

Access to Justice: An Economic Approach

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PROMOTOR: prof. dr. E.E.C. van Damme

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CHAPTER 1

Introduction

This Ph.D. thesis is a collection of four papers on economic analysis of access to justice. In the introduction, I will introduce the reader to the concept of access to justice and its economic analysis. The setup of the introduction is as follows. In Section 1.1, I give a verbal definition of access to justice, and define the scope of the thesis. In Section 1.2, I address the barriers to access to justice. Section 1.3 reviews the literature. In Section 1.4, I give an overview of the thesis, providing a summary of each paper. Section 1.5 concludes.

1.1. ACCESS TO LEGAL JUSTICE

In order to formally define access to justice, I start with the basic concepts of ‘legal right’, ‘fairness’ and ‘efficiency’.

Legal Right In this thesis, a *legal right* is defined as a right where a party has the legal title to certain property, benefits or other interests, and in that case, her remedy for an infringement of it, is by an action in a court of law. Furthermore, an *infringement* is defined as the violation of a legal right. A *private legal right* is a right that is vested in, and can be claimed in court by a private citizen. Private rights include, for instance, the right of a victim of tortious injury to compensation, the right of a parent to custody, and the right of an accused not to be deprived of his property or other interests without due process of law. A private right is distinguished from a *public right*, which is vested in and claimed only by political entities. In this thesis, we restrict ourselves to the infringement and enforcement of private legal rights.

Legal Dispute A *legal dispute* refers to the disagreement over the existence of an infringement, or over the type and amount of compensation that may be claimed by the injured party for the infringement. Furthermore, a *resolution* to a legal dispute is a legally enforceable decision that prescribes the type and amount of compensation to be received by the injured party from the party liable. A resolution may take the form of, for instance, settlement agreement, mediation, or court decision.

Legal System A *legal system* is a system for interpreting the laws, enforcing the legal rights and resolving legal disputes. A legal system is composed of people and legal institutions. The people involved in the legal system include the litigants, their attorneys, the judges and other interested parties. The institutions typically include different levels of courts, law enforcing agencies and alternative dispute resolution mechanisms.

To formally define ‘efficiency’, ‘fairness’ and ‘access to justice’, we need some notations. Consider two litigants, plaintiff p and defendant d , who are involved in a legal dispute over an asset of value v , which has to be divided between the two parties. An example of this situation is a dispute between two siblings over the inheritance of a sum of money. A court or an arbitrator has to divide the inheritance between the two siblings. Assume that the “legally right resolution” will be the one that the court or arbitrator would accurately reach after extensive investigation of the facts of the case and the law applicable. Let θ^p (with $0 \leq \theta^p \leq 1$) (resp. θ^d (with $0 \leq \theta^d \leq 1$ and $\theta^p + \theta^d = 1$)) denote the share of the disputed asset that party p (resp. d) is legally entitled to. $\theta^p = 0$ indicates that p

is not legally entitled to the asset and that d is not liable; $\theta^p = 0.5$ indicates that p and d are each entitled to 50 percent of the asset. Throughout the thesis I assume that the parties in dispute are risk neutral. Let π (with $0 \leq \pi \leq v$) denote the expected level of *award*, i.e., the (expected) payment p will receive from d in the legal resolution. The 2-vector $\theta = (\theta^p, \theta^d)$ is called the *right legal resolution*. Furthermore, let c^p (resp. c^d) denote the *aggregate legal costs* incurred by p (resp. d). The legal costs include for instance attorney fees, court fees, the value of litigants' time, and out-of-pocket expenses.

Measures of Efficiency Efficiency refers to the ability of a legal system to avoid waste by using as little input as required by technology to resolve a legal dispute. I say a resolution is *efficient* if there exists no other resolution that requires less legal costs. The first efficiency measure is given by the fraction of value v that is dissipated in the legal competition:¹

$$r = \frac{c^p + c^d}{v}.$$

Because the value of a claimed legal right is not always directly observed or easily measured, I propose an alternative measure of efficiency. It is given by the damage payments share of total legal costs:²

$$r' = \frac{c^p + c^d}{\pi}.$$

The first efficiency measure will be used in Chapter 3. The second efficiency measure will be used in Chapter 4. ||

Fairness in Legal Dispute Resolution Fairness refers to the ability of a legal system to enforce legal rights accurately. I say a dispute resolution is *fair* if $\pi = \theta^p \cdot v$, i.e., if p (resp. d) receives (resp. pays) what he is legally entitled to (resp. liable for). The degree of *unfairness* of a legal outcome ρ is measured by the (normalized) difference between what d should compensate p according to the law and the facts of the case and what d actually pays p :

$$\rho = \frac{1}{v} | \theta^p v - \pi |, \quad (1)$$

where the normalization is introduced to make the measure invariant to the scale of the case. The higher the value of ρ , the more unfair is the resolution and the less accurate the legal system is considered to be. The definition of fairness will be used in Chapter 4. The measure of unfairness will be used in Chapter 5. ||

Measure of Access to Justice In this thesis, the term *access to justice* refers to the ability of a legal system to produce legal outcomes that match the ones would be produced by an accurate and transaction-cost-free system. Write the net payoffs for p and d as $u^p = \pi - c^p$ and $u^d = v - \pi - c^d$. Let the 2-vector $\mathbf{u} = (\frac{1}{v}u^p, \frac{1}{v}u^d)$ be the (normalized) *outcome* of the legal dispute. The *measure of distortion to access to justice* λ is given by the *Euclidean distance* between \mathbf{u} and the right legal resolution θ :

$$\lambda(c^p, c^d, \pi | \theta^p, \theta^d, v) = \| \mathbf{u} - \theta \| = \left\{ \left[\frac{1}{v}(\pi - c^p) - \theta^p \right]^2 + \left[\frac{1}{v}(v - \pi - c^d) - \theta^d \right]^2 \right\}^{\frac{1}{2}}. \quad (2)$$

¹This share calculation adopts the same formulation of rate-of-rent-dissipation which is a measure for intensity of rent-seeking activities that is commonly used in rent-seeking literature. See, e.g., Tullock (1980).

²This share calculation is similar to the formulation used in Hensler *et al.* (1987), Carroll *et al.* (2005), and Hersch and Viscusi (2007).

δ measures how different or ‘distant’ the actual legal outcome is from the ‘right legal resolution’. The higher the value of δ , the more severe is the distortion to access to justice.

Substituting and rearranging, we have $\lambda = [(\rho + \frac{c^p}{v})^2 + (\rho - \frac{c^d}{v})^2]^{\frac{1}{2}}$. By differentiation, we have

$$\lambda_\rho > 0. \quad (3)$$

That is, the degree of distortion to access to justice is increasing with the magnitudes of unfairness. An implication of this result is that given the levels of legal costs, it is sufficient to analyze the changes in unfairness of a legal outcome to determine the pattern of changes in distortion to access to justice. Furthermore, it follows from the definitions of ρ and r that $\delta = 0$ if $\rho = 0$ and $r = 0$ (or $r' = 0$). That is, distortion to access to justice vanishes if the legal system is accurate and the enforcement of legal rights is immediate and cost-free. The measure of distortion to access to justice will be used in Chapter 3.

In reality the legal systems are far from ideal. Judges and juries may not be able to accurately determine the magnitude of damages: a severely injured victim may be under-compensated and a lightly injured victim may be overcompensated. Parties to a legal dispute incur substantial lawyer fees and court fees when they access the court system to secure their legal rights. Trials are frequently delayed due to court congestion. To enhance access to courts and access to legal services, the matters targeted for particular attention often include the speed of dispute resolution, the costs of legal services and legal proceedings, the funding and allocation of legal aid, and the consistency and randomness of jury awards. Chapters 2 - 5 of the thesis will investigate certain aspects of these issues. The premise of this thesis is that access to justice can be enhanced through better design of legal systems. The thesis will endeavor to investigate a small number of issues related to access to legal resolutions to civil disputes (such as torts, contracts, property and competition) according to law. Many important applied issues will be side-stepped in the thesis, including the effects of different liability rules, the consequence of litigants’ optimism bias on litigation outcomes, and the effects of evidentiary rules, etc.

1.2. OBSTACLES TO ACCESS TO JUSTICE

Access to justice is often diminished due to delay, congestion, high legal costs, lack of resources and improperly designed legal rules. While not exhausting all the issues of importance, in my thesis I restrict my discussion to five sources of inefficiency that combine to diminish access to justice. They are [1] the *costs* of litigation, [2] the *delays* in court system and in out-of-court settlement, [3] the *uncertainty* associated with trial outcomes, [4] the divergent interests of lawyer and client and [5] the technical *difficulty* associated with determining damage compensations.

Firstly, high costs associated with litigation can make it financially prohibitive for individuals with limited resources to take legal actions. Calculation based on McQuillan *et al.* (2007) shows that for filed tort cases in the U.S., attorney fees for a plaintiff amounts to \$ 99,458 on average, which is approximately 41% of the damage compensation that the plaintiff receives. Swanson (1988)³ shows

³In the U.K. the legal expenses are usually allocated to the “losing” party in the dispute. Since the reasonable legal expenses must then be determined, a separate division of the judiciary has evolved to fulfill this function: the Taxing Masters of the High Courts of Justice. In order to make fact-based determinations of claims for expenses, the regulations of the High Court provide that a detailed account of the proceedings must be tendered to the Taxing Master. It was this set of files which were consulted for the construction of the data set in Swanson (1988)’s study. Swanson named these legal cases as “taxed cases”.

that for the tried cases (i.e., cases that went to trial) in the U.K. the plaintiffs incurred on average legal expenses in the neighborhood of £5,300, approximately 68.5% of the damage payments received by the plaintiffs in those cases.

Secondly, excessive delays in a court system may delay compensations to injured victims and therefore obstruct early access to justice.⁴ Filed cases in Texas take, on average, 26 months to resolve.⁵ Statistics estimate that tort cases in the U.K. take, on average, five years to resolve (see NAO (2001), Swanson (1998)). In Italy, 12 to 13 years are expected for the final determination of a civil dispute.⁶ Such delays can cause evidence to deteriorate, injured parties fail to receive compensation when they most need it and individuals to be deterred from bringing cases.

Thirdly, parties' asymmetric information about trial outcomes may distort access to justice. Parties to a dispute may have different information about the likely trial outcomes. For instance, the plaintiff may be privately informed about the severity of her damages; or the defendant may be privately informed about whether he behaved negligently. Empirical evidence (see, e.g., Sieg (2000) and Fournier and Zuehlke (1998)) verifies that if one side in a legal dispute has information about likely trial outcomes that the other side does not have, then incentives can be created for uninformed party to use delay as a means of gather information, and similarly, for the informed party to credibly convey information to the uninformed party through inefficient delay. Inefficient litigations occur inevitably when the benefits of learning and of establishing credibility exceed the costs of waiting.

Fourthly, diverging interests of lawyer and client may put obstacles in the way of access to justice. This argument rests on the simple observation that lawyers are not necessarily benefited by the early resolution of disputes. This is most obvious in the case of a lawyer who is paid solely on the time he has spent on handling the dispute, according to an hourly fee; for such a lawyer, protracted litigation is more profitable than an early settlement.⁷ To the extent this lawyer can act on this incentive, litigation may occur even though it would be in the client's interest to settle. Even if the client formally controls the decision to litigate or settle a claim, the lawyer may have substantial influence over the client, for example by regulating the information available to the client (see Hay and Spier (1998)).

Finally, judges and jurors may experience difficulties in determining the level of damages when the damages are for intangible harms such as pain, physical and emotional distress and loss of companionship. These damages are called noneconomic damages. There are no well-established legal doctrines for determining when noneconomic damage should be awarded or how much of the welfare loss it is intended to replace. Because these damages are not directly measurable and readily quantifiable, there has long been critics that financial compensations for these damages are random outcomes. Since randomness implies that variation in awards for individuals with identical injury, the tort system is not fair when damage awards are random. Furthermore, because noneconomic damages are difficult to measure and quantify, a significant amount of court time must be devoted to proving

⁴See Zhou (2008a) and Kessler (1996).

⁵See Zhou (2008a). Fenn and Rickman (1999) report similar delay figures for medical negligence and employee claim cases filed in UK, as do Worthington (1991) for motor vehicle accident cases in New South Wales and Kakalik *et al.* (1990) for civil cases filed in Los Angeles.

⁶See Varano (1997).

⁷Helland and Klick (2006) finds that lawyers systematically delay settlement to accrue additional fees when compensated by hourly fees or through a lodestar calculation.

the noneconomic losses, giving rise to trial delays and high administration costs which will be borne by the litigants in the form of court fees.

My thesis will selectively investigate a number of issues related to the costs of litigation, the delays in court system and in out-of-court settlement, the uncertainty associated with damage compensations, and the divergent interests of lawyer and client on access to justice, respectively. Furthermore, I will provide an analysis to ascertain whether noneconomic damages are random outcomes and what factors determine the incidence and magnitude of noneconomic damages.

1.3. LITERATURE REVIEW

My thesis is built on two bodies of literature on economic analysis of law. Particularly, the thesis is related to the rich body of economic analysis of legal procedures and to the empirical analysis of noneconomic damage compensations. To provide a meaningful context for my work, the section to follow will selectively review some of the results of the two different bodies of literature.

1.3.1. REVIEW OF ECONOMIC ANALYSIS OF LEGAL PROCEDURES

The economics analysis of legal procedures is one of the liveliest research area in the field of law and economics. Surveys of the theoretical literature are provided by Cooter and Rubinfeld (1989), Hay and Spier (1998), Daughety (2000), and Spier (2007), (2008). The literature on legal procedures that is most closely related to this thesis can be classified into four groups, according to the research questions addressed. They are: (1) private litigation spending;⁸ (2) settlement breakdown; (3) duration of settlement; and (4) lawyer's role in settlement and litigation.

1.3.1.1. *Private litigation spending*

This literature abstracts from settlement decisions and considers litigants' decisions to invest in the lawsuit. The central research question addressed in this literature is how much resources do the litigants invest in the lawsuit. In this literature, the parties' private litigation expenditure is endogenous rather than exogenous. The parties' investment choice will reflect the beliefs that they hold about the investments and responses of their opponents.

The structure of the game studied in this literature is similar to those of other types of contests, including tournaments in internal labor markets, a variety of sports, and patent races. In these games, the strategies employed by the parties hinge on the anticipated reaction of the opponent – each party would like his rival to “back off” and invest less resources in the lawsuit. To this end, the plaintiff might derive a strategic benefit from aggressive spending, for example, when the defendant's best response function is decreasing in the plaintiff's effort level. Conversely, the plaintiff would benefit from a commitment to lower spending levels if the defendant's best-response function slopes upward. Either scenario can arise in the general framework. Using this analytical framework, Hirshleifer and Osborne (2001) compare the effort levels of the one-shot, simultaneous move legal contest with those of two-stage sequential contests. They find that given the (exogenous) opportunity to exert effort first, the litigant with higher stakes at trial overcommits to his effort with respect to his one-shot simultaneous Nash equilibrium level; the litigant with lower stakes at trial under-commits.

⁸The term “private litigation spending” is first used by Spier (2007).

1.3.1.2. Settlement breakdown

The central research questions of this literature have been: Why do parties to a dispute choose to go to trial, rather than settling the case out-of-court? and what determines the likelihood that a case will settle?

Static models of settlements with asymmetric information The most widely accepted explanation on settlement breakdown, stemming from Bebchuk (1984) and advanced by Reinganum and Wilde (1986) and Nalebuff (1987), is that litigants have asymmetric information (AI) about likely trial outcomes. These models are inherently “static” in the sense that they assume that one party makes a take-or-leave-it offer to the other party, with trial commencing if the offer is rejected. The way these models work is as follows: when one side in a legal dispute has information that the other side does not have, incentives are created for the former to credibly convey information to the latter. In this way, the uninformed party may be able to draw inferences – from the privately informed player’s bargaining behavior – about the likely trial outcomes. However, informed parties with weak cases will rationally attempt to pass themselves off as strong case holders. The uninformed party, anticipating this, will rationally refuse to settle with a positive fraction of opponents who claim that their cases are strong. Trials occur inevitably when the benefits of establishing credibility exceed the costs of trial.⁹

However, static models cannot help us to understand how long it takes parties to reach settlement, and whether the legal system can have an influence on the duration of bargaining. For this, we need to allow litigants to make sequential offers, with trial only occurring after a series of these.

*Alternative framework: mutual optimism*¹⁰ Before the widespread adoption of modeling techniques from information economics, economists took a non-Bayesian approach to settlement breakdowns. The parties’ *divergent expectations* about trial outcomes were at the heart of these earliest models settlement and litigation (see Landes (1971), Posner (1973), Gould (1973), Shavell (1982), Danzon and Lillard (1983), and Priest and Klein (1984)). The way these models work is as follows: To settle, the parties need to identify settlement terms that make them both better off, in their view, than going to trial. A crucial determinant of settlement, therefore, is the parties’ expectation about trial outcomes. When both parties are sufficiently optimistic about their trial outcomes, there may be no mutually acceptable settlement terms. Consequently, trial commences.

A major problem with these models is: central to *all* these models are the parties’ differential beliefs about trial outcomes between the parties. However, these models fail to explain why a party would *maintain* her own optimistic belief about her prospects at trial, once she becomes aware of her opponent’s different belief. Rational choice theory predicts that each party would revise downward her optimistic belief of her own prospects once she discovers – during the process of bargaining – how optimistic her opponent is (see Aumann (1976)). As a result, one would expect that the parties’ beliefs to converge during the bargaining process, eventually making settlement possible. Further analysis is needed to explain why such a convergence does not occur.

⁹For an excellent review of this literature, see Waldfogel (1998).

¹⁰The term “mutual optimism” is first used by Spier (2007).

1.3.1.3. Duration of settlement

The most important questions addressed in this literature are: How long it takes parties to reach an agreement? and whether the legal system can have an influence on the duration of bargaining?

Settlement over time and efficiency of negotiations Spier (1992) was the first to examine the dynamics of pretrial negotiation.¹¹ The model presented in her paper is a dynamic extension of Bebchuk (1984). The main contribution of Spier's (1992) work is that it describes the distribution of settlement over time, and evaluates the efficiency of the pretrial negotiations in a dynamic framework. Spier (1992) assumes the plaintiff has private information about the amount of the damages he has suffered.¹² Settlement bargaining takes place over a finite period of time with the defendant making all of the offers. In each period, the gains from settlement are the costs to be avoided in the subsequent periods. Therefore, when the costs of continuing bargaining and going to trial are high, it benefits the defendant to raise the likelihood of settlement by making a high offer. In subgame perfect equilibrium, the sequence of offers is increasing over time. Low type plaintiffs get less from a trial than high type plaintiffs and hence will settle early for lower damage payments, while high type plaintiffs will be prepared to delay agreement until settlement offers raise. The reason that the parties cannot do better by avoiding the inefficient delay and share the gains from early settlement is that there is no way for a high type plaintiff to "prove" that her damage level is high except by going through a costly litigation.

Institutional Determinants of Settlement Delays Much effort has been devoted to the development of strategic models of pretrial bargaining with private information. At the same time, empirical analyses of data on pretrial settlement and litigation have generated an interesting list of facts to be explained. Chapter 2 of the thesis is closely related with the literature on the *duration* of civil litigation, especially with analysis on the effect of legal system on delay in litigation. Fournier and Zuehlke (1996) develop an empirical model, based on Spier's theoretical analysis, of the causes of settlement delay. They found that fee shifting (i.e., changing from the American to the English rule for allocating legal fees) causes a greater delay in settlement.¹³ Hersch *et al.* (2007) investigate medical malpractice claims from Texas and Florida to assess the consequence of the early offer reform.¹⁴ Kessler empirically examines the causes of delay in automobile liability settlement, with focus on court congestion and prejudgment interest. He found that (1) longer delays in trial courts translate into longer delays in settlement, and that (2) prejudgment interest law increases delay.

¹¹A related dynamic model is given by Ordoover and Rubinstein (1986). However, in Ordoover and Rubinstein (1986) the magnitude of the settlement offers is given exogenously and the game reduces to a war of attrition.

¹²This private information may be due, inter alia, to knowledge of injury severity, the suffering involved (damages are often awarded for 'pain and suffering') or the earnings opportunities foregone as a result of the injury.

¹³With the so-called American rule, each side pays for its own costs in litigation. With the so-called English rule the loser must pay for the winner's legal costs.

¹⁴Hersch *et al.* analyze the sample of medical malpractice claims from the Texas Department of Insurance Commercial Liability Closed Claim Report for the years 1988-2004. I analyze five different insurance lines of commercial claims from the Texas dataset for the years 1988-2005.

1.3.1.4. Lawyer's role in settlement and litigation

The most important questions addressed in this literature are: how does lawyer's participation in the bargaining process affect the likelihood and terms of settlement? and how do lawyer's and client's incentives to settle a claim vary under different fee arrangements?

Strategic effect of contingency fee on settlement process Starting from the seminal work of Schwartz and Mitchell (1970), there has been a rich literature exploring the incentives created by contingent fee arrangement for lawyers to settle. These models are usually based on the assumption that the lawyer has control over the lawsuit (as opposed to leaving that control with the client). The studies by Schwartz and Mitchell (1970), Miller (1987), Thomason (1991), and Gravelle and Waterson (1993) and Watts (1994) show that contingency fee creates an excessive incentive, relative to the client's interest, for the lawyer to settle the claim. The usual explanation is that, by settling, the lawyer obtains his share of the damage awards and avoids the additional efforts that would be required if the case were to go to trial. Other studies (by Polinsky and Rubinfeld (2001), Miceli (1994), Rickman (1999)) have reached the opposite conclusion that the lawyer may have an insufficient incentive to settle under the contingent fee system. Polinsky and Rubinfeld (2001) argue, for instance, if the case were to go to trial, the lawyer would invest less efforts on the case than is in the client's interest. Therefore, lawyers' settlement demands could be higher than their clients would want, resulting in settlements occurring too infrequently.

The strategic role that *client's choice* of fee arrangement plays in settlement bargaining was the focus of the studies of Bebchuk and Guzman (1996), Farmer and Pecorino (2001) and Choi (2003). These studies have shown that by using a contingent fee contract, a plaintiff can improve her bargaining position vis-à-vis a defendant in pretrial settlement.¹⁵ The intuition behind this result is as follows: contingency fees put the plaintiff in a position in which she does not have to pay additional fees if the case is litigated rather than settled. In other words, the plaintiff's "reservation value" – the smallest amount she is willing to accept for not going to trial – is higher under the contingency fee arrangement. Therefore, compared with the case of hourly fees, the plaintiff will reject more settlement offers and litigate more often when the lawyer is paid on a contingency fee basis.

Alternative frameworks Besides the standard analytical framework based on the theories of incentives, two other creative approaches are worth mentioning.

The study by Bar-Gill (2006) relates the likelihood of settlement to lawyer's psychological or behavioral characteristics. By using evolutionary game theory, Bar-Gill (2006) shows that by credibly threatening to resort to costly litigation, lawyers with systematic tendency to be over-optimistic about the outcome of trial succeed in extracting more favorable settlements than lawyers without such a bias.¹⁶ In this way, market-selection forces dictate an equilibrium with a positive level of optimism bias and a positive likelihood of litigation.

Instead of focusing on the effects of individual incentives or characteristics, the research by Hadfield (2000) has taken a much wider scope to investigate the implications of legal service market

¹⁵However, Choi (2003) does not address the problem of information asymmetry between the plaintiff and the lawyer as I do in my study.

¹⁶I am grateful to an anonymous committee member for pointing out the relevance of this article to my work.

imperfection on the justice system.¹⁷ Hadfield (2000) identifies various sources of market imperfections and discusses the implications of these imperfections on matters such as costs of litigation and pattern of settlement. Hadfield's (2000) study attributes the lack of supply of legal service to factors such as artificial barriers to entry, demanding cognitive skills, and a lack of opportunity for lawyers to gain litigation experience. Hadfield (2000) argues that insufficient supply of legal skills enables the lawyers to impose a price beyond the marginal cost of their service in litigation and settlement. Empirical evidence provided in the paper substantiates the existence of these imperfections and their adverse effects on the legal system.

1.3.2. REVIEW OF ECONOMIC ANALYSIS OF NONECONOMIC DAMAGES

Victims of tortious injury suffer from accidents in more than financial ways. Adequate access to justice requires that the victims be compensated fully for their losses without delay or transaction costs. While the other parts of the thesis analyze the time and costs of compensation, Chapter 4 addresses the issue of full compensation: besides economic losses such as medical expenses and lost earnings, also noneconomic losses such as pain, suffering and loss of enjoyment of life should be compensated. The main source of discomfort about noneconomic damages has been that they are hard to quantify because they encompass highly intertwined elements, many of which have psychological aspects. For this reason, there have long been claims that noneconomic damage awards are random.¹⁸ Randomness implies variation in awards for individuals of similar circumstances who suffer the same type of injury. Therefore, the tort system is not fair and access to justice is distorted when damage awards are provided randomly.

It is the intent of Chapter 4 to examine the validity of the claim that noneconomic damages are random outcomes. This part of my work is closely related to the large empirical literature on noneconomic damages and the effects of noneconomic damage reforms on litigation outcomes and frequency, malpractice insurance payouts, malpractice premiums, defensive medicine, physician supply, overall health insurance premiums, mortality rates, and more.¹⁹ But I focus, in this review, on a much smaller, but not less important, body of work that investigates the unpredictability of noneconomic damages. This is because the latter literature is more closely related to my work.

Viscusi (1988a) was among the first to examine the predictability of noneconomic damages. In an insightful paper, Viscusi (1988a) studies product liability claims from Insurance Services Office between mid-1976 and mid-1977. Viscusi (1988a) showed that the hypothesis that noneconomic damage awards are entirely random outcomes should be rejected. Following Viscusi (1988a), Bovbjerg *et al.* (1989) studied the predictability of noneconomic damages in personal injury lawsuits from Florida and Kansas City. Bovbjerg *et al.* (1989) found that severity of injury significantly influenced the magnitude of noneconomic damages and was the best single predictor of the awards, explaining approximately 40% of the variance in noneconomic damage payments. But there are considerable unexplained variations across injury categories.

¹⁷I am grateful to an anonymous defense committee member for pointing out the relevance of Hadfield's (2000) work to my study.

¹⁸See discussions in Daniels (1989); Daniels & Martin, (1995); Litan (1993); MacCoun (1993); Saks (1992); Vidmar (1994), (1995); Weiler (1991).

¹⁹See Morrisey and Kilgore (2007) for a review of this literature.

1.4. OVERVIEW OF THE THESIS

This Ph.D. thesis consists of a collection of four papers in economic analysis of access to justice. These papers are classified into three topics: [1] economic analysis of legal procedures, [2] economic analysis of substantive law, and [3] economic analysis of legal representations. In what follows an overview of these papers will be given, respectively. Section 4.5 introduces some basic notions that will be used throughout the thesis.

Economic analysis of litigation delays

In Chapter 2, I analyze the duration of bargaining and the causes of delay in pretrial negotiation.

Motivation. The analysis in this chapter is motivated by the fact that parties to a legal dispute will frequently delay settlement. Such delays can mean that evidence deteriorates, that injured parties fail to receive compensation when they most need it and that individuals are deterred from bringing cases. As a result, the legal system may fail to provide access to justice timely. Questions about the timing of pretrial negotiation are inherently difficult to address because of the dynamic nature of litigation and the complexity of factors that affect legal process, but the analysis can shed light on the allocation of resources in the civil justice system.

Research question. The chapter is an attempt to understand (i) why it takes so long for parties to reach an agreement, and (ii) can the legal system have an influence on the duration of litigation.

Data. I use data gathered from the Texas Department of Insurance Commercial Liability Insurance Closed Claim Report to empirically model the determinants of the duration of negotiation in five lines of commercial liability insurance. The cases cover the period 1988 to 2005. Particular emphasis is placed on the durational effect of statutes awarding prejudgment interest to prevailing plaintiffs.

Methodology. I structure the empirical analysis of bargaining by using a model developed by Spier (1992) and adapted by Fenn and Rickman (1999) where pretrial negotiation takes place over a finite period of time prior to a fixed trial date. Comparative statics results are then corroborated with empirical estimates of a hazard function (that is, the conditional likelihood of settlement at a certain time given that settlement has not occurred earlier). The hazard function is adjusted to account for the heterogeneity of lawsuits and the time dependence suggested by theory.

Results. I present two major findings on this topic:

- (a) I found no evidence supporting the theoretical prediction that higher prejudgment interest rates lead to longer delays in settlement. This observation, if it is indeed correct, is inconsistent with a theoretic model where only the plaintiff has private information;
- (b) Contrary to the basic premise of the theoretic model, longer delays in trial courts are associated with longer delays in out-of-court settlement. This finding suggests that policies that streamline the court system by reducing court congestion will expedite both public and private resolution of disputes. While not validating the prediction of Spier's (1992) model, the evidence of time-dependent behavior found in my data lends credence to theorists who emphasizes the dynamic structure of settlement negotiation;

- (c) Inconsistent with my theoretical prediction, the empirical evidence reveals that cases with higher prejudgment interest rates receive smaller settlement payment, holding claim and other institutional characteristics constant. In other words a reform that is designed to compensate plaintiffs' loss from foregone investment opportunities through the imposition of prejudgment interest has the unexpected effect of worsening the plaintiff's bargaining position *vis-à-vis* the defendant in pretrial negotiation.

Economic analysis of asymmetric costs of access to justice.

The paper presented in Chapter 3 is Zhou (2007). I study the welfare and distributional implications of asymmetric litigation costs. In particular, this chapter abstracts from settlement decisions and focuses on the litigants' investment decisions in pursuing lawsuits.

Motivation. In economic analysis of legal contests, researchers often assume that access to court interventions and legal representations is equally costly for the plaintiff and the defendant and that the parties choose their legal effort levels only once and simultaneously. In this chapter my main objectives are to study the influence of asymmetric litigation costs on litigants' legal investment incentives and the subsequent equilibrium of the 'litigation game' and consider the dynamics of legal process. This is worthwhile, because my model generates significantly different efficiency and distributional implications than symmetric, static models. Moreover, when we are directly evaluating the performance of legal institutions and making policy recommendations for litigation-system reform, it is useful to proceed within a framework that is fully consistent with various asymmetry and timing considerations.

Methodology. Building on the analytical framework of Dixit (1987), Hirshleifer and Osborne (2001), Hamilton and Slutsky (1990), Baik and Shogren (1992) and Leininger (1993), I generate a model of litigation where the litigants exert effort sequentially in multiple periods. The probability of courtroom success depends on the cumulative investment levels. The litigants' investment choice will reflect the beliefs that they hold about the investments and responses of their opponents.

Results. Several empirically relevant observations emerge:

- (a) Distortion to access to justice and total legal costs in a sequential litigation are typically larger (resp. smaller) than that of static litigation model when the 'have' (resp. 'have not') leads.
- (b) The flexibility of multiple actions neither benefits nor harms the litigants.
- (c) In all equilibria where the 'have' is the plaintiff, all actions of the 'have' are necessarily taken in the first period only, while the 'have not' defendant may allocate her actions arbitrarily throughout all the periods;²⁰ in all equilibria where the 'have not' is the plaintiff, both parties may exert effort multiple times, but all leads to the same trial outcomes. This implies that the Stackelberg outcome can be sustained as an equilibrium at which the litigation only lasts for two rounds.

²⁰This implies that the 'have not' could also allocate all her actions solely in period 2.

- (d) In an unevenly matched litigation contest, the Stackelberg outcome in which the ‘have not’ (or disadvantaged player or ‘underdog’) leads will emerge as the only equilibrium outcome when the sequencing is endogenous. This implies that endogenous sequencing protocol minimizes litigation cost and may work to improve access to justice.

Economic Analysis of Noneconomic Damages in Medical Malpractice Claims

Adequate access to justice requires that victims be compensated fully for their losses without delay or expenses. The preceding chapters focused on the time and expenses associated with access to justice. Chapter 4 will focus on the issue of full compensation: besides economic losses such as medical expenses and lost earnings, also noneconomic losses such as pain, suffering and loss of enjoyment of life should be compensated. Chapter 4 contributes to the economic analysis of noneconomic damages. The chapter studies whether noneconomic damages are random outcomes and what determinants the incidence and magnitude of damages.

Motivation. Noneconomic damages are key components of liability damage awards. For medical professional liability claims in Texas, for example, noneconomic damages comprise from 20 percent to 46 percent of all awards in which damage payment has been received.²¹ Noneconomic damages have attracted the most attention from tort reformers because the legal criteria for such compensation are not well articulated. That is, there are no well-established legal doctrines for determining when noneconomic damage should be awarded or how much of the welfare loss it is intended to replace. For this reason, they have been the subjects of frequent and extensive amendments in recent years.²²

There have been two major critiques against the provision of noneconomic damages. First, because they are not directly measurable and readily quantifiable, they are unpredictable. Second, because they are difficult to measure and quantify, a significant amount of court time must be devoted to proving the noneconomic losses, giving rise to high administration costs.

Research question. The purpose of my analysis is (i) to understand what determines the incidence and magnitude of damage payments for noneconomic losses and (ii) to clarify whether noneconomic damage awards are entirely random phenomena.

Data. I use data gathered from the Texas Department of Insurance Commercial Liability Insurance Closed Claim Report to empirically model the determinants of the noneconomic damages in medical malpractice insurance claims. The cases cover the period 1988 to 2005.

²⁰This implies that the ‘have not’ could also allocate all her actions solely in period 2.

²¹See Table 4.2. Viscusi (1988a) reports similar figures for product liability closed claims filed in the US.

²²By 2005, 24 states have enacted caps on noneconomic damages. From 1991 to 2005 alone caps on noneconomic damages were enacted in 12 states. During this period, such caps were struck down by supreme courts in 5 states. In some states, such as Illinois and Ohio, caps were struck down by state supreme courts and later reenacted in amended form. Sometimes this cycle repeated itself. See Avraham (2006a) for a comprehensive survey on noneconomic damages reforms in the US.

Methodology. I provide a limited test to empirically estimate the likelihood and the amount of noneconomic damage awards. In particular, I will isolate compensation for particular types of injuries from effects such as the differences in the size of the financial losses (e.g. earning loss, medical expenses, etc.) and victims' employment status associated with different injury categories.

Results. My empirical evidence shows that

- (a) Consistent with the findings of Viscusi (1988a) and Rodgers (1993), I find that noneconomic damage awards are not completely random outcomes. They vary, in predictable ways, with changes in the *economic* characteristics of the case: the victim's financial loss is the single best predictor of noneconomic damages, accounting for 64 percent and 25 percent of the variance in the incidence and magnitude of the awards, respectively;
- (b) Moreover, the incidence of noneconomic damage awards are higher for unemployed or self-employed victims than for employed ones; Furthermore, when compared to victims receiving collateral insurance payment, victims without collateral insurance are more likely to be compensated. These results suggest that when awarding noneconomic damages the tort system has objectives other than merely making whole the victims for their physical and mental anguish.
- (c) By going to trial a victim increases the amount of compensation for noneconomic harm by nearly 73.5% when compared to a victim who settles out of court. This result indicates that the various aspects of the litigation process, such as litigation costs and plaintiff's risk aversion, lower the plaintiffs' bargaining position *vis-à-vis* the defendant. Subsequently the defendant lowers the settlement offer amount below the expected court award.
- (d) The incidence and magnitude of awards are not systematically related to the type of injury. Permanent and catastrophic injuries do not necessarily receive more awards for noneconomic damages than temporary, insignificant injuries. This suggest that the tort system *might* not be fair.²³

Economic Analysis of Legal Delegations

Chapters 5 addresses a widespread but so far underappreciated issue in economic analysis of access to justice: the delegation of bargaining and litigation.

Motivation. Central to *all* economic analysis of litigation and settlement is the informational difference about trial outcomes between the litigants. None of the informational differences, however, has been adequately explained by *any* of the existing models; that is, it is not yet understood why this system might generate the divergent expectations which must be the source of these differences in perspectives. The incorporation of the attorneys as key participants in the bargaining game provides a crucial link in the analysis of settlement-litigation decision. It explains why a difference in perspective on a lawsuit might exist; and how this difference might plausibly lead to litigation. Furthermore, existing asymmetric information theories do not explain the absence of bargaining (i.e., absence of settlement offers in pretrial negotiation) observed in the TCS study.²⁴ Inspection of litigation and

²³See Section 1.1 for the definition of 'fairness'.

²⁴Swanson and Mason (1998) is an exception. But Swanson and Mason did not investigate the role of agency problems in bargaining processes.

settlement data from the U.K. Courts of Justice²⁵ shows that the likelihood of bargaining and the plaintiffs' chance of success at trial depend crucially on plaintiff characteristics such as the type of accident and the way litigation is financed. Particularly, for the types of cases associated with more uncertain legal outcomes²⁶, plaintiffs are less likely to bargain with the defendants than plaintiffs involved in cases that are associated with less uncertainty²⁷; plaintiffs receiving legal aid from the government or financial support from trade unions are more likely to negotiate with the defendants than privately funded plaintiffs. Furthermore, the plaintiffs are more likely to win at trial if they face less uncertainty about trial outcomes and if they receive financial support.

Research question. The theory presented in this chapter is an attempt to rigorously explain these empirically significant observations of [1] partial bargaining.²⁸ That is, the likelihood that the plaintiff bargains with the defendant prior to trial is neither zero nor one. [2] low plaintiff trial success rate,²⁹ and [3] plaintiff-characteristics dependent settlement-litigation behavior.

Methodology. This chapter deals with the issue of litigation versus settlement by taking as its starting point the asymmetric information between litigants and their attorneys. It examines the plaintiff and her attorney as an uninformed principal and an informed agent who are bargaining with another principal – the tortfeasor's insurer. I consider the role played by information of claim strength (i.e., defendant's liability for damages) in determining patterns of settlement and litigation. The approach taken in this chapter to settlement-litigation decision under asymmetric information is based on the work of Myerson (1979). It involves the design of a contract offer by the client that recognizes that the attorney may have an incentive to misinform him about the perspective of the case in order to delay settlement and increase billable hours while working less.

Results. The major results in this chapter can be summarized as:

- (a) A plaintiff will refrain from litigation and opt for settlement when her case is strong and that she is likely to prevail at trial. Bargaining may not occur, even if the plaintiff could obtain a higher payoff from bargaining than from going to trial without bargaining. The intuition is easily conveyed: The attorney's productivity in settlement bargaining increases with the case strength. Therefore, the plaintiff wants to encourage the attorney to admit that the case is strong, whenever it is true, so that the attorney will bargain hard with the defendant to obtain a high settlement payment in settlement. However, to prevent the attorney from misrepresenting the strength of the case when the case is strong, the plaintiff must somehow 'punish' the att-

²⁵The data is a random sample from the files of the Taxing Masters in the U.K. Courts of Justice for the year of 1987 selected by Timothy Swanson. See Swanson (1998).

²⁶They are motor vehicle accidents and medical negligence cases.

²⁷These are plaintiffs involved in workplace injury cases and cases against the public body.

²⁸This term was first used by Swanson and Mason (1998).

²⁹Similar empirical observations were recorded by Farber and White (1991), Vidmar *et al.* (1998), Sieg (2000) and Spurr (2000). Farber and White provide evidence from 252 U.S. medical malpractice cases from 1977 to 1989 and show that the defendants have won all the cases tried to completion. Vidmar *et al.* report that plaintiffs prevail in 22.5% of the California medical malpractice cases from 1991 through 1997. Using data on 8,306 medical malpractice cases in Florida, Sieg shows that only 29% of tried cases result in a verdict for the plaintiff. Spurr (2000) provides evidence from 424 medical malpractice cases in Michigan that, the cases that went to trial are drawn disproportionately from claims that are weak.

orney for reporting that the case is weak. Such punishment takes the form of pushing cases towards trial without negotiation (hence no payment to the attorney).

- (b) The pattern of the plaintiff's settlement-litigation decision depends on the risks associated with litigation and the plaintiff's ability to monitor the attorney. Litigation occurs more frequently if it is *a priori* less profitable for the plaintiff to pursue. The intuition behind this result is as follows. The plaintiff's prospect at trial increases with the strength of her case. With a stronger case, it is less costly for the attorney to obtain favorable settlement terms from the defendant. Since the plaintiff bears the full costs of pretrial negotiation, out-of-court settlement (resp. litigation) becomes more (resp. less) attractive an option for the plaintiff when negotiation is less costly.
- (c) Litigation occurs more frequently if it is *a priori* more risky for the plaintiff to pursue. The intuition behind this result is as follows. When the plaintiff's uncertainty about trial outcome is low, she can better monitor her attorney's performance in settlement bargaining and the principal-agent impediments to settlement is mitigated. Therefore, the plaintiff pursues litigation less often when the trial outcomes are more predictable. An implication of this result is that institutional characteristics determining the degree of plaintiff uncertainty about trial outcomes figure large in settlement-litigation strategies.
- (d) There is another aspect of the attorney-client relationship regarding the financing of litigation that can affect a plaintiff's incentive regarding settlement: legal aid (for both settlement and litigation) reduces the costs inherent in representative bargaining that impede settlement. Therefore, plaintiffs receiving legal aid go to court less often than those receiving no legal aid.

1.5. CONCLUSIONS AND LESSONS FROM THE OVERALL WORK

This thesis contributes to the economic analysis of access to justice. Particularly, the focus of my analysis has been on the three independent but related aspects of access to justice: legal procedures, substantive law and finally legal service.

The stakes in the legal dispute are potentially high and the parties involved are often sophisticated players. Parties to a legal dispute react strategically to the design and changes in substantive legal rules and to the avenues through which legal rights are pursued and enforced. My work shows that legal policies designed to improve access to justice may have unintended or counter-productive effects due to the presence of such strategic interactions. Private parties might, for example, delay damage settlement in the presence of high prejudgment interest whose policy intention is to constrain delay.

Furthermore, my work emphasizes the role of lawyers in distorting access to justice. Lawyers may have an incentive to misinform their clients about the perspective of lawsuits in order to delay settlement and increase billable hours while working less. My analysis has shown that when the clients anticipating such strategic behavior of their lawyers, they may use inefficient litigation as a way of extracting information about the prospects of their cases.

Litigations are games of asymmetric information and application of unequal resources. The implication of my analysis is that legislatures and legal reform agencies need to be aware of the strategic dimensions of their oversight role. Cost-efficient and timely access to justice requires law-making that

takes into account of the strategy reaction of individuals to legal rules as well as the interactions of individuals to one another.

Finally, the findings of this thesis reaffirm earlier analysis of settlement and litigation: when parties to a dispute have incomplete information about trial outcomes, costly delay and court intervention are more likely to occur despite of common knowledge that there are gains from early settlement. This implies that authorities with a reputation for producing predictable legal outcomes can reduce the inefficiency inherent in access to justice.

The studies presented in this thesis has focused on but a small number of issues related to access to justice, namely, [1] litigation costs, [2] delays in court and in out-of-court settlement, [3] predictability of damage awards, and [4] divergent interests and information asymmetry between a lawyer and his client. Many important applied issues were side-stepped in the thesis, including the effects of different liability rules, whether and how can a client provide incentives to his lawyer under an hourly-fee arrangement which is the typical compensation structure for European jurisdictions, and what are the efficiency and welfare implications of “third party contingency fee” arrangement which has been in place across several European jurisdictions.

CHAPTER 2

Determinants of Delay in Litigation: Theory and Evidence

2.1. INTRODUCTION

Settlements are frequently delayed in legal disputes. Filed cases in Texas take, on average, 25 months to resolve.³⁰ In the UK, cases sampled for Lord Chancellor's Department (1986) indicate that filed cases take between 18 and 40 months to reach trial. In Italy, 12 to 13 years are expected for the final determination of a civil dispute.³¹ The purpose of this chapter is to study what factors determine the duration of litigation. My main interest is in the institutional causes of delay in the settlement of legal disputes.

The decision to litigate or settle a civil dispute, as it relates to the process of pretrial bargaining, has been the subject of extensive investigation in law and economics. Asymmetric information models, starting with Cooter *et al.* (1982), P'ng (1983), Bebchuk (1984), and advanced by Reinganum and Wilde (1986), Nalebuff (1987), Schweizer (1989) and Daughety and Reinganum (1994), offer possible explanations of the litigation puzzle.³² What most of these papers have in common is that the game is formulated in extensive form and essentially consists of a sequence of two periods. After the suit has been filed, one litigant, in the first period, making a settlement offer which, in the second period, the other litigant either accepts or rejects. If the last-moving litigant accepts, the case settles out of court at the proposed terms. Otherwise, the case goes to trial. The way these models work is as follows: when one side in a legal dispute has information that the other side does not have, incentives are created for the former to credibly convey information to the latter; litigation occurs inevitably when the benefits of establishing credibility exceed the costs of litigation. The central finding of this literature has been that the presence of asymmetric information yields a positive probability of trial.

