO sets (r, f) such that $\gamma < \frac{c-r}{(1-q)D_p}$, namely $\kappa = (r < \frac{cD_m}{D_m+D_p}, \frac{cD_p}{D_m+D_p})$ with $\beta = 0$. In equilibrium, $\beta = 0$ implies $\gamma = 1$ (see Claim 3). Note that $\gamma = 1$ implies $c = (1-q)(D_m + D_p)$. Therefore, this constitutes an equilibrium contract with $u_m = I - c = I - (1-q)(D_m + D_p)$.

(3) If $c > (1-q)\gamma(D_m + D_p)$, consider the two contracts specified in Claim 5:

(a) The MCO sets (r, f) such that $\gamma = \frac{c-r}{(1-q)D_p}$, namely $\kappa = (c - (1-q)\gamma D_p, (1-q)\gamma D_p)$ with $\beta = 0$. When $\gamma = \frac{c-r}{(1-q)D_p}$, however, in equilibrium $\beta = m > 0$; therefore, this contract is not possible in equilibrium.

(b) The MCO sets (r, f) such that $\gamma < \frac{c-r}{(1-q)D_p}$, namely $\kappa = (r < c - (1 - q)\gamma D_p, (1-q)\gamma D_p)$ with $\beta = 0$. In equilibrium, $\beta = 0$ implies $\gamma = 1$. This constitutes an equilibrium contract with $u_m = I - (1-q)(D_m + D_p)$.

To summarize:

If $c < (1-q)(D_m + D_p)$, then the MCO will employ $\kappa^* = (\frac{cD_m}{D_m+D_p}, \frac{cD_p}{D_m+D_p})$ with $\beta^* = m$ and $\gamma^* = \frac{c}{(1-q)(D_m+D_p)}$ resulting in $u_m = I - c$.

If $c > (1-q)(D_m+D_p)$, then the MCO will employ $\kappa^* = (r^* < c-(1-q)D_p, (1-q)D_p)$ with $\beta^* = 0$ and $\gamma^* = 1$ resulting in $u_m = I - (1-q)(D_m + D_p)$. ■

A.3.3 Effect of Disclosure Rules on the Likelihood of Lawsuits

Let γ_o represent the probability that an injured patient will file a claim when contracts are observable and γ_u represent the probability of an injured patient filing a claim when contracts are unobservable.

Proposition 3 *Given any feasible point* (c, p, q, L, D_m, D_p), $\gamma_o \leq \gamma_u$.

Proof: Consider each possible case given $D_m + D_p > L$:

(1) If $mc < c < (1-q)(D_m + D_p)$, then $\gamma_o = 0$ and $\gamma_u = \frac{c}{(1-q)(D_m+D_p)} > 0$. Therefore, $\gamma_o < \gamma_u$.

(2) If $mc < (1-q)(D_m + D_p) < c$, then $\gamma_o = 0$ and $\gamma_u = 1$. Therefore, $\gamma_o < \gamma_u$.

(3) If $(1-q)(D_m + D_p) < mc < c$, then $\gamma_o = 1$ and $\gamma_u = 1$. Therefore, $\gamma_o = \gamma_u$.

If $D_m + D_p < L$, then the patient never sues. Therefore, $\gamma_o = \gamma_u$.■

A.3.4 Effect of Disclosure Rules on the Likelihood of Treatment

Let β_o represent the probability that the physician will provide compliant treatment when contracts are observable and β_u represent the probability of compliant treatment when contracts are unobservable.

Proposition 4 *Given any feasible point* (c, p, q, L, D_m, D_p), $\beta_o \geq \beta_u$.

Proof: Consider each possible case given $D_m + D_p > L$:

(1) If $mc < c < (1-q)(D_m + D_p)$, then $\beta_o = m$ and $\beta_u = m$. Therefore, $\beta_o = \beta_u$.

(2) If $mc < (1-q)(D_m + D_p) < c$, then $\beta_o = m$ and $\beta_u = 0$. Therefore, $\beta_o > \beta_u$.

(3) If $(1-q)(D_m + D_p) < mc < c$, then $\beta_o = 0$ and $\beta_u = 0$. Therefore, $\beta_o = \beta_u$.

If $D_m + D_p < L$, then the physician never compliantly treats. Therefore, $\beta_o = \beta_u$.■

A.4 The Efficient Damage Rule

Proposition 5 *Regardless of the observability of the contract terms, the following specifies the efficient damage rule:*

If $(p-q)H > c$, *the court can approximate arbitrarily the first-best solution by increasing damages. This results in* $\kappa^* = (c, 0)$, $\beta^* \to 1$ *and* $\gamma^* \to 0$.

If $(p-q)H < c$, *the court can achieve the first-best solution by setting* $D_m + D_p = 0$. *This results in* $\kappa^* = (0, 0)$, $\beta^* = 0$ *and* $\gamma^* = 0$.