Less well understood is how long it takes parties to reach an agreement, and whether the legal system can have an influence on the duration of bargaining. Questions about the duration of negotiation are inherently difficult to address because of the dynamic nature of litigation and the complexity of factors that affect legal process, but the analysis can shed light on the allocation of resources in the civil justice system. Using a novel dataset from the Texas Department of Insurance (TDI) Commercial Liability Insurance Closed Claim Report, I empirically model the determinants of the duration of litigation in five lines of commercial liability insurance. The cases cover the period 1988 to 2005. Particular emphasis is placed on the durational effect of statutes awarding prejudgment interest to prevailing plaintiffs. Such statutes impose interest on damage awards to victorious plaintiffs from the time the injury occurred until the date of judgment. Legislators, courts and commentators favor these statutes partly because they believe that prejudgment interest expedites settlement out-of-court.³³ The 'rationale' behind these statutes seems to be as follows: if defendants, who would

³⁰See Table 2, Panel A. Fenn and Rickman (1999) report similar delay figures for medical negligence and employee claim cases filed in UK, as do Worthington (1991) for motor vehicle accident cases in New South Wales and Kakalik *et al.* (1990) for civil cases filed in Los Angeles.

³¹See Varano (1997).

³²Waldfoegel (1998) reviews much of this literature.

³³Prejudgment interest statutes are also enacted to achieve "full compensation", on the grounds that a plaintiff with a valid claim should have been compensated for her damages immediately after the injury occurred.

otherwise delay settlement, are deprived the interest that they earn on claims that are unpaid but adjudicated to be valid, then they will have less of an incentive to delay. Little research has investigated the validity of this simple policy rationale because of lack of data on prejudgment interest laws and the impact of these laws.³⁴ The TDI data provides an unique opportunity: the mandatory prejudgment interest rate in Texas has fallen substantially in 2005, providing a “natural experiment” to evaluate the impact of change in prejudgment interest rate on litigation durations.

I structure the empirical analysis of bargaining using a model developed by Spier (1992), and adapted by Fenn and Rickman (1999), where pretrial negotiation takes place over a finite period of time prior to a fixed trial date. I formulate hypotheses to explain the effects of the legal system and the bargaining environment on the duration of settlement and settlement payment. I then estimate reduced form empirical specifications which are based on the structural theoretical model. I present three findings on this topic:

- (a) I found no evidence supporting the theoretical prediction that higher prejudgment interest rates lead to longer delays in settlement. This observation, if it is indeed correct, is inconsistent with a theoretic model where only the plaintiff has private information;
- (b) Contrary to the basic premise of the theoretic model, longer delays in trial courts are associated with longer delays in out-of-court settlement. This finding suggests that policies that streamline the court system by reducing court congestion will expedite both public and private resolution of disputes. While not validating the prediction of Spier’s (1992) model, the evidence of time-dependent behavior found in my data lends credence to theorists who emphasizes the dynamic structure of settlement negotiation;
- (c) Inconsistent with my theoretical prediction, the empirical evidence reveals that cases with higher prejudgment interest rates receive smaller settlement payment, holding claim and other institutional characteristics constant. In other words a reform that is designed to compensate plaintiffs’ loss from foregone investment opportunities through the imposition of prejudgment interest has the unexpected effect of worsening the plaintiff’s bargaining position *vis-à-vis* the defendant in pretrial negotiation.

The analysis presented in this chapter extends the existing empirical literature that studies the effect of legal system on settlement delay. Fournier and Zuehlke (1996) develop an empirical model, based on Spier’s theoretical analysis, of the causes of settlement delay. They found that fee shifting (i.e., changing from the American to the English rule for allocating legal fees³⁵) causes a greater delay in settlement because fee shifting magnifies the effect of asymmetric information between parties to a legal dispute, making settlement more difficult. Hersch *et al.* (2007) investigate medical malpractice claims from Texas and Florida to assess the consequence of the early offer reform.³⁶ They find that the reform expedites payments to claimants by two years. Most closely related to this chapter is by

³⁴Kessler (1996) is an exception. Using a novel dataset on resolved automobile insurance bodily injury claims collected by the Insurance Research Council, Kessler (1996) empirically examines the causes of delay in pretrial negotiation, with a focus on court congestion and prejudgment interest.

³⁵In the U.S. legal system, each party pays their own legal expenses, regardless of the trial decision. In the English system, the loser pays the winner’s legal expenses.

³⁶Hersch *et al.* analyze the sample of medical malpractice claims from the Texas Department of Insurance Commercial Liability Closed Claim Report for the years 1988-2004. I analyze five different insurance lines of commercial claims from the Texas dataset for the years 1988-2005.

Kessler (1996). Kessler empirically examines the causes of delay in automobile liability settlement, with a focus on court congestion and prejudgment interest. He found that (1) longer delays in trial courts translate into longer delays in settlement, and that (2) prejudgment interest law increases delay.

This chapter shares an obvious common thread with this earlier body of work. It departs in that, firstly, I have the unusual opportunity to use information on the insurers' *prior* estimates on the level of damages and the extent of legal costs provided by the TDI data.³⁷ These prior estimates, which are established based on the insurer's experience with the insurance type and the nature of injuries, are reported *before* a suit is filed. They serve as *exogenous* variables influencing subsequent bargaining durations.³⁸ In contrast, Fournier and Zuehlke (1996) use the average court verdict amount as a proxy for expected trial stake. However, there is usually a sample selection bias associated with using tried claims: the group of court-adjudicated cases is a highly selected sample of cases that are brought for damage compensation.³⁹ Kessler (1996) uses *ex post* amounts to measure damages and legal costs. Since actual damage payments and legal expenditure are *endogenously* determined by accumulation of litigation duration, endogeneity arises when they are included as explanatory variables. The present study contributes to this literature by overcoming the problems of selection bias and endogeneity that plague earlier studies.

Secondly, whereas Kessler (1996) and Hersch *et al.* (2007) have restricted their analysis to single insurance lines,⁴⁰ the data I analyze cover a rich variety of insurance claims: general liability, auto liability, multiperil liability, medical professional liability, and other professional liability. Thus a comparison of these different insurance lines is possible. Given the apparent prevalence of settlement delay across different insurance classes, a comparative analysis is of interest.⁴¹ In particular, I show that claims associated with more complex and less routine insurance types take shorter to settle, *ceteris paribus*. So far no theoretic work has investigated how claim complexity and usualness affect the litigation duration. My result serves as evidence that there are considerable unexplained variations in litigation durations across insurance issues and that there are numerous factors not quantified (and perhaps not quantifiable) in the analysis of dynamic pretrial negotiation that are important determinants of delays.

The rest of the chapter is organized as follows. Section 2.2 describes the legal environment of my model. In particular, I will describe the time line of the litigation process and the functioning of prejudgment interest. Section 2.3 considers the theoretical foundation for empirical hazard models of the bargaining process. In particular, I present a version of the dynamic model developed by

³⁷Exception is Fenn and Rickman (2001). They used insurers' initial estimates as exogenous measures of damages, liability and expenses. However, Fenn and Rickman (2001) did not provide evidence on the predictive power of these variables as proxies for actual amounts.

³⁸In the empirical section, I provide supporting empirical evidence that these prior estimates are exogenous measures of scale.

³⁹See Priest and Klein (1984) for discussion on sample selection bias associated with litigated cases. See Viscusi (1988b) for similar critiques.

⁴⁰Similarly, Fenn and Rickman (2001) restricted their analysis to motor accident cases. Fenn and Rickman (1999) restricted to medical negligence and employee cases but did not discuss the difference between them.

⁴¹Hensler *et al.* (1987) and Hersch and Viscusi (2007) specially notes that auto liability cases are less complex than other insurance lines. Among the paid claims for the years 1988-2005, my calculation using the TDI data indicates that more than 57% of auto claims do not result in a suit being filed. This ratio is approximately 20% for general liability, 30% for multiperil liability, 10% for medical professional liability and 20% for other professional liability.

Spier (1992) to examine how variation in the bargaining environment and the characteristics of the legal system affect the hazard function of settlement. Section 2.4 describes the Texas Department of Insurance data used in the analysis and provides summary statistics on litigation durations, as well as information on trends over 1988-2005 period for which data are available. The limitation of the data is also discussed. Section 2.5 describes estimation methods. Section 2.6 presents the empirical results, discusses the limitations of my analysis and describes robustness checks of my results. Section 2.7 concludes.

2.2. LEGAL ENVIRONMENT

Litigation time line and litigation duration. Because they are the focus of my analysis, and because their meaning is not always common parlance, the description of the time line of litigation and the definition of “litigation duration” will be given in some detail.

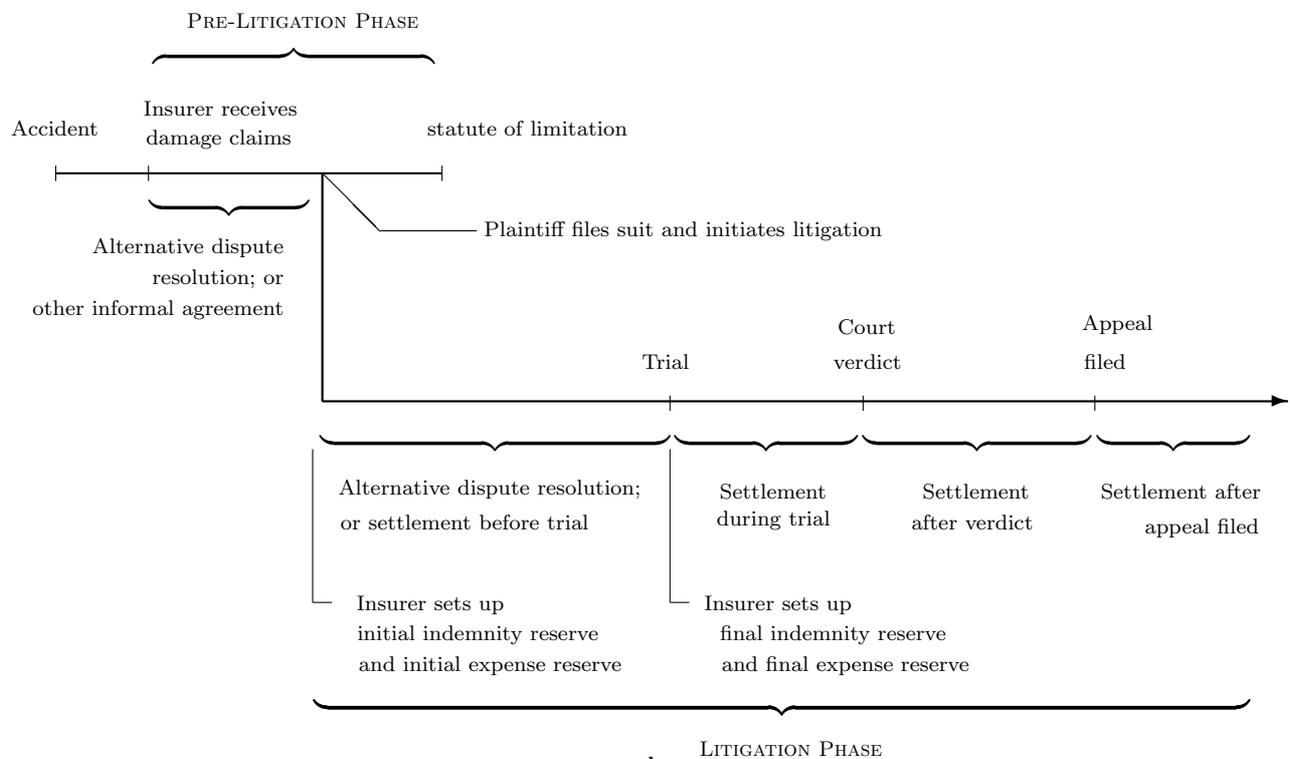


Figure 2.1. Time Line of Litigation

Figure 2.1 shows the time line of litigation.⁴² Assume that an accident has taken place and the plaintiff and the defendant (“insurer” is a synonym) start bargaining over a sum of damage payment. Bargaining takes place in two phases depending on whether the plaintiff has filed a lawsuit or not: the pre-litigation phase and the litigation phase. At any time in the pre-litigation phase, as long as no agreement has reached, the plaintiff has the option of filing a lawsuit to initiate the litigation phase. During the pre-litigation phase, a case may terminate by either of the three stages of disposition: (a) alternative dispute resolution, (b) other informal agreement between the parties, or (c) statute

⁴²Watanabe (2005) describes a similar, but less detailed, time line of pre-litigation and litigation. The setup of insurer’s reserve amounts will be discussed in detail in Section 2.4.

of limitation. The plaintiff may no longer initiate a litigation if neither a lawsuit is filed nor an agreement is reached by the end of the statute of limitation.⁴³

If a case is filed, the court will notify the litigants about the date of trial. During the litigation-phase, a case may terminate in either of the seven stages of disposition: (i) alternative dispute resolution, (ii) settlement before trial, (iii) settlement during trial, (iv) court verdict, (v) settlement after verdict, (vi) settlement after appeal filed and (vii) case dismissed. Before the trial starts, the parties may choose to resolve their disputes either by *alternative dispute resolution* or by *settlement before trial*. If the parties have not resolved their disputes prior to trial, they may still choose to *settle during trial* until a *court verdict* is rendered. In addition, the court may dismiss the case during the trial. If the plaintiff or the defendant is dissatisfied with the court verdict, then they can appeal to a higher court. The parties may choose to settle, with the knowledge of the court verdict, before or after the filing of an appeal.

In the TDI data, *alternative dispute resolution* refers to the informal proceedings that help parties resolve their dispute *outside* of formal litigation. Unlike settlement, which is typically achieved by the litigants themselves (and their lawyers), alternative dispute resolution proceedings often involve third parties (arbitrators or mediators) who offer opinions and advice.⁴⁴ *Settlement* refers to the formal procedure that parties resolve their dispute *within* the litigation process. Unlike alternative dispute resolution, settlements are often reviewed by a judge to make sure they are adequate.

DEFINITION. Throughout the chapter, *litigation duration* refers to the time elapsed between filing of a case and case termination. We say that *settlement is delayed* if a case's litigation duration is positive.

Overwhelmingly higher costs and longer delays are associated with litigations than with non-legal disputes.⁴⁵ Consequently, the literature on litigation and settlement to date has predominantly focused on the litigation process after the filing of the lawsuit and before the date of trial.^{46,47} TDI data include 186,077 paid claims of which 40.6% are not filed claims and 59.4% filed claims. Furthermore, a predominantly large share of cases in the sample (96%) of filed suits consists of cases resolved prior to trial, either by an alternative dispute resolution (32%) or through formal judicial process (64%).⁴⁸ Given these facts and to make the analysis tractable, in the theory section I will follow the literature to consider a simplified version of the litigation process by focusing on the parties' bargaining behavior during the litigation-phase and *prior to* trial. In particular, I abstract, as do

⁴³A *statute of limitation* is a length of time determined by law to be the maximum period of time, after the accident, that litigation against the defendant may be initiated.

⁴⁴See Spier (2005) for detailed description.

⁴⁵In the TDI data, the average defense expenses for filed claims and for disputes resolved without filing are \$33,157 and \$1,083, respectively. The average elapsed time between the date that the case reported to insurer and the date of settlement is 860 days for filed cases and 354 days for cases resolved without filing, respectively.

⁴⁶It is usually assumed in this literature that court verdict is immediately reached when trial starts.

⁴⁷Exceptions include Bebchuk (1996), Watanabe (2005), Waldfoegel (1995) and Sieg (2000). Bebchuk (1996) considers a multi-period bargaining model to explain why a plaintiff may file a lawsuit with negative expected value at trial. In his model, however, the players have complete information over the likely trial outcomes, and in equilibrium settlement occurs immediately after the bargaining starts. Sieg (2000) estimates a two-stage bargaining model with asymmetric information to study the plaintiff's decision to file a lawsuit, the magnitude of legal costs, and the terms of settlement in medical malpractice cases.

⁴⁸For detailed descriptive statistics, the interested reader is referred to Table 2.2, Panel A.

Spier (1992) and Fenn and Rickman (1999), from the plaintiff's decisions of whether and when to file a lawsuit. Furthermore, I will not distinguish between alternative dispute resolution or settlement before trial. Such a distinction is not important for the present analysis. They are both referred as "settlement before trial" in the theoretic model and in the empirical model. To further simplify the exposition, I ignore bargaining after trial and filing of appeal in the theoretic analysis and assume that litigation ends on the date of trial.

■ **Description of prejudgment interest.** Delays in litigation have fueled ongoing popular support for tort reform in Europe and in the United States. There appear to be two major reasons for delay in litigation: first, one or the other litigant may have strategic incentives to delay; and second, delay may be caused by court congestion.⁴⁹ Procedural rules have been put forward as remedies. Specially, most European and U.S. jurisdictions have adopted laws to impose interest on damage awards to prevailing plaintiffs from the time the injury occurred until the date of judgment. Such interest is called *prejudgment interest*.⁵⁰ Suppose N is the number of days between the date of injury and date of judgment, and R is the statutorily imposed daily prejudgment interest rate. Then, by a prejudgment interest law, a defendant deemed liable for a damage of θ in court will be required to pay the plaintiff $\theta(1 + R)^N$.

The basic goal of the prejudgment interest law is to encourage early settlements. The 'rationale' behind this law seems to be as follows: Suppose that the defendant refuses to settle early; if the court takes away from defendant the interest that he gains on damages that are unpaid but determined by court to be valid, disincentives will be created for the defendant to prolong litigation.⁵¹ Following this 'logic', the prejudgment interest rates in Italy has doubled following the Italian civil justice reform of 1990.

However, prejudgment interest may have the counter effect of increasing delay. First, prejudgment interest increases the value of cases to plaintiffs.⁵² The effect will be to increase the number of case filings thereby increasing court congestion, because some cases that would have negative expected returns in the absence of prejudgment interest have now become profitable for plaintiffs to pursue as a consequence of the reform. Second, when litigants have incomplete information about the severity of damage, then prejudgment interest can increase the parties' uncertainty about the value of the case.⁵³ Suppose that liability is not disputed, but that the plaintiff has private information about the level of damages. Further suppose that from the defendant's perspective, the value of the case in the absence of prejudgment interest is distributed with variance σ^2 . Prejudgment interest increases the variance of the distribution of case values to $\sigma^2(1 + R)^{2N}$. A key goal of this chapter is to explore how and to what extent such an increase in the litigants' uncertainty about the case scale increases delay.

⁴⁹For empirical evidence that court congestion increases delay, see Fournier and Zuehlke (1998) and Kessler (1996).

⁵⁰Prejudgment interest law varies among jurisdictions in the US. Some states (e.g. Alaska and Georgia) set a fixed prejudgment interest rate by statute; others (e.g. Texas and Iowa) tie the rate to an established index. See Philips and Freeman (2003) for a survey across the U.S. states.

⁵¹See, e.g., Pennsylvania Supreme Court (1981), Knoll (1996), Calhoun(1990), and Wilson *et al.* (1986), and Rubin and Shepherd (2007).

⁵²See Miller (1997).

⁵³See Kessler (1996).

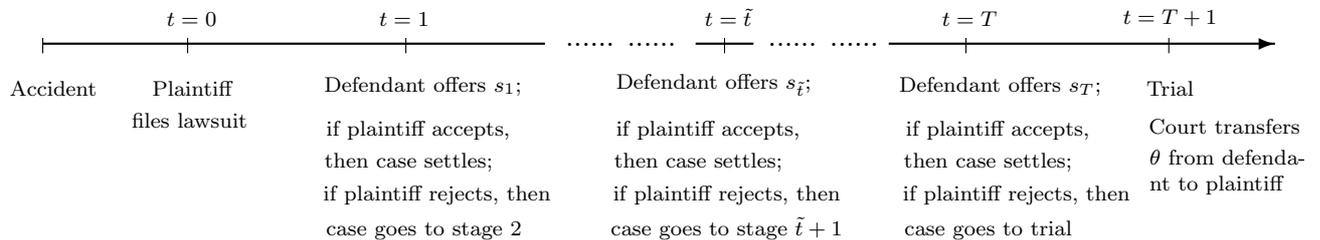
From the discussions above, we can see that theoretical analysis and empirical validation are required to better understand the effects of prejudgment interest on delay. I found that, consistent with the findings of Kessler, cases with high prejudgment interest rates at the date of closure are less likely to settle early in the negotiations. These empirical results are consistent with a theoretical model of wasteful delay, and they cut against using the prejudgment interest to expedite damage payment.

■ **Description of major legal reforms in the same period.** To produce an unbiased estimate of the effect of prejudgment interest reform, it is necessary to separate the effect of prejudgment interest from the potential effects of other legal reforms that took place in the same period.

2.3. THEORETICAL FOUNDATION

■ **Basic model.** I base my empirical analysis (as do Fournier and Zuehlke (1998), Kessler (1996) and Fenn and Rickman (1999)) on Spier’s (1992) dynamic model of pretrial bargaining. It should be stressed that the model I am inheriting from Spier makes by necessity simplifying assumptions about the bargaining structure. My purpose is to adopt a framework that can be estimated empirically, rather than to produce a comprehensive model that contributes to the theoretical literature. Therefore, my intention is to analyze a model in as parsimonious a fashion as possible, while at the same time retaining enough of the key elements of the theoretical structure to capture the most salient aspects of the litigation process. Apart from the role of prejudgment interest in the analysis and the introduction of factors pertinent to empirical estimation, the general spirit of the model introduced below follows an approach to the settlement-litigation decision that is broadly consistent with a substantial body of research in the game theoretical analysis of bargaining.

Assume that an accident has taken place and that the *plaintiff* has filed a suit to brought charges against the *defendant*. Let θ be the value of damages for which the defendant is liable. Let $\pi \in [0, 1]$ be the defendant’s fault (“liability” and “negligence” are a synonyms). Suppose that the court will enforce the payment of θ from the defendant to the plaintiff with probability π and without interest



2.2. Diagram of Model Structure – Pretrial Negotiation

in the event that the case goes to trial. Further assume θ is private knowledge to the plaintiff.⁵⁴ π is common knowledge.

Following the Bayesian approach, assume that the defendant has some subjective prior probability distribution for the unknown parameter θ . For simplicity, assume that the defendant's prior is uniformly distributed over $[0, \xi]$. Here, $\xi > 0$ is a "severity parameter": as ξ increases, both the mean and variance of the defendant's priors increase. This is a reasonable assumption, as empirical evidence suggests that claim types associated with higher expected damages usually have larger variances in damages across claims as well.⁵⁵

Settlement bargaining takes place over T periods. The defendant makes all of the offers.⁵⁶ In each period, t , the defendant makes a settlement offer, s_t , which the plaintiff may either accept or reject.⁵⁷ If she rejects, the game continues with the defendant making another offer in the following period. Trial takes place in period $T + 1$ if litigants cannot agree. In the event that the case goes to trial, the court will transfer θ from the defendant to the plaintiff.

The defendant incurs a cost $c \geq 0$ at the beginning of each period and the litigants remain in conflict prior to the trial.⁵⁸ In addition, the defendant incurs a cost $k \geq 0$ if the case actually goes to court. These costs are exogenously given. The litigants discount time at the same rate; their discount factor is δ where $\delta \in (0, 1)$. The game is illustrated in Figure 2.2.

Following Spier (1992), I will now derive the probability of settlement over time. Let the lower bound of the distribution of types at the beginning of period t be denoted θ_t . The defendant designs a sequence of T offers which partitions the distribution of plaintiff types. Following Spier (1992), when c and k are sufficiently small, so that

$$(\delta + \dots + \delta^{T-1})c + \delta^T k < \delta^T \pi \xi \tag{4}$$

then the equilibrium settlement offers are given by

$$s_1^* = \delta^T \pi \xi$$

$$s_t^* = \delta^{-(t-1)} s_1^*, \quad t = 2 \dots T \tag{5}$$

and the distribution of plaintiffs remaining at the beginning of period t is uniform on $[0, \xi]$, where:

$$\theta_1 = 0 \tag{6}$$

⁵⁴This is a reasonable assumption as the plaintiff is likely to have more information on the actual damages she has suffered owing to a harm than is the defendant. Reinganum and Wilde (1986), Spier (1994) and Daughety and Reinganum (1994) make the same assumption that the damages victims suffers are privately observed.

⁵⁵See Table 2.3, Panel B. Fenn and Rickman (1999) report similar evidence that the mean estimated damages and their standard deviation of 'insignificant' injuries are lower than those of 'permanent major' injuries, respectively.

⁵⁶I found no empirical evidence supporting this assumption. In the United States, the claimant's lawyer generally make the first move by making a specific demand to the tortfeasor's insurer (see Kritzer (1989)). However, it can be shown that some feature of the equilibrium outcome is robust to the order of offers or who make the offers in the negotiation process.

⁵⁷This assumption puts the whole bargaining power on the defendant's side, although generally the plaintiff may make counter offers. This assumption is made to avoid the multiplicity of equilibria associated with updating of beliefs.

⁵⁸We may interpret c as the costs of the defendant's legal counsel. The plaintiff's attorney is usually paid on a contingency fee basis. The model can be easily generalized to include costs for the plaintiff as well. This extension hardly changes the results, but comes at the expense of notation. See Spier (1989, 1992).

$$\theta_t = \delta^{-T} \sum_{i=1}^{t-1} \delta^i c, \quad t = 2, \dots, T \quad (7)$$

$$\theta_{T+1} = \theta_T + k \quad (8)$$

If condition (4) is violated, then

at period $t = 1$ the defendant makes settlement offer $s_1^* = \delta^T \pi \xi$, and

$$\text{the plaintiff accepts regardless of her type.} \quad (9)$$

Interpretation. The formal proof the results (5)-(9) is similar to that in Spier (1992). I omit it. But it is worth sketching it, because the comparative statics of this model are fairly intuitive and could result quite reasonably from a variety of bargaining models. In subgame perfect equilibrium, just enough high types must remain in the last period to make the high offer, $\delta \pi \xi$, credible. Since at this time the costs c are sunk, θ_T depends on k but not on c (equation (8)). In each period, the gains from settlement are the costs to be avoided in the subsequent periods. Therefore, when the costs of continuing litigation are high (i.e., when T and c are high), it benefits the defendant to raise the likelihood of settlement by making a high offer (equation (7)). Low type plaintiffs get less from a trial than high type plaintiffs and hence will settle early for lower damage payments, while high type plaintiffs will be prepared to delay agreement until settlement offers raise ($\{\theta_t\}_{t=2}^T$ is an increasing sequence). The reason that the parties cannot do better by avoiding the inefficient delay and share the gains from early settlement is that there is no way for a high type plaintiff to “prove” that her damage level is high except by going through a costly litigation.

From these results above, I derive the hypotheses that I will test empirically. They relate to the probability of settlement in period t conditional on the fact that settlement has not occurred earlier, i.e. the *hazard rate*, $h(t; \cdot)$. Due to (7), we have when (4) holds

$$h(t; \xi, \pi, c, T, \delta) = \frac{\theta_{t+1} - \theta_t}{\theta_T - \theta_t} = \frac{c(1 - \delta)\delta^t}{\delta^T(1 - \delta)\pi\xi - c(\delta - \delta^t)}, \quad t = 1, 2, \dots, T - 1. \quad (10)$$

By differentiation, we have

$$h_\xi < 0; \quad h_\pi < 0; \quad h_c > 0; \quad h_T > 0; \quad h_t \begin{matrix} \geq \\ \leq \end{matrix} 0 \Leftrightarrow \frac{\delta c}{\delta^T(1 - \delta)} \begin{matrix} \geq \\ \leq \end{matrix} \pi\xi; \quad (11)$$

Differentiating (10) twice, we have

$$h_{\xi t} \begin{matrix} \leq \\ \geq \end{matrix} 0 \Leftrightarrow \frac{\delta c}{\delta^T(1 - \delta)} \begin{matrix} \geq \\ \leq \end{matrix} \pi\xi; \quad h_{\pi t} \begin{matrix} \leq \\ \geq \end{matrix} 0 \Leftrightarrow \frac{\delta c}{\delta^T(1 - \delta)} \begin{matrix} \geq \\ \leq \end{matrix} \pi\xi; \quad (12)$$

$$h_{ct} \begin{matrix} \geq \\ \leq \end{matrix} 0 \Leftrightarrow \frac{\delta c}{\delta^T(1 - \delta)} \begin{matrix} \geq \\ \leq \end{matrix} \pi\xi; \quad h_{Tt} \begin{matrix} \geq \\ \leq \end{matrix} 0 \Leftrightarrow \frac{\delta c}{\delta^T(1 - \delta)} \begin{matrix} \geq \\ \leq \end{matrix} \pi\xi. \quad (13)$$

Interpretation. Inequalities (11) suggest that, the hazard rate of settlement is decreasing in trial stakes, uncertainty about the severity of damage (both captured by the size of ξ), and the defendant’s fault (captured by the size of π). The hazard rate is increasing in bargaining costs (as captured by the magnitude of c) and the length of time to trial (as captured by the length of T). The settlement hazard is increasing over time, when litigation costs are high, length of time-to-trial is long, and expected damage and uncertainty are low. Furthermore, the model can also predict how changes in

bargaining environment and legal system affect the settlement hazard over time. Inequalities (12) and (13) suggest that, when the legal costs are high, length of time-to-trial is long, and trial stakes, uncertainty and defendant fault are low, the negative effect of uncertainty, stakes and defendant fault on settlement hazard diminishes as time elapses; the positive effects of costs and time-to-trial on settlement hazard increase as time elapses.

In summary, the screening model of pretrial negotiation identifies two important determinants of litigation duration: the dispersion in trial outcomes, and the costs of bargaining.

The results above lead to the following hypotheses:

Hypothesis 1. *The duration of bargaining will decrease when the costs of continuing litigation increase.*

Hypothesis 2. *The duration of bargaining will increase when the severity of injury increases.*

Hypothesis 3. *The duration of bargaining will increase when the defendant is at fault, that is, when the defendant is liable for the plaintiff's damage.*

Hypothesis 4. *The duration of bargaining will decrease when the defendant faces less uncertainty about the level of damages.*

Hypothesis 5. *The longer time that it takes for a case to reach trial (i.e., the longer the length of T), the shorter is the duration of bargaining.*

□ **Prejudgment interest.** Up to this point it has been assumed that the litigation is undertaken in absence of prejudgment interest statute. In that case, delay results from inevitable information asymmetry between the litigants. However, the laws of most European and U.S. jurisdictions provide that interest is added to the original judgment from the time of the injury to the date of judgment. The objective of this section is to understand the effect of such a statute on the duration of settlement. It is shown that prejudgment interest worsens the adverse selection problem of the defendant, thereby stretching out litigation.

Formally, let the R be the statutorily imposed prejudgment interest rate. Then in the event that the case goes to trial, the court will enforce the payment of $\theta(1 + R)^T$ from the defendant to the plaintiff. All other assumptions and notations remain the same as in the basic model.

Analogous to the analysis in the previous section, when c and k are sufficiently small so that the maximum amount at stake is larger than what the settlement costs would be, that is

$$(\delta + \dots + \delta^{T-1})c + \delta^T k < \delta^T \pi \xi (1 + R)^T \quad (14)$$

then the equilibrium settlement offers are given by

$$s_1^* = \delta^T \pi \xi (1 + R)^T$$

$$s_t^* = \delta^{-(t-1)} s_1^*, \quad t = 2, \dots, T \quad (15)$$

and the distribution of plaintiffs remaining at the beginning of period t is uniform on $[0, \xi]$, where:

$$\theta_1 = 0 \quad (16)$$

$$\theta_t = \delta^{-T} \sum_{i=1}^{t-1} \delta^i c, \quad t = 2, \dots, T \quad (17)$$

$$\theta_{T+1} = \theta_T + k \quad (18)$$

If condition (14) is violated, then in period $t = 1$ the defendant makes settlement offer $s_1^* = \delta^T \pi \xi (1 + R)^T$, and the plaintiff accepts regardless of her type. In particular, when the defendant's uncertainty about the severity of damage is sufficiently small (i.e., when $\xi \leq [(\delta + \dots + \delta^{T-1})c + \delta^T k] / \delta^T \pi (1 + R)^T$) so that condition (14) is violated, all the cases will settle in period $t = 1$ and prejudgment interest will display no effect on the duration of settlement.

Due to (17), we have when (14) holds

$$h(t; \xi, \pi, c, T, \delta, R) = \frac{\theta_{t+1} - \theta_t}{\theta_T - \theta_t} = \frac{c(1 - \delta)\delta^t}{\delta^T(1 - \delta)\pi\xi(1 + R)^T - c(\delta - \delta^t)}, \quad t = 1, 2, \dots, T - 1. \quad (19)$$

By differentiation, we have

$$h_R < 0. \quad (20)$$

Differentiating (19) twice, we get

$$h_{Rt} \leq 0 \Leftrightarrow c \geq \delta^{T-1}(1 + R)^T(1 - \delta)\pi\xi, \quad (21)$$

$$h_{R\xi} > 0. \quad (22)$$

Remark. Comparing inequalities (4) and (14), we see that prejudgment interest provides a defendant, who would otherwise settle immediately when bargaining and litigation costs are high, with incentive to delay settlement. This is because prejudgment interest increases the expected trial stake and thus increases the difference between the expected total amount at stake and what the settlement costs would be. Furthermore, (20) indicates that the probability of settlement is decreasing in prejudgment interest rate. This is because prejudgment interest increases both the expected trial stake and the defendant's uncertainty about trial outcomes. (21) suggests that when legal costs are high, length of time to trial are long, and expected trial stakes and uncertainty about the severity of damage are low, the duration elasticity of the hazard function is decreasing with the prejudgment interest rate. (22) suggests that the hazard rate of settlement decreases with prejudgment interest rate more rapidly the higher the defendant's uncertainty about the severity of damage.

The results lead to the following hypotheses:

Hypothesis 6. *The duration of bargaining will increase when prejudgment interest rate increases.*

Hypothesis 7. *The effect of prejudgment interest on the duration of bargaining will decrease when the defendant's uncertainty about the severity of damage decreases.*

Furthermore, I derive hypothesis on the expected settlement that I will test empirically. Let $p(t; \cdot)$ denote the probability of settlement in period t ; let ψ denote the expected settlement amount. Due to (15) and (17), we have when (14) holds, the expected settlement in equilibrium is

$$\psi(\xi, \pi, c, T, \delta, R) = \sum_{t=1}^T p(t; \xi, \pi, c, T, \delta, R) s_t^* = \sum_{t=1}^T \frac{\theta_{t+1} - \theta_t}{\theta_T - \theta_1} \delta^{T-t+1} \pi \xi = \frac{T(\delta - 1)\delta^T \pi \xi (1 + R)^T}{\delta^T - 1} \quad (23)$$

By differentiation, we have

$$\psi_R > 0 \quad \text{and} \quad \psi_T > 0. \quad (24)$$

Remark. (24) suggests that the expected settlement is increasing with the level of prejudgment interest rate (as captured by the size of R) and the length of time to trial (as captured by the length of T). This is because prejudgment interest increases the expected trial stake and thus improves the plaintiff's bargaining position *vis-à-vis* the defendant. The higher the prejudgment interest rate and the longer the length of time to trial, the larger the trial stake.

This result leads to the following hypotheses:

Hypothesis 8. *The expected settlement will increase when prejudgment interest rate increases.*

Hypothesis 9. *The expected settlement will increase when the length of time to trial increases.*

2.4. DATA DESCRIPTION

The data are from the Texas Department of Insurance (TDI) Commercial Liability Insurance Closed Claim Report. Texas requires detailed reports for all claims for which the total damage payments by all insurers are at least \$ 10,000. A rich variety of case-specific information is recorded for the majority of claims, including the date of the accident, the dates for initiation, settlement and closure of the lawsuit (for most of the cases); the defendant's prior estimate of the level of damages. These are the key variables of interest in this chapter. I analyze data from all available years, which currently include the years 1988 - 2005.⁵⁹

Five lines of commercial liability insurance are represented in TDI data: (i) monoline general liability, (ii) commercial auto liability, (iii) commercial multiperil liability, (iv) medical-professional-liability and (v) other professional liability. Commercial insurance provides liability coverage for businesses, as opposed to personal insurance that are purchased by individuals.⁶⁰ Monoline general liability insurance provides coverage for liability arising out of accidents resulting from the operation or products of a business as well as contractual liability. Commercial auto liability insurance provides coverage for commercial automobiles. Commercial multiperil liability insurance covers risks to business due to perils that are named in the insurance policy, such as fire, earthquake or thunder. Medical professional liability is insurance purchased by hospitals or medical professionals to address the liability from their patients. Other professional liability is insurance purchased by management of corporations as well as other non-medical professionals such as lawyers to address liability from shareholders and from clients.⁶¹ As motivated in the introduction, investigating the difference in litigation process among these insurance lines is of interest in this chapter of the thesis. Further, the insurance lines serve as control variables for case scale and defendant's uncertainty about trial outcome.⁶²

□ **Rules for inclusion in the sample.** TDI data include 186,077 paid claims across these

⁵⁹All dollar values throughout the chapter are adjusted to 2005\$ using standard measure of general price trends published by the Bureau of Labor Statistics, the Consumer Price Index for All Urban Consumers.

⁶⁰For definitions of these lines of insurance, see the Insurance Information Institute (2005).

⁶¹The description of insurance types is taken from Hersh and Viscusi (2007).

⁶²This point will be further discussed in the latter part of this section.

five insurance types over the years 1988-2005. While the data is very rich, it still has limitations that make necessary several restrictions on the set of cases included in my sample. Firstly, because my primary focus is on the duration of *pretrial* negotiation, the data were sampled to obtain only those observations for which a suit was filed. Due to this restriction, 75,619 claims are dropped.⁶³ Obviously, the resulting sample is not representative of all cases brought for damage award, nor should it be. Omission of the cases settled without suit filed does not introduce selectivity bias, since the focus of my analysis is confined to legal dispute resolution process and such cases are not in the population of interest. Secondly, I drop 10,694 cases initiated *before* but terminated *after* the initiation of prejudgment interest reform. This restriction allows me to unambiguously identify the effect of prejudgment interest on litigation duration.⁶⁴ Thirdly, an additional 30,458 claims are dropped because information on the type of injury is not recorded. Fourthly, a further 2,163 claims are dropped because information on the effect of joint and several liability is not recorded.⁶⁵ Missing or potentially misrecorded data on insurance type, insured's liability and litigation durations further reduce the number of sampled observations.⁶⁶ Because of these restrictions, the resulting sample of 67,130 cases contains 65,747 that terminated in a settlement before trial and 1,383 that terminated after a trial had begun. I refer to the sample of 67,130 cases as my bargaining sample.

□ **Litigation duration and stages of case disposition.** The variables and model parameters are defined in Table 2.1 (see appendix), and the corresponding descriptive statistics are presented in tables 2.2 and 2.3.

Panel A of Table 2.2 provides an overview for the litigation sample of average litigation durations, by each of the five insurance policy types and by stages of disposition. Calculations (not explicitly reported in the table) based on the litigation sample show that the overwhelming share of cases in the sample, 98%, consists of suits resolved prior to trial, either by an alternative dispute resolution (31%) or through formal judicial process (67%). Additional 2% settled after a trial had begun but before a court verdict was reached.

Let *DURATION* be the time elapsed between the date that a suit is filed and the date that the claim is closed. *DURATION* for cases settled before trial are considerably shorter than for cases settled during trial. For settlements before trial, auto liability has the shortest *DURATION* of 20 months; other professional liability is 20% greater, with *DURATION* around 24 months; The longest *DURATION* for settlement before trial is for general liability, with average *DURATION* of around 30 months. Settlement during trial generates the longest delay in settlement with an average *DURATION* of 32 months.

The *DURATION* for these three categories of case disposition averages 25 months across all lines. Auto liability claims have the shortest *DURATION*, averaging 20 months. The longest litigation durations are for general liability lawsuits, with average *DURATION* of 30 months. Table 2.2 Panel B reports the median values that correspond to the entries in Panel A. Because of the skewed distributions of

⁶³The descriptive statistics of these cases are reported in the appendix. See Table 2.3 Panel C.

⁶⁴I am grateful to Eric van Damme and Timothy Swanson for raising the issue of unambiguous identification of the effect of prejudgment interest reform.

⁶⁵The potential effect of joint and several liability on the duration of litigation will be discussed in the latter part of the paper.

⁶⁶One case is dropped because information on insurance type is missing. Four additional cases are dropped because information on insured's fault is not recorded. Nine cases are dropped because litigation durations are reported as zero.

TABLE 2.2 LITIGATION DURATION BY INSURANCE POLICY TYPE (IN MONTHS)

Panel A: Means (standard deviations)

	General liability	Auto liability	Multiperil liability	Medical professional liability	Other professional liability	All lines	Observations
Disposition of Lawsuit							
Alternative dispute resolution	25 (13)	19 (11)	23 (13)	23 (12)	25 (15)	22 (12)	21,079
Settlement before trial	32 (18)	20 (13)	25 (15)	28 (15)	24 (14)	26 (16)	44,668
Settlement during trial	35 (15)	29 (14)	31 (13)	32 (14)	29 (13)	32 (14)	1,383
All stages	30 (17)	20 (13)	24 (14)	27 (14)	25 (14)	25 (15)	
Observations	18,313	23,134	10,776	14,149	758		67,130

(continued overleaf)

TABLE 2.2 (Continued)

Panel B: Medians

	General liability	Auto liability	Multiperil liability	Medical professional liability	Other professional liability	All lines	Observations
Disposition of Lawsuit							
Alternative dispute resolution	23	17	21	20	22	20	21,079
Settlement before trial	28	17	22	25	20	22	44,668
Settlement during trial	34	27	31	30	28	30	1,383
All stages	26	17	21	24	21	21	
Observations	18,313	23,134	10,776	14,149	758		67,130

Source: Author's calculations based on the Texas Department of Insurance Commercial Liability Insurance Closed Claim database for the years 1988-2005.

Note: Durations reported in this table are the time elapsed between the date that a suit is filed and the date that the case is closed.

Table 2.3: Descriptive Statistics^a

Panel A. Legal System, Bargaining Environment and Delegation of Bargaining

	BEFORE TRIAL		DURING TRIAL		ALL CASES	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
LEGAL SYSTEM						
<i>PREJUDGMENT INTEREST RATE</i> (%)	9.88	0.75	9.98	0.30	9.89	0.75
<i>CONGESTION</i> (months)	18	10	19	11	18	10
<i>JOINT & SEVERAL LIABILITY</i> (1=yes)	0.13	0.33	0.17	0.38	0.13	0.34
<i>NONECONOMIC DAMAGES</i> (1=yes)	0.38	0.49	0.45	0.50	0.38	0.49
BARGAINING ENVIRONMENT						
<i>INITIAL INDEMNITY RESERVE</i> (\$)	75,404	217,650	107,938	322,760	76,074	220,367
<i>INITIAL EXPENSE RESERVE</i> (\$)	9,000	23,776	12,154	25,433	9,065	23,815
<i>INSURED'S FAULT</i> (%)	81.00	31.60	76.71	33.62	80.91	31.65
<i>MULTIDEF</i> (1=yes)	0.416	0.493	0.495	0.500	0.417	0.493
DELEGATION STRATEGY						
<i>PLAINTIFF LAWYER</i> (1=yes)	0.998	0.041	0.999	0.027	0.998	0.041
<i>OUTSIDE DEFENSE COUNSEL</i> (1=yes)	0.838	0.369	0.901	0.299	0.839	0.367
Observations	65,747		1,383		67,130	

a. all dollar values are in 2005 \$. The source for these values is author's calculations based on the Texas Department of Insurance Commercial Liability Insurance Closed Claim database for the years 1988-2005.

the litigation durations, the median values are below the means.

□ **Legal system, bargaining environment, delegation and case characteristics.** Four sets of explanatory variables are employed in the analysis to account for possible variations in the mean and dispersion of unobservable trial outcomes and those in the costs of continuing litigation. A first set of variables captures aspects of the institutional environment where bargaining takes place. By far, the most important is *PREJUDGMENT INTEREST RATE* — the variable that controls for the magnitude of prejudgment interest rate imposed on damage payment. In Texas, from which the present sample was drawn, the rate fixed at 10 percent a year from 1988 to July 2003. In August 2003, Texas enacted prejudgment interest reform. Consequently, the rate was set to be the prime rate ('annual interest rate' is a synonym) of the Federal Reserve System with ceiling of 15 percent a year and floor of 5 percent a year.⁶⁷ *PREJUDGMENT INTEREST RATE* equals 10% for cases terminated before 1st August 2003, and equals 5% for damage negotiations initiated after 1st August 2003.

Further, *CONGESTION* measures the speed of court proceedings. It is the average number of months required for a case to reach trial from the date that suit was filed in a given district. The variable thus controls for district-specific determinants of duration. Fournier and Zuehlke's (1996) show that cases filed in jurisdictions with relatively long court congestions tend in most instances to have greater probability of settlement.

To distinguish the effect of prejudgment interest reform from other aspects of legal system, three additional legal system variables will be included. *JOINT & SEVERAL LIABILITY*, indicates those cases where joint and several liability affects settlement or trial verdict. Korhauser and Revesz (1994) found that joint and several liability can affect both the probability of litigation and the size of the award.⁶⁸

⁶⁷See Texas Office of Consumer Credit Commission (2007).

⁶⁸Korhauser and Revesz (1994) established that, absent of insolvency considerations, cases associated with joint and

Due to the often complex effects of this liability scheme, I do not construct a continuous measure of its effect but focus instead on a dummy variable categorizing whether joint and several liability impacts damage award. 13% of the cases in my sample is impacted by joint and several liability. Litigated cases are less likely to be affected by joint and several liability than cases settled before trial.

The last legal system variable, *NONECONOMIC DAMAGES*, is a dummy variable indicating whether a plaintiff receives compensation for noneconomic losses – for example, intangible losses such as pain and suffering.⁶⁹ Unlike for economic damages, tort law has no objective criteria for measuring noneconomic damages. Due to their subjective nature, it is often hard to predict the magnitudes of such damages. Therefore, this variable also serves as a measure of the defendant's uncertainty.⁷⁰ Noneconomic damages were warranted in 38% of the cases in my sample. Cases settled prior to trial are less likely to involve noneconomic damages payment than cases settled after trial had begun.

A second set of variables reflect changes in the bargaining environment. *INITIAL INDEMNITY RESERVE* and *INITIAL EXPENSE RESERVE*, control for the scale of the defendant's prior estimate on the severity of damage and the level legal expenses, respectively. These reserve amounts are determined based on the insurer's experience with the injury type and the nature and severity of damage: a higher initial indemnity reserve (resp. initial expense reserve) corresponds to a higher expected value of damage (resp. higher expected level of legal expenditures and greater litigation length). Initial reserve levels are established by insurers for the time that a damage claim was reported, which will generally be before a suit is filed. That is, they are set before any actual damage payments are made and actual defense expenditures are incurred. When insurers set up their initial reserve amounts for a case, they should reserve an amount that corresponds to the actual expected damages and legal costs for that case type. The estimate of the expected damages and expected costs will change as additional information arrives. Although in retrospect all claims in the sample should have strictly positive reserve amounts, at the time when the initial reserves were established the available information on the claim may not suggest a positive expected damage or expenses. Indeed, data on all claims reported to the TDI from 1988 to 2005 show that in 3% of the cases, insurers have actually made zero damage payment and in 33% of the cases, insurers have actually incurred zero legal expenses.

The initial reserve amounts have relatively weak predictive power for actual damage payments, legal expenses and length of litigation time, which is what one would expect given their predetermined nature. A regression of actual defense expenditure on *INITIAL EXPENSE RESERVE* yields a coefficient of 1.1 (p -value = 0.000), demonstrating that on average, actual expenses track expected expenses closely. However, the R -squared in this equation is only 0.05, showing that there is a great deal of

several liability have lower likelihood of settlement when the probabilities that the defendants will be found liable are sufficiently uncorrelated across cases. Furthermore, Korhauser and Revesz (1994) found that when the probabilities are perfectly correlated, the plaintiff will extract more surplus from settlement in a joint and several liability case. The theoretical models discussed in this chapter do not consider how joint and several liability might affect the settlement process. My purpose here is to determine if there are any empirical differences in the duration of joint and several liability cases relative to others.

⁶⁹Economic damages were awarded in all paid claims. Therefore, the incidence of economic damage award is not included as an explanatory variable.

⁷⁰Viscusi (1988a), Sharkey (2005), Avraham (2006b), Rubin and Shepherd (2007) and Cummins and Weiss (1993) make similar remarks on the unpredictability of noneconomic damages. Jury instructions often explicitly acknowledge the subjective and imprecise nature of noneconomic damages. See, e.g., Judicial Council of California Civil Jury Instructions No. 2905 A (2004).

variation across cases in actual expenses for any given *INITIAL EXPENSE RESERVE* level.⁷¹ A regression of elapsed time between litigation duration on *INITIAL EXPENSE RESERVE* shows a similar significant, but weak, relation, with a coefficient 0.003 (p -value = 0.000), and an R -squared of 0.007. A regression of damage payment on *INITIAL INDEMNITY RESERVES* shows a similar weak relation, with a coefficient of 0.78 (p -value = 0.000) and an R -squared of 0.18.

INSURED'S FAULT refers to the insured's percentage of fault after reallocating for plaintiff's negligence. On average, the insured's share of fault is 81%. Together with *INITIAL INDEMNITY RESERVE*, they provide a case-specific measure of expected damages. Fenn and Rickman (2001), in their study of motor vehicle accident cases, found that a case in which the insurer believes its insured is fully at fault was, *ceteris paribus*, associated with shorter delays. A drawback to my measure might arise if the insured's fault is endogenously determined in litigation process where the insurer uses delay to signal the insured's fault to a plaintiff who is less informed about the distribution of fault.

MULTIDEF indicates cases that involve multiple defendants and is included to control for potential differences in the settlement decisions of multiple defendants.⁷² Approximately 42% of the cases in my sample involves multiple defendants. There is a significant difference in multiple defendants involvement between litigated and settled cases. Fournier and Zuehlke's (1996) empirical evidence suggests that settlement takes longer to obtain when there are multiple litigants.

A third set of variables, 'delegation strategy', controls for the litigants' delegation strategies that may be associated with the both settlement likelihood and the included variables of interest. Hersch and Viscusi (2007) show that for larger stake cases and more complex cases insurers rely more heavily on outside counsel. Helland and Klick (2006) find that lawyers systematically delay settlement to accrue additional fees when compensated by hourly fees or through a lodestar calculation.

Finally, I include two categorical variables, *INSURANCE* and *INJURY*, to control for the effects of omitted case specific characteristics that may be correlated with both settlement likelihood and the included variables of interest. Kessler's (1996) empirical evidence suggests that claims arising out of more serious injuries take longer to settle and that increased case complexity increases delay.⁷³ Table 2.3, Panel B reports the mean and standard deviation of court verdict by different insurance lines and injury types. I report court verdicts for all tried cases (that is, cases received court verdicts) from the population, not alone the tried cases in the sample, to provide a comprehensive measure of the defendant's uncertainty about the stakes involving different insurance and injury types. Auto liability is the most commonly specified insurance category. It also has very low trial stakes per claim and very low variation in court verdict amount across claims.

Professional liabilities have the opposite characteristics; these are infrequently occurring claims with very high trial stakes per case and very large variation in court verdict amount across cases. Back injury is the most commonly specified injury category. It also has very low damage payments per claim with very low variation in payments across claims. Fatal injuries and very severe injuries types such as amputation, burns-heat, systemic poison-toxic, brain damage and spin cord injuries,

⁷¹Restricting this regression to the 67% of the observations reporting nonzero initial expense reserves yield an R -squared of 0.09.

⁷²The theoretic analysis discussed above do not consider the impact of the participation of multiple parties on settlement process. My purpose here is determine if there exist empirical differences in the duration of these cases relative to others.

⁷³See Kessler (1996), page 445.

Table 2.3. (continued)

Panel B: Court Verdict by Insurance & Injury Types

	Mean	Std. devn.	Observations
INSURANCE LINE			
Monoline general liability (\$)	918,219	3,160,960	681
Commercial auto liability	471,636	1,643,413	1,253
Commercial multiperil	1,119,324	3,867,493	438
Medical professional liability	3,566,801	28,053,925	488
Other professional liability	2,544,966	10,117,273	31
All lines	1,219,656	11,860,978	2,891
INJURY TYPE			
Death (\$)	4,074,435	3.28e+07	347
Amputation	1,700,604	2,685,387	42
Burns (heat)	841,353	1,467,806	47
Burns (chemical)	771,471	1,216,696	14
Systemic poisoning (toxic)	816,404	1,304,336	7
Systemic poisoning (other)	182,123	284,585	11
Eye injury (blindness)	1,192,381	1,808,639	35
Respiratory condition	2,841,058	6,215,495	13
Nervous condition	703,397	1,365,239	55
Hearing loss or impairment	2,380,039	4,064,951	20
Circulatory condition	600,334	876,920	28
Multiple injuries	793,219	3,272,379	711
Back injury	485,507	1,543,377	857
Skin disorder	1,266,976	3,364,021	9
Brain damage	5,412,468	9,911,498	109
Scarring	1,073,026	2,447,380	92
Spinal cord injuries	4,323,863	9,545,227	46
Other	1,460,703	5,597,202	590
All types	1,219,656	11,860,978	2,891

a. all dollar values are in 2005 \$. The source for these values is author's calculations based on the Texas Department of Insurance Commercial Liability Insurance Closed Claim database for the years 1988-2005.

have the opposite characteristics; these are infrequently occurring injuries with very high damage payments per case and very large variation in payments across cases. The insurance line and injury types thus may serve as measures of the defendant's uncertainty about trial stake and helps to capture case scale effects.⁷⁴ A drawback to these measures might arise if the defendants can estimate trial stakes using information other than insurance line and injury types.⁷⁵

2.5. THE EMPIRICAL MODELS

2.5.1. MODELS OF LITIGATION DURATION

To analyze the influence of legal regime and that of bargaining environment on the duration of settlements, hazard models were estimated. My focus here is the effect of each *exogenous* characteristic of the lawsuit on the probability of settlement, conditional on settlement not having already reached,

⁷⁴The sample moments of trial award distributions are not used as variables in the analysis since the number of claims proceed to trial was small, and there is a sample selection bias affecting such claims. See Viscusi (1988a) for similar critiques on using sample moments of trial award distributions as proxies for expected trial outcome and variance in trial outcomes.

⁷⁵I thank Kathryn Spier for pointing out this issue.

and holding other case characteristics constant. The intervening *endogenous* settlement payment and actual litigation costs are not explicitly modeled.

In what follows, I estimate two alternative empirical specifications and investigate the robustness of the results. The second specification is a generalization of the first. It should be stressed that the empirical models I am using are reduced form models and not structural models.

■ **Cox's (1972) semiparametric proportional hazard model** is the most popular approach towards characterizing the hazard function $h(t; \cdot)$. The model is consistent with the empirical literature of dynamic pretrial bargaining⁷⁶ and flexible enough to account for potential inappropriate distribution assumptions that may be involved in parametric methods.⁷⁷ The hazard function for case i is

$$h_i(t; \mathbf{x}_i) = h_0(t) \times \exp(\mathbf{x}_i' \beta)$$

where t is the elapsed time since the start of bargaining, \mathbf{x}_i is a vector of observed explanatory variables. The parameter vector β is the vector of coefficients, measuring the influence of observed characteristics. The term $\exp(\mathbf{x}_i' \beta)$ shifts the baseline hazard function $h_0(t)$, and a positive coefficient indicates that the observed case characteristics increase the settlement hazard and reduce the litigation duration. The model is semiparametric in that the baseline hazard $h_0(t)$ is a nonparametric function of time, with the influence of other observable case characteristics specified assuming a particular functional form. Furthermore, the model is a proportional hazard one since the ratio of the hazard function for any group with certain observed characteristics to that of the baseline hazard is equal to a constant, dependent only on the observed characteristics; i.e. $h(t)/h_0(t)$, the relative hazard function, is not time varying.

■ **Cox model with time varying effects of the covariates.** To this point, our discussion of Cox model is fairly standard. Most applications make the baseline hazard rate a function of explanatory variables and estimate a single duration elasticity. However, it is important to consider the validity of the proportionality assumption. The results of section 2.3 (see inequalities (11), (12) and (13)) suggest that changes in the bargaining environment and the legal system may not lead to strictly proportional shifts in the hazard function.

Consequently, I generalize, in a similar fashion as Fournier and Zuehlke (1998) and Fenn and Rickman (2001) do, the usual proportional hazard specification by allowing the duration elasticity of each observation to vary with the vector of explanatory variables. The model being estimated now takes the form of

$$h_i(t; \mathbf{x}_i) = h_0(t) \exp(\mathbf{x}_i' \beta(t)). \quad (25)$$

where $h_i(t; \mathbf{x}_i)$ is the hazard rate at time t for case i with covariates \mathbf{x}_i . Following Stablein *et al.* (1981), I assume that $\beta(t)$ is a vector of linear functions of time. This is equivalent to adding an interaction term of \mathbf{x} and time to the model, which was proposed by Cox (1972) to check the assumption of proportional hazards for the covariates.

⁷⁶See, e.g., Fenn and Rickman (2001) and Kessler (1999).

⁷⁷The advantages of using Cox (1972) model to analyze time to event data have been widely recognized. See, e.g., Kalbfleisch and Prentice (1980), Meyer (1990), Kessler (1999) and Perperoglou (2005).

The value of adopting this specification follows directly from my comparative statics (11) and (18). This specification allows both the intercept and slope of the log-hazard function of cases to vary with changes in the legal system and bargaining environment.

Suppose that there are n observations and k distinct settlement times. Further suppose that I rank the settlement times such that $t_1 < t_2 < \dots < t_k$ where t_j denotes the settlement time for the j th case. Furthermore, let R_j denote the set of cases that have not settled until time t_j . Then the probability that the ℓ th case will settle at time t_j given that some case in set R_j will settle at time t_j is

$$\frac{h_\ell(t_j; \mathbf{x}_\ell)}{\sum_{\tau \in R_j} h_\tau(t_j; \mathbf{x}_\tau)} = \frac{\exp(\mathbf{x}'_\ell \beta(t_j))}{\sum_{\tau \in R_j} \exp(\mathbf{x}'_\tau \beta(t_j))} \quad (26)$$

Taking the product of the conditional probabilities in (26) yields the partial likelihood function

$$\mathcal{L} = \prod_{j=1}^k \left[\frac{\exp(\mathbf{x}'_j \beta(t_j))}{\sum_{\tau \in R_j} \exp(\mathbf{x}'_\tau \beta(t_j))} \right],$$

with corresponding log-likelihood function

$$\ln \mathcal{L} = \sum_{j=1}^k [\mathbf{x}'_j \beta(t_j) - \ln \sum_{\tau \in R_j} \exp(\mathbf{x}'_\tau \beta(t_j))]. \quad (27)$$

For the proportional hazard model where a single duration elasticity is estimated, $\beta(t_j) = \beta$ for all $j \in \{1, 2, \dots, k\}$.

2.5.2. MODELS OF SETTLEMENT PAYMENT

To analyze the influence of change in prejudgment interest rate on the level of settlement payment, a linear regression model was estimated. As before, it should be stressed that the empirical model I am using is a reduced form model and not a structural model. Let the estimated value of settlement payment be given by

$$\psi_i = \mathbf{x}'_i \tilde{\beta} + \epsilon_i, \quad (28)$$

for each case i . \mathbf{x}_i is a vector of observed explanatory variables. The parameter vector $\tilde{\beta}$ is the vector of coefficients, measuring the influence of observed characteristics. A positive coefficient indicates that the observed case characteristics increase the settlement payment. The parameters for settlement payments are estimated by ordinary least squares (OLS) regression.

2.6. EMPIRICAL EVIDENCE

2.6.1. DURATION OF LITIGATION

Graphical analysis. I begin by graphing the non-parametric Kaplan-Meier hazard functions over the first 60 months of litigation for different factors that could influence the duration of settlement.⁷⁸ The empirical hazard is the fraction of unsettled claims at the start of a month which settle during the month.⁷⁹ These functions plot rates of settlement against the litigation durations.

⁷⁸I am grateful to Eric van Damme and Jan van Ours for suggesting me to graph these functions and to devote attention to analyzing them.

⁷⁹Formally, defining the risk set in month m , R_m , as the number of claims not settled by the start of month m , and the number of settlements in month m as S_m , the Kaplan-Meier empirical hazard is defined as S_m/R_m .

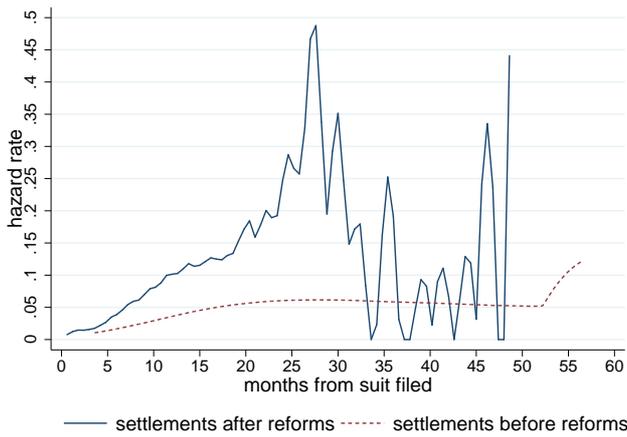


Figure 2.3: Effects of Prejudgment Interest Reform and Other Legal Reforms

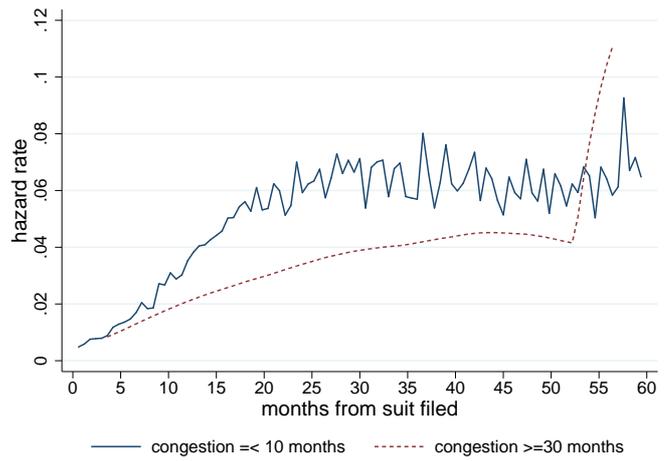


Figure 2.4: Effect of Court Congestion

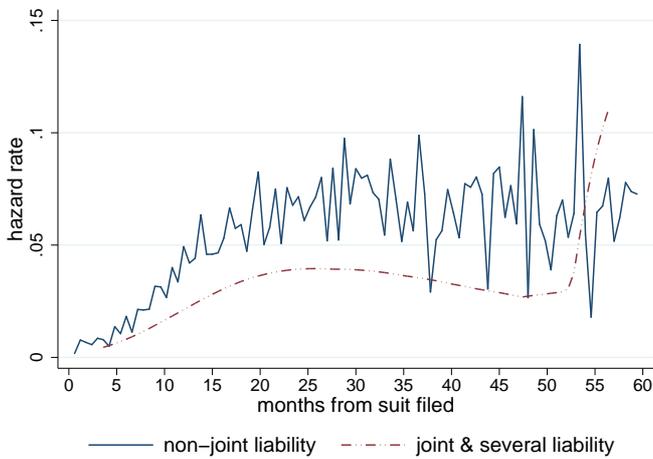


Figure 2.5: Joint & Several Liability

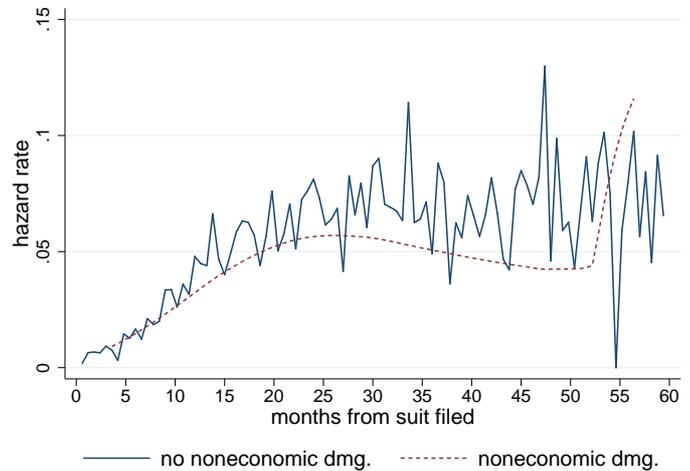


Figure 2.6: Non-Economic Damages

Figures 2.3, 2.4, 2.5 and 2.6 depict the settlement hazards stratified by different institutional factors. Claims settled after the downward adjustment of prejudgment interest rate have higher settlement hazards and therefore take shorter to settle (Figure 2.3). However, one should not immediately conclude that the increase in settlement hazards results solely from the prejudgment interest rate reform. The prejudgment interest reform was enacted since August 2003. Several other reforms were enacted in the same period in Texas. Further analysis will be conducted in section 2.6.2 to isolate the effect of prejudgment interest reform.

Delay in trial courts increases delay in settlement (Figure 2.4); the doctrine of joint and several liability has a negative impact on the settlement hazards (Figure 2.5); when non-economic damages are warranted, the probability of a settlement decreases and the litigation duration increases (Figure 2.6). These graphical analyses suggest a clear link between delay and the institutional factors.

Figure 2.7 depicts the settlement hazards stratified by the insurer's initial estimate of the extent of damage. During the first 20 months from the suits were filed, there is no apparent difference in settlement hazards between claims with high initial indemnity reserves and those with low reserves. As litigation prolongs, the difference becomes more pronounced: cases expected to have higher damage levels by the insurer have higher settlement hazards and therefore take shorter to settle. This graphical analysis suggests that the effects of initial indemnity reserve on the settlement hazard are not constant

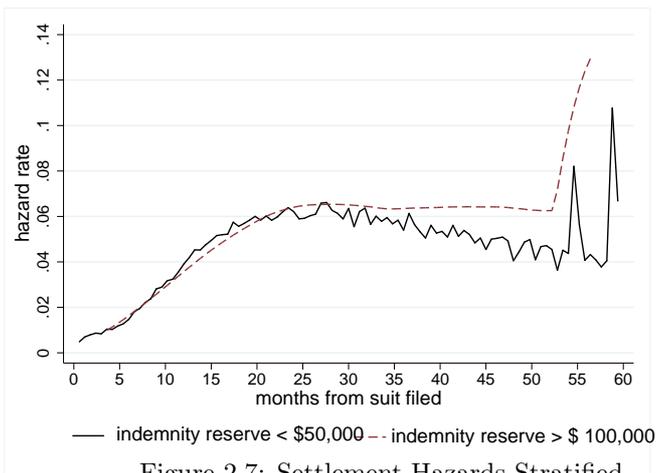


Figure 2.7: Settlement Hazards Stratified by Expected Damages

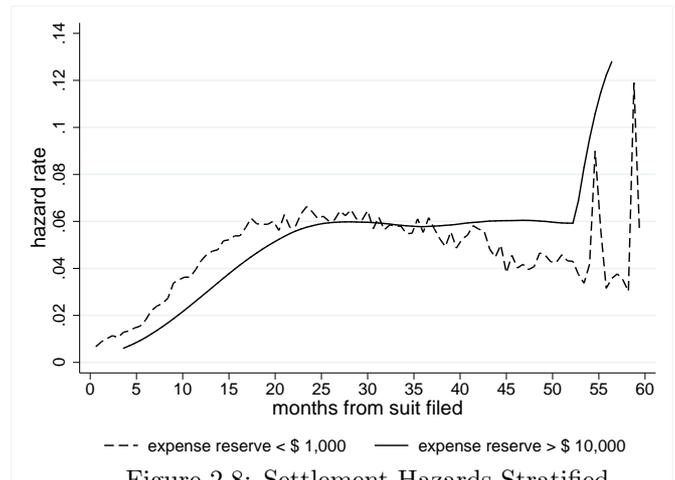


Figure 2.8: Settlement Hazards Stratified by Expected Costs

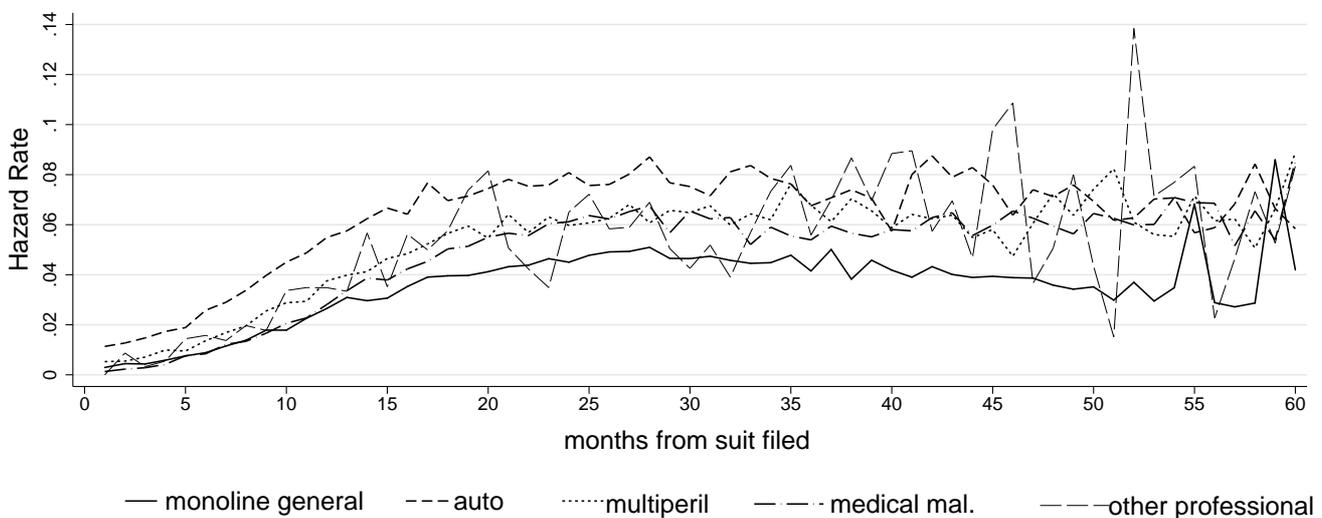


Figure 2.9: Settlement Hazard by Insurance Lines

over time. A caveat to this graphic analysis is that it might not provide an adequate impression of the influence of damages on settlement hazards: The theory presented in section 2.3 suggests that settlement hazards tend to increase with the severity of damages and decrease with legal costs.⁸⁰ But high damages are usually associated with high legal costs.⁸¹ Since the analysis in Figures 2.7 does not single out the effect of damages on settlement hazards from that of legal costs, the effect of damages is likely to be underestimated.

Figure 2.8 provides an interesting snapshot of the settlement hazards stratified by the insurer's initial estimate of the level of defense expenditure. Cases with large initial expense reserves have lower settlement hazards during the first 30 months from the suit was filed. This pattern is reversed, however, as litigation prolongs. This graphical analysis suggests that there is no evidence of a systematic relation between litigation duration and defense expenditures. However, the graph may misrepresents the influence of legal costs on settlement hazards: legal costs usually increase with the severity of

⁸⁰Fenn and Rickman (2001) and Fournier and Zuehlke (1996) make the same prediction that settlement hazards increase with the severity of damage and decrease with the level of legal costs.

⁸¹A regression of *INITIAL INDEMNITY RESERVES* on *INITIAL EXPENSE RESERVES* for all claims reported to the TDI from 1988 to 2005 yields a coefficient of 2.8 (p -value = 0.000) and an R -squared of 0.10. Restricting this regression to the 95% of the observations reporting nonzero initial expense reserves yield an R -squared of 0.16.

damages. Moreover, the hazard rate of settlement tends to increase with the severity of damages but decrease with the level of legal costs. Since Figure 2.8 does not separate the effect of legal costs on settlement hazards from the effect of damages, the effect of legal costs is likely to be underestimated.

Figure 2.9 shows the sample hazards for insurance of different types. There is a clear marked variation across types. In particular, the settlement hazards are much higher for auto liability claims than for monoline general liability and for medical professional liability claims. Table 2.2, together with this figure clearly indicate that the pattern of settlement delays differ considerable across different insurance lines.

■ **Regression analysis.** Table 2.4 reports the Cox regression estimates of the time-dependence coefficients and the baseline coefficients.⁸² Both specifications reported make the baseline ($t = 1$) hazard rate a function of the case characteristics discussed in section 2.4. The specifications differ in their treatment of the duration elasticity. The specification reported in the first column is rather simple, allowing the initial hazard rate a function of explanatory variables but estimating a *single* duration elasticity.

The specification in the second column generalizes the first model by making the duration elasticity a function of the legal system variables and bargaining environment variables. This specification allows me to determine whether there is empirical support for the propositions obtained from my comparative static analysis of Spier's model. Particularly, do the settlement hazards of claims increase or decrease with prejudgment interest rate and delays in trial court? In addition, the second specification makes the incremental effect of prejudgment interest on the duration elasticity a linear function of *INITIAL INDEMNITY RESERVE* and *INITIAL EXPENSE RESERVE*. Essentially, interaction terms for each of these two variables with *PREJUDGMENT INTEREST RATE* are added to the list of explanatory variables that determine the duration elasticity. The benefit of the inclusion of interaction terms is the refinement in explaining the impact of prejudgment interest.

For the simpler specification, reported in columns 1 of Table 2.4, the significantly negative sign of the coefficient of *PREJUDGMENT INTEREST RATE* suggests that cases with higher prejudgment interest rates take longer to settle. In other words a reform that is designed to reduce delay through the imposition of prejudgment interest have the actual effect of increasing delay, in line with my theoretical prediction.

A one percentage point increase in prejudgment interest rate would reduce the settlement hazard by 67 percent.⁸³ An important caveat to this interpretation is raised by the lack of control for the effects of changes in social, economic and legal systems.⁸⁴ Recall that *PREJUDGMENT INTEREST RATE* equals 10 for cases terminated before 1st August 2003 and 5 for damage negotiations initiated after 1st August 2003. My model cannot determine whether the empirical differences attributed to prejudgment interests reflect the impact of such interests on litigation behavior, or these differences reflect developments in technology, social environment or other features of the legal system in the

⁸²The continuous variables are in terms of natural logs so that the coefficients in the equation equals the duration elasticities of the hazard rate with respect to the independent variables. In addition, I add one to all values before taking natural logs because some claims report zero values.

⁸³ $1 - \exp\{-1.696\} \approx 81.7\%$

⁸⁴I am grateful to two anonymous defense committee members for raising this issue concerning potential model misspecification.

TABLE 2.4. COX REGRESSION PARAMETER ESTIMATES^a

Variable	BARGAINING SAMPLE (<i>N</i> = 67, 130)	
	Log (<i>DURATION</i>)	Log (<i>DURATION</i>)
Time-Dependence Parameters		
Log(<i>PREJUDGMENT INTEREST RATE</i>)		-0.683 (0.113)
Log(<i>CONGESTION</i>)		0.023** (0.009)
<i>JOINT & SEVERAL LIABILITY</i>		0.209* (0.024)
<i>NONECONOMIC DAMAGES</i>		0.094* (0.013)
BARGAINING ENVIRONMENT		
Log(<i>INITIAL INDEMNITY RESERVE</i>)		-0.142* (0.018)
Log(<i>INITIAL EXPENSE RESERVE</i>)		0.057** (0.009)
Log(<i>INSURED'S FAULT</i>)		-0.031* (0.011)
<i>MULTIDEF</i>		0.292* (0.017)
INTERACTION		
Log(<i>INITIAL INDEMNITY RESERVE</i>)		0.045** (0.007)
Log(<i>INITIAL EXPENSE RESERVE</i>)		-0.014** (0.004)
Baseline Parameters		
LEGAL SYSTEM		
Log(<i>PREJUDGMENT INTEREST RATE</i>)	-1.696* (0.043)	-0.906 (0.213)
Log(<i>CONGESTION</i>)	-0.055** (0.006)	-0.127* (0.027)
<i>JOINT & SEVERAL LIABILITY</i>	-0.073* (0.014)	-0.762† (0.080)
<i>NONECONOMIC DAMAGES</i>	-0.086** (0.008)	-0.376† (0.041)
BARGAINING ENVIRONMENT		
Log(<i>INITIAL INDEMNITY RESERVE</i>)	0.016** (0.002)	0.127** (0.009)
Log(<i>INITIAL EXPENSE RESERVE</i>)	-0.013** (0.001)	-0.085** (0.004)
Log(<i>INSURED'S FAULT</i>)	0.003** (0.006)	0.108* (0.035)
<i>MULTIDEF</i>	-0.150* (0.010)	-1.042† (0.053)
DELEGATION STRATEGY		
<i>PLAINTIFF LAWYER</i>	-0.278† (0.095)	-0.287† (0.095)
<i>OUTSIDE DEFENSE COUNSEL</i>	-0.268* (0.011)	-0.265* (0.011)

(continued overleaf)

TABLE 2.4. (Continued)

Variable	BARGAINING SAMPLE (<i>N</i> = 67,130)	
	Log (<i>DURATION</i>)	Log (<i>DURATION</i>)
CASE CHARACTERISTICS		
Insurance		
Monoline general liability	-0.209* (0.037)	-0.214* (0.037)
Commercial auto liability	0.201* (0.037)	0.181* (0.037)
Commercial multiperil	-0.038* (0.038)	-0.041* (0.038)
Medical professional liability	-0.093* (0.038)	-0.108* (0.038)
Injury		
Death	-0.060* (0.015)	-0.058* (0.015)
Amputation	-0.088* (0.031)	-0.090* (0.031)
Burns (heat)	-0.093* (0.028)	-0.094* (0.028)
Burns (chemical)	-0.114† (0.051)	-0.104† (0.051)
Systemic poisoning (toxic)	-0.454* (0.036)	-0.590* (0.038)
Systemic poisoning (other)	0.035† (0.071)	0.056† (0.071)
Eye injury (blindness)	-0.019* (0.034)	-0.023* (0.034)
Respiratory condition	-0.418* (0.032)	-0.510* (0.033)
Nervous condition	-0.089* (0.031)	-0.081* (0.031)
Hearing loss or impairment	-0.054† (0.051)	-0.057† (0.051)
Circulatory condition	0.017* (0.044)	0.031* (0.044)
Multiple injuries	0.064* (0.011)	0.066* (0.011)
Back injury	0.030* (0.012)	0.030* (0.012)
Skin disorder	0.144* (0.055)	0.139† (0.055)
Brain damage	-0.161* (0.019)	-0.160* (0.019)
Scarring	0.121* (0.022)	0.118* (0.022)
Spinal cord injuries	-0.120* (0.030)	-0.120* (0.030)
Other	0.021* (0.013)	0.024* (0.013)
Log likelihood	-677,292.87	-676,514.41

a. Standard errors are shown in parentheses.

† significant at 10 percent level; * significant at 5 percent level; ** significant at 1 percent level. Omitted insurance policy type is other professional liability.

Source: Author's calculations based on the Texas Department of Insurance Commercial Liability Insurance Closed Claim database for the years 1988-2005.

same period. This problem will be further addressed in section 2.6.2. The coefficient of my measure of court congestion, *CONGESTION*, is significantly negative. This indicates that delays in trial courts increase delays in settlement out of court. Furthermore, the coefficient of *JOINT & SEVERAL LIABILITY* and that of *NONECONOMIC DAMAGES* are significantly negative. This suggests that cases take longer to settle when joint and several liability impacts settlement or potential verdict and when non-economic damage is an element of compensation.

However, some of the baseline coefficient in the first model are not consistent with my theoretical predictions. The coefficient of my measure of stakes, *INITIAL INDEMNITY RESERVE* is significantly positive. The coefficient of my measure of litigation time-length and legal costs, *INITIAL EXPENSE RESERVE*, is significantly negative. The coefficient of my measure of the tortfeasor's liability, *INSURED'S FAULT* is significantly positive. Therefore, it appears that a claim on which the insurer expects that the damages and liabilities are higher, *ceteris paribus*, be associated with shorter delays; a case that the insurer expects to cost more, *ceteris paribus*, be associated with longer delays. These results deserve close attention: they conflict with the prediction obtained from the theory and questions the appropriateness of Cox's (1972) proportional hazard model in fitting the sample data.

Furthermore, the significantly negative coefficient of *MULTIDEF* provides an intuitively appealing result: settlement agreement is more difficult to reach when there are multiple parties negotiating.⁸⁵

As a final note on this simple model, the significantly negative coefficients of *PLAINTIFF LAWYER* and *OUTSIDE DEFENSE COUNSEL* and suggest a clear link between settlement delay and the litigants' delegation strategies: settlement is more difficult to obtain for cases in which the defendant retains an outside defense counsel. However, I am not able to establish causality between lawyer involvement in the litigation game and increased delay.

One shortfall of the first specification in Table 2.4 is that attribute variation (i.e., variation in the explanatory variables), to the extent it has any impact, is constrained to generate parallel shifts in the log-hazard function. The baseline coefficients reported above determine intercept shifts in the linear relationship between the log-hazard function and the log of current duration. The generalized model reported in column 2 allows variation in legal system, bargaining environment and parties' delegation strategy to change both the intercept and slope of this linear relationship. The coefficients reported under the heading Time-Dependence Parameters gauge the effect of changes in institutional and bargaining environments on the slope, or duration elasticity, of this linear relationship.

As in the first model, the baseline coefficient of *PREJUDGMENT INTEREST RATE* is negative, but statistically insignificant and much smaller in absolute value. The time-dependence coefficient of *PREJUDGMENT INTEREST RATE* is a linear function of *INITIAL INDEMNITY RESERVE* and *INITIAL EXPENSE RESERVE*. The constant term of this linear function is negative but statistically insignificantly. The increment to the duration elasticity following a percentage increase in prejudgment interest rate is estimated to be -0.305 at the means of *INITIAL INDEMNITY RESERVE* and *INITIAL EXPENSE RESERVE*.⁸⁶ This result might best be interpreted as follows: on average, high prejudgment interest discourages settlement. But the adverse effect is not significant. The incremental effect of *PREJUDGMENT INTEREST*

⁸⁵Kornhauser and Revesz (1994) show that cases associated with multiple defendants who share joint and several liability have lower likelihood of settlement when the plaintiffs' probabilities of trial success are sufficiently uncorrelated across cases.

⁸⁶ $-0.683 + 0.045 \cdot \ln(76,074) - 0.014 \cdot \ln(9,065) \approx -0.305$. The time-dependence coefficient of *PREJUDGMENT INTEREST RATE*, estimated at the means of *INITIAL INDEMNITY RESERVE* and *INITIAL EXPENSE RESERVE* for back injury, skin disorder, death, amputation, are -0.09, -0.033, -0.008, and -0.019, respectively.

RATE on duration elasticity is found to be increasing in stakes and decreasing in litigation costs. However, as mentioned earlier there is a caveat to the accuracy of my analysis raised by the lack of control for the effects of changes in social, economic and legal environments.⁸⁷

Both the baseline coefficient and the time-dependence coefficient of *CONGESTION*, my measures of trial delays, are negative and statistically significant. Thus, an increase in trial delays results in a log-hazard profile with significantly lower intercept and a smaller slope. Hence, cases filed in jurisdictions with longer trial delays always tend to have longer settlement delays. This result contradicts the prediction of the theoretic model (see inequalities (11)) that increased delays in trial courts lead to decreased delays in out-of-court settlement (i.e., $h_T > 0$).

The estimates of *JOINT & SEVERAL LIABILITY* provide an interesting result. As in the first model, the baseline coefficient of *JOINT & SEVERAL LIABILITY*, is negative and statistically significant, but much larger in absolute value. In contrast to its baseline effect, the time-dependence coefficient of *JOINT & SEVERAL LIABILITY* is significantly positive. Thus, cases where joint and several liability has an impact on settlement has a log-hazard profile with a lower intercept and a greater slope. Since the time-dependence coefficient is small relative to the baseline coefficient, however, the effect of joint and several liability shifts the hazard profile downward for majority of cases settled before trial.⁸⁸

There is a similar pattern associated with my measure of uncertainty in law, *NONECONOMIC DAMAGES*, where the baseline and time-dependence effects work in opposition. Its baseline coefficient is far more negative than that of the simple model, and its estimated time-dependence coefficient is positive but much smaller in absolute value than its base-line effect. Thus, allowing non-economic loss as an element of damage compensation results in a log-hazard function with a lower intercept and a greater slope. Since the time-dependence coefficient is small relative to the baseline coefficient, however, the unexpected time-dependence effect of *NONECONOMIC DAMAGES* does not overcome the baseline effect until duration exceeds approximately 55 months,⁸⁹ encompassing approximately 93% of the cases in the bargaining sample. This indicates that uncertainty in law generates longer delays in settlement for most of the cases.

Turning to the insurer's prior estimates on stakes, the baseline coefficient of *INITIAL INDEMNITY RESERVE* is significantly positive and greater in absolute value than the corresponding estimate from the simpler model. The time-dependence coefficient of *INITIAL INDEMNITY RESERVE* is a linear function of *PREJUDGMENT INTEREST RATE*: it is estimated to be -0.035 at the mean of *PREJUDGMENT INTEREST RATE*. Thus, an increase in *INITIAL INDEMNITY RESERVE* results in a log-hazard profile with a significantly larger intercept and a significantly smaller slope. The net effects, judged within the observed range of duration, are not consistent with the theory. Estimated at the mean of *PREJUDGMENT INTEREST RATE*, a unit increase in *INITIAL INDEMNITY RESERVE*, results in a *lower* probability of settlement after approximately 38.8 months, encompassing only 17.3% of the cases in the bargaining sample. This finding is not consistent with Spier's (1992) theoretic prediction and with Fenn and Rickman's (2001) and Kessler's (1996) evidence from motor-insurance claims and Fenn and Rickman's (1999)

⁸⁷I am grateful to two anonymous defense committee members for raising this issue concerning potential model misspecification.

⁸⁸The time-dependence effect of *JOINT & SEVERAL LIABILITY* does not overcome the baseline effect until duration exceeds approximately 38 ($\exp\{0.762/0.209\} \approx 38$) months, encompassing approximately 82% of the cases in the bargaining sample.

⁸⁹ $\exp\{0.376/0.094\} \approx 55$.

study of medical negligence and employee cases. They found that delays increase when the estimated damages are high. However, this result has foundation in the work of Priest and Klein (1984).⁹⁰

Turning to the measures of litigation costs, *INITIAL EXPENSE RESERVE*, provides an intuitive result that is consistent with the theory. Its baseline coefficient is significantly negative in the generalized model. The time-dependence coefficient of *INITIAL EXPENSE RESERVE*, is a linear function of *PREJUDGMENT INTEREST RATE*: it is estimated to be 0.024 at the mean of *PREJUDGMENT INTEREST RATE*. Thus, an increase in *INITIAL EXPENSE RESERVE* results in a log-hazard profile with a significantly smaller intercept and a significantly greater slope. The net effects, judged within the observed range of duration, are not supported by the theory. A unit increase in *INITIAL EXPENSE RESERVE*, results in a higher probability of settlement until more than 36 months after a suit is filed, encompassing approximately 80% of the cases in the bargaining sample. This finding is not consistent with Spier's (1992) theoretic prediction.

In relation to the insured's fault (i.e., the plaintiff's likelihood of prevailing in court), the prediction of the theoretic model is not supported by the empirical result: for 76% of the out-of-court settlements,⁹¹ higher fault is significantly associated with higher settlement hazards and therefore shorter delays. Although this evidence conflicts with the prediction obtained from the theory and questions the validity of Spier's model in this regard, it has foundation in the work of Priest and Klein (1984).⁹²

Turning to the parties' delegation strategies, the coefficients of *PLAINTIFF LAWYER* and *OUTSIDE DEFENSE COUNSEL* are both significantly negative. This suggests that cases involving plaintiff lawyer and outside defense counsel are significantly and strongly associated with longer delays.

The coefficients also indicate that claims associated with less complex and more routine insurance lines take shorter to settle. In the augmented model, for example, the hazard rate of settlement of commercial auto liability claims is approximately 1.5 times ($\exp\{0.181\} \exp\{-0.214\} \approx 1.5$) as great as that for monoline general liability, 1.5 times ($\exp\{0.181\} / \exp\{-0.041\} \approx 1.3$) as great as that for commercial multiperil, 1.3 times as great as that for medical professional liability claims and 1.2 times as great as that for other professional liability.

The injury variables reflect both case complexity and the scale of the claim. The estimated effects of injury types on settlement hazards are economically plausible. In comparison with the omitted category of multiple injuries, cases take longer to settle if they are associated with fatal injuries and very serious injury types: amputations, burns, systemic poisoning-toxic, brain damage and spinal cord injuries. In contrast, less complex and minor injuries such as skin disorder, back injury and circulatory conditions have shorter settlement delays.

⁹⁰Priest and Klein (1984) assumes that settlement occurs when the parties can identify settlement terms that make them both better off, in their view, than going to trial. A crucial determinant of settlement, therefore, is the defendant's assessment of the severity of damage. When the defendant estimates that the severity of damage is high, she is more likely to agree with the plaintiff's settlement terms.

⁹¹The time-dependence effect, following a unit increase in *INSURED'S FAULT*, does not overcome the baseline effect until duration exceeds approximately 31 ($\exp\{0.108/0.031\} \approx 33$) months, encompassing approximately 76% of the cases settled prior to trial.

⁹²Priest and Klein (1984) assumes that settlement occurs when the parties can identify settlement terms that make them both better off, in their view, than going to trial. A crucial determinant of settlement, therefore, is the defendant's assessment of its own liability. When the defendant's (or the insured's) fault is high, *ceteris paribus*, the defendant is more likely to agree with the plaintiff's settlement terms.

2.6.2. CAVEATS AND ROBUSTNESS CHECKS

The results in the previous section suggest that prejudgment interest has unjustifiably large negative influence on the duration of settlement. In this section, I discuss the steps I take to control for the effects of omitted legal factors that may be correlated with both settlement probability and the included variables of interest.

The prejudgment interest reform was enacted since August 2003. Several other reforms were enacted in the same period in Texas. The most prominent of these are noneconomic damage caps reform, early offer reform for medical professional liability claims, and joint and several liability reform (see Avraham (2006a)). The effect of noneconomic damage caps, when they are binding, is to reduce trial awards.⁹³ As discussed in Section 2.3, reduction in trial awards could lead to an increase in settlement hazards. The early offer statute provides the insurer in a medical professional liability claim with an option of making a prompt settlement offer to the plaintiff that covers earning losses and medical expenses. If the offer is rejected, then the plaintiff may pursue extensive litigation. However, the standard of proof will be raised at trial.⁹⁴ Hersch *et al.* (2007) estimate that settlement will be expedited by the introduction of early offer statute. The joint and several liability reform provides that defendant pays only assessed percentage of fault unless the defendant is 50 percent or more responsible, and that defendants can designate other responsible parties whose fault contributed to causing plaintiff's harm. As discussed in Section 2.4, joint and several liability can affect both the probability of litigation and the size of the award, thereby affecting the settlement hazards.