Proof: Consider the case in which contracts are observable by the patient and treatment maximizes social welfare. Recall that the patient's cut-off point is $m = \frac{(1-q)(D_m+D_p-L)}{(1-q)(D_m+D_p-L)+(1-p)}$ By setting $D_p \to \infty$ and $D_m \to \infty$, the physician treats with (near) certainty as $m \to 1$. Because the physician is treating at the patient's cut-off point, the patient will never sue. Also, large damage amounts result in $mc < (1-q)D_m + D_p$. Therefore, the MCO employs a fee-for-service contract with full reimbursement to maximize its payoff (see Proposition 1). The socially optimal outcome (treating with certainty and no lawsuit) is approximated when the court sets damages high.

Alternatively, consider the case in which contracts are not observable by the patient. As in the observable contract case, by setting damages high, the court encourages the physician to treat with (near) certainty as $\lim_{D_m+D_p \to \infty} m = 1$. Likewise, when the court sets damages high, the patient is discouraged from suing as $\lim_{D_m+D_p \to \infty} \gamma = 0$. Finally, when damages are high, $c < (1-q)(D_m + D_p)$. According to Proposition 2, the contract terms will depend on the relative rates at which damages against the MCO and damages against the physician increase.[3]

If social welfare is maximized when the physician does not treat (i.e., $(p-q)H < c$), the analysis is the same regardless of the observability of the contract terms. The court will set damages so that no treatment is provided and the patient does not sue. This is accomplished by setting damages equal to zero (i.e., $D_m = 0$ and $D_p = 0$). When damages are equal to zero, the patient will never sue because litigation costs (L) exceed expected damages. Knowing that the patient will not sue, the MCO will pay the physician nothing and the physician will not treat.

[3]This characteristic of the model is merely a feature of its assumptions. Intuitively, when both physician and MCO damage amounts are high, the MCO must pay the physician the cost of treatment. This payment can be split in any way between the reimbursement amount and the fixed payment. The MCO is indifferent between the various splits because high physician damages provide the physician with an incentive to treat. The payment from the MCO merely satisfies his individual rationality constraint.

State	Year in Effect	Statute Cite
Arizona	1996	Ariz. Rev. Stat. Ann. §20-1076(A)
Vermont	1996	Vt. State. Ann. tit. 18, §9414
Virginia	1996	Va. Code Ann. §38.2-3407.10
Washington	1996	Wash. Rev. Code §48.43.095(1)
New York	1997	N.Y. Ins. Law §3217-a
North Carolina	1997	N.C. Gen. Stat. §58-3-191
Maine	1997	Me. Rev. Stat. Ann. tit. 24A §4302(1)
Rhode Island	1997	R.I. Gen. Laws §23-17.13-3
Connecticut	1998	Conn. Gen. Stat. Ann. §38a-478g(b)(1)
Kentucky	1998	Ky. Rev. Stat. Ann. §301.17A-510
New Jersey	1998	N.J. Stat. Ann. §26:2S-5
Georgia	1999	Ga. Code Ann. §33-20A-5
Hawaii	1999	Haw. Rev. Stat. Ann. §432E-7
Iowa	1999	Iowa Code Ann. §514K.1
Minnesota	1999	Minn. Stat. Ann. §62J.72
Pennsylvania	1999	40 Pa. Cons. Stat. Ann. §991.2136
South Dakota	1999	S.D. Codified Laws §58-17C-5
California	2000	Cal. Health & Safety Code §1367.10
Illinois	2000	Ill. Comp. Stat. Ann. 134/15
New Hampshire	2000	N.H. Rev. Stat. Ann. §420-J:8
Massachusetts	2001	Mass. Gen. Laws Ann. ch. 176O, §7

Table A.1: This table provides statutory citations for disclosure laws passed by state legislatures and the year each statute went into effect.

State	EC	NEC	PC
AL	..	..	91–5
AK	..	P	P
AZ	..	..	..
AR	..	..	..
CA	..	P	..
CO	P	P	P
CT	..	..	..
DE	..	..	..
FL	P	P	P
GA	..	..	P
HI	..	P	..
ID	..	P	P
IN	P	P	P
IL	..	95–6	P
IA	..	..	P
KS	..	P	P
KY	..	..	..
LA	P	P	P
ME	..	..	..
MD	..	P	..
MA	..	P	..
MI	..	93	..
MN	..	..	..
MS	..	..	..
MO	..	P	..
MT	..	95	..
NE	P	P	P
NV	..	..	P
NH	..	..	P
NJ	..	..	97
NM	P	P	..
NY	..	..	..
NC	..	..	96
ND	..	95	P
OH	..	97–8	96–8
OK	..	..	95
OR	..	91–8	P
PA	P	P	97
RI	..	..	..
SC	P	P	P
SD	91–5	P	..
TN	..	..	..
TX	P	P	P
UT	..	P	..
VT	..	..	..
VA	P	P	P
WA	..	..	..
WV	..	P	..
WI	P	P	P
WY	P	P	P

Table A.2: Note: Entries indicate year statute went into effect. If the statute was repealed or deemed unconstitutional prior to 2000, then a range is given to indicate the years in effect. A "P" indicates that the cap went into effect prior to 1991. EC = economic damage cap; NEC = non-economic damage cap; PC = punitive damage cap.