An important limitation to my results reported in Table 2.4 is that I do not distinguish between changes in the settlement hazards that are caused by the prejudgment interest reform from those that are caused by the other reforms enacted in the same period. To see if this might be driving my key findings,⁹⁵ I rerun the model in the second column of Table 2.4 but omit the observations where joint and several liability is applicable or noneconomic damage is an element of damage compensation. In addition to that, I omit medical professional liability claims for which the early offer statute and noneconomic damage caps are applicable. Because of these restrictions, the resulting subsample contains 29,583 cases. I will refer to this subsample as the restricted sample.

After controlling for the potential effects of noneconomic damage caps reform, early offer statute and joint and several liability reform, the baseline coefficient of *PREJUDGMENT INTEREST RATE* becomes larger in absolute value but remains statistically insignificant. Meanwhile, the time-dependence coefficient of *PREJUDGMENT INTEREST RATE* becomes smaller. The decrement to the duration elasticity following a percentage increase in *PREJUDGMENT INTEREST RATE* is estimated to be -0.135 at the means of *INITIAL INDEMNITY RESERVE* and *INITIAL EXPENSE RESERVE* for the bargaining sample. This is much

⁹³Using the Texas Department of Insurance Commercial Liability Insurance Closed Claim database for the years 1988-2004, Hyman (2008) *et al.* estimate that for pro-plaintiff jury verdicts, the caps affect 47% of verdicts, and reduces average verdict amount by 26%. In cases settled without trial, the caps affect 18% of cases; and reduces average settlement payment by 18%.

⁹⁴Under this system, a defendant has the option, not the obligation, to offer the injured victim, within 180 days after a claim is filed, periodic payment of the claimant's net economic losses as they accrue. Economic losses under an early-offers statute must cover medical expenses, including rehabilitation, plus lost wages, to the extent that all such costs are not already covered by insurance or other collateral sources, plus attorney's fees.

⁹⁵I gratefully acknowledge the suggestions from two anonymous defense committee members, Ronen Avraham, Paul Fenn and participants of American Law and Economics Association 18th Annual Meeting (May 2008) for me to conduct a robust check to verify whether my results are affected by changes in the legal system.

smaller in absolute value than the value of -0.305 derived from column 2 of Table 2.4. The incremental effect of *PREJUDGMENT INTEREST RATE* on the duration elasticity is also found to be increasing in stakes and decreasing in litigation costs. Thus, my empirical evidence suggests, the initial decrease in the baseline hazard rate experienced by cases with high prejudgment interest rate is reinforced more quickly for cases with lower stakes and higher litigation costs.

Moreover, claims involve noneconomic damage, joint and several liability and medical malpractice are usually more complex and associated with higher uncertainty.⁹⁶ The smaller time-dependence coefficient of *PREJUDGMENT INTEREST RATE* for in restricted sample suggests that the adverse effect of *PREJUDGMENT INTEREST RATE* on duration elasticity increases with uncertainty. This is consistent with the prediction (inequality (22)) of the theoretic model ($h_{R\xi} > 0$).

2.6.3. ALTERNATIVE DELAY INDICATORS

In this subsection I briefly describe exercises I conducted to see if the results above are robust to my empirical modeling assumptions. The previous subsections reveal a negative but statistically insignificant impact of prejudgment interest and court delays on litigation durations measured as the time elapsed between the date of filing of a case and the date of case termination. In this subsection, I investigate the robustness of this finding to the use of alternative measures of litigation delays: [1] the time elapsed between injury and case termination, and [2] the time elapsed between the insurer receiving a damage claim and case termination.

I rerun the model in the second column of Table 2.4. To control for the effects of omitted institutional characteristics that may be correlated with both settlement likelihood and prejudgment interest rates, the regressions are run on the restricted sample. Estimates of the time-dependence coefficients and the baseline coefficients are presented in columns 2 and 3 of Table 2.5.

For litigation durations measured as time between injury and case closure, reported in column 2 of Table 2.5, the baseline hazard of *PREJUDGMENT INTEREST RATE* is negative, and large in absolute value, but statistically insignificant. As with previous specifications, this model finds a insignificantly lower baseline hazard rate for cases with higher a prejudgment interest rates. Unlike in the previous specifications, however, the duration elasticity is estimated to be positive (1.54) at the means of *INITIAL INDEMNITY RESERVE* and *INITIAL EXPENSE RESERVE* of the restricted sample. Since the time-dependence coefficient is small relative to the baseline coefficient, however, a unit increase in *PREJUDGMENT INTEREST RATE* results in a hazard profile with a lower probability of settlement for approximately 77.9 months, encompassing approximately 99 % of cases in the restricted sample. Therefore, the overall effect of *PREJUDGMENT INTEREST RATE* is consistent with my results.

The measure of court backlog, *CONGESTION*, provides an interesting result. Its baseline coefficient was significantly negative in the previous models, but is significantly positive when litigation duration is measure by time elapsed from injury. Its time-dependence coefficient becomes significantly negative. Thus, an increase in *CONGESTION* results in a log-hazard profile with a significantly greater intercept and a significantly smaller slope. The time-dependence effect of an increase in *CONGESTION* overcomes

⁹⁶See Section 2.4 for discussion on uncertainty associated with noneconomic damage claims and medical malpractice claims. Among the litigated cases for the years 1988-2005, my calculation using the TDI data indicates that the standard deviations for trial awards with joint and several liability (resp. with single liability claims) is \$ 3.59e+07 (resp. \$ 3,109,769). This serves as evidence that higher uncertainty is associated with claims with joint and several liability.

TABLE 2.5. ROBUSTNESS CHECKS: ALTERNATIVE SPECIFICATIONS FOR PRETRIAL SETTLEMENT^a

Variable	Tort reforms	Time between	Time between
	(<i>N</i> = 29, 583)	Injury & Closure (<i>N</i> = 29, 583)	Claim & Closure (<i>N</i> = 29, 583)
	Log (<i>DURATION</i>)	Log (<i>DURATION-1</i>)	Log (<i>DURATION-2</i>)
Time-Dependence Parameters			
Log(<i>PREJUDGMENT INTEREST RATE</i>)	-0.198 (0.137)	1.358 (0.133)	-0.599 (0.166)
Log(<i>CONGESTION</i>)	0.000* (0.013)	-0.038* (0.018)	-0.030* (0.017)
BARGAINING ENVIRONMENT			
Log(<i>INITIAL INDEMNITY RESERVE</i>)	-0.035* (0.023)	-0.044* (0.020)	-0.173* (0.025)
Log(<i>INITIAL EXPENSE RESERVE</i>)	0.057* (0.012)	0.003* (0.010)	0.027* (0.012)
Log(<i>INSURED'S FAULT</i>)	-0.074* (0.015)	-0.029* (0.020)	0.102* (0.018)
<i>MULTIDEF</i>	0.000** (0.000)	0.187* (0.033)	-0.101* (0.029)
INTERACTION			
Log(<i>INITIAL INDEMNITY RESERVE</i>)	0.017** (0.009)	0.013** (0.008)	0.047** (0.009)
Log(<i>INITIAL EXPENSE RESERVE</i>)	-0.014** (0.005)	0.004** (0.004)	-0.012** (0.005)
Baseline Parameters			
LEGAL SYSTEM			
Log(<i>PREJUDGMENT INTEREST RATE</i>)	-1.411 (0.247)	-6.712 (0.338)	-2.553 (0.391)
Log(<i>CONGESTION</i>)	-0.042* (0.039)	0.111 [†] (0.065)	0.069 [†] (0.059)
BARGAINING ENVIRONMENT			
Log(<i>INITIAL INDEMNITY RESERVE</i>)	-0.012* (0.013)	0.070* (0.018)	0.238* (0.021)
Log(<i>INITIAL EXPENSE RESERVE</i>)	-0.080** (0.006)	-0.056** (0.010)	0.004** (0.009)
Log(<i>INSURED'S FAULT</i>)	0.273* (0.047)	0.160 [†] (0.076)	-0.360 [†] (0.060)
<i>MULTIDEF</i>	-0.207 (0.135)	-0.783 [†] (0.119)	0.337 [†] (0.099)
DELEGATION STRATEGY			
<i>PLAINTIFF LAWYER</i>	-0.362* (0.016)	-0.054 [†] (0.135)	-0.053 (0.135)
<i>OUTSIDE DEFENSE COUNSEL</i>	-0.170* (0.017)	-0.236* (0.016)	-0.244* (0.016)

(continued overleaf)

TABLE 2.5. ROBUSTNESS CHECKS: ALTERNATIVE SPECIFICATIONS^a

Variable	Tort reforms	Time between	Time between
	(<i>N</i> = 29, 583)	Injury & Closure	Claim & Closure
		(<i>N</i> = 29, 583)	(<i>N</i> = 29, 583)
	Log	Log	Log
	(<i>DURATION</i>)	(<i>DURATION-1</i>)	(<i>DURATION-2</i>)
CASE CHARACTERISTICS			
Insurance			
Monoline general liability	-0.170*	-0.148*	-0.134*
	(0.017)	(0.017)	(0.017)
Commercial auto liability	0.251*	0.340*	-0.014*
	(0.016)	(0.017)	(0.016)
Other professional liability	0.016*	-0.075*	0.078*
	(0.047)	(0.047)	(0.047)
Injury			
Death	-0.175*	0.015*	-0.016*
	(0.024)	(0.024)	(0.024)
Amputation	-0.150†	-0.059†	0.013†
	(0.053)	(0.053)	(0.053)
Burns (heat)	-0.137*	-0.002†	-0.013*
	(0.042)	(0.043)	(0.042)
Burns (chemical)	-0.199†	-0.132†	-0.120†
	(0.076)	(0.076)	(0.076)
Systemic poisoning (toxic)	-0.291*	-0.656†	-0.133†
	(0.063)	(0.064)	(0.063)
Systemic poisoning (other)	-0.042	0.031†	-0.082
	(0.120)	(0.120)	(0.120)
Eye injury (blindness)	-0.034†	-0.062†	-0.017†
	(0.059)	(0.059)	(0.059)
Respiratory condition	-0.577†	-1.049†	-0.386*
	(0.052)	(0.057)	(0.052)
Nervous condition	-0.138*	-0.153*	-0.050**
	(0.046)	(0.046)	(0.046)
Hearing loss or impairment	-0.092†	-0.078†	-0.144†
	(0.085)	(0.085)	(0.085)
Circulatory condition	0.006†	0.111†	0.045†
	(0.076)	(0.076)	(0.076)
Multiple injuries	0.038*	0.096*	0.043*
	(0.016)	(0.016)	(0.016)
Back injury	0.003*	-0.013*	-0.060**
	(0.016)	(0.016)	(0.016)
Skin disorder	-0.087†	-0.142†	0.014†
	(0.093)	(0.093)	(0.093)
Brain damage	-0.167*	-0.135*	-0.113**
	(0.035)	(0.035)	(0.035)
Scarring	0.115*	0.200*	0.121**
	(0.033)	(0.033)	(0.033)
Spinal cord injuries	-0.194*	-0.113*	-0.059**
	(0.048)	(0.048)	(0.048)
Other	0.032*	0.037*	0.053*
	(0.019)	(0.019)	(0.019)
Log likelihood	-274,367.35	-272,746.2	-275,447.1

a. Standard errors are shown in parentheses.

† significant at 10 percent level; * significant at 5 percent level; ** significant at 1 percent level.

Source: Author's calculations based on the Texas Department of Insurance Commercial Liability Insurance Closed Claim database for the years 1988-2005. All three regressions exclude medical professional liability claims, joint and several liability claims and claims involve noneconomic damages claims. Omitted insurance policy type is multiperil liability.

the baseline effect fairly slowly. A unit increase in *CONGESTION* results in a hazard profile with a lower probability of settlement after approximately 18 months, encompassing 46.1% of the cases in the restricted sample. This result suggests that the effect of trial delay on settlement delay is not constant over time.

A final robustness check reported in column 3 of Table 2.5, treats litigation duration as elapsed time between the date that a case is reported to insurer and date of case closure.

The estimated effect of *PREJUDGMENT INTEREST RATE* is robust to this alternative measure. The baseline hazard remains negative and statistically insignificant. The time-dependency coefficient is estimated to be -0.183 at the means of *INITIAL INDEMNITY RESERVE* and *INITIAL EXPENSE RESERVE* of the restricted sample. This is comparable to the value of -0.135 derived from column 1 of Table 2.5.

Turning to my measure of trial delays, the baseline coefficient of *CONGESTION* is significantly positive but smaller than that in the previous model. The time-dependence coefficient is significantly negative and smaller in absolute value than that in the previous specification. The time-dependence effect of a unit increase in *CONGESTION* overcomes the baseline effect after approximately 10 months, encompassing but 17% of the cases in the restricted sample. This result suggests that the effect of trial delay on settlement delay is not constant over time.

2.6.4. EFFECT OF PREJUDGMENT INTEREST ON SETTLEMENT PAYMENT

In this section I briefly describe exercises I conducted to examine the effect of change in prejudgment interest rate on the level of settlement payment.

■ **Regression analysis.** Table 2.6 in the appendix reports the OLS regression estimates of the coefficients.⁹⁷ My key interests are the effects of prejudgment interest and court backlogs on plaintiff's payoff. As before, to isolate the effect of prejudgment interest reform from the effects of other legal reforms I omit the observations where joint and several liability is applicable or noneconomic damage is an element of damage compensation. In addition to that, I exclude medical professional liability claims for which the early offer statute is applicable.

A one percentage point increase in prejudgment interest rate would reduce the settlement payment by 26 percent.⁹⁸ This suggests that cases with higher prejudgment interest rates receive smaller settlement payment, holding claim and other institutional characteristics constant. In other words a reform that is designed to reduce delay through the imposition of prejudgment interest has the unexpected effect of worsening the plaintiff's bargaining position *vis-à-vis* the defendant in pretrial negotiation. This result is inconsistent with my theoretical prediction.

The unrealistically large negative effect raises a caveat to my analysis. Recall that *PREJUDGMENT INTEREST RATE* equals 10 for claims closed before 1st August 2003 and 5 for damage negotiations initiated after 1st August 2003. My model cannot determine whether the empirical differences attributed to prejudgment interests reflect the impact of such interests on litigation behavior, or these differences reflect developments in technology and social environment in the same period. Changes in the legal system that is not controlled for in my model (e.g., damage caps) may also display a negative effect on the magnitude of damage payments.

⁹⁷The continuous variables are in terms of natural logs so that the coefficients in the equation equals the duration elasticities of the hazard rate with respect to the independent variables. In addition, I add one to all values before taking natural logs because some claims report zero values.

⁹⁸ $1 - \exp\{-0.557\} \approx 42\%$

The coefficient of *CONGESTION*, my measures of trial delays, are positive and statistically significant. Hence, cases filed in jurisdictions with longer trial delays always tend to receive larger settlement payment. This result is consistent with the prediction of the theoretic model (see inequalities (24)) that increased delays in trial courts lead to increased settlement payment (i.e., $\psi_T > 0$).

2.7. CONCLUSION

The social costs of delay in the resolution of legal disputes have motivated an extensive literature investigating its causes. However, much less work has investigated a related and more policy-relevant question: how do legal systems affect delay in settlement? To address this question, I have presented a model developed by Spier (1992) and adapted by Fenn and Rickman (1999) where pretrial negotiation takes place over a finite period of time prior to a fixed trial date. In the absence of direct information on the trial outcome, the defendant presents the plaintiff with an increasing sequence of offers. Facing such a schedule, low type plaintiffs will settle early for lower damage payments, while high type plaintiffs will be prepared to delay agreement until settlement offers raise. The model predicts that duration of settlement is influenced by variables reflecting the legal system. These include the level of the prejudgment interest rate and the time required for a case to reach trial. Using the Texas Department of Insurance Commercial Liability Insurance Closed Claim database on 67,130 filed cases for the years 1988-2005, I estimate the influence of these institutional factors on the timing of settlement and present two major findings.

My empirical work suggests changes in prejudgment interest rate have no statistically significant effect on the duration of litigation. This observation, if it is indeed correct, is inconsistent with a theoretic model where only the plaintiff has private information. An important limitation to this result is that I am not able to identify all the shocks in the social, economic and legal environments that changed the duration of litigation around the time of prejudgment interest reform. My parameter estimates for the effect of prejudgment interest therefore contain a potential misspecification bias. The same lack of control for changes in social, economic and institutional environments has plagued my analysis on the effect of prejudgment interest on damage payments. Further, I show that longer delays in trial courts are associated with longer delays in out-of-court settlement. This finding suggests that policies that streamline the court system by reducing court congestion will expedite both public and private resolution of disputes.

On balance, the evidence in favor the screening interpretation of settlement delay is weak. There were a number of phenomena that did not seem to be readily explained by Spier's (1992) model of pretrial bargaining. Chief among these is the puzzle of why longer delays in out-of-court settlement are associated with longer delays in trial courts. Might the opportunity that delays in court provide to proceed with discovery or inference of new information explain this unpredicted effect?⁹⁹ In addition, the litigation duration apparently moves in opposite directions over the insured's fault after reallocating for the plaintiff's negligence. Higher prejudgment interest rate that enlarge trial stakes are associated with lower settlement payment. These are intriguing results, which present challenging problems for analysis. Further theoretical and empirical research will obviously be required to fully describe the determinants of litigation delays in these data. Finally, there were considerable unexplained variations in litigation durations as well as variations across case characteristics, suggesting

⁹⁹A similar remark about alternative causes of delay in litigation was made by Kennan and Wilson (1990).

that there are numerous factors not quantified in my analysis that are important determinants of litigation delays.

This is consistent with the view that it is extremely difficult to model the complexities of the bargaining process with its emphasis on strategic behavior under uncertainty and asymmetric information. Nevertheless, the screening model does provide a simple but theoretically consistent way of analyzing delay determinants, and it does receive some empirical support. My interpretation is that is a promising way of bringing some understanding to the empirical regularities in this complex area.

2.8. APPENDIX

TABLE 2.1. VARIABLE DEFINITIONS

Variable	Definitions
<i>DURATION</i>	The number of months from the date suit filed to the date claim closed.
<i>DURATION-1</i>	The number of months from the date of injury to the date claim closed.
<i>DURATION-2</i>	The number of months from the date reported to insurer to the date claim closed.
<i>STAGE</i>	Legal stage where settlement was reached. The stages are <ul style="list-style-type: none"> - Alternative dispute resolution; - Settlement before trial; - Settlement during trial, before court verdict; - Court verdict; - Settlement reached after verdict; - Settlement after appeal filed; - Case dismissed or summary judgment.
<i>SETTLEMENT PAYMENT</i>	Total settlement amount including economic damages, noneconomic damages, prejudgment interest, and exemplary damages.
LEGAL SYSTEM	
<i>PREJUDGEMENT INTEREST RATE</i>	The prejudgment interest rate of Texas. The rate is 10% a year for claims settled before August 2003 and 5% a year for claims reported after August 2003.
<i>JOINT & SEVERAL LIABILITY</i>	Indicator with value 1 if the doctrine of joint and several liability has an impact on settlement or court verdict, 0 otherwise.
<i>NONECONOMIC DAMAGES</i>	Indicator with value 1 if non-economic loss is an element of damage compensation, 0 otherwise.
<i>CONGESTION</i>	Population mean of the number of months required to continue litigation until the date of trial for cases in the same judicial district.
BARGAINING ENVIRONMENT	
<i>INITIAL INDEMNITY RESERVE</i>	The amount of the insurer's initial indemnity reserve.
<i>VARIANCE</i>	Sample variance of the log-dollar amount awarded to prevailing plaintiffs in completed trials for cases of the same injury type and judicial circuit.
<i>INITIAL EXPENSE RESERVE</i>	The amount of the insurer's initial expense reserve.
<i>INSURED'S FAULT</i>	Insured's percentage of fault after reallocating for claimant's negligence.
<i>MULTIDEF</i>	Indicator with value 1 if multiple defendants were involved, 0 otherwise.
DELEGATION STRATEGY	
<i>PLAINTIFF LAWYER</i>	Indicator with value 1 if the plaintiff hires a lawyer; 0 otherwise.
<i>OUTSIDE DEFENSE COUNSEL</i>	Indicator with value 1 if the defendant hires an outside counsel; 0 otherwise.
CASE CHARACTERISTICS	
<i>INSURANCE</i>	Categorical variable indicating the line of insurance associated with the claim, including monoline general insurance, commercial auto liability, commercial multiperil liability, medical professional liability. The omitted category is other professional liability.
<i>INJURY</i>	Categorical variable indicating the type(s) of injury associated with the claim, including death, amputation, burns, etc. The omitted category is multiple injury.

Table 2.3: Descriptive Statistics^a

Panel C. Settlement duration, Settlement Payment, Legal System, and Bargaining Environment of Dropped Cases

	Mean	Std. Dev.	Observations
DEPENDENT VARIABLES			
<i>SETTLEMENT DURATION</i> (months)	35	26	118,947
<i>SETTLEMENT PAYMENT</i> (\$)	66,029	351,762	118,947
LEGAL SYSTEM			
<i>PREJUDGMENT INTEREST RATE</i> (%)	9.72	1.15	118,947
<i>CONGESTION</i> (months)	15.60	11.57	118,947
<i>JOINT & SEVERAL LIABILITY</i> (1=yes)	0.03	0.16	103,828
<i>NONECONOMIC DAMAGES</i> (1=yes)	0.17	0.38	118,947
BARGAINING ENVIRONMENT			
<i>INITIAL INDEMNITY RESERVE</i> (\$)	24,611	91,676	118,947
<i>INITIAL EXPENSE RESERVE</i> (\$)	2,283	10,615	118,947
<i>INSURED'S FAULT</i> (%)	27.83	44.18	118,943
<i>MULTIDEF</i> (1=yes)	0.12	0.33	118,947

a. all dollar values are in 2005 \$. The source for these values is author's calculations based on the Texas Department of Insurance Commercial Liability Insurance Closed Claim database for the years 1988-2005. *SETTLEMENT DURATION* refers to the elapsed time between the date that the case was reported to insurer and the date of settlement.

TABLE 2.6. OLS REGRESSION ESTIMATES OF THE EFFECT OF PREJUDGMENT INTEREST ON SETTLEMENT PAYMENT^a

Log(<i>SETTLEMENT PAYMENT</i>) (N=29,583)	
LEGAL SYSTEM	
Log(<i>PREJUDGMENT INTEREST RATE</i>)	-0.557 [†] (0.055)
Log(<i>CONGESTION</i>)	0.028** (0.008)
BARGAINING ENVIRONMENT	
Log(<i>INITIAL INDEMNITY RESERVE</i>)	0.103** (0.003)
Log(<i>INITIAL EXPENSE RESERVE</i>)	0.006** (0.001)
Log(<i>INSURED'S FAULT</i>)	-0.066** (0.010)
Log(<i>DURATION</i>)	0.110** (0.009)
<i>MULTIDEF</i>	0.234* (0.015)
DELEGATION STRATEGY	
<i>PLAINTIFF LAWYER</i>	0.271 (0.128)
<i>OUTSIDE DEFENSE COUNSEL</i>	0.083* (0.015)
CASE CHARACTERISTICS	
Insurance	
Monoline general liability	0.000* (0.044)
Commercial auto liability	0.032* (0.044)
Commercial multiperil	-0.072* (0.044)

TABLE 2.6. (*Continued*)

Log(<i>SETTLEMENT PAYMENT</i>) (N =29,583)	
Injury	
Death	0.970* (0.023)
Amputation	0.628* (0.050)
Burns (heat)	0.496* (0.040)
Burns (chemical)	0.271 [†] (0.072)
Systemic poisoning (toxic)	0.302 [†] (0.060)
Systemic poisoning (other)	-0.123 (0.113)
Eye injury (blindness)	0.372 [†] (0.056)
Respiratory condition	0.208* (0.049)
Nervous condition	0.094* (0.043)
Hearing loss or impairment	0.153 [†] (0.080)
Circulatory condition	0.177 [†] (0.072)
Multiple injuries	0.099* (0.015)
Back injury	0.042* (0.015)
Skin disorder	-0.030 [†] (0.088)
Brain damage	1.051* (0.033)
Scarring	0.261* (0.031)
Spinal cord injuries	1.006* (0.045)
Other	0.055* (0.018)
CONSTANT	10.927 (0.198)
R-squared	0.0722

a. Standard errors are shown in parentheses.

[†] significant at 10 percent level; * significant at 5 percent level; ** significant at 1 percent level.

Source: Author's calculations based on the Texas Department of Insurance Commercial Liability Insurance Closed Claim database for the years 1988-2005. The regressions excludes medical professional liability claims, joint and several liability claims and claims involve noneconomic damages claims. Omitted insurance policy type is other professional liability.

CHAPTER 3

In Litigation: How Far Do The “Haves” Come Out Ahead?

3.1. INTRODUCTION

IN ECONOMIC ANALYSIS of private litigation spending,¹⁰⁰ researchers often make two simplifying assumptions: First, access to court intervention is equally costly for both parties; Second, the parties decide how much effort to invest in the lawsuit only once and simultaneously. In this chapter my main objectives are to (i) study the effect of asymmetric litigation costs on litigants’ investment incentives and the subsequent equilibrium of the ‘litigation game’ and to (ii) study litigations where parties have the flexibility to add to their previous efforts after observing their opponents’ most recent effort in an intermediate stage. This is worthwhile, because my model generates significantly different efficiency and distributional implications than symmetric, static models. Moreover, when we are directly evaluating the performance of legal institutions and making policy recommendations for litigation-system reform, it is useful to proceed within a framework that is fully consistent with various asymmetry and timing considerations.

Litigants often vary substantially in their litigation costs and parties with cost advantages tend to come out ahead in litigation and adjudication.¹⁰¹ This idea is an old one, but it has received renewed attention in the last three decades. Galanter’s seminal work (1974) made a compelling case for the proposition that the advantaged players, who are called the “haves”, tend to come out ahead in litigation. Galanter argues that the “haves” tend to win more often because they are likely to enjoy superior material resources and have access to lawyers capable of making superior arguments on their behalf. Superior resources enable the “haves” to purchase the best available legal assistance and expert witnesses, that may improve the chances of victory at trial. As a consequence, the “haves” win more often in litigation than “have nots”. Second, Galanter contends, “repeated players,” who tend to be “haves”, will come out ahead because they are usually more adept at conforming their claims to the requirements of the law; hence less experienced individuals (“one-shotters”) with grievances will be deterred from initiating lawsuits against repeat players or contesting legal claims submitted by them. It is this aspect of Galanter’s theory that I will focus on, that is, the *consequences of asymmetry* in the parties’ adeptness at handling lawsuits.

The question of ‘how just is the justice system in the presence of asymmetry?’ is the most important question I seek to answer in this chapter. Drawing from Galanter’s work, I study the

¹⁰⁰The term “private litigation spending” is first used by Spier (2007). It refers to the literature that studies how litigants decide how much time and effort to invest in the lawsuit.

¹⁰¹For empirical evidence see, e.g. Wheeler et al. (1987), Eisenberg and Farber (1996) and Songer et al. (1999). Wheeler et al. (1987) provide evidence from 5,904 U.S. supreme court cases from 1870 to 1970 that confirms the hypothesis that financially and organizationally stronger parties tend to prevail in litigation against weak parties, for different types of cases, time period and types of legal representation. Using data on over 200,000 U.S. federal civil litigations, Eisenberg and Farber (1996) show that the distribution of litigation costs for individuals has more variation than the distribution of litigation costs for corporations. Lawsuits where the plaintiff is an individual and the defendant a corporation are found to have lower plaintiff win rates than those suits where the plaintiff is a corporation and the defendant an individual or a corporation. Songer et al. (1999) provide evidence from U.S. courts of Appeals from 1925 to 1988 in support of the hypothesis that appellate litigants with significant organizational strength are much more likely to win than less organized litigants who lack of litigation expertise and economies of scale.

effect of asymmetry on the payoffs of advantaged players, the “haves”, and disadvantaged players, who are called the “have nots”. I will be generating a game theoretical model of litigation and give a quantitative impression on the effect of asymmetry. While no single paradigm can fully capture the intricacies of litigation process, for the purpose of this chapter three different litigation protocols come ready for use: (1) static legal process, (2) sequential legal process with exogenous sequencing and (3) sequential legal process with endogenous sequencing. The static protocol is most often seen in the litigation literature. Although this is a good approximation in a variety of legal contests,¹⁰² usually during a litigation, the development and presentation of evidence occurs sequentially in a sequence of periods. Therefore, my contention has been that a litigation protocol with multiple rounds, in which the plaintiff having the first move and both sides react to each other’s choices, is closer to the usual setting of litigation process. In addition, I contend that very often in legal disputes either party may put forward (or defend against) a claim and precommit his/her effort. Examples of such litigation games include custody, divorce and business contract disputes. Hamilton and Slutsky (1990), Baik and Shogren (1992) and Leininger (1993) endogenize the sequence of moves in two-stage, two-player contests. Building on these previous studies, I develop a model that endogenizes the timing of initiating a lawsuit and to study the equilibrium sequence of legal efforts. Furthermore, and for the first time in the literature, I establish a *measure of distortion to access to justice* for comparative static exercises: I compare the degree of distortion of justice within a given litigation protocol across different magnitudes of asymmetry; I also compare trial outcomes across different protocols with the same degree of asymmetry.

To summarize my results, I find that when the parties are unevenly matched, the plaintiff wins more often and earns higher payoff in a sequential legal process than in a static play. Further analysis suggests that in a sequential process, a moderate degree of asymmetry with a weak player leading may work to improve access to justice. The theory also implies that in disputes such as divorce, patent and contract, where either side can make or defend claims, the “have nots” will initiate the litigation to challenge the “haves”. The “haves” go along with this and scale back expenditure. Endogenous sequencing always minimizes litigation cost and in some cases may improve access to justice. Its outcome Pareto-dominates static play outcome.

The remainder of the chapter is organized as follows: section 3.2 represents the related literature. Section 3.3 sets up the model and introduces the normative criteria. Section 3.4.1 analyzes static litigation game. Section 3.4.2 analyzes sequential litigation game with exogenous timing. Section 3.4.3 endogenizes the choice of timing. Section 3.5 concludes.

3.2. RELATION TO THE LITERATURE

My analysis is based on and related to three strands of literature. First, my analysis is based on the literature on rent-seeking contests. Second, my analysis is related to papers that similarly use the contest framework to analyze litigant spending. Third, I relate to analysis that use auction-theoretic framework to address the issue of litigation spending.

The structure of the legal contests considered in this chapter is similar to those of other types of contests, including lobbying, patent races, tournaments in labor markets, and a variety of sports.

¹⁰²In these legal contests, there is either no opportunity of exchanging information granted by procedural requirement or significantly high costs associated with observing opponent’s legal action exist.

There is a large literature studying contests, originating from Tullock's seminal work (1980). Tullock studies contests with identical players choosing their effort levels *only once* and *simultaneously*. The study is primarily concerned with the relationship between the value of a contestable rent and the value of resources expended in the competition for it. Tullock (1980) finds that the aggregate social cost of rent seeking is increasing in the number of players and the marginal return to the players' investment. The early literature on legal spending has predominantly adopted Tullock's (1980) model, owing to its stylized feature and great simplicity.¹⁰³

However, in the political-economic reality rent seeking often has a dynamic nature. Recognizing the dynamic characteristics of many contests where one player moves before the other, Dixit (1987), Baik and Shogren (1992) and Leininger (1993) extend Tullock's (1980) static contests to sequential ones. These latter studies have demonstrated that in a dynamic setting the social cost of rent-seeking is significantly different from that in a static setting. Dixit (1987) analyzes a two-player, two-stage sequential contest. The contest outcome functions are assumed to be of Tullock's (1980) type. In this game, the strategies employed by the players hinge on the anticipated reaction of the opponent – each player would like his rival to “back off” and exert less effort in the contest. To this end, the first-moving player might derive a strategic benefit from aggressive spending, for example, when the second-moving player's best response function is decreasing in the first-moving player's effort level (i.e., downward sloping). Conversely, the first-moving player would benefit from a commitment to lower spending levels if the second-moving player's best-response function slopes upward. Either scenario can arise in the general framework. Using the analytical framework of Dixit (1987), Hirshleifer and Osborne (2001) compare the effort levels of the one-shot, simultaneous move legal contest with those of two-stage sequential contests. They find that given the (exogenous) opportunity to exert effort first, the player with higher stakes at trial overcommits to his effort with respect to his one-shot simultaneous Nash equilibrium level; the player with lower stakes at trial under-commits. These interesting results however rely critically on the assumption that litigants can exert effort only once. This is a good approximation in lawsuits with either a large fixed cost of investing in litigation or a one-time opportunity of presenting one's case in court. However, in many other legal contests litigants have the flexibility to add to their previous efforts after observing their opponent's most recent effort in an intermediate stage. This chapter extends Hirshleifer and Osborne (2001) and captures three main elements present in a litigation game. Firstly, the litigants observe their opponent's recent effort in an intermediate period; Secondly, the probability of courtroom success depends on the cumulative effort levels; Finally, litigants exert effort sequentially rather than simultaneously.

Furthermore, in models of litigation with endogenous legal expenses, timing sequences are usually specified *exogenously*.¹⁰⁴ However, very often in a legal dispute, either party may initiate as the plaintiff. Examples abound. In a custody case, when both the mother and the father want the custody of their children, both sides may put forward (or defend against) a claim. When a divorce agreement cannot be reached between spouses, both the husband and the wife can initiate the lawsuit. When a contractual dispute has taken place between a big company purchaser and a small business supplier, both sides may act as a claimant. I analyze the timing decisions of the litigants by using

¹⁰³See, e.g. Kobayoshi and Lott (1996) and Farmer and Pecorino (1999).

¹⁰⁴See, e.g. Hirshleifer and Osborne (2001), Braeutigam et al. (1984), Katz (1988), Hause (1989), Kobayoshi and Lott (1996), and Farmer and Pecorino (1999).

the analytical framework of Baik and Shogren (1992) and Leininger (1993). Baik and Shogren (1992) and Leininger (1993) study a two-player, two-stage contest in which a player's strategy consists of two components: (1) the timing of her move (i.e., exerting effort early or late) and (2) the level of her rent-seeking effort. In the first stage of the game the players simultaneously determine whether to exert effort early or late. If the players make different timing decisions, the rent-seeking game is played sequentially. If however both players make the same timing decision, the contest is played with simultaneous moves. It is found that players want to conduct the competition *sequentially* (and not *simultaneously*) which yields higher payoffs due to lower expenditures.

Finally, it is worthwhile to mention a closely related approach to economic analysis of litigation. Baye *et al.* (2005) use an auction-theoretic framework to examine symmetric litigation environments where the legal ownership of a disputed asset is unknown to the court. The court observes only the quality of the case presented by each party, and awards the asset to the party presenting the best case. The probability of plaintiff victory depends on both parties' expenditure choices, The more each party spends the worse the prospect of litigation for the other. Baye *et al.* (2005) find that equilibrium legal expenditures are increasing in the proportion of the winner's attorney fees that must be paid by the loser, while the expected payoffs of the litigants are a decreasing function of this proportion. Litigation systems with lower equilibrium legal expenditures provide a greater incentive for parties to sue than systems that entail higher equilibrium legal expenditures. However, the auction-theoretic framework has an undesirable feature: when the plaintiff's litigation expenditure is marginally higher (resp. lower) than that of the defendant, he will succeed (resp. lose) at trial with certainty. Building on Hirshleifer and Osborne (2001), Braeutigam *et al.* (1984), Katz (1988), Hause (1989), Kobayashi and Lott (1996), and Farmer and Pecorino (1999), I modify this assumption so that a litigant always has a strictly positive probability to win at trial whenever her expenditure on the lawsuit is positive.

3.3 MODEL OF LITIGATION

Consider two litigants, party 1 and party 2, who are involved in a civil dispute over the damage award of value V , which has to be divided between the two parties. V is common knowledge. An example of this situation is a car accident in which two cars collide. The court has to decide how much fault of each car-driver contributed to the accident. Assume that the "legally right decision" will be the one that the court would accurately reach after extensive investigation of the causes of the accident and the amount of damages. With knowledge on the genuine cause of the accident and the amount of damage due, a legal decision would be available. I assume that the parties in dispute are risk neutral.

Let θ_1 (with $0 \leq \theta_1 \leq 1$) (resp. θ_2 (with $0 \leq \theta_2 \leq 1$ and $\theta_1 + \theta_2 = 1$)) denote party 1's (resp. 2's) (exogenous) *legal right* to the disputed asset. $\theta_1 = 0$ indicates that party 1 is not legally entitled to the asset; $\theta_1 = \theta_2 = 0.5$ indicates that 1 and 2 are each entitled to 50 percent of the asset. I assume that θ_1 and θ_2 are common knowledge among the litigants but not known by the court. Therefore the court's decision is subject to the influence of legal efforts. I define a litigation system as *just* if the system allocates a *net* payoff of $\theta_1 V$ (resp. $\theta_2 V$) to 1 (resp. 2) in equilibrium. The 2-vector

$$\theta = (\theta_1, \theta_2)$$

is called the *right legal resolution*. For the purpose of the current study, it suffices to simplify the discussion and study a particular transparent case, where the two parties have equal legal entitlement,

i.e., $\theta_1 = \theta_2 = \frac{1}{2}$. This normalization allows me to focus my attention on the sole effect of asymmetry on parties' legal decisions and the subsequent litigation outcomes. However, it

The *trial success probability* or *win rate* of party 1 (resp. 2) is given by

$$w = \frac{ae_1}{ae_1 + e_2} \quad \text{and} \quad 1 - w = \frac{e_2}{ae_1 + e_2} \tag{29}$$

where e_1 (resp. e_2) denote the *aggregate legal effort* expended by party 1 (resp. 2) on presenting a convincing case. Here a ($a \in (0, \infty)$) denotes the degree of *asymmetry* in 1 and 2's *adeptness* or *cost efficiency* in conforming their claims to the requirements of the law. For example, $a = 1$ implies the parties are equally adept with handling the case; $a = 2$ means that party 1 is twice as adept as 2. Using Galanter's (1974) terminology and without loss of generality, when the parties are unevenly matched, I call the more adept party the "*have*" and the less adept party the "*have not*". This parameter, which controls the magnitude of asymmetry, will play a central role in my analysis.

Furthermore, note that there is a positive but diminishing marginal effect of each party's effort on his own win rate,

$$w_1 > 0, \quad w_{11} < 0, \quad w_2 < 0, \quad w_{22} > 0,$$

where subscripts denote partial derivatives and the arguments (e_1, e_2) are omitted for brevity. These conditions also ensure that an increase in each party's effort level hurts the other, and therefore makes it strategically desirable for each to precommit his/her effort level in such a way as to induce a lower effort from the other in response. Whether this implies a commitment at a higher or a lower level of ones' own effort depends on whether the other's best response function is downward sloping or upward sloping.¹⁰⁵

For simplicity, I assume the American rule is applicable, i.e., each party pays his own legal bills regardless of the outcome. The *value of the case*¹⁰⁶ to party 1 and party 2 given the effort of their adverse parties are

$$u_1 = \begin{cases} \frac{ae_1}{ae_1 + e_2}V - e_1 & \text{if } e_1 + e_2 > 0 \\ \frac{1}{2}V & \text{otherwise,} \end{cases} \quad \text{and} \quad u_2 = \begin{cases} \frac{e_2}{ae_1 + e_2}V - e_2 & \text{if } e_1 + e_2 > 0 \\ \frac{1}{2}V & \text{otherwise,} \end{cases} \tag{30}$$

respectively. I assume the court is equally likely to recognize either party if neither has presented quality evidence. This specification in equation (19) provides a simple and tractable way of illustrating the different efficiency and distributional implications of the asymmetric, sequential model and the symmetric, static model. More general models will not change my conclusion qualitatively.

I measure the intensity of legal competition by the *rate of dissipation*:

$$r := \frac{e_1 + e_2}{V},$$

which is the total legal investment made by both parties discounted by the value of the stake in dispute, i.e., the proportional resources dissipated in legal competition is r .

¹⁰⁵The general significance of the slopes of reaction functions has been extensively discussed by Fudenberg and Tirole (1984), Bulow et al. (1985) and Eaton and Grossman (1986).

¹⁰⁶Skaperdas (1996) and Clark and Riis (1998) give axiomatic foundations for contest success functions having this form.

Let the 2-vector $\mathbf{u} = (\frac{1}{\sqrt{V}}u_1, \frac{1}{\sqrt{V}}u_2)$ be the (normalized) *trial outcome*. The *measure of distortion to access to justice* δ in this chapter is simply given by the *Euclidean distance* between the trial outcome \mathbf{u} and the right legal resolution θ :

$$\delta := \|\mathbf{u} - \theta\|.$$

Once we are equipped with the measure of distortion to access to justice, we can put it to use in comparative static exercises. In the following section, I will examine the comparative statics of equilibrium distortion to access to justice with respect to the changes in magnitude of asymmetry for the static litigation protocol, the sequential protocol with exogenously determined sequencing and the sequential protocol with endogenous sequencing, respectively. I will also examine the comparative statics of equilibrium distortion with respect to the changes in the timing of litigation process.

3.4. ANALYSIS

3.4.1. THE BASIC GAME: STATIC LITIGATION

Typically, the static, simultaneous-decision protocol is adopted in the private litigation spending literature. This is a good approximation in variety of a litigation with either a large fixed costs of exerting efforts or a one-time opportunity of action granted by procedural requirement. However, usually during the litigation, the development and presentation of evidence occurs sequentially. Therefore, my contention has been that the sequential decision protocol, in which the plaintiff having the first move and both sides react to each other's choices, is closer to the usual sequence of litigation process. As a benchmark, though, this section first studies simultaneous choices in a one-shot game.

The sequence of the game is, in period 1 party 1 chooses his legal effort level. In period 2, without knowing 1's effort level, 2 makes her decision. Then the game ends. The unique Nash equilibrium is given by

$$e_1^c = e_2^c = \frac{a}{(a+1)^2}V. \quad (31)$$

where the superscript c stands for simultaneous, or "Cournot", decisions.

Litigation Intensity The *rate of rent dissipation* is given by

$$r^c(a) := \frac{e_1^c + e_2^c}{V} = \frac{2a}{(a+1)^2}, \quad (32)$$

which indicates that, a fraction of $\frac{2a}{(a+1)^2}$ of the total stakes is dissipated in the litigation process.

Figure 3.1 depicts the variations of equilibrium rate of rent dissipation as the degree of asymmetry changes. The magnitude of resource dissipation drops as the degree of asymmetry enlarges ($\frac{dr^c(a)}{da} > 0$, for $a < 1$ and $\frac{dr^c(a)}{da} < 0$ for $a > 1$). The intuition is straightforward: facing too strong an opponent, the "have not" is pessimistic about her chance of winning and subsequently invests less than when she would if her strength was in close range with the "have". The "have" exploits the "have not"'s pessimism by investing less as well. The total legal effort level falls.

Note that the "have" and the "have not" are equally "aggressive" in pursuing trial victory - irrespective of the asymmetry - they invest the same amount of legal efforts to win the case. This symmetric expenditure in rent-seeking games with "bias" has been discussed by Tullock (1980).

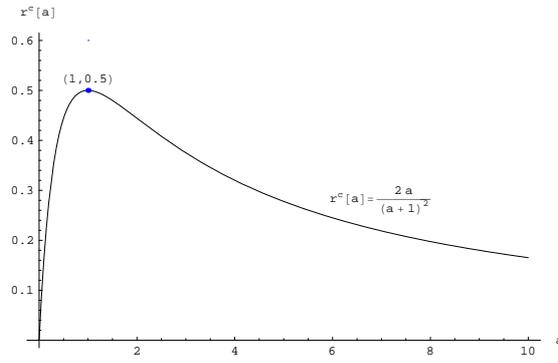


Figure 3.1. Rent Dissipation (Static Litigation)

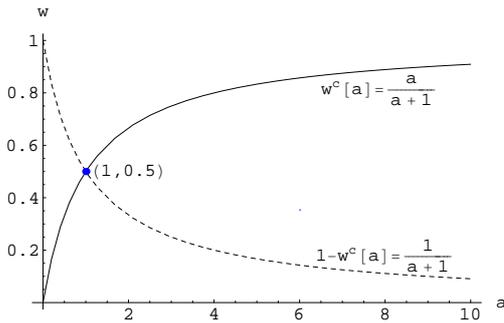


Figure 3.2. Win Rates (Static Litigation)

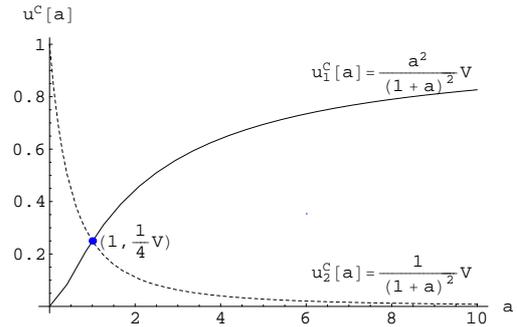


Figure 3.3. Trial Payoffs (Static Litigation)

Win rate and Trial payoff These legal expenses determine the weight of evidence, the win rate and subsequently the court decision on the division of interests and obligations among the parties:

$$w^c(a) = \frac{a}{a+1} \quad \text{and} \quad 1 - w^c(a) = \frac{1}{a+1}, \quad (33)$$

$$u_1^c(a) = \frac{a^2}{(1+a)^2} V \quad \text{and} \quad u_2^c(a) = \frac{1}{(1+a)^2} V. \quad (34)$$

Obviously, asymmetry influences litigants' payoffs in equilibrium. When litigants are symmetric ($a = 1$), they split the pie equally ($w = 1 - w = \frac{1}{2}$ and $u_1^c = u_2^c = \frac{V}{4}$). When asymmetry is present, the "have" achieves a more favorable trial outcome ($w^c > 1 - w^c$ and $u_1^c > u_2^c$ for $a > 1$).

Distortion to access to justice According to my measure, the degree of distortion amounts to,

$$\delta^c(a) = \frac{\sqrt{2}(1+a^2)}{2(1+a)^2}. \quad (35)$$

Figure 3.4 depicts the effect of asymmetry on distortion to access to justice in a simultaneous-move equilibrium. An important feature of this figure is that the degree of distortion significantly drops as asymmetry vanishes. Note however in equilibrium the distortion can never be fully eliminated. This is because the parties necessarily incur costs to receive their entitlements. Finally, I would like to remark that the degree of distortion is sensitive to the method of measurement. Alternative measurement methods may provide different results.

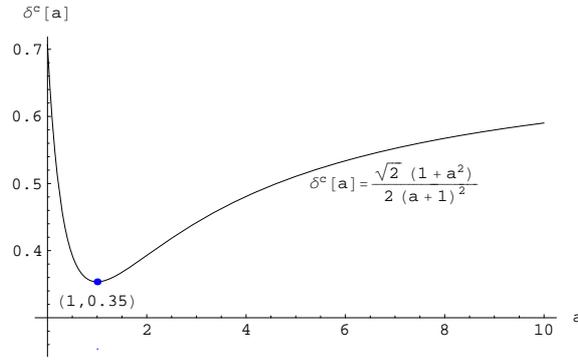


Figure 3.4. Distortion to Access to Justice (Static Litigation)

3.4.2. SEQUENTIAL LITIGATION GAME WITH EXOGENOUS SEQUENCING

In reality, one could observe that litigants expend effort in several periods to win a lawsuit. They have the flexibility to add to their previous efforts after observing their rival’s most recent effort in an intermediate stage. In this section, I study the strategic interactions and the associated outcomes of such sequential litigation process. The key questions in this section are:

- (i) Will it be profitable for parties to commit?
- (ii) In which way does asymmetry influence parties’ commitment decisions?
- (iii) How does asymmetry alter the parties’ equilibrium payoffs when commitment has taken place?

I. TWO STAGE GAME

I begin by studying a simple case where the litigation takes place in only two rounds. Then I will extend the analysis to the more complicated situation where the litigation takes place in four rounds.

Without loss of generality, let party 1 be the plaintiff and 2 the defendant. The plaintiff commits first to a level of litigation effort e_1 – after which it is observed and the defendant responds with e_2 . I require equilibrium of this model to be subgame perfect.

With backward induction, let’s first consider the decision of the defendant, who has the opportunity to decide on her legal effort after observing the quality of the plaintiff’s case. The defendant’s optimal legal effort as a function of the plaintiff’s observable legal effort is given by

$$e_2(e_1) = \begin{cases} (ae_1V)^{\frac{1}{2}} - ae_1 & \text{if } e_1 \leq \frac{V}{a} \\ 0 & \text{otherwise,} \end{cases} \tag{36}$$

that is, the defendant only invests to prepare a counter claim if the plaintiff’s effort level falls below $\frac{V}{a}$.

Taking into account of the defendant’s reaction pattern $e_2(e_1)$, the plaintiff would decide on his observable legal efforts after accessing the likely response of the defendant given e_1 . The plaintiff maximizes his expected trial payoff

$$u_1(e_1, e_2) = \frac{ae_1}{ae_1 + e_2(e_1)}V - e_1 \tag{37}$$

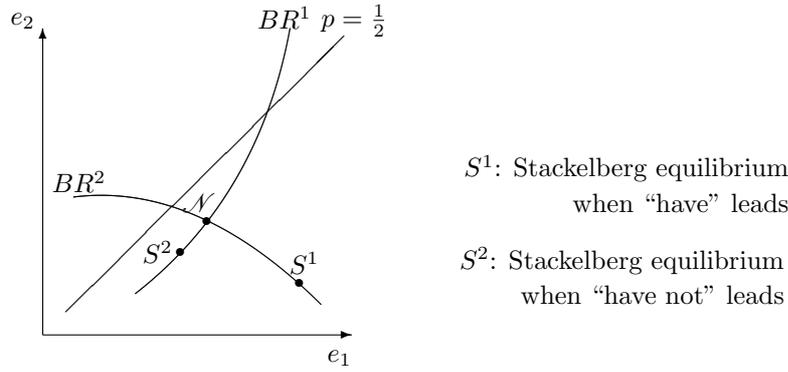


Figure 3.5. Best response functions

substituting (26), we have

$$u_1(e_1, e_2) = \begin{cases} (ae_1V)^{\frac{1}{2}} - e_1 & \text{if } e_1 \leq \frac{V}{a} \\ V - e_1 & \text{otherwise,} \end{cases} \quad (38)$$

In analyzing the impact of asymmetry on the litigants' investment incentives, it will be helpful to discuss separately two ranges for the parameter a : where $a \in (0, 2]$ and where $a \in [2, \infty)$.

In equilibrium of the two-stage game the plaintiff invests

$$e_1^P = \begin{cases} \frac{a}{4}V & \text{if } a \in (0, 2] \\ \frac{V}{a} & \text{if } a \in [2, \infty). \end{cases} \quad (39)$$

In response, the defendant invests

$$e_2^D = \begin{cases} \frac{a(2-a)}{4}V & \text{if } a \in (0, 2] \\ 0 & \text{if } a \in [2, \infty), \end{cases} \quad (40)$$

where the superscript P and D indicates "plaintiff" and "defendant", respectively.

Note that, when the parties are unevenly matched and the plaintiff is the "have" (resp. "have not"), he overcommits (resp. under-commits) to his effort as compared to his one-shot simultaneous Nash equilibrium level ($e_1^P > e_1^c$ when $a > 1$ and $e_1^P < e_1^c$ when $a < 1$). Figure 3.5 develops the corresponding intuition using best response functions. The dynamic strategies employed by the litigants hinge on the anticipated reactions of the rival – each player would like his opponent to "back off" and invest less in the contest (see Dixit (1987); Katz (1988)).¹⁰⁷ To this end, the plaintiff will derive strategic benefit from aggressive spending when the defendant's best response function is decreasing in the plaintiff's investment (i.e., is downward-sloping). This situation arises when the plaintiff is a "have" and the defendant a "have not" ($a > 1$). Conversely, the plaintiff would benefit from a commitment to lower spending levels if the defendant's best response curve slopes upward. This situation arises when the plaintiff is a "have not" and the defendant a "have" ($a < 1$).

¹⁰⁷See Bulow *et al.* (1985) for a general discussion of strategic commitment in contests.

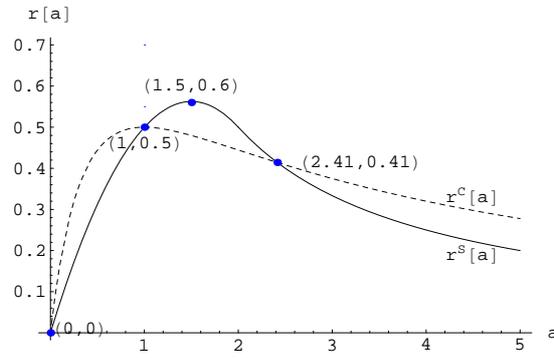


Figure 3.6. Rent Dissipation (Exogenous Sequencing (with plaintiff moving first) vs. Static Process)

Litigation Intensity In a sequential litigation process with exogenous sequencing, the rate of dissipation is

$$r^s(a) = \frac{e_1^P + e_2^D}{V} = \begin{cases} \frac{a(3-a)}{4} & \text{if } a \in (0, 2], \\ \frac{1}{a} & \text{if } a \in [2, \infty), \end{cases} \quad (41)$$

where the superscript s stands for sequential, or “Stackelberg”, decisions. A fraction of $\frac{a(3-a)}{4}$ (resp. $\frac{1}{a}$) of the stake is wasted in litigation when the plaintiff is no more than (resp. at least) twice as adept as the defendant.

Figure 3.6 depicts the relation between the equilibrium rate of dissipation and asymmetry. In general, the total resources dissipated is negatively correlated with asymmetry. This result is intuitive: deterred by her rival’s advantage, the “have not” refrains from investing actively. The “have” exploits his rival’s passiveness by subsequently exerting less effort.

The most intensive litigation will exhaust more than half of the value in dispute ($\max r^s(a) = 0.56$). This takes place when a “have” plaintiff makes an aggressive move to deter its opponent. Refer to figure 3.5, the marginal payoff of the “have not” defendant is decreasing with respect to the plaintiff’s effort level. Therefore, a “have” plaintiff can curb the defendant’s incentive by overcommit to a higher level of effort and thereby gaining bigger victory in litigation. However, when the difference on both sides is not significantly large, the “have not” defendant would not be adequately deterred and would react aggressively. The result is a very intensive legal combat.

Figures 3.6 also illustrates the distinct influences of asymmetry on the intensity of legal investment as the dynamics of legal process differ. When $1 < a < 2.41$, the aggregate legal effort levels with exogenous sequencing is higher than that in simultaneous decisions ($r^c(a) < r^s(a)$). When $0 < a < 1$ or $a \in [2, \infty)$, sequential decision gives rise to less intensive a litigation ($r^s(a) < r^c(a)$).

Win rate and Trial payoff

$$w^s(a) = \begin{cases} \frac{1}{3-a} & \text{if } a \in (0, 2], \\ 1 & \text{if } a \in [2, \infty). \end{cases} \quad \text{and} \quad 1 - w^s(a) = \begin{cases} \frac{2-a}{3-a} & \text{if } a \in (0, 2], \\ 0 & \text{if } a \in [2, \infty). \end{cases} \quad (42)$$

Proposition 3.1 *In a sequential legal process with exogenous sequencing,*

(i) *a plaintiff wins more often than a defendant.*

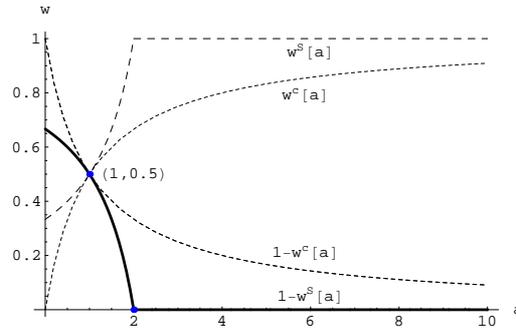


Figure 3.7. Win Rates (Exogenous Sequencing (with plaintiff moving first) vs. Static Process)

- (ii) The plaintiff's trial payoff (weakly) exceeds his payoff in the static play. That is, $u_1^P(a) \geq u_1^c(a)$ for all a .
- (iii) A defendant's trial payoff exceeds her payoff in the static play if and only if she is a "have". That is, $u_2^D(a) \geq u_2^c(a)$ for $a \geq 1$ and $u_2^D(a) \leq u_2^c(a)$ for $a \leq 1$.
- (iv) The exogenous sequencing outcome Pareto-dominates the static play outcome if and only if the defendant is a "have" ($a < 1$).

Proof. (i) can be directly derived by comparing equations (33) and (42). Figure 3.7 depicts the effect. Further we have,

$$u_1^P(a) = \begin{cases} \frac{a}{4}V & \text{if } a \in (0, 2], \\ \frac{a-1}{a}V & \text{if } a \in [2, \infty). \end{cases} \quad \text{and} \quad u_2^D(a) = \begin{cases} \frac{(2-a)^2}{4}V & \text{if } a \in (0, 2], \\ 0 & \text{if } a \in [2, \infty). \end{cases} \quad (43)$$

Comparing equations (34) and (43), we have that (ii) holds. That is, the plaintiff is better off in a sequential legal process with exogenous sequencing than in a static process. The intuition is easily conveyed. Consider the plaintiff's trial payoff in the two protocols. Refer to figure 3.5, we see that the Nash equilibrium N of the static protocol is the intersection of the two best response functions. In a sequential protocol, the plaintiff chooses his most preferred point on the defendant's best response function. Therefore, the Nash equilibrium of the static play is feasible for the plaintiff. When the static play Nash equilibrium differs from that when the plaintiff has the first move, which is the case when parties are unevenly matched, the plaintiff does strictly better as a first mover.¹⁰⁸ Figure 3.8 shows the result graphically.

Furthermore, (iii) can be derived by comparing equations (34) and (43). (iv) is directly implied by (ii) and (iii) of proposition 3.1. ||

Distortion to access to justice The degree of distortion to access to justice is given by

$$\delta^s(a) = \begin{cases} \frac{1}{4}[8 + 5a(a-4) + a(a-4)^2]^{\frac{1}{2}} & \text{if } a \in (0, 2], \\ \left(\frac{1}{2} + \frac{1}{a^2} - \frac{1}{a}\right)^{\frac{1}{2}} & \text{if } a \in [2, \infty). \end{cases} \quad (44)$$

¹⁰⁸A player in a game becomes a "first mover" when he can commit to an effort level, that is, choose a effort level irrevocably and reveal it to the opponent.

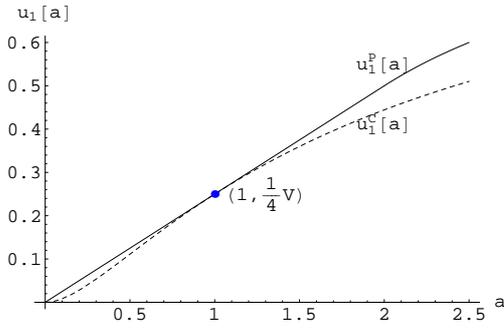


Figure 3.8. Plaintiff Payoff (Exogenous Timing)

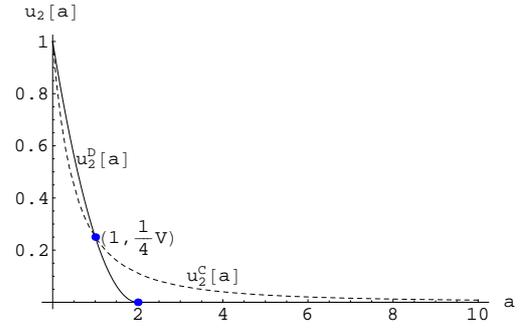


Figure 3.9. Defendant Payoff (Exogenous Timing)

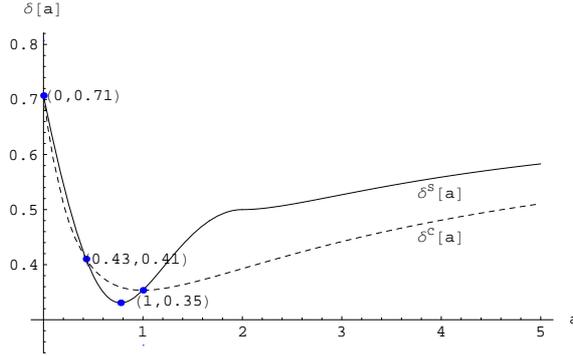


Figure 3.10. Distortion to Access to Justice (Exogenous Sequencing vs. Static Process)

Figures 3.10 depicts the influence of asymmetry on access to justice when timing is exogenous. The distortion reaches its minimum when the plaintiff is (approx.) 80 percent as adept as the defendant rather than when both sides are evenly matched. The dynamics of legal process may accentuate or diminish the effect of asymmetry in terms of access to justice. In general, the degrees of distortion differ under the two protocols. Interestingly, the figure shows that in a sequential litigation protocol, a moderate degree of asymmetry with a weak player leading may work to mitigate the distortion of justice ($\delta^s(a) < \delta^c(a)$ when $0.43 < a < 1$).

II. SEQUENTIAL LITIGATION GAME WITH MULTIPLE STAGES

For the next results we need some more notations. Let $e_i^t \geq 0$ denote player i 's effort level in period t , $t = 1, 2, 3, 4$. Player 1 (resp. player 2) exerts effort in odd (resp. even) periods. The aggregate effort level of 1 (resp. 2) is denoted by e_1 (resp. e_2) so that $e_1 \equiv e_1^1 + e_1^3$ and $e_2 \equiv e_2^2 + e_2^4$. A strategy specifies the effort level that a player chooses whenever it is his turn to exert effort, given his effort level and his opponent's effort level chosen in all previous periods. Furthermore, let E_1^t (resp. E_2^t) denote the sequence of effort of player 1 (resp. player 2) prior to and including period t , with $E_2^1 = \{0\}$. A *pure behavior strategy* for player i at period t is a map $e_i^t: E_1^{t-1} \times E_2^{t-1} \rightarrow [0, \infty)$, $i = 1, 2$ and $t = 1, 2, 3, 4$. A pure strategy for player 1 in the game as a whole is denoted $\mathbf{e}_1 = (\mathbf{e}_1^1, \mathbf{e}_1^3)$ and for player 2, $\mathbf{e}_2 = (\mathbf{e}_2^2, \mathbf{e}_2^4)$.

I require the equilibrium of this game to be subgame perfect. The effort level of 1 (resp. 2) at period t in subgame perfect equilibrium is denoted by \tilde{e}_1^t (resp. \tilde{e}_2^t). The aggregate effort level of 1 (resp. 2) in subgame perfect Nash equilibrium is denoted by $\tilde{\mathbf{e}}_1$ (resp. $\tilde{\mathbf{e}}_2$).

Before giving the main results on multiple stage sequential legal contest, I will first provide some essential properties on the payoff functions. Some further notations are needed. Let $R_i(e_j)$ be player i 's one-shot best response function. That is,

$$R_i(e_j) = \arg \max_{e_i \geq 0} u_i(e_i, e_j) \quad \text{for } i, j = 1, 2; i \neq j.$$

Lemma 3.1. Given e_j , $u_i(\cdot, e_j)$ is strictly concave in e_i .

Proof. Twice differentiate equation (30), we have that

$$\frac{\partial^2 u_1(e_1, e_2)}{\partial e_1^2} = -\frac{2a^2 V e_1}{(ae_1 + e_2)^2} < 0 \quad \text{and} \quad \frac{\partial^2 u_2(e_1, e_2)}{\partial e_2^2} = -\frac{2a V e_2}{(ae_1 + e_2)^2} < 0.$$

This property guarantees that $R_i(\cdot)$ is a well-behaved function: it is single valued and continuously differentiable. The strictly concavity of $u_i(\cdot)$ ensures that fixing the level of e_j , u_i strictly increases as e_i approaches $R_i(e_j)$. ||

Lemma 3.2 (e_1^c, e_2^c) is an unique Nash equilibrium in the one-shot simultaneous move game.

Proof. Twice differentiate both sides of equation (30), we get

$$\frac{\partial^2 u_1}{\partial e_1 \partial e_2} = \frac{2a^2 V e_1}{(ae_1 + e_2)^3} - \frac{aV}{(ae_1 + e_2)^2} \quad \text{and} \quad \frac{\partial^2 u_2}{\partial e_1 \partial e_2} = \frac{2a^2 V e_2}{(ae_1 + e_2)^3} - \frac{aV}{(ae_1 + e_2)^2}.$$

Hence, $\frac{\partial^2 u_1}{\partial e_1 \partial e_2} > 0$ if and only if $ae_1 > e_2$; $\frac{\partial^2 u_2}{\partial e_1 \partial e_2} > 0$ if and only if $ae_1 < e_2$. That is, $\frac{dR_1(e_2)}{de_2} > 0$ for all $(e_1, e_2) \in \{(e_1, e_2) \mid ae_1 > e_2\}$; $\frac{dR_1(e_2)}{de_2} = 0$ for (e_1, e_2) for all $(e_1, e_2) \in \{(e_1, e_2) \mid ae_1 = e_2\}$; $\frac{dR_1(e_2)}{de_2} < 0$ for all $(e_1, e_2) \in \{(e_1, e_2) \mid ae_1 < e_2\}$; $\frac{dR_2(e_1)}{de_1} > 0$ for all $(e_1, e_2) \in \{(e_1, e_2) \mid ae_1 < e_2\}$; $\frac{dR_2(e_1)}{de_1} = 0$ for (e_1, e_2) for all $(e_1, e_2) \in \{(e_1, e_2) \mid ae_1 = e_2\}$; $\frac{dR_2(e_1)}{de_1} < 0$ for all $(e_1, e_2) \in \{(e_1, e_2) \mid ae_1 > e_2\}$. Hence, $R_1(e_2)$ and $R_2(e_1)$ cross locus at (e_1^c, e_2^c) , where $ae_1 = e_2$. We have, (e_1^c, e_2^c) exists and is unique. ||

Further, let (e_i^P, e_j^D) denote the Stackelberg equilibrium in a two-period game where player i leads. That is,

$$e_i^P = \arg \max_{e_i \geq 0} u_i(e_i, R_j(e_i)) \quad \text{and} \quad e_j^D = R_j(e_i^P).$$

Lemma 3.3. Given $e_j = R_j(e_i)$, $u_i(\cdot, R_j(\cdot))$ is strictly concave in e_i .

Proof. Differentiate equation (30), we get $\frac{du_1}{de_1} = \frac{aV e_1}{(ae_1 + e_2)^2} - 1$ and $\frac{du_2}{de_2} = \frac{V e_2}{(ae_1 + e_2)^2} - 1$. Solving for $\frac{aV e_1}{(ae_1 + e_2)^2} - 1 = 0$ and $\frac{V e_2}{(ae_1 + e_2)^2} - 1 = 0$ we have that $R_1(e_2) = \frac{\sqrt{aV e_2 - e_2}}{a}$ and $R_2(e_1) = \frac{\sqrt{V e_1 - e_1}}{a}$. Therefore,

$$u_1(e_1, R_2(e_1)) = \frac{a^2 V e_1}{\sqrt{V e_1} + (a^2 - 1)e_1} - e_1 \quad \text{and} \quad u_2(R_1(e_2), e_2) = \frac{aV e_2}{\sqrt{aV e_2} + (a - 1)e_2} - e_2. \quad (45)$$

Twice differentiate equation (45) we have that

$$\frac{\partial^2 u_1(e_1, R_2(e_1))}{\partial e_1^2} = -\frac{a^2 V^{\frac{3}{2}} [\sqrt{V} + 3(a^2 - 1)\sqrt{x}]}{4[\sqrt{V} + (a^2 - 1)\sqrt{x}]^3 x^{\frac{3}{2}}} < 0 \quad \text{and}$$

$$\frac{\partial^2 u_2(R_1(e_2), e_2)}{\partial e_2^2} = -\frac{a^{\frac{3}{2}} V^{\frac{3}{2}} [\sqrt{aV} + 3(a - 1)\sqrt{x}]}{4[\sqrt{aV} + (a - 1)\sqrt{x}]^3 x^{\frac{3}{2}}} < 0.$$

Therefore, given $e_j = R_j(e_i)$, $u_i(\cdot, R_j(\cdot))$ is strictly concave in e_i .

Lemma 3.3 implies that, (e_i^P, e_j^D) exists and is unique (and similar when j leads, (e_j^P, e_i^D) exists and is unique.)

Lemma 3.4. *In the two-stage sequential litigation game,*

if $w^c > 1/2$, then

$$e_1^D < e_1^c < e_1^P, \text{ and } e_2^P < e_2^c \text{ and } e_2^D < e_2^c;$$

if $w^c = 1/2$, then

$$e_1^P = e_1^F = e_1^c, \text{ and } e_2^P = e_2^F = e_2^c.$$

Proof. This is straightforward from comparing equations (31), (39) and (40).

The above lemma summarizes the main findings in Dixit (1987). When parties are unevenly matched, given the (exogenous) opportunity to move first, the favorite over exerts, and the have not, eases up. The intuition is explained in Figure 3.1. From (34) we know that an increase in a player's effort level hurts his rival, and therefore given the opportunity to precommit each player has incentive to induce a lower effort from the other in response. Whether this implies a commitment at a higher or lower level of one's own effort depends on the slope of other's best response function. In the neighborhood of the Nash equilibrium N , the 'have not's best response function (BR_2) is downward sloping and that of the favorite (BR_1) is upward sloping. So to curb the 'have not's incentive, the favorite precommits to a higher e_1 , moving the outcome from N to S_1 . To prevent the favorite from exerting higher effort, however, the 'have not' commits to a lower e_2 , and move the outcome from N to S_2 .

Proposition 3.2. *For legal contests of four rounds, in subgame perfect equilibrium, the aggregate effort levels of party 1 and party 2 are*

$$\tilde{e}_1 = e_1^P \text{ and } \tilde{e}_2 = e_2^D.$$

There exists a continuum of subgame perfect equilibrium path in which, 1 and 2 invests $(\tilde{e}_1^1, \tilde{e}_1^3)$ and $(\tilde{e}_2^2, \tilde{e}_2^4)$ such that

$$\tilde{e}_1^1 = e_1^P, \quad \tilde{e}_1^3 = 0 \quad \text{and} \quad \tilde{e}_2^2 + \tilde{e}_2^4 = e_2^D,$$

if and only if $w(e_1^c, e_2^c) > 1/2$;

there exists a continuum of subgame- perfect-equilibrium paths, namely, 1 and 2 invests $(\tilde{e}_1^1, \tilde{e}_1^3)$ and $(\tilde{e}_2^2, \tilde{e}_2^4)$ such that,

$$\tilde{e}_1^1 + \tilde{e}_1^3 = e_1^P \quad \text{and} \quad \tilde{e}_2^2 + \tilde{e}_2^4 = e_2^D,$$

if and only if $w^c \leq 1/2$.

Proof. It is to show that in subgame perfect equilibrium, the aggregate effort levels of player 1 and 2 are

$$\tilde{e}_1 = e_1^P \text{ and } \tilde{e}_2 = e_2^D.$$

There exists a continuum of subgame perfect equilibrium paths in which, 1 and 2 invests $(\tilde{e}_1^1, \tilde{e}_1^3)$ and $(\tilde{e}_2^2, \tilde{e}_2^4)$ such that

$$(\tilde{e}_1^1, \tilde{e}_1^3) = (e_1^P, 0) \text{ and } (\tilde{e}_2^2, \tilde{e}_2^4) \in \text{Conv}\{(e_2^D, 0), (0, e_2^D)\},$$

respectively, if and only if $p_1 (e_1^c, e_2^c) > 1/2$; there exists a continuum of subgame perfect equilibrium paths, namely, 1 and 2 invests $(\tilde{e}_1^1, \tilde{e}_1^3)$ and $(\tilde{e}_2^2, \tilde{e}_2^4)$ such that,

$$(\tilde{e}_1^1, \tilde{e}_1^3) \in \text{Conv}\{(e_1^P, 0), (0, e_1^P)\} \text{ and } (\tilde{e}_2^2, \tilde{e}_2^4) \in \text{Conv}\{(e_2^D, 0), (0, e_2^D)\}.$$

respectively, if and only if $p_1 (e_1^c, e_2^c) \leq 1/2$.

Using backward induction, we start with the last period.

$t = 4$

Given the first three periods choices e_1^1, e_2^2 , and e_1^3 , agent 2 solves the following program:

$$\max_{e_2 \geq e_2^2} u_2(e_1, e_2).$$

The solution to the optimization problem above is

$$e_2 = \max\{e_2^2, R_2(e_1^1 + e_1^3)\}. \quad (46)$$

Equation (46) describes player 2's continuation reaction function in the last period. Hence, the following efforts constitute the subgame-perfect-equilibrium investment of 2 in period $t = 4$:

$$\tilde{e}_2^4(e_1^1, e_1^3, e_2^2) = \begin{cases} 0 & \text{if } e_2^2 \geq R_2(e_1^1 + e_1^3) \\ R_2(e_1^1 + e_1^3) - e_2^2 & \text{if } e_2^2 \leq R_2(e_1^1 + e_1^3). \end{cases} \quad (47)$$

The uniqueness of these strategies is implied by lemmas 3.1, 3.2 and 3.3.

The logic of the proof is as follows: Given the 2nd period effort and the aggregate effort of player 1, if player 2 finds herself above her best response function, then she will find that she has exerted "too much" effort and refrain from expending further effort. Otherwise, it is best for player 2 to add to her 2nd period amount up to her best response function. Note that since effort is irreversible, the best player 2 can do in case of an excessive 2nd period choice is to do nothing further.

$t = 3$

Given e_1^1 and e_2^2 , and conjecturing player 2's last period effort level e_2^4 , player 1 solves $\max_{e_1 \geq e_1^1} u_1(e_1, e_2)$. The solution is then

$$e_1 = \max\{e_1^1, R_1(e_2)\}. \quad (48)$$

Equation (48) describes 1's continuation reaction function, which provides us with the subgame-perfect-equilibrium level of effort of 1 in period $t = 3$,

$$\tilde{e}_1^3(e_1^1, e_2^2) = \begin{cases} 0 & \text{if } e_1^1 \geq R_1(e_2^2) \text{ and } e_2^2 \geq R_2(e_1^1) \\ e_1^P - e_1^1 & \text{if } e_1^1 \leq e_1^P \text{ and } e_2^2 \leq e_2^D \\ 0 & \text{if } e_1^1 \geq e_1^P \text{ and } e_2^2 \leq R_2(e_1^1) \\ R_2^{-1}(e_2^2) - e_1^1 & \text{if } e_1^1 \leq R_2^{-1}(e_2^2) \text{ and } e_2^D \leq e_2^2 \leq e_2^c \\ R_1(e_2^2) - e_1^1 & \text{if } e_1^1 \leq R_1(e_2^2) \text{ and } e_2^2 \geq e_2^c. \end{cases} \quad (49)$$

The uniqueness of these strategies is implied by lemmas 3.1 and 3.3.

The logic of the proof is as follows: Given the first two period efforts and conjecturing the rival's last period effort, it is best for player 1 to exert no further effort in case of an excessive first period choice, since effort is irreversible. These are the situations when [1] both parties are above their best response functions or when [2] 1 has exceeded *his* Stackelberg amount. There are three cases in which 1 should exert additional effort: [1] if player 2 is above *her* one-shot simultaneous move Nash equilibrium amount and 1 still below *his* best response function, it is best for player 1 to add to his first period amount up to *his* best response function due to lemmas 3.1 and 3.2 ; [2] suppose 2 is above her Stackelberg amount but still below her one-shot Nash equilibrium level. Based upon lemmas 3.1 and 3.3, we know it is best for 1 to increase to 2's best response function as to prevent 2 from exerting further effort; [3] if both are below their Stackelberg amounts, then it is optimal for 1 to add to his first period amount up to *his* Stackelberg level; Figure 3.11 depicts the corresponding strategic actions of player 1 in period $t = 3$ when he is the favorite, given various positions of the pair (e_1^1, e_2^2) .

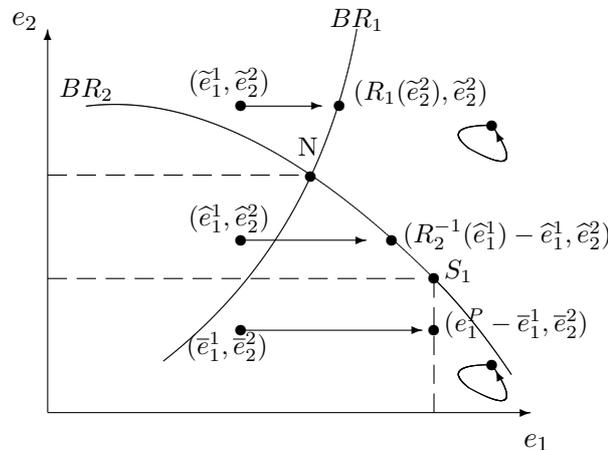


FIGURE 3.11

$t = 2$

Now consider the second period. Clearly party 2 has no incentive to choose an effort level higher

than her best-response function, given party 1's first period effort and conjecturing 1's following period effort. In subgame perfect equilibrium, we must have,

$$\tilde{e}_2^2(e_1^1) = \begin{cases} e_2^c & \text{if } e_1^1 \leq e_1^c \text{ and } w^c > 1/2 \\ R^2(e_1^1) & \text{if } e_1^c \leq e_1^1 \leq e_1^P \text{ and } w^c > 1/2 \\ y, \text{ s.t. } 0 \leq y \leq R^2(e_1^1) & \text{if } e_1^1 \geq e_1^P \text{ and } w^c > 1/2 \\ y, \text{ s.t. } 0 \leq y \leq R^2(e_1^1) & \text{if } e_1^1 \geq e_1^P \text{ and } w^c \leq 1/2. \\ y, \text{ s.t. } 0 \leq y \leq e_2^D & \text{if } e_1^1 \leq e_1^P \text{ and } w^c \leq 1/2. \end{cases} \quad (50)$$

Based upon lemma 3.3, the logic of the proof is explained as follows. Given party 1's first period effort and conjecturing 1's following period effort, if the 'have not' player 2 finds that the 'have' 1 is below *his* one-shot static-play Nash equilibrium amount, then 2 will *immediately* exert efforts up to *her* one-shot static-play Nash equilibrium amount; if 2 finds that 1 is above *his* one-shot Nash equilibrium amount but below *his* Stackelberg amount, then it is best for 2 to *immediately* increase her efforts up to *her* best response function. From equation (49), we know that any different effort level by 2 will provide 1 with a strict incentive to exert additional effort in the following period and thereby hurting 2; if favorite party 1 is above his Stackelberg amount, then 2 will anticipate that 1 will exert no further effort due to equation (49). Hence, 2 may allocate her effort between the periods due to equation (47). Similar reasoning can be applied to cases in which 1 is underdog. Figure 3.12 depicts the corresponding strategic actions of party 2 in period $t = 2$ when she is the underdog.

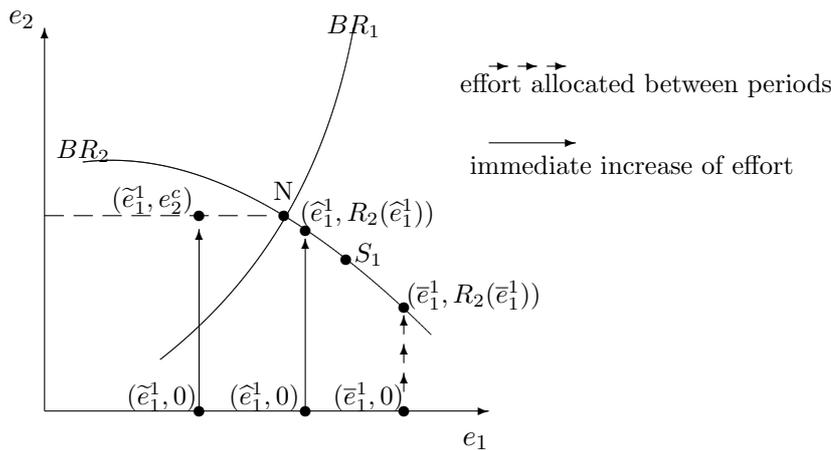


FIGURE 3.12

$t = 1$

Similarly, in the first period, party 1 has no incentive to choose an effort level higher than his best response function. Then the remaining question is will party 1 invest an amount other than his two-period Stackelberg level? It will be helpful to discuss separately two ranges for the value of w^c :

where $w^c > 1/2$ and where $w^c \leq 1/2$.

I. $w^c > 1/2$

If party 1 chooses $e_1^1 \leq e_1^P$ in period $t = 1$, then we know from equation (50) that in period $t = 2$, party 2 will choose e_2^2 such that $e_2^2 = R_2(e_1^1)$. Further, from (49) we know that in period 3, party 1 will exert no more effort, i.e., $e_1^3 = 0$. In the last period, 2 will choose $e_2^4 = 0$. As a result, in subgame perfect equilibrium, the aggregate effort levels of party 1 and 2 are

$$\tilde{e}_1 = e_1^1 \text{ and } \tilde{e}_2 = R_2(e_1^1).$$

Lemma 3.3 implies that party 1's payoff is maximized when he sets $e_1^1 = e_1^P$. Any amount of $e_1^1 < e_1^P$ will lead party 2 to invest $e_2^2 > e_2^D$ in period 2 (and $e_2^4 = 0$ in period 4), resulting in a lower payoff for 1. Now suppose party 1 chooses $e_1^1 > e_1^P$ in period $t = 1$. Then 1 can always improve his payoff by reducing e_1^1 to e_1^P due to lemma 3.3.

So in subgame perfect equilibrium, 1 and 2 invests $(\tilde{e}_1^1, \tilde{e}_1^3)$ and $(\tilde{e}_2^2, \tilde{e}_2^4)$ such that

$$(\tilde{e}_1^1, \tilde{e}_1^3) = (e_1^P, 0) \text{ and } (\tilde{e}_2^2, \tilde{e}_2^4) \in \text{Conv}\{(e_2^D, 0), (0, e_2^D)\},$$

respectively.

II. $w^c \leq 1/2$

If party 1 chooses $e_1^1 \leq e_1^P$ in period $t = 1$, then from equation (50) we know in period $t = 2$, party 2 will choose e_2^2 such that $0 \leq e_2^2 \leq R_2(e_1^1)$. From equation (49), we know that in period 3, party 1 will choose an amount e_1^3 equals to $e_1^P - e_1^1$. In the last period, 2 will choose $R_2(e_1^1 + e_1^3) - e_2^2$. But $e_1^1 + e_1^3 = e_1^P$ and $R_2(e_1^P) = e_2^D$. Now suppose that party 1 chooses $e_1^1 > e_1^P$ in period $t = 1$. But 1 can always improve his payoff by reducing e_1^1 to e_1^P due to lemma 3.3.

As a result, in subgame perfect equilibrium, the aggregate effort levels of party 1 and 2 are

$$\tilde{e}_1 = e_1^P \text{ and } \tilde{e}_2 = e_2^D.$$

This outcome can be realized via a continuum of subgame-perfect-equilibrium paths, namely, 1 and 2 invests $(\tilde{e}_1^1, \tilde{e}_1^3)$ and $(\tilde{e}_2^2, \tilde{e}_2^4)$ such that,

$$(\tilde{e}_1^1, \tilde{e}_1^3) \in \text{Conv}\{(e_1^P, 0), (0, e_1^P)\} \text{ and } (\tilde{e}_2^2, \tilde{e}_2^4) \in \text{Conv}\{(e_2^D, 0), (0, e_2^D)\}.$$

respectively. ||

This result says that doubling the number of periods of interaction has no real impact on the aggregate effort level. Since the aggregate effort has not changed, the corresponding equilibrium rate of rent dissipation, the respective payoffs and the subsequent distortion to access to justice are the same in a four-period game as in a two-period one. The equilibrium level of rent dissipation, payoffs and

subsequent distortion to access to justice is therefore the same in a four-period game as in a two-period one.

In the Stackelberg outcome, the favorite leader takes all action in the first period as a leader, thereby curbing the underdog follower's incentive. This is because a lower effort by a favorite leader in the first period would trigger a more aggressive response by the follower, which is unfavorable. In contrast, an underdog leader allocates her effort throughout all the periods as for her there is no need to overcommit. A follower, being either a favorite or an underdog, may distribute investment throughout all the periods.

3.4.3. SEQUENTIAL LITIGATION GAME WITH ENDOGENOUS SEQUENCING

Now assume that, the legal procedure does *not* prescribe which party exerts effort first and which party responds, that is, either party may initiate as the plaintiff in a litigation. This is often the case in legal disputes such as custody, divorce and contract:

- (i) In custody litigation, who will put forward (or defend against) a claim if one partner has superior ability to manipulate and intimidate the children regarding their statements to the custody evaluator?
- (ii) If a divorce agreement cannot be reached between a spouse, who will initiate the lawsuit when gender bias in family courts works to the female's (or male's) advantage?
- (iii) Legal costs are typically higher for foreign firms in business contract disputes. They incur higher costs in communications and in translating business documents into a form that will be understood by a domestic court. Will the domestic firm act as a claimant given its typical advantage?

These questions will be answered in this section.

3.4.3.1. *Equilibrium Sequence of Litigation with Announcement*

Now consider the *extended litigation game with announcement stage* (hereafter "extended litigation game"). I will construct and solve analytically a specific parametric model based on the more general and nonparametric models of Hamilton and Slutsky (1990), Baik and Shogren (1992) and Leininger (1993).¹⁰⁹ Litigants 1 and 2 first decide and announce the rounds in which they will choose their effort levels. This is done simultaneously. The litigants then choose their effort levels, knowing when the opponent does so, in the rounds to which they were committed in the announcement stage. If both parties choose to exert efforts in the same rounds, a simultaneous play subgame occurs; if the litigants choose to exert efforts at different rounds, then the party choosing to exert efforts in odd (resp. even) rounds becomes the plaintiff (resp. defendant), giving rise to a sequential play subgame.

Formally, define $\Gamma = \{\mathcal{N}, \mathcal{S}, u\}$ to be the extended litigation. The set of players is $\mathcal{N} = \{1, 2\}$. Let I_1 and I_2 be compact, convex intervals of \mathbb{R}^1 which are litigants 1's and 2's possible effort levels in the basic game, i.e., in the game without the announcement stage. As in the basic game, the payoffs to the two litigants depend only on the efforts exerted in the basic game (see equation (30)). $\mathcal{T} \equiv \{\text{First}, \text{Second}\}$ is the set of possible times at which to choose the level of effort. Let m be the period in which litigant 1 has chosen to exert effort and n be the period litigant 2 has chosen to exert effort. The set of strategies for litigant 1 is $\mathcal{S}_1 = \{\text{First}, \text{Second}\} \times \Phi_1$, where Φ_1 is the set of functions that map $\{(\text{First}, \text{First}), (\text{First}, \text{Second}), (\text{Second}, \text{First}) \times I_2, (\text{Second}, \text{Second})\}$ into I_1 . Litigant 2's

¹⁰⁹Hamilton and Slutsky (1990), Baik and Shogren (1992) and Leininger (1993) endogenize the sequence of moves in two-stage, two-player contests.

strategy set is $\mathcal{S}_2 = \{\text{First, Second}\} \times \Phi_2$, where Φ_2 is the set of functions that map $\{(\text{First, First}), (\text{First, Second}) \times I_1, (\text{Second, First}), (\text{Second, Second})\}$ into I_2 . Define $s_1 = (m, \phi_1) \in \mathcal{S}_1$, where $\phi_1 \in \Phi_1$, and $s_2 = (n, \phi_2) \in \mathcal{S}_2$, where $\phi_2 \in \Phi_2$. The payoff functions are

$$u_1^E(s) = \begin{cases} u_1^c & \text{if } (m, n) \in \{(\text{First, First}), (\text{Second, Second})\} \\ u_1^P & \text{if } (m, n) = (\text{First, Second}) \\ u_1^D & \text{if } (m, n) = (\text{Second, First}), \end{cases}$$

and

$$u_2^E(s) = \begin{cases} u_2^c & \text{if } (m, n) \in \{(\text{First, First}), (\text{Second, Second})\} \\ u_2^D & \text{if } (m, n) = (\text{First, Second}) \\ u_2^P & \text{if } (m, n) = (\text{Second, First}), \end{cases}$$

where the superscript “E” stands for extended litigation.

We can now formally analyze the equilibria in the extended litigation.

Proposition 3.3. *In extended two-stage litigation with announcement stage,*

- (i) *The litigation intensity in endogenous sequencing decision falls below that under simultaneous decision. That is, $r^E(a) \leq r^c(a)$ for all a .*
- (ii) *The “have” (resp. “have not”) wins less (resp. more) often in a sequential protocol than in a static play. That is, $w^E(a) > w^c(a)$ when $0 \leq a < 1$ and $w^E(a) < w^c(a)$ when $a > 1$.*
- (iii) *The endogenous sequencing outcome Pareto-dominates the static play outcome. That is, $u_i^E \geq u_i^c$ for all a for $i = 1, 2$.*
- (iv) *The distortion to access to justice is smaller in the endogenous sequencing process than that in the static process for moderate degrees of asymmetry.*

Proof. To prove the proposition, we first need to establish the timing of choices. The timing of choices can be determined by the comparison of payoffs with the three different orders of play. The normal form of the extended litigation is

		Litigant2	
		First	Second
Litigant 1	First	(u_1^c, u_2^c)	(u_1^P, u_2^D)
Second	(u_1^D, u_2^P)	(u_1^c, u_2^c)	

(i) When $0 \leq a \leq 1$, by comparing equations (34) and (43), we obtain $u_1^P > u_1^c > u_1^D$ and $u_2^D > u_2^P > u_2^c$. It is a *dominant strategy*¹¹⁰ for the “have not” party 1 to take the role of a plaintiff and invest early and that the “have” party 2 is better off observing then reacting to 1’s action than competing for the first-mover-advantage. The unique subgame perfect equilibrium is (First, Second); Similarly when $a \geq 1$, the unique subgame perfect equilibrium is (Second, First).

¹¹⁰A strategy is called dominant if it always earns a higher payoff for the one uses it.

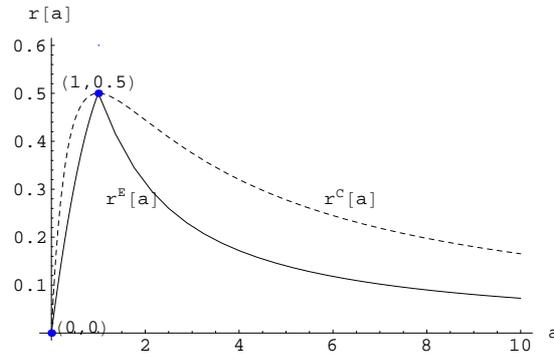


Figure 3.13. Rent dissipation (Endogenous Sequencing vs. Static Process)

The intensity of litigation is given by

$$r^E(a) = \begin{cases} \frac{a(3-a)}{4} & \text{if } 0 \leq a \leq 1, \\ \frac{3a-1}{4a^2} & \text{if } a \geq 1. \end{cases} \quad (51)$$

Figure 3.13 illustrates the effect of asymmetry on litigation cost.

(ii) The win rate and trial payoff of the players in the extended two-stage litigation with announcement stage are given by

$$w^E(a) = \begin{cases} \frac{1}{3-a} & \text{if } 0 \leq a \leq 1, \\ \frac{2a-1}{3a-1} & \text{if } a \geq 1. \end{cases} \quad \text{and} \quad 1 - w^E(a) = \begin{cases} \frac{2-a}{3-a} & \text{if } 0 \leq a \leq 1, \\ \frac{a}{3a-1} & \text{if } a \geq 1, \end{cases} \quad (52)$$

respectively. The third result of the proposition can be derived by comparing equations (33) and (52).

When the sequence of moves is endogenously determined, the dynamics of legal process diminishes the effect of asymmetry in terms of win rates. Figure 3.14 illustrates the difference between the two protocols.

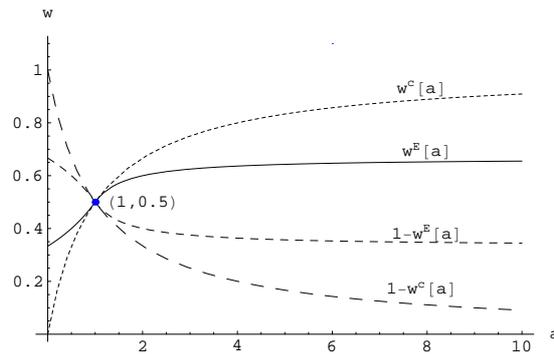


Figure 3.14. Win Rates (Endogenous Sequencing vs. Static Process)

(iii) The payoffs of the parties are given by

$$u_1^E(a) = \begin{cases} \frac{a}{4}V & \text{if } 0 \leq a \leq 1, \\ \frac{(2a-1)^2}{4a^2}V & \text{if } a \geq 1. \end{cases} \quad \text{and} \quad u_2^E(a) = \begin{cases} \frac{(2-a)^2}{4}V & \text{if } 0 \leq a \leq 1, \\ \frac{1}{4a}V & \text{if } a \geq 1. \end{cases} \quad (53)$$

This last result of proposition 3.3 can be directly derived by comparing equations (34) and (53). ||

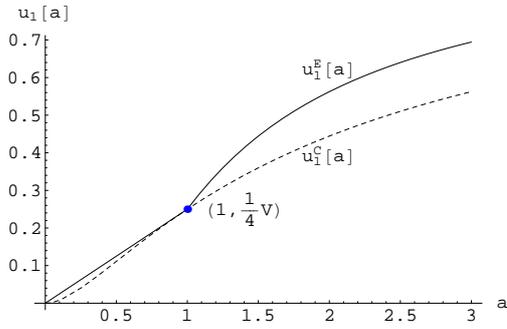


Figure 3.15. 1's Trial Payoff (Endogenous Timing)

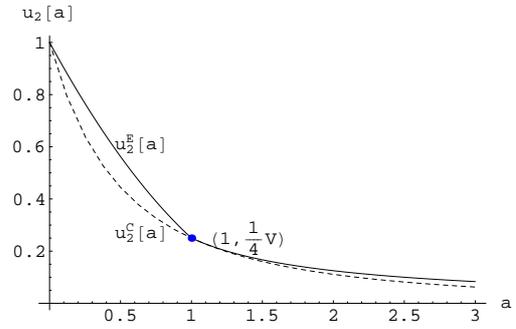


Figure 3.16. 2's Trial Payoff (Endogenous Timing)

Distortion to access to justice The degree of distortion to access to justice is given by

$$\delta^E(a) = \begin{cases} \frac{1}{4}[8 + 5a(a - 4) + a(a - 4)^2]^{\frac{1}{2}} & \text{if } 0 \leq a \leq 1, \\ \frac{1}{4}[8 + (1 + a)(1 - 4a)a^{\frac{1}{3}}]^{\frac{1}{2}} & \text{if } a \geq 1. \end{cases}$$

Figure 3.17 depicts the influence of asymmetry on access to justice when timing is endogenous. The distortion reaches its minimum when one litigant is (approx.) 80 percent as adept as the other. The figure also illustrates the different impacts that asymmetry would exert on justice as the timing changes. Note that, $\delta^E(a) < \delta^C(a)$ for some a . The enhanced access to justice stems from the parties' flexibility in coordinating their legal actions to soften competition: the "have not" would always has the first move and commit to a low effort level; the "have" goes along and scales back expenditure. Both sides can therefore save a significant amount of effort and avoid fierce litigation.

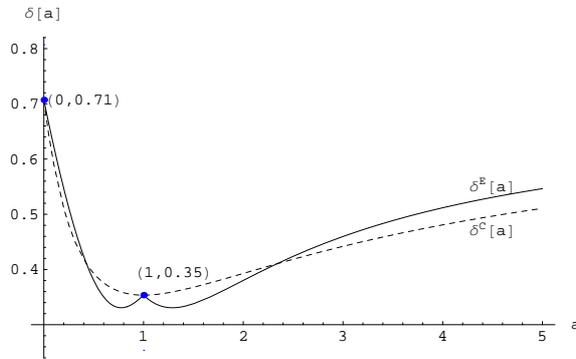


Figure 3.17. Distortion to Access to Justice (Endogenous Sequencing vs. Static Process)

3.5. CONCLUSION

In a game theoretical model, the findings of this study reaffirm Galanter's thesis that the "haves come out ahead." The parties with lower costs in litigation consistently fared better than their weaker opponents and the disparity in success rates was greatest when the disparity in strength was greatest. The total legal costs are always low toward the extremes of disparity in strength (where a is close to 0 or ∞) and highest for intermediate values of disparity in strength. Distortions to access to justice are always high toward the extremes of asymmetry and lowest for intermediate values of asymmetry.

Several notable additions of this analysis to the fairly extensive literature that has been built on Galanter's insights are the discovery that

[1] in a sequential litigation protocol where the roles of the plaintiff and the defendant are exogenously determined, the tendency of the "haves" to achieve greater trial victory and win more frequently than their less advantaged opponents through aggressive litigation investment is remarkably higher when he "haves" are plaintiffs than when they defendants;

[2] while the dynamics of legal process *always* benefits the plaintiff, it hurts the defendant when she is disadvantaged and the sequencing of move and countermove is exogenous;

[3] in lawsuits such as custody, patent and contract, where the roles of the plaintiff and the defendant are left to be determined by the parties themselves, the "have not" will initiate the lawsuit to challenge the "have" as to soften litigation intensity. The "have" goes along with this and scales back expenditure.

[4] in both static legal process and sequential process with endogenous sequencing, the extent of rent dissipation is decreasing in the disparity in adeptness; however, in sequential legal process with exogenous sequencing, this is not necessarily the case.

[5] the outcome of endogenous sequencing litigation protocol Pareto dominates the outcome of the static play;

[6] The flexibility of multiple actions neither benefits nor harms the litigants.

CHAPTER 4

Economic Determinants of Noneconomic Damages in Medical Malpractice Claims

4.1. INTRODUCTION

VICTIMS OF TORTIOUS INJURY suffer from accidents in more than financial ways. Adequate access to justice requires that the victims be compensated timely and fully for their losses. I have discussed the issue of timely compensation in Chapter 2. This chapter deals with the issue of full compensation: besides economic losses such as medical expenses and lost earnings, also noneconomic losses such as pain, suffering and loss of enjoyment of life should be compensated. A problem associated with such compensatory damages is that they are difficult to quantify. For this reason, there has long been claims that awards for noneconomic harm are random and unpredictable. It is the purpose of this chapter to investigate, in medical malpractice claims, that (i) whether noneconomic damages are arbitrary, and (ii) what determines the incidence and magnitude of noneconomic damages awards. This is worthwhile, because the popular beliefs that noneconomic damages awards are capricious and unpredictable have made these awards an contentious issue in all of the various medical malpractice reform attempts in recent years in the United States.^{111,112} My analysis provides the most recent evidence that these beliefs are unfounded. I begin with a general conceptual discussion on the economics of non-economic damages.

The aim of compensatory damages is to make the victim whole and restore the victim to the position she was in before the injury, at least to the extent that monetary damages can do so.¹¹³ Compensatory damages consist of awards for both economic damages and noneconomic damages. Whereas economic damages are designed to reimburse an accident victim's lost earnings and medical costs, noneconomic damages are intended to compensate the victim for her physical pain or mental anguish. The specific compensable elements of noneconomic damages vary by jurisdiction. But generally damages are awarded for bodily harm (e.g., disfigurement, disability), emotional distress (e.g., fear, anxiety, depression, and embarrassment), and loss of enjoyment of life (e.g., limitations on one's lifestyle and resulting feelings).¹¹⁴ Therefore, noneconomic damages encompass highly intertwined elements, many of which have psychological or social aspects.

The following simple theoretic framework may help to conceptualize the idea of compensation for noneconomic losses.¹¹⁵ Let U denote the *lifetime utility* of a victim and let w denote the level

¹¹¹In 2003, The former U.S. President Bush has urged Congress at least six times to impose substantial nationwide restrictions on medical malpractice cases, including a cap on noneconomic damages of over \$250,000. In his recent health care reform, U.S. President Obama has rejected caps on noneconomic damages in medical malpractice cases. President Obama told the American Medical Association (and the American public) that medical malpractice caps are "unfair to people who have been wrongfully harmed." See also Kinney (1995). Kinney (1995) summarizes federal efforts to reform noneconomic damages in the 90s.

¹¹²Proponents for restricting and eliminating non-economic damages also argue that jury awards and settlements are too high. This chapter, however, focuses on the predictability of noneconomic damages. Whether these awards levels are appropriate is not of interest in this chapter.

¹¹³See Restatement (Second) of Torts, 1979, § 901.

¹¹⁴See Restatement (Second) of Torts, 1979, § 905.

¹¹⁵I am grateful to Eric van Damme for suggesting me to adopt this framework.

of the victim's *lifetime income*. Furthermore, let x denote the level of *physical and mental distress* suffered by the victim. Assume, for simplicity, that the victim's lifetime utility depends only on her lifetime income and physical and mental distress so that $U = U(w, x)$. Assume that the victim's utility increases with her lifetime income and decreases with her physical and mental distress, or $U_w > 0$ and $U_x < 0$. Further assume that without the injury, the victim's lifetime income is w_0 and her physical and mental distress is 0. The victim's utility before the injury is then $U(w_0, 0)$. After the injury, the victim's lifetime income drops to w_1 and her distress level becomes x_1 . Hence, her lifetime utility becomes $U(w_1, x_1)$. The level of the victim's *noneconomic loss* is given by $-x_1$. Furthermore, let c_e denote the level of economic damages awards and c_n the level of noneconomic damages awards. To restore the victim to the position she was in before the injury, we must have that $U(w_1 + c_e + c_n, x_1) = U(w_0, 0)$.

However, in practice the conceptual framework above is difficult to implement for determining exactly *how much* the victims should be compensated. The components of noneconomic damage awards are defined in only general ways.¹¹⁶ Jury instructions for noneconomic loss do not provide precise quantitative guidance. Because of this lack of guidance, there have long been claims that noneconomic damage awards are random.¹¹⁷ Since randomness implies variation in awards for individuals who suffer identical injury, when damages are random the tort system is not horizontally fair.¹¹⁸ Furthermore, when compensations are random, the tort system may not be fair if a fair system is one that restores a victim of to the position she was in before the injury. When compensations are provided randomly more severely injured victims may receive less compensation than less severely injured ones.¹¹⁹

Empirical findings offer little support to the claims that awards for noneconomic harm are unpredictable.¹²⁰ In an insightful paper, Viscusi (1988a) studied over 10,000 closed product liability claims and found that noneconomic damage awards vary systematically with the economic losses, the character of injuries, and liability doctrine involved in claims. Bovbjerg *et al.* (1989) studied the predictability of noneconomic damages in personal injury lawsuits from Florida and Kansas City. They categorized the injury types by degrees of severity which were measured on a nine-point scale. They found that the juries award the least damages for insignificant and temporary injuries and the largest for catastrophic permanent injuries. However, they also found considerable unexplained variability across and within categories of injury severity, raising the possibility that juries do not award damages uniformly from case to case. In the same genre, the latter research by Balder *et al.* (1995), Bobbers *et al.* (1989) and (1991), Goodman *et al.* (1989), Hans & Ermann (1989), Peterson (1984), Sloan & Hsieh (1990), Vidmar & Rice (1993) has been able to account for between half and two-thirds of the variation in awards in sampled cases by using from just one to a small handful of explanatory variables.

This chapter shares an obvious common thread with this earlier body of work. It departs in that, first, I have the usual opportunity to analyze data on out-of-court settlement. In contrast, Bovbjerg

¹¹⁶This remark has been given by Wissler *et al.* (1997).

¹¹⁷See, e.g., discussions in Daniels (1989), Daniels & Martin (1995), Litan (1993), MacCoun (1993), Saks (1992), Vidmar (1994), (1995), Weiler (1991).

¹¹⁸Horizontal fairness implies that individuals suffer the same degree of injury recover the same amount of damage compensation. See Section 1.1, page 6.

¹¹⁹For definition of fairness, see Section 1.1.

¹²⁰See Morrison and Vigore (2007) for a review of this literature.

et al. (1989) and others have restricted their analysis to tried cases. The vast majority of cases are settled out-of-court in the shadow of litigation. But little is known about the pattern of awards for noneconomic harm in out-of-court settlement. Moreover, there is usually a sample selection bias associated with using tried cases: the group of court-adjudicated cases is a highly selected sample of all cases brought for damage award.¹²¹ The present study contributes to this literature by expanding the current knowledge on noneconomic damages and by overcoming the problems of selection bias that plague earlier studies. Using a novel dataset from the Texas Department of Insurance (TDI) Commercial Liability Insurance Closed Claim Report, I provide a comprehensive prospective on the incidence and magnitude of noneconomic damage awards in medical malpractice cases and analyze the relationship of these awards to other characteristics of the case. I present four robust findings on this topic:

- (a) Consistent with the findings of Viscusi (1988a) and Rodgers (1993), I find that noneconomic damage awards are not completely random outcomes. They vary, in predictable ways, with changes in the *economic* characteristics of the case: the victim's financial loss is the single best predictor of noneconomic damages, accounting for 64 percent and 25 percent of the variance in the incidence and magnitude of the awards, respectively;
- (b) Moreover, the incidence of noneconomic damage awards are higher for unemployed or self-employed victims than for employed ones; Furthermore, when compared to victims receiving collateral insurance payment, victims without collateral insurance are more likely to be compensated. These results suggest that when awarding noneconomic damages the tort system has objectives other than merely making whole the victims for their physical and mental anguish.
- (c) By going to trial a victim increases the amount of compensation for noneconomic harm by nearly 73.5% when compared to a victim who settles out of court. This result indicates that the various aspects of the litigation process, such as litigation costs and plaintiff's risk aversion, lower the plaintiffs' bargaining position *vis-à-vis* the defendant. Subsequently the defendant lowers the settlement offer amount below the expected court award.
- (d) The incidence and magnitude of awards are not systematically related to the type of injury. Permanent and catastrophic injuries do not necessarily receive more awards for noneconomic damages than temporary, insignificant injuries. The lack of systematic relationship could be a result, in part, of variability the type of evidence that could be presented at trial, in the bargaining skill of the parties, the gender and income of the victim, or other factors that are not taken into account by the current model.¹²²

Taken together, my results cast doubt on the validity of the claim that noneconomic damage awards are random and unpredictable and serve as evidence against damage caps. The chapter is organized as follows. In Section 4.2, I briefly describe the provision of noneconomic damages in the US legal system and the recent noneconomic damage reforms. Section 4.3 provides an overview of the noneconomic damage awards by injury type. The role of noneconomic damages is not uniform, even for a particular injury class. Section 4.4 describes estimation methods. Section 4.5 presents the empirical results. Section 4.6 presents summary measures of the efficiency of the tort system for

¹²¹See Priest and Klein (1984) for discussion on sample selection bias associated with litigated cases. See Viscusi (1988b) for similar critiques on using expected court verdict as proxy for expected levels of damage.

¹²²See Section 1.1 for the definition of 'fairness'.

medical malpractice claims in the Texas Department of Insurance Commercial Liability Insurance Closed Claim database. The legal costs share of total damage payments average about 0.59 for all claims involve noneconomic damage payments. This ratio is somewhat higher for cases without noneconomic damage payments. Furthermore, I find that the tort system is more efficient in awarding noneconomic damages for fatal injury and very serious injury types than for temporary, insignificant injuries. Section 4.6 provides a discussion on fairness issues in noneconomic loss compensation based on the empirical results. Section 4.7 concludes.

4.2. LEGAL BACKGROUND

Provision of Noneconomic Damages

In the US, noneconomic damages are provided extensively through the tort law system, but only moderately by insurance markets.¹²³ In the American tort system, noneconomic damages are estimated by the juries, influenced by the effort of the lawyers and eventually modified and approved by the court.

Juries are often urged to “reasonably compensate” the victims for noneconomic losses.¹²⁴ However, what compensation is reasonable and the objectives that are to be promoted by this compensation have not been well defined. Standard jury instructions sometimes explicitly state that there are no objective guidelines by which the jury can follow to measure the money equivalent of noneconomic losses.¹²⁵ Furthermore, as Vidmar and Rice (1993) and others have observed, since juries are ad hoc groups of lay persons familiar only with the case at hand, they are not aware of the level of awards in similar cases with which to compare and adjust their damage assessment.

As a result, lawyers have tried to offer a number of heuristic devices to help juries quantify noneconomic losses. However, courts have often rejected these attempts. Some jurisdictions in the US forbid the jurors to use the “per diem” method, where the jury awards the victim a small amount per unit of time (such as a day or an hour) and then multiplies it by the victim’s life expectancy.¹²⁶ The reasons of prohibition are that assuming the noneconomic loss suffered by the victims is additive over each time interval is at best an approximation to the true value; In addition, it begs the fundamental issue of what each unit of noneconomic loss is worth.¹²⁷ Courts have similarly rejected the “Golden Rule” which asks jurors to determine the amount of compensation they need to receive (ex post) if they had to experience the victims’ pain and suffering. The reason of rejection is that the courts think the “Golden rule” approach is too clearly based on nonobjective factors: it is impermissible in virtually every jurisdiction to ask jurors to imagine themselves in the circumstances of the victim and to use

¹²³There are different explanations for the absence of an insurance market for noneconomic loss. For instance, Suurmond and Van Velthoven (2005) shows that there is a lack of demand for insurance for noneconomic damages: even if noneconomic losses would be fully compensated - a risk averse individual would never purchase insurance against the risk of incurring noneconomic losses. Croley and Hanson (1995) argue that there is a lack of supply of insurance. They show that market failures, such as moral hazard, would prohibit insurance companies from selling insurance for noneconomic damages.

¹²⁴For instance, the Restatement (Second) of Torts (1979, § 912) particularly notes: “The discretion of the judge or jury determines the amount of recovery, the only standard being such an amount as a reasonable person would estimate as fair compensation.”

¹²⁵See Douthwaite, (1988), page 274.

¹²⁶See Pearson *et al.* (2005) and McCaffery *et al.* (1995).

¹²⁷For discussion of this point, see Viscusi (1988a). Totaro (2006) makes a similar remark.

that visualization in determining the level of noneconomic damages.¹²⁸ Yet some jurisdictions in the US allow jurors to use the “per diem” approach. Similarly, “day-in-the-life” videos are admissible in courts if they are carefully prepared.¹²⁹ Once the jury determines the amount of damage, the court may reduce the amount via a remittitur process,¹³⁰ or because there are statutory caps under which the court must adjust the jury award.¹³¹

Noneconomic Damages Reform

The claims that noneconomic damages are random have made these damage components the subject of much legislation and continuing suggestions for further modifications of the legal system in order to limit or prohibit noneconomic damage awards. For instance, in 1986 the U.S. Department of Justice Tort Policy Working Group reported that noneconomic damages were subjective awards and are unpredictable and that the magnitude of these awards was so substantial that a cap was needed.¹³² In 2003, former US President Bush proposed a nationwide \$250,000 cap on all noneconomic damages awarded in medical malpractice lawsuits. Following the proposal seven states passed legislation or amended their constitutions to create caps on noneconomic damages. Texas, for instance, established a tree-tiered system for awarding noneconomic damages in medical malpractice cases in 2003 (see House Bill 4, Texas Legislature (2003)). A \$ 250,000 cap applies to all doctors involved in a case, with a \$ 250,000 cap against any single institution and a \$ 500,000 cap on all health-care institutions combined.¹³³ By 2007, 26 states in the US have imposed caps on non-economic damages.¹³⁴ During this period, noneconomic damage caps were struck down by supreme courts in five states. In some states, such as Illinois and Ohio, caps were struck down by state supreme courts and later reenacted in amended form. Sometimes this cycle repeated itself.¹³⁵

The above discussions lead to the following hypothesis about the predictability of noneconomic damage awards:

Hypothesis *Noneconomic damage awards are entirely random events.*

In this case the constant term will be statistically significant in each equation, while the substantive coefficients will not be as a consequence.¹³⁶

¹²⁸See Boucher (2008), page 169.

¹²⁹See Varner and James (1999).

¹³⁰A remittitur process is a legal process which allows a judge to reduce a jury award if the judge believes that the amount is not supported by the facts and that it is excessive.

¹³¹For an extensive review of the provision of noneconomic damages, see Avraham (2006b).

¹³²See U.S. Department of Justice Tort Policy Working Group, Report (February 1986).

¹³³Reforms in the other states are as follows. Florida imposed caps on noneconomic damages for medical negligence at \$ 500,000 for physicians and \$ 750,000 for hospitals; West Virginia capped noneconomic damages at \$ 250,000 per occurrence; \$ 500,000 per occurrence for wrongful death, permanent and substantial deformity, loss of limb or bodily function; Colorado extended its pre-existing \$ 250,000 cap on noneconomic damages for medical negligence cases to cases of physical impairment and disfigurement. Ohio capped noneconomic damages at \$ 250,000 or three times economic damages to a maximum of \$ 350,000 per victim or \$ 500,000 per occurrence. Oklahoma capped noneconomic damages at \$ 300,000 in cases involving pregnancy.

¹³⁴See Bustos and Avraham (2008), page 2.

¹³⁵See Avraham (2006a) for a comprehensive survey on noneconomic damages reforms in the US. See also Bovbjerg (1989); National Conference of State Legislatures (1988); Sanders & Joyce (1990) for legislations on noneconomic damages.

¹³⁶The constant term in the regression equation is not determined by the values of the explanatory variables. Therefore, a statistically significant constant term with statistically insignificant coefficients indicate that the dependent variable

Table 4.2: Descriptive Statistics: Overall distribution of noneconomic damage awards^a

TYPE OF INJURY	ALL CLAIMS			CLAIMS WITH POSITIVE NONECONOMIC DAMAGES	
	Fraction of cases with Noneconomic Damages	Mean Noneconomic Damages	Fraction of Payment for Noneconomic Damages	Mean Noneconomic Damages	Fraction of Payment for Noneconomic Damages
	Death	.33	120,143	.76	363,720
Amputation	.32	113,239	.69	348,809	.69
Burns (heat)	.42	82,798	.31	434,831	.72
Burns (chemical)	.38	65,173	.24	317,051	.63
Systemic poisoning (toxic)	.56	105,535	.43	272,026	.77
Systemic poisoning (other)	.51	106,462	.35	210,327	.69
Eye injury (blindness)	.36	110,639	.25	304,743	.68
Respiratory condition	.36	83,095	.24	229,072	.66
Nervous condition	.44	102,694	.27	235,690	.62
Hearing loss or impairment	.34	192,867	.24	1,012,727	.72
Circulatory condition	.37	93,488	.23	253,754	.62
Multiple injuries	.31	42,275	.20	133,783	.62
Back injury	.29	51,215	.16	176,079	.55
Skin disorder	.37	78,392	.24	251,187	.64
Brain damage	.34	329,283	.19	1,512,229	.56
Scarring	.44	71,856	.29	163,102	.66
Spinal cord injuries	.30	211,062	.16	693,724	.53
Other	.35	68,614	.23	462,335	.67
Observations		17,960		6,187	

a. all dollar values are in 2005 \$. The source for these values is author's calculations based on the Texas Department of Insurance Commercial Liability Insurance Closed Claim database for the years 1988-2005.

4.3. DESCRIPTIVE STATISTICS

The data are from the Texas Department of Insurance (TDI) Commercial Liability Insurance Closed Claim Report. Texas requires detailed reports for all claims for which the total damage payments by all insurers are at least \$10,000. A rich variety of case-specific information is recorded for majority of claims, including the total amount of damage payment, the level of noneconomic damage payment, the type of injury and the plaintiffs percentage of fault. I analyze data from all available years, which currently include the years 1988 - 2005.¹³⁷

□ **Rules for inclusion in the sample.** TDI data include 20,116 paid medical malpractice claims across 18 injury types over the years 1988-2005. While the data is very rich, it still has limitations that make necessary a restriction on the set of cases included in my sample. I drop 2,156 claims are dropped because information on the type of injury is not recorded. Because of this restriction, the resulting sample of 17,960 cases contains 17,086 cases that terminated in a settlement out-of-court and 874 that terminated during or after trial. I refer to the sample of 17,960 cases as my full sample. Subsequently, I expand the analysis in the first part of Section 4.5 to include only claims for which the insurer reports positive victim age and assess the role of victim's age in noneconomic damage

of the regression equation is not significantly influenced by changes in any of the explanatory variables.

¹³⁷All dollar values throughout the chapter are adjusted to 2005\$ using standard measure of general price trends published by the Bureau of Labor Statistics, the Consumer Price Index for All Urban Consumers.

payments. Because of this restriction, 4,430 cases are dropped from the full sample.

□ **Distribution of Noneconomic Damages.** The variables and model parameters are defined in Table 4.1 (see appendix), and the corresponding descriptive statistics are presented in tables 4.2 and 4.3. Table 4.2 reports the distribution of noneconomic damages. The results are striking in terms of the importance of noneconomic losses in comparison with the economic losses. The effect of noneconomic losses is particularly prevalent for systemic poisoning (toxic) and systemic poisoning (other) victims, as more than half of these accident victims received noneconomic damage losses compensation.

The mean value of noneconomic damage award, which includes claims for which there was a positive award but not necessarily a noneconomic damage component, ranges from a low for \$51,215 for back injury to a high values of and \$329,282 for brain damages.

There is considerably less variation in the share of the award comprised by noneconomic losses. The third column of statistics in Table 4.2 indicates that noneconomic losses comprises from 16 percent to 43 percent of all awards in which medical malpractice liability payment has been received.

These rather impressive statistics regarding the influence of noneconomic damages may understate the importance of these concerns in which they arise. The statistics in the final columns of Table 4.2 address the noneconomic damage contribution excluding cases where noneconomic damage awards are zero, and the role of noneconomic damage increases by 40 percent in most cases. The mean values of noneconomic damage awards now exceed \$1,000,000 in two cases – hearing loss of impairment and for brain damages. In 2005 dollars these noneconomic damage amounts exceed \$451,946 as an average for the injury category. The recommendation by the former President Bush that noneconomic damages be capped at \$250,000 would clearly be a binding constraint on average for these injuries.

The levels of compensation for brain damages and spinal cord injuries should be regarded as very extreme outliers rather than the norm. In 13 out the 18 injury categories in which there is positive noneconomic damage compensation, the level of such compensation is below \$25,000.

□ **Explanatory Variables.** Three sets of explanatory variables are employed in the analysis to account for possible variations in the factors that might affect the incidence and magnitude of awards for noneconomic harm. A first set of variables captures the economic characteristics of the case. *FINANCIAL LOSS* is the amount (in 2005 dollars) of the financial losses that have been awarded in either settlement or at trial for the victim's medical expenses and lost earnings. This variable reflects the severity of injury, as one would expect that more severe injuries are associated with higher medical expenses and lost working hours. *FINANCIAL LOSS* has relatively high explanatory power in predicting the noneconomic damage awards. A regression of *AMOUNT OF NONECONOMIC DAMAGES* on *FINANCIAL LOSS* yields a coefficient of 0.59 (t -value = 74.98), demonstrating that on average, noneconomic losses track financial losses closely. Furthermore, the pseudo R -squared in this equation is 0.24, showing that there is a large proportion of variation across cases in the level of noneconomic damages for any given financial loss amount. Several studies have shown positive correlation between noneconomic losses and economic losses, which include loss of income and property damages.¹³⁸

The next variable, *EMPLOYED*, indicates whether the victim is employed outside of the home. Employment status is often an important determinant of the incidence and level of noneconomic

¹³⁸See, e.g., Viscusi (1988a), Rodgers (1993), Croley and Hanson (1995) and Avraham (2005).

Table 4.3: Descriptive Statistics

	Mean	Std. Dev.
ECONOMIC VARIABLES		
<i>FINANCIAL LOSS</i> (\$)	61,131	362,738
<i>EMPLOYED</i> (1=yes)	0.41	0.49
<i>COLLATERAL PAYMENT</i> (1=yes)	0.38	0.48
<i>EMPLOYED</i> (1=yes)	0.41	0.49
<i>INITIAL EXPENSE RESERVE</i> (\$)	16,786	24,919
<i>AGE</i> (years)	39	24
	N	%
STAGE		
<i>Settlement out of court</i>	17,086	95.13
<i>Settlement during or after trial</i>	874	4.87
INJURY		
Death	6,082	33.86
Amputation	422	2.35
Burns (heat)	170	0.95
Burns (chemical)	74	0.41
Systemic poisoning (toxic)	50	0.28
Systemic poisoning (other)	81	0.45
Eye injury (blindness)	471	2.62
Respiratory condition	204	1.14
Nervous condition	140	0.78
Hearing loss or impairment	103	0.57
Circulatory condition	247	1.38
Multiple injuries	500	2.78
Back injury	416	2.32
Skin disorder	203	1.13
Brain damage	1,722	9.59
Scarring	429	2.39
Spinal cord injuries	424	2.36
Other	7,638	42.53
Observations	17,960	

a. all dollar values are in 2005 \$. The source for these values is author's calculations based on the Texas Department of Insurance Commercial Liability Insurance Closed Claim database for the years 1988-2005. The number of observation for *AGE* is 13,530.

damages in juror's decision making. As employment income forms the basis for calculating most economic damage awards, noneconomic loss becomes an important element of compensation for people who do not work outside the home, like retired seniors, children, and homemakers. The victims are employed in 41% of the cases in my sample.

The third economic variable, *COLLATERAL PAYMENT*, indicates whether the victim receives collateral insurance payments. The variable is included to control for the potential negative effect of receiving collateral insurance payments on the probability and level of noneconomic damage awards. Viscusi (1988a) shows that jurors are less likely to award noneconomic damages when the victims already receive collateral insurance payments; and when they do, the level of awards is lower. Victims receive collateral insurance payment in 38% of the cases in my sample.

Furthermore, I include a dummy variable, *STAGE*, to control for the effects of omitted case characteristics that may be correlated with both the legal stage where settlement was reached and the

included variables of interest. As motivated in the introduction, the group of cases that is filed and litigated in court is a usually highly selected sample of cases.

To control for the potential effects of litigation expenditure on damage payments, I use information on the initial reserve amounts established by the insurer given the characteristics of the claim. These reserve amounts are established based on the insurer's experience with the injury type and the nature and severity of damage: a higher initial expense reserve corresponds to a higher expected value of legal expenditures. Initial reserve levels are established by insurers for the time that a damage claim was reported, which will generally be before a suit is filed. That is, they are established prior to any actual damage payments are made and actual defense expenditures are incurred. When insurers set up their initial reserve amounts for a case, they should reserve an amount that corresponds to the actual expected damages and legal expenses for that case type. The estimate of the expected damages and expected costs will change as additional information arrives.

Finally, the type of injury is characterized through a series of 18 injury categories, such as brain damage, back injuries, and so forth, and a catch-all 'other' injury category. Injury type may provide another measure of severity since certain types of injuries lead to greater levels of physical and emotional distress than others. Systemic poisoning, for example, is more life threatening than skin disorder. A burn from heat may be more painful than back injury.

4.4. EMPIRICAL MODELS

Two aspects of noneconomic damage awards – the likelihood and the amount of noneconomic damage payment – merit further empirical investigation. In particular, I will isolate compensation for particular types of injuries from effects such as the differences in the size of the financial losses (e.g. earning loss, medical expenses, etc.) associated with different injury categories. Using the same empirical strategy as that in Viscusi (1988a), I estimate two equations for the case sample. The first is for the level of noneconomic damages, and the second is for the incidence of noneconomic damages. The equations include the same explanatory variables.

Let the estimated value of noneconomic losses be given by

$$[\text{Noneconomic Damages}]_i = \mathbf{x}'_i \beta + \epsilon_i, \quad (54)$$

for each observation i . \mathbf{x}_i is a vector of observed explanatory variables. The parameter vector β is the vector of coefficients, measuring the influence of observed characteristics.

The likelihood of receiving noneconomic damage payment is given by

$$\text{Prob}[\text{Noneconomic Damages}]_i = \text{Prob}\{[\text{Noneconomic Damages}]_i - \epsilon_i > 0\} \quad (55)$$

where the observed noneconomic damages variable equals 1 if the estimated noneconomic damages are positive and 0 otherwise.

Two statistical issues immediately arise. The first statistical issue involves estimation of the equation for the amount of noneconomic damage awards. Using OLS to analyze the nonzero damage payment responses would yield biased estimates. The problem is that the dependent variable is censored from below, with no observations for it if noneconomic damage payments are not positive. In this case, the relationship defined by equation (54) can be consistently estimated using the Tobit estimator.¹³⁹

¹³⁹See Maddala (1983).

The second statistical issue is that the dependent variable estimated in (55) has a binary nature. Estimating (55) using ordinary least squares (OLS) methods could lead to biased estimates of the coefficients. Assuming that the error term follows a normal distribution, the probit estimator yield unbiased estimates of the probability response and will be used here.

4.5. EMPIRICAL EVIDENCE

Columns 1 and 2 of Table 4.4 report the regression estimates of the incidence and magnitude of noneconomic damage awards. Our key interest is on the predictability of these awards. Column 1 of Table 4.4 reports the logit regression results for the incidence of noneconomic damage awards; Column 2 of Table 4.4 reports the tobit regression estimates for the log of noneconomic damage levels. The level of economic damages, the two indemnity reserve variables are also in terms of natural logs so that the coefficients in equation (54) equal the pertinent elasticities. Columns 3 and 4 of Table 4.4 add the victim's age to the regressions reported in the first two columns of Table 4.4. Adding the age variables to the regressions will capture some effects of *EMPLOYED* – the victim's employment status in the first two columns of the table. I begin by focusing on the results in columns 1 and 2 of Table 4.4.

Columns 1 and 2 of Table 4.4 show that there are four variables that affect or are associated with, in a significant way, the incidence of awards for noneconomic harm; and there are three variables that affect or are associated with, in a significant way, the level of awards. The explanatory variables account for nearly two-third of the variability in the incidence of awards and over one quarter of the variability in the level of awards, respectively. One can therefore reject the hypothesis that noneconomic damage awards in medical malpractice cases are entirely random outcomes. These results cast doubt on the validity of the claim that awards for noneconomic harm are random and unpredictable.

The estimates in Table 4.4 also show that the specific factors that affect noneconomic damage compensation. Consider first the economic variables. Cases with higher financial losses are more likely to receive noneconomic damage payments, and when they do the amount of such payments are higher. This is plausible – more serious injuries are probably associated with higher levels of medical expenses and lost working hours and, presumably, greater pain, suffering and loss of enjoyment of life. Because the dependent variable, were expressed as natural logarithms, the coefficient in the first model (reported in column 2 of Table 4.4) for *FINANCIAL LOSS* represents the elasticities of the level of noneconomic damage awards with respect to changes in financial losses. Thus, noneconomic damage awards increase with financial losses, as expected, but the elasticity of that is more than unity. It is not clear why cases with higher levels of financial losses are compensated proportionately more than cases with smaller financial losses.

The incidence of noneconomic damage awards are significantly higher for unemployed or self-employed victims than for employed ones. This is consistent with the view that noneconomic compensation is more important to those who do not work outside the home, such as the elderly, children, and homemakers. That's because victims who do not work outside their homes cannot collect a lost wages portion of economic damages. The "worth" of a homemaker's work inside the home is not easily measured by a dollar amount, and would only be compensated through noneconomic damages. However, I find no evidence of a statistically significant variation in the magnitudes of compensations between employed and unemployed individuals.

TABLE 4.4. ESTIMATES OF NONECONOMIC DAMAGE EQUATIONS^a

Variable	INCIDENCE OF NONECONOMIC DAMAGES (N = 17,960)	Log(1+ AMOUNT OF NONECONOMIC DAMAGES) (N = 17,960)	INCIDENCE OF NONECONOMIC DAMAGES (N = 13,530)	Log(1+ AMOUNT OF NONECONOMIC DAMAGES) (N = 13,530)
Log(FINANCIAL LOSS +1)	0.567** (0.008)	1.536* (0.013)	0.578** (0.009)	1.499* (0.014)
EMPLOYED	-0.502† (0.068)	-1.168 (0.121)	-0.498† (0.083)	-1.097 (0.132)
COLLATERAL PAYMENTS	-0.126† (0.066)	-0.255 (0.119)	0.063† (0.078)	0.054 (0.125)
STAGE (1= trial)	0.088 (0.149)	0.551* (0.048)	0.107 (0.177)	0.549† (0.062)
Log(INITIAL EXPENSE RESERVE +1)	0.020* (0.010)	0.015* (0.017)	0.001* (0.012)	0.018* (0.017)
Log(AGE+1)	- (-)	- (-)	-0.064* (0.033)	-0.128† (0.054)
Death	0.133 (0.138)	0.551 (0.250)	0.221 (0.174)	0.518 (0.287)
Amputation	-0.430 (0.251)	-0.875 (0.436)	-0.565 (0.319)	-1.076 (0.488)
Burns (heat)	0.195 (0.315)	0.763 (0.584)	-0.047 (0.418)	0.318 (0.680)
Burns (chemical)	-0.530 (0.520)	-0.857 (0.912)	-0.401 (0.598)	-0.613 (0.971)
Systemic poisoning (toxic)	0.932 (0.519)	2.277 (0.955)	0.711 (0.697)	1.703 (1.053)
Systemic poisoning (other)	-0.093 (0.480)	0.506 (0.775)	-0.650 (0.557)	-0.210 (0.820)
Eye injury (blindness)	-0.007 (0.225)	0.113 (0.401)	0.039 (0.269)	0.107 (0.430)
Respiratory condition	0.158 (0.288)	0.250 (0.537)	0.289 (0.339)	0.384 (0.574)
Nervous condition	0.284 (0.356)	0.319 (0.631)	0.608 (0.388)	0.790 (0.644)
Hearing loss or impairment	0.304 (0.401)	0.675 (0.766)	0.585 (0.421)	1.387 (0.767)
Circulatory condition	-0.010 (0.279)	-0.080 (0.495)	0.135 (0.322)	0.028 (0.537)
Multiple injuries	-0.487 (0.226)	-0.857 (0.406)	-0.620 (0.264)	-1.088 (0.432)
Back injury	-0.516 (0.263)	-1.067 (0.455)	-0.690 (0.309)	-1.327 (0.488)
Skin disorder	0.352 (0.268)	0.668 (0.537)	0.290 (0.347)	0.599 (0.639)
Brain damage	-0.883 (0.173)	-1.897 (0.286)	-0.625 (0.213)	-1.452 (0.329)
Scarring	0.057 (0.214)	0.180 (0.373)	0.199 (0.249)	0.381 (0.391)
Spinal cord injuries	-1.209 (0.295)	-2.143 (0.458)	-1.172 (0.351)	-2.038 (0.491)
Other	-0.003 (0.134)	0.007 (0.242)	-0.018 (0.168)	-0.111 (0.277)
CONSTANT	-2.447 (0.165)	-5.062 (0.307)	-2.696 (0.224)	-4.906 (0.375)
Pseudo R-Squared	0.6504	0.2606	0.6756	0.2757

a. Standard errors are shown in parentheses.

† significant at 10% level; * significant at 5% level; ** significant at 1% level.

Source: Author's calculations based on the Texas Department of Insurance Commercial Liability Insurance Closed Claim database for the years 1988-2005.

Furthermore, there is a significantly negative effect of receiving collateral insurance payments on the probability of noneconomic damage awards. This result suggests that the victim's financial situations have considerable influence on the jury's decision to award noneconomic damages. However, the magnitude of such payments is not significantly associated with the level of economic losses.

The incidence and magnitude of damage payments for cases settled out-of-court but in the shadow of litigation clearly reflect the juror's concern. There is no statistically significant difference in the likelihood of noneconomic damages between cases settled before trial and cases settled during or after trial. However, by going to trial the victims increase the amount of compensation for noneconomic harm by nearly 73.5% ($\exp\{0.551\} - 1 \approx 73.5\%$) when compared to victims who settle out of court. This result indicates that the various aspects of the litigation process, such as litigation costs and plaintiff's risk aversion, lower the plaintiffs' reservation price and the defendant's settlement offer amount below the expected court award. The significantly positive coefficient of *INITIAL EXPENSE RESERVE* provides an intuitively appealing result: the defendant spends more costs on cases with high damages.

However, noneconomic damages seem to vary less systematically with injury types. For instance, the incidence and amount of awards for serious and catastrophic injuries such as brain damage and spinal cord injuries are not significantly higher than those of less serious injury categories such as back injury and skin disorder. The lack of systematic relationship could be a result, in part, of variability in the bargaining skill of the parties, the type of evidence that could be presented at trial, the age, gender and income of the victim, or other factors that are not taken into account by the current model.

The inclusion of *AGE* in columns 3 and 4 of Table 4.4 reflects the duration of noneconomic damages. It turns out that the coefficients of *AGE* are negative and statistically significant. This is plausible: physical and mental anguishes that are permanent will usually be endured for a longer period the younger the victim is. Therefore, younger victims are likely to receive more noneconomic damage payments, and when they do the amount of such payments are higher. As a final note on this empirical analysis, the TDI database does not contain information on victim's gender and income. Therefore, I am not able to assess the effects of these important individual characteristics on the incidence and magnitude of noneconomic damages. The omission of these variables could well bias estimated coefficients on some of the variables included in the models.¹⁴⁰ But it can be argued that income and gender are relevant variables in explaining the variations in noneconomic losses only in that people who do not work outside the home, like women and children, tend to receive more noneconomic damage awards as a compensation for less economic damage payments. The inclusion of *EMPLOYED* remedies the potential model misspecification bias associated with omission of victim gender and income.

4.6. MEASURES OF THE EFFICIENCY OF NONECONOMIC LOSS COMPENSATION

For the sample of 17,960 medical malpractice claims in the TDI database, there is information on whether the plaintiff retained an attorney as well as on the defendant's legal costs. With reasonable assumptions it is possible to calculate the role of legal costs relative to the net payment amount received by claimants for medical malpractice cases. Analysis of all claims, not simply those in which

¹⁴⁰I am grateful to an anonymous defense committee member for raising this important issue.

a suit was filed, might lead to a lower estimate of the magnitude of transactions costs. For purposes of these calculations, I assume that for plaintiffs who retained an attorney the plaintiff's legal costs are one-third of the total damage award she receives, which is consistent with available empirical evidence.¹⁴¹ For plaintiffs who did not retain an attorney I assume that the plaintiff's legal costs are zero. These cost estimates might understate the actual costs as they do not include and out-of-pocket expenses and the value of plaintiff's time.

Let π denote the level of *damage award*. Let c^p (resp. c^d) denote the *legal costs* incurred by the plaintiff (resp. defendant). The measure of efficiency is given by the damage payments share of total legal costs:¹⁴²

$$r' = \frac{c^p + c^d}{\pi}.$$

Table 4.4 reports the efficiency measures by different types of injury for medical malpractice claims with noneconomic damage payments. Efficiency measures for claims without noneconomic damage payments are included for comparison. The legal costs per net damage payment amount for all cases with noneconomic damage payments average 0.59 and range from 0.51 to 0.68. That is, on average, the tort system generates transactions costs more than half of the value of the net payment received by the plaintiff. The injury types with the lowest degree of efficiency are back injury and nervous condition, for which the values of legal costs average 0.68 relative to the total damage payment to plaintiffs. These values are much higher than those for more serious injuries or fatal injury such as spinal cord injuries (0.51), brain damage (0.51) and death (0.57). Amputation is the only serious or permanent injury type with a costs to damages ratio greater than 0.6. Furthermore, the total legal costs for each dollar received by plaintiffs average 0.66 for claims where noneconomic damage is not an element of compensation.

4.7. FAIRNESS IN NONECONOMIC LOSS COMPENSATIONS

The results in Section 4.5 shows a lack of systematic relationship between the injuries types and the incidence and level of noneconomic losses. In this section, I provide a simple example to illustrate that given the definition of 'unfairness' as the (normalized) difference between a victim's legally entitled compensation and the actual compensation received,¹⁴³ such a lack of systematic variation might indicate that a tort system is unfair if (i) according to the law the system is to restore an individual to the same level of utility before an injury, and (ii) noneconomic losses are higher for more serious injury categories, and (iii) the victims are fully compensated for their financial losses.

To start, assume for simplicity that a victim's *lifetime utility* U depends only on her *lifetime income* w and the level of her *physical and mental distress* x so that $U = U(w, x)$. Further assume that the victim's utility increases with her lifetime income and decreases with her physical and mental distress, or $U_w > 0$ and $U_x < 0$. Suppose that in absence of any injury, the victim's lifetime income is w_0 and her physical and mental distress is 0. The victim's utility before any injury is then $U(w_0, 0)$.

¹⁴¹Hensler et al.'s (1987) study of tort litigation costs in Cook County and San Francisco notes that contingency fees were typically one-third of the award. See Hensler *et al.* (1987), pp. 25-26. Hersch and Viscusi (2007) make the same assumption about the plaintiff's legal costs when measuring the efficiency of tort liability litigation.

¹⁴²This share calculation is similar to the formulation used by Hensler *et al.* (1987), Carroll *et al.* (2005), and Hersch and Viscusi (2007).

¹⁴³See Section 1.1 for a formal definition of unfairness.

TABLE 4.4. EFFICIENCY IN NONECONOMIC DAMAGE AWARDS BY TYPE OF INJURY^a

	Noneconomic Damage	No Noneconomic Damage	Observations
Injury Type			
Death	0.57	0.62	5,652
Amputation	0.65	0.65	383
Burns (heat)	0.65	0.64	157
Burns (chemical)	0.58	0.50	71
Systemic poisoning (toxic)	0.61	0.98	45
Systemic poisoning (other)	0.61	0.71	77
Eye injury (blindness)	0.55	0.59	441
Respiratory condition	0.59	0.74	194
Nervous condition	0.68	0.95	131
Hearing loss or impairment	0.55	0.59	103
Circulatory condition	0.67	0.68	235
Multiple injuries	0.63	0.59	479
Back injury	0.68	0.69	388
Skin disorder	0.52	0.75	184
Brain damage	0.51	0.57	1,623
Scarring	0.62	0.72	396
Spinal cord injuries	0.51	0.56	392
Other	0.61	0.69	7,152
All Types	0.59	0.66	16,785

Source: Author's calculations based on medical professional liability claims in the Texas Department of Insurance Commercial Liability Insurance Closed Claim database for the years 1988-2005. For claims in which the plaintiff retained an attorney, efficiency measure equal (defendant's legal costs + (1/3) total damage payments)/total damage payments. For claims in which no plaintiff lawyer was used, efficiency measure equals defendant's legal costs / total damage payments. 1,175 cases are dropped from the full sample due to lack of information on the defendants payments to in-house counsel.

Now suppose after a skin disorder (resp. brain damage), the victim's lifetime income drops to w^s (resp. w^b) and her distress level becomes x^s (resp. x^b). Hence, her lifetime utility becomes $U(w^s, x^s)$ (resp. $U(w^b, x^b)$) after the skin order (resp. brain damage). The level of the victim's *financial losses* (resp. *noneconomic losses*) are given by w^j (resp. $-x^j$), where $j = s, b$. Suppose that $x^b > x^s$. That is, brain damage results in more noneconomic losses than skin disorder does.

Write the level of *economic damage awards* (resp. *noneconomic damage awards*) received by the victim for injury j as c_e^j (resp. c_n^j). Suppose that according to the law, the victim is entitled to a level of compensation \tilde{c}^j that would restore her to the same level of utility before the injury, i.e., $U(w^j + \tilde{c}^j, x^j) = U(w_0, 0)$. Further assume that the victim always receives full compensation for her financial losses so that $c_e^j = w_0 - w^j$ for $j = s, b$.

I say a tort system is *fair* if $c_e^j + c_n^j = \tilde{c}^j$, i.e., if the victim receives what she is legally entitle to. Now it is to show that the tort system is unfair if $c_n^s = c_n^b$ given that $x^b \leq x^s$, $c_e^s = w_0 - w^s$ and $c_e^b = w_0 - w^b$. Suppose in negation that $c_n^s = c_n^b$, $x^b > x^s$, $c_e^s = w_0 - w^s$ and $c_e^b = w_0 - w^b$ and that the tort system is fair. Then by definition we have that $U(w^s + c_e^s + c_n^s, x^s) = U(w^b + c_e^b + c_n^b, x^b) = U(w_0, 0)$. Substituting we have that $U(w_0 + c_n^s, x^s) = U(w_0 + c_n^b, x^b)$. By assumption $c_n^s = c_n^b$, so we have $U(w_0 + c_n^s, x^s) = U(w_0 + c_n^s, x^b)$. But $U_x < 0$. Therefore, $x^s < x^b$ implies that $U(w_0 + c_n^s, x^s) > U(w_0 + c_n^s, x^b)$. We have reached a contradiction.

Therefore, if $c_e^s = c_e^b$ and $x^b > x^s$ then the tort system is fair only if $c_n^b > c_n^s$.

4.8. CONCLUSION

My results provide but a very limited test of the rationality of the process by which noneconomic damages are determined. The tort law provides no clear guidelines for the calculation of noneconomic damages. Many of the noneconomic damage cap reforms have been based on a belief that these awards are entirely random. Using Texas Department of Insurance Commercial Liability Insurance Closed Claim data for the 1988-2005 period, I provide evidence that the tort system awarding noneconomic damages is far from random. Abstracting from the potential omitted variable bias, my evidence shows a reasonably stable and predictable relationship between the characteristics of the claim and the actual outcome in the great majority of cases that are settled informally out of court. The critiques on noneconomic damage awards are not supported by the evidence.

In particular, my main finding has been that noneconomic damage awards vary quite systematically with the economic characteristics of the case. These economic characteristics include the amount of financial losses, whether the victim is employed, whether the victim collects collateral insurance payments and level of the insurer's initial expense reserve. These information are usually available at the initial stage of a damage claim and can be used by the parties and the jury to aid the calculation of noneconomic losses. Moreover, I have shown that the amount of noneconomic damages is significantly higher in tried cases than in cases settled out-of-court. This result suggests that the group of tried cases is a selected sample of all cases brought for damage compensation. However, this systematic variation does not imply that no reform efforts are needed. For instance, I have shown that the tort system in Texas might not be fair as victims with fatal, permanent and catastrophic injuries (e.g., death, brain damage and spinal cord injuries) do not receive significantly higher amount of compensation than victims with temporary, minor injuries (e.g., skin disorder).

Furthermore, I have shown that on average, the total legal costs for each dollar received by plaintiffs are 0.59 for claims where noneconomic damage is an element of compensation. For cases involve noneconomic damage payments, the tort system is more efficient in awarding damages for permanent and catastrophic injuries than for temporary, insignificant injuries. The damage payments share of legal costs is lower for cases receiving noneconomic damage payments than for cases receiving only economic damage payments.

Many important issues have been sidestepped, including the effects of victim's income and gender on the incidence and magnitude of noneconomic damages, and whether compensations with economic damages alone could provide a simple solution to the various problems related with noneconomic damage compensations. It would be interesting, for example, to see whether more objective measures could be developed to reduce the uncertainty and costs associated with noneconomic loss compensation and how policies can be designed to encourage this. Finally, it is needed to point out that the omission of variables reflecting the victim's income and gender could well bias estimated coefficients on some of the variables included in the models.

Over all, the implications for policy are evident: the proponents of legal reform must be more sophisticated and balanced than they have been in discussing the current performance of noneconomic damage compensations.

4.9. APPENDIX

TABLE 4.1. VARIABLE DEFINITIONS

Variable	Definitions
<i>NONECONOMIC DAMAGES</i>	Damages awarded for the purpose of compensating a victim for physical pain and suffering, mental or emotional pain or anguish, loss of consortium, disfigurement, physical impairment, loss of companionship and society, inconvenience, loss of enjoyment of life, injury to reputation, and all other nonpecuniary losses of any kind other than exemplary damages ¹⁴⁴
<i>INCIDENCE OF NONECONOMIC DAMAGES</i>	Indicator with value 1 if non-economic loss is an element of damage compensation, 0 otherwise.
<i>AMOUNT OF NONECONOMIC DAMAGES</i>	The amount of noneconomic damage payment
<i>FINANCIAL LOSS</i>	The amount of compensation for the victim's medical expenses, lost income and out of pocket expenses.
<i>EMPLOYED</i>	Indicator with value 1 if the victim is employed outside of the home; 0 if the victim is unemployed or self-employed
<i>COLLATERAL PAYMENT</i>	Indicator with value 1 if the victim collects collateral insurance payment; 0 otherwise
<i>INITIAL EXPENSE RESERVE</i>	The amount of the insurer's initial expense reserve.
<i>STAGE</i>	Legal stage where settlement was reached. The stages are - Settlement before trial; - Settlement during or after trial
<i>AGE</i>	The victim's age in years.
<i>INJURY</i>	Categorical variable indicating the type(s) of injury associated with the claim, including death, amputation, burns, etc

¹⁴⁴See Texas Statutes Civil Practice & Remedies Code, Chapter 41: Damages, Section 41.001(12).

CHAPTER 5

Jackpot Justice: The Value of Inefficient Litigation

5.1. INTRODUCTION

LITIGATIONS are wars without bloodshed, yet more expensive and all-consuming than warfares with. The total annual cost of tort litigation across the U.S. in 2006 comes to some \$ 865.37 billion¹⁴⁵ (6.5% of U.S. GDP), which is more than the Pentagon budget, plus Iraq and Afghan conflicts combined; however, less than 15 percent of that amount goes to compensate injured people (See McQuillan *et al.* (2007)). In 2003, the U.K. had a 0.7% ratio of tort cost to GDP,¹⁴⁶ the same size as its costs of war in Iraq and Afghanistan (approx. £ 8 billion). Statistics estimate that tort cases in the U.K. take, on average, five years to resolve and legal expenses exceed the damage paid (see NAO (2001), Swanson (1998)). One might expect knowledge of the expensiveness of litigation to provide incentives for litigants to engage frequently in negotiation as to avoid these expenses, and that only strong cases are pushed towards trial, causing plaintiff win rates (the frequency that the court rule in favor of the plaintiff) at trial to be large. However, empirical evidence¹⁴⁷ shows that bargaining between the litigants occurs only on an infrequent basis – the average personal injury case in the United Kingdom receives fewer than two offers in its 5-year lifetime; while the average trial success rate of the plaintiff rests around 43%. Further inspection of disaggregated data shows that settlement-litigation distributions and trial win rates depend crucially on plaintiff characteristics such as the type of accident and the way litigation is financed. Particularly, the plaintiffs are less likely to go to trial if their trial outcomes are more predictable and if they receive financial support for litigations; the plaintiffs are more likely to win at trial if they face less uncertainty about trial outcomes and if they receive financial support. The theory presented in this chapter is an attempt to rigorously explain these empirically significant observations of [1] partial bargaining¹⁴⁸, [2] low plaintiff trial success rate and [3] party-dependent settlement-litigation behavior.

The chapter deals with the issue of litigation versus settlement by taking as its starting point the asymmetric information between litigants and their attorneys. It examines the plaintiff and her attorney as an uninformed principal and an informed agent who are bargaining with another principal – the tortfeasor’s insurer. For simplicity, I assume (as do Bebchuk (1984), Schweizer (1989), Watts (1994) and Watanabe (2007)) that the interests of the insurer and his attorney are perfectly aligned. So I can represent the insurer and his attorney as a single player called the “defendant”. Given asymmetric information on various aspects of pretrial bargaining, litigation can be explained as an instrument a plaintiff uses to extract information. Both the litigant and the attorney can be viewed

¹⁴⁵These costs include, among others, administrative costs (\$ 59 billion), claimant’s attorney costs (\$ 53 billion), first-party defense costs (\$ 39 billion), deadweight costs (\$ 36 billion), and dynamic costs (\$ 537.37 billion). The dynamic costs include costs of accidental deaths (\$ 7.51 billion), health care expenditures (\$ 124 billion), reduced access to health care (\$ 38.78 billion), and lost sales of new products from less innovation (\$ 367.08 billion). See McQuillan *et al.* (2007).

¹⁴⁶This ratio was 0.6% in Denmark, 0.7% in France, 0.8% in Japan, 1.0% in Belgium and in Spain, 1.1% in Germany, and 1.7% in Italy. See Tillinghast (2006).

¹⁴⁷Two sets of data are included in the discussion of this section: Swanson’s Taxed Cases Study (TCS) [see Swanson (1988) and Swanson and Mason (1998)] and the Oxford Study by Harris *et al.* (1987).

¹⁴⁸This term was first used by Swanson and Mason (1998). The term refers to the fact that the probability that the plaintiff bargains with the defendant is neither zero nor one.

as lacking information about the case's prospects at trial. This chapter examines the case where the attorney has better information. This is a reasonable assumption because attorneys, via repeated and frequent litigation, acquire experience and knowledge about the statutes, precedents, and rules of procedure and evidence which are rarely possessed by occasional plaintiffs. A key matter for us in considering the issue is the role played by information of claim strength (i.e., defendant's liability for damages) in determining patterns of settlement and litigation.

The approach taken in this chapter to litigants' settlement-versus-litigation decision under asymmetric information is based on the work of Myerson (1979). It involves the design of a contract offer by a plaintiff that recognizes that her attorney may have an incentive to misinform her about the perspective of the case in order to delay settlement and increase billable hours while working less. An incentive-compatible contract in which a plaintiff will commit to resort to costly litigation when her case is reported to be weak can, however, be shown to be at least as good as any contract in which the plaintiff will settle all her dispute out of court. That is, since the plaintiff does not know the genuine strength of her case, the plaintiff must set the attorney's reward as a function of some report on the case prospects from the attorney, and the incentive contract must satisfy the constraint that the attorney should have an incentive to report truthfully the information desired by the client. Because of this constraint, the settlement-versus-litigation decision can be optimal only in a constrained sense,¹⁴⁹ and expensive litigation results from the information asymmetry.

The major results in this chapter can be summarized as:

- (a) A plaintiff will not pursue litigation when she learns from her attorney that her case is strong and that she is likely to prevail at trial. Bargaining may not occur, even if the plaintiff could obtain a higher payoff from bargaining than from going to trial without bargaining. The intuition is easily conveyed: The attorney's productivity in settlement negotiation increases with the case strength. The plaintiff, therefore, wants to encourage the attorney to admit that the case is strong, whenever it is true, so that the attorney will bargain hard with the defendant to obtain a high damage award in settlement. However, to prevent the attorney from misrepresenting the strength of the case when the case is strong, the plaintiff must somehow 'punish' the attorney for reporting that the case is weak. Such punishment takes the form of pushing cases towards trial without negotiation (hence no payment to the attorney).
- (b) The pattern of the plaintiff's settlement-litigation decision depends on the probability distribution of the case strength and therefore on the risks associated with litigation and the plaintiff's ability to monitor the attorney. Litigation occurs more frequently if it is *a priori* less profitable for the plaintiff to pursue. The intuition behind this result is as follows. The plaintiff's prospect at trial increases with the strength of her case. With a stronger case, it is less costly for the attorney to obtain favorable settlement terms from the defendant. Since the plaintiff bears the full costs of pretrial negotiation, out-of-court settlement (resp. litigation) becomes more (resp. less) attractive an option for the plaintiff when negotiation is less costly.
- (c) Litigation occurs more frequently if it is *a priori* more risky for the plaintiff to pursue. The intuition behind this result is as follows. When the plaintiff's uncertainty about trial outcome is low, she can better monitor her attorney's performance in settlement bargaining and the principal-agent impediments to settlement is mitigated. Therefore, the plaintiff pursues litiga-

¹⁴⁹This is a common result in the mechanism design literature.

tion less often when the trial outcomes are more predictable. An implication of this result is that institutional characteristics determining the degree of plaintiff uncertainty about trial outcomes figure large in settlement-litigation strategies.

- (d) There is another aspect of the attorney-client relationship regarding the financing of litigation that can affect a plaintiff's incentive regarding settlement: legal aid (for both settlement and litigation) reduces the costs inherent in representative bargaining that impede settlement. Therefore, plaintiffs receiving legal aid go to court less often than those receiving no legal aid.

My model is able to explain key features of the U.K. tort settlement-litigation data – partial bargaining, low plaintiff win rate and heterogeneity between plaintiffs: plaintiffs with less uncertainty about trial outcomes and receiving financial assistance in litigation go to court less often than those with higher uncertain and receiving no financial assistance. The next section provides empirical evidence by using detailed database of 242 cases developed by Swanson(1988) from the U.K. Royal Courts of Justice. The U.K. database contains information on the legal expenses, trial outcomes, and various characteristics of the litigants and their attorneys, allowing direct tests of the model's predictions.

The model is a good representation of many real *civil* dispute situations. The vast majority of tort, prisoner and civil right lawsuits are characterized by the plaintiffs' informational disadvantage *vis-à-vis* the attorneys.¹⁵⁰ This is because attorneys, via repeated and frequent play in the litigation game, accumulate experience and knowledge about the statutes, precedents, and rules of procedure and evidence which are rarely possessed by occasional plaintiffs. Furthermore, In the process of pretrial bargaining, as it relates to the decision to litigate or settle a civil dispute, attorneys exercise predominant control over and take responsibility for the dispute-resolution delegated to them by their clients. Although clients usually participate in the litigation process, attorneys in personal injury cases often enjoy considerable latitude in deciding how to resolve their clients' claims in settlement negotiation. This study therefore provides a theory that explicitly incorporates this empirically significant facet of the dispute resolution process into the game-theoretic analysis of litigation-settlement decision.

The chapter is organized as follows. I begin by reviewing the literature and by presenting evidence on the litigation frequency and trial outcomes in UK tort liability litigation in section 5.2. The evidence suggests a need to expanding existing litigation models to include the delegation of pretrial negotiation. The game theoretic model is constructed in section 5.3: section 5.3.1 describes the basic model of pretrial negotiation developed in previous work; the basic ingredients of my model are discussed in section 5.3.2; the formal solution and properties of the litigant's settlement-litigation decision are developed and illustrated in section 5.3.3; section 5.3.4 describes the variations in the plaintiff's settlement-litigation pattern, corresponding to changes in her optimism/pessimism about the trial outcome; section 5.3.5 discusses the effect of different forms of litigation financing on plaintiff's settlement-litigation decision; section 5.3.6 presents a result about how bargaining outcome and litigation incidence change with changes in the risks associated with litigation. Section 5.4 concludes.

¹⁵⁰Bebchuk (1984), Hylton (1993) and Boon (1995) make similar arguments. Using information on plaintiff and defendant identities in over 65,000 federal civil suits drawn from the Administrative Office of the U.S. Courts data set, Siegelman and Waldfogel (1999) find that plaintiffs in tort, prisoner and civil right cases usually suffer a more severe informational disadvantage than in other types of cases.

5.2. MOTIVATION

5.2.1. THEORETICAL MOTIVATION

Two central puzzles in the U.K. tort litigation data from Swanson's Taxed Cases Study (TCS) are the *high* proportion of cases which require ultimate resolution by a court and the *low* likelihood of trial success of the plaintiffs.¹⁵¹ These plaintiffs must pay the costs of the entire legal process, usually without getting compensated.¹⁵² Swanson's Taxed Cases Study (TCS)¹⁵³ shows that in the tried cases (i.e., cases that went to trial) the plaintiffs incurred on average legal expenses in the neighborhood of £5,300, approximately 68.5% of the damage payments received by the plaintiffs in those cases. However, more than 50% of the plaintiffs received no damage payments after having incurred a substantial amount of legal costs. Similarly in the U.S., plaintiff trial success rate appears to be low. Waldfogel (1995), for instance, empirically documents that the plaintiffs only win approximately 50% of the times at trial by using data from broad variety of cases (including contract, tort, civil right and property disputes).

The decision to litigate or settle a civil dispute, as it relates to the process of pretrial bargaining, has been the subject of extensive investigation in law and economics. Asymmetric information (AI) models, starting with Cooter *et al.* (1982), P'ng (1983), Bebchuk (1984), and advanced by Reinganum and Wilde (1986) and Nalebuff (1987), offer possible explanations of the litigation puzzle. What most of these models have in common is that the game is formulated in extensive form and essentially consists of a sequence of two periods. After the suit has been filed, one litigant, in the first period, making a settlement offer which, in the second period, the other litigant either accepts or rejects. If the last-moving litigant accepts, the case settles out of court at the proposed terms. Otherwise, the case goes to trial. The way these models work is as follows: when one side in a legal dispute has information that the other side does not have, incentives are created for the former to credibly convey information to the latter; delays occur inevitably when the benefits of establishing credibility exceed the costs of waiting; informed parties proceed to trial *only* when they expect to win, causing plaintiff win rates at trial to be high. The central finding of this literature has been that the presence of asymmetric information yields a positive probability of trial.¹⁵⁴

Central to *all* these models is the informational difference about trial outcomes between the litigants. None of the informational differences, however, has been adequately explained by *any* of these models; that is, it is not yet understood why this system might generate the divergent expectations which must be the source of these differences in perspectives. The incorporation of

¹⁵¹In the U.S. however, the vast majority of cases that are filed settle out of court and countless others are settled even before a lawsuit is filed. Less than 4 percent of the civil cases that are filed in the U.S. state court proceed to trial. Only 2 percent of the civil cases that are filed in the U.S. federal court proceed to trial. See Ostrom *et al.* (2001) p.29.

¹⁵²In the British legal system the losing litigant of a civil case has to pay the winner's court costs, in addition to her own legal expenses. In the US as well as in many European jurisdictions, each side pays their own legal costs.

¹⁵³In the U.K. the legal expenses are usually allocated to the "losing" party in the dispute. Since the reasonable legal expenses must then be determined, a separate division of the judiciary has evolved to fulfill this function: the Taxing Masters of the High Courts of Justice. In order to make fact-based determinations of claims for expenses, the regulations of the High Court provide that a detailed account of the proceedings must be tendered to the Taxing Master. It was this set of files which were consulted for the construction of the data set in Swanson (1988)'s study. Swanson named these legal cases as "taxed cases".

¹⁵⁴For an excellent review of this literature, see Waldfogel (1998).

the attorneys as key participants in the bargaining game provides a crucial link in the analysis of settlement-litigation decision. It explains why a difference in perspective on a lawsuit might exist; and how this difference might plausibly lead to inefficient litigation.

To my knowledge, this paper is the first attempt to rigorously analyze the role of the attorneys in causing the informational differences between the litigants that gives rise to expensive litigation. Other authors have investigated different, but not less important, aspects of lawyer's role in settlement and litigation.¹⁵⁵ In these studies lawyers are not necessarily barriers to settlement; sometimes their participation may facilitate settlement by furnishing information to their clients,¹⁵⁶ or by providing credibility to party communications in pretrial negotiation.¹⁵⁷ In another theory, the lawyer's incentives regarding settlement depend on her fee arrangement with the client; some fee structures are more likely than others to discourage the lawyer from seeking an early settlement.¹⁵⁸ Within this literature, perhaps the most closely related work to this chapter is that of Watts (1994). Watts (1994) analyzes a three-player litigation model where the plaintiff's lawyer is able to learn part of the defendant's private information regarding the trial outcome, at a lower cost than the plaintiff could. Watts (1994) shows that a lawyer paid by contingency fee may settle a case to avoid the expense of preparing for trial, even when the plaintiff could obtain a higher payoff from trial than from settlement. Yet another theory by Choi (2003) shows that by using a contingent fee contract that provides incentive to a lawyer, a plaintiff can improve her bargaining position vis-à-vis a defendant in pretrial settlement.¹⁵⁹ Besides the by now standard analytical framework based on the theories of incentives, two other approaches to lawyer's role in litigation are worth mentioning. By using evolutionary game theory, Bar-Gill (2006) shows that attorneys with optimistic bias, by credibly threatening to resort to costly litigation, succeed in extracting more favorable settlements than attorneys without optimism bias.¹⁶⁰ In this way, market-selection forces dictate an equilibrium with a positive level of optimism and a positive probability of litigation. Instead of focusing on individuals incentives and behavior, Hadfield (2000) has taken a much wider scope to consider the effects of legal service market imperfections on the entire justice system.¹⁶¹ The consequence of a short supply of legal skills for litigation costs and settlement patterns is discussed at length in Hadfield's (2000) study. Hadfield's (2000) attributes the insufficient supply of legal service to factors such as artificial barriers to entry, demanding cognitive skills, and a lack of opportunity for lawyers to gain litigation experience. With imperfect competition on the market for legal skills, lawyers price their services beyond the marginal costs and the terms of settlement do not mirror the court's decisions but the relative costs of lawyering for the parties in the dispute.

Furthermore, existing AI theories do not explain the absence of bargaining (i.e., absence of settlement offers in pretrial negotiation) observed in the TCS study,¹⁶² as will be elaborated in the

¹⁵⁵See Section 1.3.1.4 for a somewhat more extensive review of this literature.

¹⁵⁶See Menkel-Meadow (1984).

¹⁵⁷See Gilson and Mnookin (1994).

¹⁵⁸See, e.g., Miller (1987), Schwartz and Mitchell (1970), Miller (1987), Thomason (1991), Gravelle and Waterson (1993) and Watts (1994).

¹⁵⁹However, Choi (2003) does not address the problem of information asymmetry between the plaintiff and the lawyer. I am grateful to Kathryn Spier for pointing out the relevance of Choi's (2003) work to my work.

¹⁶⁰I am grateful to an anonymous committee member for pointing out the relevance of this article to my work.

¹⁶¹I am grateful to an anonymous defense committee member for pointing out the relevance of Hadfield's (2000) work to my study.

¹⁶²Swanson and Mason (1998) is an exception. But Swanson and Mason did not investigate the role of agency problems

following section.

5.2.2. EMPIRICAL MOTIVATION

The empirical features I focus on are the likelihood that the plaintiff bargains with the defendant, the frequency of litigation and the chance that the plaintiff prevails in court in the event of a trial.¹⁶³ Table 5.1 shows the frequency of bargaining of different types of plaintiffs. In my sample of 242 tort cases from the U.K. Courts of Justice for the year of 1987, the majority of cases are bargained (74%) and settled out of court (66%) for all plaintiff types. However, a significant proportion of claims (26%) are forced to trial without bargaining.

Disaggregate data reveals, however, a more confusing picture that cannot be explained by existing models. Table 5.1 shows the frequency of bargaining of different types of plaintiffs. The majority of cases are bargained (74%) and settled out of court (66%) for all plaintiff types. The frequency of litigation, however, appears to be highly dependent on the plaintiff's uncertainty about trial outcomes and on the financing of litigation. For players whose disputes are governed by *customary* tort law¹⁶⁴ that is characterized by a relatively high uncertainty of trial outcomes (these are motor accident and medical negligence cases), the frequency is 41%. Union-represented plaintiffs in workplace injury lawsuits, who litigate under *statutory* labor law¹⁶⁵ that is characterized by a relatively low uncertainty of trial outcomes¹⁶⁶, settled all their claims out of court. Furthermore, for those who have inexpensive

TABLE 5.1. DISTRIBUTION OF LITIGATIONS AND SETTLEMENTS BY PLAINTIFF'S TYPE

	All Types	Privately-funded	Legal aid	Union assisted	Union represented
Negotiated cases (%)	74%	68%	83%	71%	100%
Settled cases (%)	66%	59%	76%	63%	100%
Tried cases without prior bargaining (%)	26%	32%	17%	29%	0%
Tried cases with prior bargaining (%)	8%	9%	7%	8%	0%

Source. Author's calculations using data from Taxed Cases Study by Swanson (1988).

Notes: Privately funded plaintiffs pay all their own legal expenses. Legal aid plaintiffs receive financial aid from the government that partially covers their legal expenses. Union assisted plaintiffs receive financial assistance from trade unions that partially covers their legal expenses. For union represented plaintiffs, their trade unions retain attorneys on their behalf and cover all legal costs associated with litigation and settlement.

in bargaining processes.

¹⁶³My data come from the files of the Taxing Masters in the U.K. Courts of Justice for the year of 1987 selected by Timothy Swanson. See Swanson (1998) for a detailed description.

¹⁶⁴Customary law is law not documented in the written code. It is not enacted by a legislative authority. It is an established pattern of legal practice where courts enforce customary rules as if they had been enacted by the proper legislative authority.

¹⁶⁵Statutory law is written law enacted by a legislature.

¹⁶⁶In England, the labor law which governs workplace injury disputes is largely a creature of Statute, (Acts of the Parliament of the United Kingdom) rather than Common law. Legal outcomes under statutory law are usually more predictable than under customary law. See O'Hara and Ribstein (2000) for a discussion on the difference in predictability between customary law and statutory law.

TABLE 5.2. DISTRIBUTION OF PLAINTIFF TRIAL SUCCESS RATES BY PLAINTIFF TYPES

	All Types	Privately-funded	Legal aid	Union assisted
Prior Bargaining	95%	92%	100%	100%
No prior bargaining	26%	17%	43%	50%
All	43%	33%	60%	61%

Source. Author's calculations using data from Taxed Cases Study by Swanson (1988).

Notes: The prior bargaining pool contains litigated cases that have undergone negotiation but have failed to settle. The no prior bargaining pool contains cases that are forced to trial without negotiation. Privately funded plaintiffs pay all their own legal expenses. Legal aid plaintiffs receive financial aid from the government that partially covers their legal expenses. Union assisted plaintiffs receive financial assistance from trade unions that partially covers their legal expenses.

access to legal services in litigations and pretrial negotiations, such as individuals receiving legal aid, the frequency is 24%. Whereas for privately-funded players, the frequency is 41%. Union-represented plaintiffs in workplace injury lawsuits, who receive full reimbursement for their legal costs¹⁶⁷, settled all their claims out of court.

Table 5.2 shows the frequency of trial success for different types of plaintiffs. The empirical evidence reveals three striking features. First, the majority of the cases (57%) actually brought to verdict result in a judgment in favor of the defense.^{168, 169} Consequently, the court does not award any compensation in these cases. Second, these win rates are drastically different between bargained and not-bargained cases – they are close or equal to 1 in the bargaining pool, which are consistent with the basic implication of the asymmetric information theories; however, they rest in the middle between 0 and 0.5 in the non-bargaining pool – an observation not explained by existing AI theories.

¹⁶⁷In England, if an injury is closely related to employment conditions (workplace injury claims) or against the public body, the plaintiff is likely to be assisted in its action by its trade-union representatives. In this case, the action is the plaintiff's in name only and is being conducted (and fully financed) for the plaintiff's benefit by the union.

¹⁶⁸Similar empirical observations were recorded by Farber and White (1991), Vidmar *et al.* (1998), Sieg (2000) and Spurr (2000). Farber and White provide evidence from 252 U.S. medical malpractice cases from 1977 to 1989 and show that the defendants have won all the cases tried to completion. Vidmar *et al.* report that plaintiffs prevail in 22.5% of the California medical malpractice cases from 1991 through 1997. Using data on 8,306 medical malpractice cases in Florida, Sieg shows that only 29% of tried cases result in a verdict for the plaintiff. Spurr (2000) provides evidence from 424 medical malpractice cases in Michigan that, the cases that went to trial are drawn disproportionately from claims that are weak.

¹⁶⁹Priet and Klein's (1984) "divergent expectation model" offers a possible explanation for the phenomenon. Priest and Klein (1984) predict that for cases that go to trial, the probability of the plaintiff winning tends towards 50%. However, Priest and Klein's (1984) result critically relies on the restrictive assumption that the chances that the plaintiff and the defendant make mistakes in observing their probabilities of winning at trial are the same. This assumption is unlikely to hold for my sample observations where the defendant is a repeat player in the litigation game and the plaintiff a one-shot player. Furthermore, Shavell (1996) has shown that any plaintiff win rare at trial is possible under more general assumptions.

TABLE 5.3. PROBIT REGRESSION PARAMETER ESTIMATES

Dependent variable	<i>BARGAINING RATE</i>	<i>WIN RATE</i>
Independent Variables		
<i>LEGAL UNCERTAINTY</i>	-0.729** (0.215)	-0.899* (0.442)
<i>FINANCIAL AID</i>	0.272 † (0.185)	0.760* (0.372)
<i>CONSTANT</i>	-0.036 (0.188)	-1.561 (0.402)
Pseudo R-squared	0.060	0.152
Observations	242	63

Source. Author's calculations using data from Taxed Cases Study by Swanson (1988).

Notes: Values are estimated by probit equations, and standard errors are reported in parentheses. *BARGAINING RATE* means the likelihood that bargaining occurred before trial. *WIN RATE* means the frequency that the plaintiffs prevailed at trial. *LEGAL UNCERTAINTY* is an indicator with value 1 if the case is medical negligence or automobile accident, 0 if the case is workplace injury or against public body. *FINANCIAL AID* is an indicator with value 1 if the plaintiff received financial support, 0 if the case was privately-financed.

† Significant at 10% level; * Significant at 5% level; ** Significant at 1% level.

Third, the win rates in the non-bargaining pool vary greatly between different types. For those who are assisted by legal aid or receive financial support from trade unions, the proportion winning in court is more than 40%, whereas for self-financed plaintiffs, the proportion is around 17%.

The first column of tables 5.3 reports the results of a regression model that demonstrate the influence of the two factors – the heterogeneity in plaintiff's uncertainty and the financing of litigation on the incidence of bargaining. There are two important features of these results: first, for the types of cases associated with more uncertain legal outcomes¹⁷⁰, plaintiffs are less likely to bargain with the defendants than plaintiffs involved in cases that are associated with less uncertainty¹⁷¹; second, plaintiffs receiving legal aid from the government or financial support from trade unions are more likely to negotiate with the defendants than privately funded plaintiffs.

The second column of table 5.3 reports the results of regression models that demonstrate the influence of the plaintiff financing and the heterogeneity in the levels of uncertainty associated with legal outcomes on the likelihood of plaintiff trial success for those cases that have not been bargained prior to trial. The important features of these results are: first, the plaintiffs in a litigation environment associated with less uncertainty are more likely to win in court; second, plaintiffs receiving legal aid from the government and those receiving financial support from trade unions are more likely win in court than privately funded plaintiffs.¹⁷²

Tables 5.1, 5.2 and 5.3 contain the key challenges for a theory of settlement-litigation decision. First it must clarify the phenomenon of “partial bargaining” – the empirical observation that the probability that parties engage in settlement negotiation is neither zero nor one. Second it must elucidate why plaintiffs would so often pursue expensive litigation when the chance of success is so low. Third it must rationalize the variation in litigation frequency across plaintiff types and identify

¹⁷⁰They are motor vehicle accidents and medical negligence cases.

¹⁷¹These are plaintiffs involved in workplace injury cases and cases against the public body.

¹⁷²I do not discuss further the plaintiff's settlement-litigation decision and trial success rate for the negotiated cases, because it is not of interest in this study and the sample in the bargaining-pool is too small (the number of observations is 19) to give empirically reliable conclusions.

factors that are relevant for settlement-litigation incentives. Finally, it must explain the heterogeneity in win ratios between different types of plaintiffs. My model is an attempt to unravel these paradoxes.

This article broadens the discussion of the strategic settlement-litigation decision. The most important distinction between my work and previous game theoretic analysis of pretrial bargaining is the principal-agent impediment to settlement. Previous studies ignore the fact that settlement negotiations are costly in themselves: attorneys spend time on discovery, establishing contact, and searching for legal precedents; they have incentive to increase the time to settlement *and* billable hours by fielding unattractive bids and encouraging clients to refuse early settlement offers. My model emphasizes the role of agency costs in bargaining processes.

5.3. THEORETICAL ANALYSIS

5.3.1. PRETRIAL BARGAINING WITHOUT ATTORNEY

The main difference between my model and previous game theoretic models of pretrial bargaining is that my model incorporates the attorney as a key participant in the bargaining game – it focuses on the principal-agent aspect of the problem. Before I start my analysis, however, Bebchuk’s (1984) canonical model of settlement bargaining deserves some review. Bebchuk considers the case where a *plaintiff* has been injured in a tort accident. The plaintiff then files a lawsuit against the *defendant*. The plaintiff and the defendant then play a bargaining game. The bargaining game has the following structure:

Let θ represent the *strength* (“legal quality” and “state of the world” are synonyms) of the plaintiff’s case, which reflects the likelihood that the plaintiff receives damage award at trial. The strength of the case depends on the quality of evidence, the law defining liability and the burden of proof. Higher values of θ indicate greater strength of the plaintiff’s case. The defendant is aware of the strength of the claim, but the plaintiff is not.¹⁷³ This is a reasonable assumption as usually the defendant is privately informed about whether he behaved negligently while the plaintiff is not.

Following the Bayesian approach, assume that the plaintiff has some subjective prior probability distribution for the unknown parameter θ prior to receiving any report from her attorney on the perspective of her suit. Let θ be distributed on $\Theta = [\underline{\theta}, \bar{\theta}]$ according to a density function $f(\cdot)$ with $f(\theta) > 0$ for all $\theta \in \Theta$. Let $F(\cdot)$ be the cumulative distribution function.

If the plaintiff goes to trial, a court will conduct its own independent investigation.¹⁷⁴ Without loss of generality, normalize the *probability* that the *plaintiff prevails at trial* to θ and normalize the amount of *judgment* (“value of damage” is a synonym) to unity.¹⁷⁵

¹⁷³P’ng (1983), Bebchuk (1984), Nalebuff (1987), Spier (1992) and Sieg (2000) make the same assumption that the defendant has private knowledge about the outcome at trial. Rubinfeld and Scotchmer (1993) assume that there is asymmetric information between attorneys and clients and derive endogenously the optimal fee arrangements arising in litigation in response to this asymmetry. But these authors did not investigate the role of agency problems in bargaining processes.

¹⁷⁴A variety of papers in the literature weaken or manipulate some of these assumptions. See Daughety and Reinganum (2005).

¹⁷⁵The model can be easily extended to a case where the size of the judgment, and not only the defendant’s liability, is uncertain.

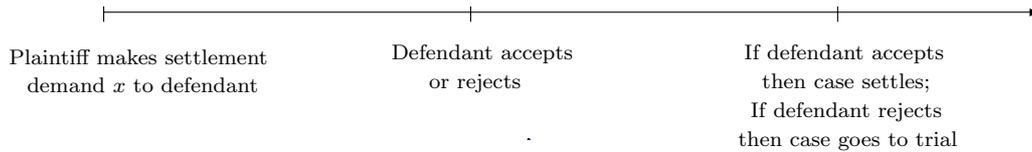


Figure 5.1 Timing of Litigation without Attorney

The sequence of the game is as follows: the plaintiff makes a settlement demand, x , to the defendant, who either agrees to pay x or refuses. Refusal means that the case proceeds to trial. Each party must pay their own court costs, denoted k (with $k > 0$) for the plaintiff and K (with $K > 0$) for the defendant (respectively), if bargaining fails and they go to trial. Assume that litigation has a positive value for the plaintiff even if the case is of the lowest type, that is, $\theta > k$ for all $\theta \in [\underline{\theta}, \bar{\theta}]$.¹⁷⁶ This assumption is made to rule out the possibility that the plaintiff will not actually go to trial even if he gets no payment whatsoever from the defendant in pretrial negotiation. The game is illustrated in Figure 5.1.

To simplify the exposition, assume that the plaintiff and the defendant are risk neutral.¹⁷⁷ The plaintiff must decide on an optimal settlement demand, x . The plaintiff knows that the defendant will only agree to pay x if $x \leq \theta + K$. The plaintiff maximizes her expected payoff by solving

$$\max_x \quad x \{1 - F(x - K)\} + \int_{\theta}^{x-K} (\theta - k)f(\theta)d\theta.$$

The first-order condition determining the optimal settlement demand \tilde{x} is

$$\frac{1}{k + K} = \frac{f(\tilde{x} - K)}{1 - F(\tilde{x} - K)}. \tag{56}$$

To illustrate, consider the equilibrium for the case where θ is uniformly distributed on $[\frac{1}{2}, 1]$. By solving the problem in equation (56) above, one can show that the equilibrium settlement demand is $\tilde{x} = 1 - k$. This is an equilibrium as long as $k + K < \frac{1}{2}$, so the limits on the integral are not violated. Then, the likelihood of settlement is $1 - F(\tilde{x} - K) = 2(k + K)$. This model provides a number of implications; I list a few here. First, the plaintiff’s equilibrium settlement demand is decreasing in her trial costs. Second, a decrease in either litigant’s trial costs leads to a reduction in the likelihood of settlement. Third, redistribution of trial costs from one litigant to the other (that is, adjustments in k and K , holding $k + K$ fixed) has no impact on the likelihood of settlement.

Up to this point it has been assumed that the plaintiff cannot obtain better information about her prospect at trial from professionals. In that case, settlement failure arises from inevitable information asymmetry. In reality, however, the plaintiff is usually able to obtain information on the strength of her claim. Furthermore, the model so far ignores the fact that settlement negotiations are costly in themselves: in order to negotiate, attorneys spend time on discovery, establishing contact, and searching for legal precedents. Finally, by construction the model cannot explain the absence

¹⁷⁶Png (1983), Reinganum and Wilde (1986) and Spier (1992) make the same assumption. The assumption is made to rule out the possibility that the plaintiff will not go to trial even if he get no payment whatsoever from the defendant in pretrial bargaining.

¹⁷⁷Bebchuk (1984), Nalebuff (1987), Spier (1992) and Sieg (2000) make the same assumption that the plaintiff is risk-neutral.

of bargaining observed in the TCS study. The next section incorporates these considerations into a simple model that includes the plaintiff’s attorney as a key player in the litigation game.

5.3.2. PRETRIAL NEGOTIATION WITH ATTORNEY

My model has *three* players. All players are assumed to be risk-neutral. I take the same structure as Bebchuk’s model but assume that the plaintiff retains an *attorney* (“agent” is a synonym) to work on her behalf to conduct pretrial bargaining with another principal – the tortfeasor’s insurer. The plaintiff-attorney and the defendant are aware of the strength of the claim θ , but the plaintiff is not. I assume that $f(\cdot)$ is twice differentiable and weakly increasing on Θ . For analytical convenience, assume that $\frac{d}{d\theta} \frac{1-F(\theta)}{f(\theta)} < 0$, for all $\theta \in \Theta$. Several common distributions, including the uniform distribution, satisfy this condition.¹⁷⁸ This assumption is used to prove propositions 1 and 2.

Let $\bar{\gamma}(\theta) = \theta + K$ be the maximum amount the defendant is willing to offer to avoid litigation in state θ , and let $\underline{\gamma}(\theta) = \theta - k$ be the minimum amount the plaintiff would be willing to accept in case she would know θ .

Assume that, in state θ , any agreement inside of the interval $[\underline{\gamma}(\theta), \bar{\gamma}(\theta)]$ can be achieved by the attorney provided that he spends sufficient time (“costs” and “effort” are synonyms).¹⁷⁹ Let $t(x, \theta)$ denote the amount of *time* needed to negotiate *settlement* x in state θ . Furthermore, assume that $t(x, \theta)$ is differentiable and absolutely continuous¹⁸⁰ in θ for all $x \geq 0$. I shall make three important assumptions:

- Assumption 5.1.* For all $\theta \in \Theta$,
 - $\frac{\partial^2}{\partial \theta \partial x} t(x, \theta) < 0$ for all $x \in (\underline{\gamma}(\theta), \bar{\gamma}(\theta))$; [5.1.1]
 - $t(x, \theta) = 0$ for all $x \in [0, \underline{\gamma}(\theta)]$; [5.1.2]
 - $\lim_{x \rightarrow \bar{\gamma}(\theta)} t(x, \theta) = +\infty$. [5.1.3]

Recall that θ represents the plaintiff’s optimism in pretrial negotiation. When θ is high (resp. low), the plaintiff is more optimistic (resp. pessimistic) about the trial outcome. Then it is less (resp. more) time consuming for the attorney to improve settlement terms. This is captured by assumption 5.1.1. Assumption 5.1.2 is a normalization implying that it is costless for the attorney to obtain a settlement that is (weakly) lower than the plaintiff’s trial payoff. Assumption 5.1.3 is a normalization implying that it is impossible for the attorney to obtain a settlement that is (weakly) larger than the defendant’s trial payoff.

¹⁷⁸This condition is also satisfied by normal, logistic, chi-squared, exponential, and Laplace distributions. See Bagnoli and Bergström (2005) for a complete list and for results allowing the identification of distributions with monotone hazard rates.

¹⁷⁹To concentrate on the principal-agent aspects of the problem, I abstract away from any bargaining aspects of negotiated settlement. In addition, strategic aspects of attorney choice will not be studied (see Jones (1989)). I am grateful to Jan Boone and Suzanne Scotchmer for making this suggestion.

¹⁸⁰The function $t : \Theta \times \mathbb{R} \rightarrow \mathbb{R}$ is absolutely continuous on Θ if for every positive number ε , there is a positive number μ such that whenever a sequence of pairwise disjoint sub-intervals $[\theta_k, \vartheta_k]$ of Θ satisfies $\sum_k |\vartheta_k - \theta_k| < \mu$ then $\sum_k d(t(x, \vartheta_k), t(x, \theta_k)) < \varepsilon$. Absolutely continuity of $t(x, \cdot)$ ensures that the attorney’s value function is differentiable almost everywhere and can be represented as an integral of its derivative. See Milgrom and Segal (2002) Theorem 2 (pp. 586).

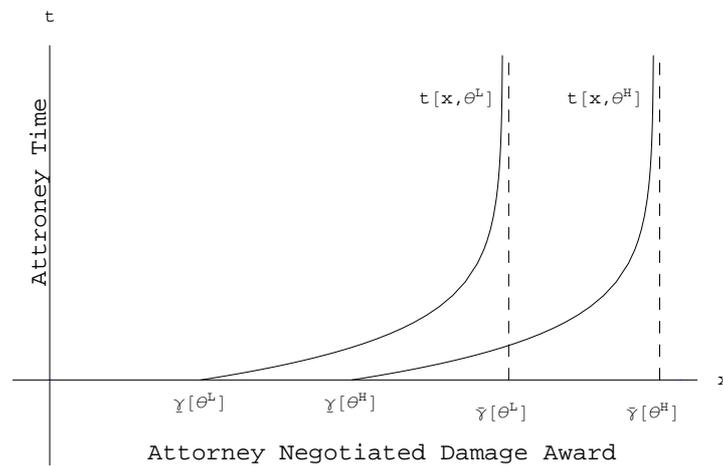


Figure 5.1. State-dependent Attorney Hours

In order to keep the presentation simple I impose two regularity conditions:

Assumption 5.2. For all $\theta \in \Theta$

$$\frac{\partial^3}{\partial x^2 \partial \theta} t(x, \theta) < 0 \text{ and } \frac{\partial^3}{\partial x \partial \theta^2} t(x, \theta) > 0 \text{ for all } x \in (\underline{\gamma}(\theta), \bar{\gamma}(\theta)); \quad [5.2.1]$$

$$\frac{d}{dx} t(x, \theta) \Big|_{x=\underline{\gamma}(\theta)} = 0. \quad [5.2.2]$$

Assumption 5.2.1 states that the attorney's bargaining technology exhibits diminishing marginal returns to both time and case strength.¹⁸¹ This assumption is used in the proofs of propositions 5.2 (i) and 5.3. Assumption 5.2.2 states that a small but positive increase in settlement amount from $\underline{\gamma}(\theta)$ will not lead to increase in the attorney's time. Since the plaintiff obtains $\underline{\gamma}(\theta)$ at trial, this assumption implies that the plaintiff is (strictly) worse off pursuing the case to trial than settling out-of-court in each state of the world. This assumption is used to prove complete information solution 1.

Figure 5.2 illustrates the relationship between two different attorney time schedules $t(x, \theta^H)$ and $t(x, \theta^L)$ in two distinct states θ^L and θ^H , where $\theta^H > \theta^L$.

Furthermore, assume that if the plaintiff forces her case to trial, the trial outcome will be independent of the attorney's time spent in pretrial negotiation.¹⁸²

In seeking resolution, the plaintiff weights the benefits and costs of settlement and litigation and has three basic instruments available to achieve her objective: (i) the plaintiff can decide whether to go to trial or to engage in negotiation; (ii) if she decides to negotiate, then she will demand a sum of settlement; and (iii) the attorney may be given a reward ("monetary transfer" is a synonym) for handling the suit.

¹⁸¹See Fudenberg and Tirole (1991) A8 (pp. 263) and A10 (pp. 267).

¹⁸²One way to justify this assumption is as follows. The English legal profession is formally divided into two divisions, solicitors and barristers. While solicitors usually conduct pretrial negotiation, barristers are best known for their role as courtroom advocates. In addition, practice rules in England prohibit joint practice between barristers and solicitors. For general discussion of the divided legal services in England, see Jackson (1977), Flood (1983) and Kritzer (1989).

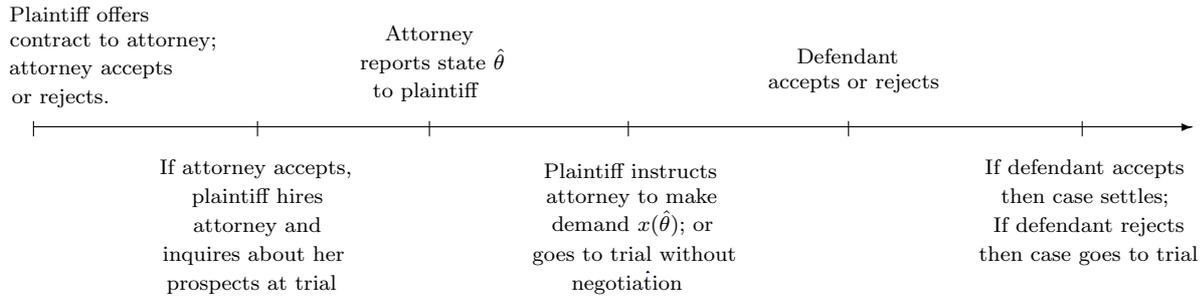


Figure 5.2 Timing of Litigation with Attorney

Formally, I shall describe a *contract* between the plaintiff and the attorney by three outcome functions $s = \langle \phi, x, r \rangle$, to be interpreted as follows. For any $\hat{\theta} \in \Theta$, if the plaintiff chooses s after receiving report $\hat{\theta}$, the plaintiff instructs her attorney to negotiate if $\phi(\hat{\theta}) = 1$ and she litigates without negotiation if $\phi(\hat{\theta}) = 0$; If the plaintiff decides to settle her claim, then $x(\hat{\theta})$ is the sum of settlement she will demand; $r(\hat{\theta})$ is the amount of *reward* the attorney receives in pretrial negotiation or in litigation. The plaintiff can “write” litigation into any contract entered into with her attorney because it is observable and verifiable (as the damage compensation that the attorney obtains from the defendant). Let S denote the *set of contracts*.

Now using the *revelation principle* (see Myerson (1979)), we may consider only plaintiff’s choices under which the attorney’s report will truthfully reveal the case strength parameter θ , so the plaintiff’s choices can be made as functions of θ . To simplify presentation, I suppose that the plaintiff designs the contract. This assumption puts the whole bargaining power (in the pair plaintiff-attorney) on the plaintiff’s side, although generally the plaintiff and the attorney bargain over reward and discuss settlement-litigation strategy.¹⁸³

To further simplify exposition, I focus on deterministic contracts.¹⁸⁴

Given the plaintiff’s choice s , if the case strength parameter is θ , and if the attorney reports θ truthfully, the attorney’s expected utility $u(\theta)$ is

$$u(\theta) = r(\theta) - t(x(\theta), \theta)\phi(\theta). \tag{57}$$

If the attorney were to misrepresent the strength of the case and report $\hat{\theta}$, when θ is the true case strength parameter, its expected utility would be

$$u(\hat{\theta}, \theta) = r(\hat{\theta}) - t(x(\hat{\theta}), \theta)\phi(\hat{\theta}).$$

The attorney’s utility of the outside option is the same across the states and is normalized to be zero. Figure 5.3 illustrates this game.

The plaintiff’s objective is then to select a contract s and maximize

$$\int_{\Theta} \{ (x(\theta) - r(\theta))\phi(\theta) + (\theta - k - r(\theta))(1 - \phi(\theta)) \} f(\theta) d\theta,$$

subject to

¹⁸³This assumption is not meant to be realistic but rather to avoid the signaling phenomena that arise in situations in which the informed attorney takes part in contract design. See Laffont and Tirole (1993) A10 (pp.39).

¹⁸⁴Under the assumptions that the attorney is risk neutral and that the attorney’s cost function is monotonic, it is not worth considering stochastic contracts, that is contracts for a given report of type draw from a nondegenerate distribution the settlement-litigation decision, the reward the attorney receives and the settlement demand the attorney produces. See Laffont and Tirole (1993) and Strausz (2006).

$$\begin{aligned}
 u(\theta) &= \max_{\hat{\theta}} u(\hat{\theta}, \theta) \quad \forall \theta \in \Theta; & [\alpha] \\
 u(\theta) &\geq 0 \quad \forall \theta \in \Theta. & [\beta]
 \end{aligned}$$

Here, condition (α) represents the incentive compatibility constraint. This condition formalizes the notion that the attorney must not prefer to misrepresent the strength of the case as $\hat{\theta}$ when the true state is θ . Condition (β) represents the individual rationality constraint; the attorney's utility cannot be lower than what is obtained in an alternative lawsuit (which is normalized to zero). We shall say a contract is *feasible* if it satisfies conditions (α) and (β) .

Following the notations in Section 1.1., let *measure of unfairness* ρ be given by difference between what the plaintiff is legal entitled (i.e., θ) to and what actually he receives from the defendant in settlement (i.e., $x(\theta)$) or litigation (i.e., θ). That is,

$$\rho(\theta) = \int_{\Theta} | \theta - [x(\theta)\phi(\theta) + \theta(1 - \phi(\theta))] | f(\theta)d\theta.$$

Rearranging we have that

$$\rho(\theta) = \int_{\Theta} | \theta - x(\theta) | \phi(\theta)f(\theta)d\theta$$

Once we are equipped with the measure of unfairness, we can put it to use in comparative static exercises. In the following section, I will examine the comparative statics of equilibrium level of unfairness with respect to the changes in magnitude of information asymmetry in parametric examples.

5.3.3. ANALYSIS OF OPTIMAL SETTLEMENT-LITIGATION DECISION

5.3.3.1. PRELIMINARY ANALYSIS: COMPLETE INFORMATION

As a preliminary, we solve the plaintiff's problem under complete information. Let $c = \langle \phi^c, x^c, r^c \rangle$ be the plaintiff's *complete-information solutions*. We have,

1. *When the plaintiff has complete information about the strength of the case, there is no litigation:*

$$\phi^c(\theta) = 1 \text{ for all } \theta \in \Theta; \text{ and}$$

2. *When the plaintiff has complete information about the strength of the case, the attorney earns no profit and his effort is optimal:*

$$r^c(\theta) = t(x^c(\theta), \theta) \quad \text{and} \quad \frac{d}{dx}t(x^c(\theta), \theta) = 1 \quad \text{for all } \theta \in \Theta.$$

Proof. I shall prove that solutions 1 and 2 hold simultaneously. It follows from assumption 5.1.3 that $x^c(\theta) < \bar{\gamma}(\theta)$ for all θ . This immediately implies that the defendant will always accept $x^c(\theta)$. This is because if the defendant rejects $x^c(\theta)$ the plaintiff will go to trial since $\theta > k$ for all $\theta \in \Theta$. Then the defendant would pay $\bar{\gamma}(\theta)$ at trial, which is more than the settlement demand. Suppose that 2 is true so that $r^c(\theta) = t(x^c(\theta), \theta)$. Further, $\frac{d}{dx}t(x, \theta) |_{x=\bar{\gamma}(\theta)} = 0$ for all $\theta \in \Theta$ implies that, given any $\epsilon > 0$, we can find a $\Delta > 0$ and an $\tilde{s} \in S$ such that $t(x^{\tilde{s}}(\theta), \theta) < \epsilon$ provided that $\theta - k < x^{\tilde{s}}(\theta) < \Delta + \theta - k$, for all $\theta \in \Theta$. Or equivalently, there exists \tilde{s} such that $x^{\tilde{s}}(\theta) - t(x^{\tilde{s}}(\theta), \theta) > \theta - k$, for all $\theta \in \Theta$. But c is optimal implies that $x^c(\theta) - t(x^c(\theta), \theta) \geq x^{\tilde{s}}(\theta) - t(x^{\tilde{s}}(\theta), \theta)$ for all $\theta \in \Theta$. Therefore, the plaintiff is better off settling all her case out-of-court. Given that solution 1 holds, solution 2 is familiar from the incentive literature. ■

Of course, this contract offer to attorney is not feasible for the plaintiff when θ is unknown, because it does not satisfy the incentive-compatibility constraint (α). The attorney would have incentives to misrepresent the strength of the claim by reporting states lower than the true θ . It will be instructive to compare this complete-information solution to the optimal litigation-settlement decision under incomplete-information, to be derived in what follows. ||

Example 5.1. *Complete Information.*

Let $K = 1$. Suppose that attorney's cost function is given by $t(x, \theta) = \ln(k + 1) - \ln(\theta + 1 - x)$. The reader can easily check that for this cost function, the optimal settlement term under complete information is:

$$x^c = \theta, \quad \text{for all } \theta \in \Theta,$$

which is increasing in θ and has range $[\underline{\theta}, \bar{\theta}]$. The optimal reward and attorney time are given by

$$r^c(\theta) = t(x^c(\theta), \theta) = \ln(k + 1), \quad \text{for all } \theta \in \Theta.$$

This contract is not feasible for the plaintiff under incomplete information. To see this, suppose that the attorney were to misrepresent the strength of the case and report $\hat{\theta}$, when θ is the true case strength parameter. Then the attorney's payoff is

$$u(\hat{\theta}, \theta) = r^c(\hat{\theta}) - t(x^c(\hat{\theta}), \theta) = \ln(\theta - \hat{\theta} + 1),$$

which is strictly decreasing in $\hat{\theta}$. Therefore, the attorney will always report that the strength of case is $\underline{\theta}$. Thus, as θ is increased, the attorney's payoff is increased, as it becomes easier to negotiate settlement terms with the defendant. But the settlement term is unchanged for the plaintiff because of the attorney's misreport.

5.3.3.2. SETTLEMENT-LITIGATION DECISION UNDER INCOMPLETE INFORMATION

Now we turn to the central part of this chapter. The objective here is to demonstrate how inefficient litigation can arise as an instrument for the plaintiff to extract information concerning the strength of cases from the attorney. The key point here is that if a plaintiff pushes *weak* cases toward trial, then the incentive compatibility problem, embodied in equations (α), is mitigated. This occurs because the attorney has less incentive to sell out when the cases are strong.

The first result demonstrates how a plaintiff could improve her net gain from settlement by pushing some weak cases toward trial. The plaintiff's optimal settlement-litigation decision has four properties:

PROPOSITION 5.1.

- (i) *The optimal contract s^* entails that the plaintiff will only force weak cases to trial and do so without bargaining with the defendant, i.e., there is a $\theta^* \in \Theta$ such that the plaintiff will go to trial if $\theta < \theta^*$.*

Further, the plaintiff's unique optimal contract $\langle \phi^*, x^*, r^* \rangle$ entails

(ii) The optimal cutoff level θ^* is given by

$$\theta^* = x^*(\theta^*) - t(x^*(\theta^*), \theta^*) + \frac{1 - F(\theta^*)}{f(\theta^*)} \frac{d}{d\theta} t(x^*(\theta^*), \theta^*) + k,$$

where $x^*(\cdot)$ is given by $\frac{d}{dx} t(x^*(\theta), \theta) - \frac{1 - F(\theta)}{f(\theta)} \frac{\partial^2}{\partial x \partial \theta} t(x^*(\theta), \theta) = 1$.

(iii) If the plaintiff decides to go to trial, the attorney's utility is zero, i.e., $u(\theta) = 0$ for $\theta \in [\underline{\theta}, \theta^*]$.

(iv) If the plaintiff decides to settle the dispute, the attorney's utility is

$$u(\theta) = - \int_{\theta^*}^{\theta} \left\{ \frac{d}{d\tilde{\theta}} t(x^*(\tilde{\theta}), \tilde{\theta}) \right\} d\tilde{\theta} \text{ for } \theta \in [\theta^*, \bar{\theta}].$$

Proof. The proof of (i) is standard, see appendix. Let a feasible contract $s \in S$ be given.¹⁸⁵ Due to (1), the plaintiff-attorney's surplus in settlement is $u(\theta) = \max_{\hat{\theta}} \{r(\hat{\theta}) - t(x(\hat{\theta}), \theta)\}$. Due to envelope theorem,¹⁸⁶ we obtain that

$$\frac{d}{d\theta} u(\theta) = - \frac{d}{d\theta} t(x(\theta), \theta).$$

This immediately implies that $u(\theta) = u(\theta^*) - \int_{\theta^*}^{\theta} \left\{ \frac{d}{d\tilde{\theta}} t(x^*(\tilde{\theta}), \tilde{\theta}) \right\} d\tilde{\theta}$. The optimal contract on $[\underline{\theta}, \theta^*]$ follows from the fact that incentive compatibility constraint is maintained when the individual rationality constraint holds in equality. So the plaintiff can maximize her expected utility without violating conditions $[\alpha]$ and $[\beta]$ by setting $u(\theta^*) = 0$. Thus, I have shown that (iii) and (iv) hold.

Due to proposition (i) and (iii) of Proposition 1, the problem of the plaintiff can be written as

$$\max_{\theta} \left\{ \int_{\underline{\theta}}^{\theta} (\tilde{\theta} - k) f(\tilde{\theta}) d\tilde{\theta} + \int_{\theta}^{\bar{\theta}} \{x^*(\tilde{\theta}) - t(x^*(\tilde{\theta}), \tilde{\theta}) - u(\tilde{\theta})\} f(\tilde{\theta}) d\tilde{\theta} \right\}. \quad (58)$$

$u(\theta) = - \int_{\theta^*}^{\theta} \frac{d}{d\tilde{\theta}} t(x^*(\tilde{\theta}), \tilde{\theta}) d\tilde{\theta}$ due to (iv) of the proposition. Integration by parts yields

$$\int_{\theta^*}^{\theta} \frac{d}{d\tilde{\theta}} t(x^*(\tilde{\theta}), \tilde{\theta}) d\tilde{\theta} = \frac{1 - F(\theta)}{f(\theta)} \frac{d}{d\theta} t(x^*(\theta), \theta). \quad (59)$$

Substituting (59) into (58) and differentiate, we obtain

$$\theta^* = x^*(\theta^*) - t(x^*(\theta^*), \theta^*) + \frac{1 - F(\theta^*)}{f(\theta^*)} \frac{d}{d\theta} t(x^*(\theta^*), \theta^*) + k.$$

Furthermore, due to envelop theorem, $\frac{d}{d\theta} \{x^*(\theta) - t(x^*(\theta), \theta) + \frac{1 - F(\theta)}{f(\theta)} \frac{d}{d\theta} t(x^*(\theta), \theta)\} = - \frac{d}{d\theta} \{t(x^*, \theta) - \frac{1 - F(\theta)}{f(\theta)} \frac{d}{d\theta} t(x^*, \theta)\}$. But $\frac{d}{d\theta} \frac{1 - F(\theta)}{f(\theta)} < 0$ and $\frac{d}{d\theta} t(x, \theta) < 0$ and $\frac{\partial^2}{\partial \theta^2} t(x, \theta) < 0$ for all $\theta \in \Theta$ by construction. Then $-\frac{d}{d\theta} \{t(x^*, \theta) - \frac{1 - F(\theta)}{f(\theta)} \frac{d}{d\theta} t(x^*(\theta), \theta)\} < 0$. It follows that expression (58) is strictly concave, so the unique maximizer of (58) is given by the first-order condition.

It remains to determine the plaintiff's optimal settlement demand. $u(\theta) = r(\theta) - t(x(\theta), \theta)$. Substituting, the plaintiff's optimization problem on $[\theta^*, \bar{\theta}]$ becomes,

$$\max_{s \in S} \int_{\theta^*}^{\bar{\theta}} \left\{ x(\theta) - t(x(\theta), \theta) + \int_{\theta^*}^{\theta} \frac{d}{d\tilde{\theta}} t(x(\tilde{\theta}), \tilde{\theta}) d\tilde{\theta} \right\} f(\theta) d\theta. \quad (60)$$

¹⁸⁵As defined in Section 5.3.2, a contract is called 'feasible' if it satisfies conditions (α) and (β) .

¹⁸⁶See Milgrom and Segal (2002) for a general formulation of the envelope theorem.

Integration by parts yields

$$\int_{\theta^*}^{\bar{\theta}} \left\{ \int_{\theta^*}^{\theta} \frac{d}{d\tilde{\theta}} t(x(\tilde{\theta}), \tilde{\theta}) d\tilde{\theta} \right\} f(\theta) d\theta = \int_{\theta^*}^{\bar{\theta}} \{ [1 - F(\theta)] \frac{d}{d\theta} t(x(\theta), \theta) \} d\theta.$$

Hence,

$$\int_{\theta^*}^{\theta} \frac{d}{d\tilde{\theta}} t(x(\tilde{\theta}), \tilde{\theta}) d\tilde{\theta} = \frac{1 - F(\theta)}{f(\theta)} \frac{d}{d\theta} t(x(\theta), \theta). \quad (61)$$

Substituting (61) into (60), the plaintiff's optimization problem then becomes

$$\max_{s \in \mathcal{S}} \int_{\theta^*}^{\bar{\theta}} \left\{ x(\theta) - t(x(\theta), \theta) + \frac{1 - F(\theta)}{f(\theta)} \frac{d}{d\theta} t(x(\theta), \theta) \right\} f(\theta) d\theta. \quad (62)$$

Differentiate with respect to x yields, in the optimal contract

$$\frac{d}{dx} t(x^*(\theta), \theta) - \frac{1 - F(\theta)}{f(\theta)} \frac{\partial^2}{\partial x \partial \theta} t(x^*(\theta), \theta) = 1. \quad (63)$$

By construction expression (62) is strictly concave, so the unique maximizer of (62) is given by the first-order condition. ■

A contract s^* that maximizes the plaintiff's expected payoff is called the *optimal contract*. In the optimal contract, $x^*(\hat{\theta})$ is the sum of settlement the plaintiff will demand after she receive report $\hat{\theta}$ from the attorney. Facing the dual problem of expensive, jackpot-like litigation and informational disadvantage against her attorney, the plaintiff uses one problem to solve another. The optimal cutoff level θ^* partitions Θ into two regions. Inefficient litigation (resp. efficient settlement) occurs whenever the strength of the case is below (resp. beyond) θ^* . In equilibrium, there must be no unexploited arbitrage opportunity for the plaintiff: at θ^* her net gain from going to trial (i.e., $\theta^* - k$) must equal to her gain from settling her claim (i.e., $x^*(\theta^*) - t(x^*(\theta^*), \theta^*) + \frac{1 - F(\theta^*)}{f(\theta^*)} \frac{d}{d\theta} t(x^*(\theta^*), \theta^*)$).

Existing theories uniformly predict that, under asymmetric information (AI), informed parties proceed to trial only when they expect a high likelihood of winning.¹⁸⁷ I predict the exact opposite: upon receiving truthful report concerning the prospects of their suits, 'informed' plaintiffs proceed to trial only when they expect a low likelihood of winning, causing plaintiff win rates at trial to be low. In this way, pretrial settlement selects likely plaintiff winners from the filed pool, causing a tendency towards low plaintiff win rates at trial. If we compare this to the complete-information solutions 1 and 2 from an *ex post* point of view, it may seem inefficient and paradoxical for the plaintiff to ever force weak cases to trial. To understand why this may be optimal, observe that the plaintiff wants to encourage the attorney to admit that the case is strong, whenever it is true, so that the attorney will bargain hard with the defendant to obtain a high damage award in settlement. But to prevent the attorney from misrepresenting the strength of the case when the case is strong, the plaintiff must somehow 'punish' the attorney for reporting that the case is weak. Such punishment takes the form of pushing cases towards trial without negotiation (hence no payment to the attorney).

¹⁸⁷See Waldfogel (1998) for an excellent summary of this literature. Waldfogel (1998) presents empirical evidence from over 65,000 federal civil cases, indicating that the settlement process (the selection of cases for trial) does not obey the basic implications of these AI theories. However, Waldfogel does not provide rigorous explanations to justify his empirical findings.

Example 5.2. *Incomplete Information.*

We continue from example 5.1. Let us further assume that θ is uniformly distributed on $[a, 1]$, so that $f(\theta) = 1/(1-a)$. Suppose the plaintiff's trial costs, k , are sufficiently low, so that $k^2 \leq 1-a$. Due to proposition 5.2, one can show that the optimal cutoff level is $\theta^* = 1 - k^2$. Thus the likelihood of trial is $F(1 - k^2) = 1 - k^2/(1-a)$. The optimal settlement demand is $x^*(\theta) = \theta - (1-\theta)^{\frac{1}{2}}$ if $\theta \in [1 - k^2, 1]$, which is increasing in θ . A number of implications arise: First, the likelihood of settlement is increasing in the plaintiff's trial costs. Second, an improvement in the plaintiff's knowledge about her prospects at trial (captured by an increase in a) leads to an increase in the likelihood of settlement. Third, the plaintiff's settlement demand is increasing in her case strength. Furthermore, it follows from the definition of unfairness that $\rho(\theta) = (1-\theta)^{\frac{1}{2}}k^2/(1-a)$. There is a number of implications: First, the degree of unfairness is increasing in the plaintiff's trial costs. Second, an improvement in the plaintiff's information about her trial outcome (captured by an increase in a) results in a decrease in the degree of unfairness. Third, the degree of unfairness is decreasing in the plaintiff's case strength.

5.3.4. 'RISK-CLASSES': RANKING OF LITIGATION LOTTERIES

Now we arrive at the principal results of the chapter. My objective here is to show that the plaintiff's settlement-litigation decision necessarily depends on the risks inherent in the legal process and the plaintiff's prior information about her prospects at trial. Particularly, it is shown that when the plaintiff is more pessimistic about her trial outcome, i.e., the distribution of case strength has relatively more probability mass to the left, her attorney would bargain harder in pretrial negotiation and obtain more favorable settlement terms from the defendant. The plaintiff litigates *more* frequently when her case is *a priori* weaker.

Plaintiffs who share a common prior distribution function are called a 'risk-class'. We want to consider a group of plaintiffs that consists of a number of risk-classes and analyze the implications of alternative settlement-litigation decisions in the presence of such heterogeneity. First we formalize the notion that one prior distribution has a higher expected case strength than another. My approach here is a direct application of the theory of *Stochastic-Dominance*.¹⁸⁸

5.3.4.1. Ranking of litigation lotteries

Consider two probability distribution functions, F_1 and F_2 , both satisfying $F_i(\underline{\theta}) = 0$, $F_i(\bar{\theta}) = 1$ and $F_i(\theta)$ is weakly increasing in θ , $i = 1, 2$. The conditional probability that the plaintiff's case strength is θ (given that her case is stronger than θ), $\lambda_i(\theta) \equiv \frac{f_i(\theta)}{1-F_i(\theta)}$, is termed the *hazard-rate* associated with $F_i(\theta)$. We say that F_1 *first-order stochastically (strictly) dominates* F_2 if $F_1(\theta) < F_2(\theta)$ for all $\theta \in (\underline{\theta}, \bar{\theta})$. The following definition is central to the analysis of this section.

DEFINITION 5.1 (Hazard-rate Dominance): We say that F_1 (*strictly*) *dominates* F_2 in terms of *hazard rate* if $\lambda_1(\theta) < \lambda_2(\theta)$ for all $\theta \in (\underline{\theta}, \bar{\theta})$.

In words, hazard rate dominance implies that, the rate of increase of the plaintiff's chance of having a better case (i.e., $\frac{d}{d\theta} \ln(1 - F(\theta)) = -\frac{f(\theta)}{1-F(\theta)}$), is larger at all possible case strength with distribu-

¹⁸⁸I am grateful to Jan Boone and Eric van Damme for suggesting me to apply the theory of Stochastic-Dominance in analyzing the dependence of settlement-litigation decision on the risks inherent in the legal process.

tion 1 than with distribution 2. Now let's explore two important implications of definitions 5.2 and 5.3.

LEMMA 5.1.1. *If F_1 dominates F_2 in hazard rate, then F_1 first order stochastically dominates F_2 .*

Proof. The proof is standard, see appendix B.

LEMMA 5.1.2. *If F_1 dominates F_2 in hazard rate, then $\int_{\Theta} \theta f_1(\theta)d\theta > \int_{\Theta} \theta f_2(\theta)d\theta$.*

Proof. By Lemma 5.1.1, if F_1 dominates F_2 in hazard rate, then $F_1 < F_2$ for all $\theta \in (\underline{\theta}, \bar{\theta})$. Since $F_1 \geq 0$ and $F_2 \geq 0$, integration by parts yield

$$\int_{\Theta} F_1(\theta)d\theta < \int_{\Theta} F_2(\theta)d\theta \text{ if and only if } 1 - \int_{\Theta} \theta f_1(\theta)d\theta < 1 - \int_{\Theta} \theta f_2(\theta)d\theta$$

and therefore

$$\int_{\Theta} F_1(\theta)d\theta < \int_{\Theta} F_2(\theta)d\theta \text{ if and only if } \int_{\Theta} \theta f_1(\theta)d\theta > \int_{\Theta} \theta f_2(\theta)d\theta.$$

We obtain the conclusion of the lemma. ■

In words, lemma 5.1.2 states that the strength of the plaintiff's case is *a priori* higher with distribution 1 than with 2. Following lemma 5.1.2, we say that the plaintiff is *more optimistic about her trial outcome* under F_1 than under F_2 , if F_1 dominates F_2 in hazard rate.

5.3.4.2. Risk-class settlement-litigation pattern

Let θ_i^* denote the optimal cutoff level, corresponding to distribution $i = 1, 2$. The equilibrium levels of settlement and attorney surplus are denoted as x_i^* and u_i^* , respectively. To further simplify notation, write $\Omega^* \equiv [\theta_1^*, \bar{\theta}] \cap [\theta_2^*, \bar{\theta}]$.

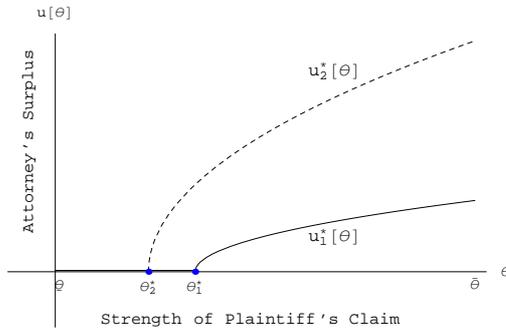
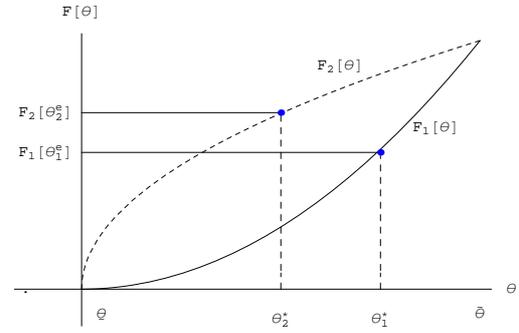
My next proposition states a comparative-static result about how the optimal cutoff level, optimal settlement demand, attorney's payoff, equilibrium probability of litigation and plaintiff's probability of winning at trial change with changes in the distribution of plaintiff's optimism about her trial outcome. This comparative static is important for empirical work, since it leads to counterintuitive and testable predictions about how bargaining outcome and litigants' welfare vary with changes in policy that affect trial outcomes.

Let $\omega_i^* = \int_{\underline{\theta}}^{\theta_i^*} \theta f_i(\theta)d\theta / F_i(\theta_i^*)$ denote the plaintiff's equilibrium (conditional) probability of winning at trial, corresponding to distribution $i = 1, 2$.¹⁸⁹

PROPOSITION 5.2. *If the plaintiff is more optimistic about her trial outcome under F_1 than under F_2 , then*

- (i) $\theta_1^* > \theta_2^*$;
- (ii) $x_1^*(\theta) < x_2^*(\theta)$ for all $\theta \in \Omega^*$;
- (iii) $u_1^*(\theta) < u_2^*(\theta)$ for all $\theta \in \Omega^*$;
- (iv) $F_1(\theta_1^*) < F_2(\theta_2^*)$; and
- (v) $\omega_1^* > \omega_2^*$.

¹⁸⁹Notice that $\int_{\underline{\theta}}^{\theta_i^*} \theta f_i(\theta)d\theta$ is the probability that the plaintiff wins at trial under F_i in equilibrium; $F_i(\theta_i^*)$ is the probability that the case will go to trial in equilibrium.


 Figure 5.3. F_1 dominates F_2 and $\theta_1^* > \theta_2^*$

 Figure 5.4. F_1 dominates F_2 and $F_1(\theta_1^*) < F_2(\theta_2^*)$

Proof. I will start by proving (ii) of the proposition. Expression (62) is a strictly concave function in x , so

$$\int_{\Omega^*} \left\{ x_i^*(\theta) - t(x_i^*(\theta), \theta) + \frac{1 - F_i(\theta)}{f_i(\theta)} \frac{d}{d\theta} t(x_i^*(\theta), \theta) \right\} f_i(\theta) d\theta > \int_{\Omega^*} \left\{ x_j^*(\theta) - t(x_j^*(\theta), \theta) + \frac{1 - F_j(\theta)}{f_j(\theta)} \frac{d}{d\theta} t(x_j^*(\theta), \theta) \right\} f_j(\theta) d\theta, \text{ for } i, j = 1, 2 \text{ and } i \neq j.$$

Adding the inequalities describing these maximum properties, we obtain for all $\theta \in \Omega^*$

$$\left\{ \frac{1 - F_2(\theta)}{f_2(\theta)} - \frac{1 - F_1(\theta)}{f_1(\theta)} \right\} \frac{d}{d\theta} t(x_2^*(\theta), \theta) > \left\{ \frac{1 - F_2(\theta)}{f_2(\theta)} - \frac{1 - F_1(\theta)}{f_1(\theta)} \right\} \frac{d}{d\theta} t(x_1^*(\theta), \theta).$$

Due to assumption 5.1.1, $\frac{d}{d\theta} t(x, \theta)$ is strictly decreasing in x . Further, hazard rate dominance implies that $\frac{1 - F_2(\theta)}{f_2(\theta)} - \frac{1 - F_1(\theta)}{f_1(\theta)} < 0$. Therefore, $x_2^*(\theta) > x_1^*(\theta)$ for all $\theta \in \Omega^*$ as required.

It remains to comparative the attorney's equilibrium surplus $u_1^*(\theta)$ and $u_2^*(\theta)$. If $x_1^*(\theta) < x_2^*(\theta)$ for all $\theta \in \Omega^*$ then $-\frac{d}{d\theta} t(x_1^*(\tilde{\theta}), \tilde{\theta}) < -\frac{d}{d\theta} t(x_2^*(\tilde{\theta}), \tilde{\theta})$ for all $\tilde{\theta} \in \Omega^*$, by assumption 5.1.1. Integrating both sides of the inequality, we get $-\int_{\Omega^*} \left\{ \frac{d}{d\theta} t(x_1^*(\tilde{\theta}), \tilde{\theta}) \right\} d\theta < -\int_{\Omega^*} \left\{ \frac{d}{d\theta} t(x_2^*(\tilde{\theta}), \tilde{\theta}) \right\} d\theta$. The last inequality implies that $u_1^*(\theta) < u_2^*(\theta)$ for all $\theta \in \Omega^*$ due to (iv) of proposition 5.1.

It remains to show that $\theta_1^* > \theta_2^*$. The proof proceeds in three steps.

Step A. $u_1^*(\theta_1^*) = u_2^*(\theta_2^*) = 0$ due to (ii) of proposition 5.2.

Step B. $u_2^*(\theta) > u_1^*(\theta)$ for all $\theta \in \Omega^*$ implies that $u_2^*(\theta_1^*) > 0$ by step A.

Step C. $u_2^*(\cdot)$ is continuous and monotone increasing on $[\theta_2^*, \bar{\theta}]$ due to (iii) of proposition 5.2; further, $u_2^*(\theta) = 0$ for all $\theta \in [\theta, \theta_2^*]$ due to (ii) of proposition 5.2. Therefore, $u_2^*(\theta_2^*) = 0$ and $u_2^*(\theta_1^*) > 0$ implies $\theta_2^* < \theta_1^*$ (see Figure 5.3).

Therefore, we obtain that if $u_1^*(\theta) < u_2^*(\theta)$ for all $\theta \in \Omega^*$, then $\theta_1^* > \theta_2^*$. This together with proposition 5.2 (iii) imply $\theta_1^* > \theta_2^*$.

Now turning to the proof of (iv) of Proposition 5.2. Due to (iii) of proposition 5.1, $u_1^*(\theta_1^*) = u_2^*(\theta_2^*) = 0$. Therefore

$$\frac{1 - F_1(\theta_1^*)}{f_1(\theta_1^*)} \frac{d}{d\theta} t(x_1^*(\theta_1^*), \theta_1^*) = \frac{1 - F_2(\theta_2^*)}{f_2(\theta_2^*)} \frac{d}{d\theta} t(x_2^*(\theta_2^*), \theta_2^*). \quad (64)$$

Due to (iii) of proposition 5.1, $x_1^*(\theta_1^*) = x_1^*(\theta_2^*) = 0$. In addition, by construction, $\frac{d}{d\theta} t(x_i^*(\theta), \theta)$ is

increasing in θ . Hence, if $\theta_1^* > \theta_2^*$ then $\frac{d}{d\theta}t(0, \theta_1^*) > \frac{d}{d\theta}t(0, \theta_2^*)$. Since $\frac{d}{d\theta}t(0, \theta_1^*) < 0$ and $\frac{d}{d\theta}t(0, \theta_2^*) < 0$, from (63) we have

$$\frac{1 - F_1(\theta_1^*)}{f_1(\theta_1^*)} > \frac{1 - F_2(\theta_2^*)}{f_2(\theta_2^*)} \quad \text{if and only if} \quad \frac{d}{d\theta} \ln(1 - F_1(\theta_1^*)) > \frac{d}{d\theta} \ln(1 - F_2(\theta_2^*)).$$

Since $\frac{d}{d\theta} \ln(1 - F_1(\theta_1^*)) \geq 0$ and $\frac{d}{d\theta} \ln(1 - F_2(\theta_2^*)) \geq 0$, we have

$$\int_{\Theta} \frac{d}{d\theta} \ln(1 - F_1(\theta_1^*)) d\theta > \int_{\Theta} \frac{d}{d\theta} \ln(1 - F_2(\theta_2^*)) d\theta \quad \text{if and only if} \quad \ln(1 - F_1(\theta_1^*)) > \ln(1 - F_2(\theta_2^*)).$$

Since $\ln(\cdot)$ is monotone increasing, we have $F_1(\theta_1^*) < F_2(\theta_2^*)$ as required (see Figure 5.4).

It remains to show that $\omega_1^* > \omega_2^*$. The proof proceeds in three steps.

Step A. $[\theta, \theta_i^*] \subset (0, 1)$ by construction. Further, $F_i(\theta) < 1 \forall \theta \in [\theta, \theta_i^*]$. So $\int_{\underline{\theta}}^{\theta_i^*} F_i(\theta) d\theta < 1$, $i = 1, 2$.

Step B. Due to proposition 5.4, $F_2(\theta_2^*) > F_1(\theta_1^*)$ if and only if

$$(F_2(\theta_2^*) - F_1(\theta_1^*)) (1 - \text{Max}\{\int_{\underline{\theta}}^{\theta_2^*} F_2(\theta) d\theta, \int_{\underline{\theta}}^{\theta_1^*} F_1(\theta) d\theta\}) > 0.$$

$$\begin{aligned} \text{But } F_2(\theta_2^*) (1 - \int_{\underline{\theta}}^{\theta_1^*} F_1(\theta) d\theta) - F_1(\theta_1^*) (1 - \int_{\underline{\theta}}^{\theta_2^*} F_2(\theta) d\theta) \\ > (F_2(\theta_2^*) - F_1(\theta_1^*)) (1 - \text{Max}\{\int_{\underline{\theta}}^{\theta_2^*} F_2(\theta) d\theta, \int_{\underline{\theta}}^{\theta_1^*} F_1(\theta) d\theta\}) \text{ implies that} \\ F_2(\theta_2^*) (1 - \int_{\underline{\theta}}^{\theta_1^*} F_1(\theta) d\theta) > F_1(\theta_1^*) (1 - \int_{\underline{\theta}}^{\theta_2^*} F_2(\theta) d\theta). \end{aligned}$$

Step C. Integration by parts yields $1 - \int_{\underline{\theta}}^{\theta_i^*} F_i(\theta) d\theta = \int_{\underline{\theta}}^{\theta_i^*} \theta f_i(\theta) d\theta$. Substituting and rearranging, we

$$\text{have } \int_{\underline{\theta}}^{\theta_1^*} \theta f_1(\theta) d\theta / F_1(\theta_1^*) > \int_{\underline{\theta}}^{\theta_2^*} \theta f_2(\theta) d\theta / F_2(\theta_2^*) \text{ and the proposition follows. } \blacksquare$$

The intuition of the comparative statics of the first result is as follows. Since with a low settlement the plaintiff cannot tell whether her case was weak or her attorney “sold out”, the attorney uses the court as an “auditor” to help him to verify to his client that the case was indeed lack of merits. With a better distribution, the plaintiff becomes more optimistic about her prospects at trial. Hence she is less easily convinced when the attorney says “times are tough”. In this way, more *strong* cases are pushed towards trial as they more often fail to meet the optimism of the plaintiff.

The second result of Proposition 5.2 means that, hard bargaining takes place when the plaintiff believes her case to be weak: she would demand more (resp. less) damage award from the defendant in settlement if she is more pessimistic (resp. optimistic) about her prospects at trial. In other words, an aggressive bargaining strategy (i.e., $x_2^*(\theta) > x_1^*(\theta)$) reflects that plaintiff expect her case to be weak (captured by $\int_{\Theta} \theta f_2(\theta) d\theta < \int_{\Theta} \theta f_1(\theta) d\theta$).

The third result of Proposition 5.2 states that the attorney earns less (resp. more) surplus when the plaintiff is more optimistic (resp. pessimistic) about her prospects at trial. The intuition underlying the comparative statics is as follows. The plaintiff obtains settlement payment achieved by the attorney but has to compensate the attorney for his time spent on the case. Further, in order to convince the attorney to reveal the true case strength, the plaintiff has to pay an informational rent. Since the attorney’s productivity improves with the strength of the case, he is *a priori* more productive under F_1 than under F_2 . It is therefore harder for the attorney to convince the plaintiff that he needs to be compensated more for his time under F_1 than under F_2 .

The fourth result of Proposition 5.2 states that the probability of trial is decreasing in the uninformed player's expected trial return (i.e., $\int_{\Theta} \theta f(\theta) d\theta$). This result stands sharply in contrast with those obtained from models that restrict attention to information asymmetry and strategic interactions between litigants (see Bebchuk (1984) and Spier (1992)). Although this surprising result may seem counterintuitive at first sight, its logic can be easily explained: the magnitude of expected trial return reflects the productivity of the attorney. The better the plaintiff's prospects at trial, the more optimistic the plaintiff is, the less costly it becomes for the attorney to obtain favorable settlement terms from the defendant. Since the plaintiff bears the full costs of negotiation, settlement (resp. litigation) becomes a more (resp. less) attractive option when negotiation is less costly.

The last result of the proposition means that, given that litigation occurs, the plaintiff is more likely to win with a better distribution. With a better distribution, the plaintiff litigates less often ($F_1(\theta_1^*) < F_2(\theta_2^*)$) but brings more strong cases to trial ($\theta_1^* > \theta_2^*$). ||

Example 5.3. *Stochastic Dominance.*

Continuing from example 5.1, let us further assume that θ is uniformly distributed on $[a, 1]$ with distribution F_1 , and uniformly distributed on $[b, 1]$ with distribution F_2 , where $0 < b < a < 1$. F_1 thus first order stochastically dominates F_2 . From the results of example 5.2, we have that the equilibrium likelihoods of trial are

$$F_1(\theta_1^*) = 1 - \frac{k^2}{1-a} < 1 - \frac{k^2}{1-b} = F_2(\theta_2^*).$$

The plaintiff's conditional probabilities of winning are

$$\omega_1^* = \frac{1}{2}(1+a-k^2) > \frac{1}{2}(1+b-k^2) = \omega_2^*.$$

The degrees of unfairness are

$$\rho_1(\theta) = \frac{(1-\theta)^{\frac{1}{2}}k^2}{1-a} > \frac{(1-\theta)^{\frac{1}{2}}k^2}{1-b} = \rho_2(\theta).$$

5.3.5. FINANCIAL AID

Up to this point, it has been assumed that the litigation is privately funded. In that case, litigation results when the informational rent is too high for the plaintiff to bear. The objective of this section is to understand the effect of such financial aid on the likelihood of settlement. It is shown that financial assistance (for both pre-litigation settlement and litigation) reduces the costs inherent in principal-agent problem between the plaintiff and her attorney, mitigates the negative effect of information asymmetry, thereby facilitates efficient settlement.

Formally, let $1 - \varrho$ (with $\varrho \in [0, 1]$) denote the *proportion of legal costs* financed by a third party (e.g. a trade union or legal aid funds) in settlement and litigation. Suppose that if the plaintiff decides to settle all her cases out of court, then the feasible contract $p = \langle \phi^p, x^p, r^p \rangle$ is chosen in the optimum solution, and let

$$\pi^p = \int_{\Theta} \{x^p(\theta) - \varrho r^p(\theta)\} f(\theta) d\theta$$

denote the plaintiff's payoff under contract p .

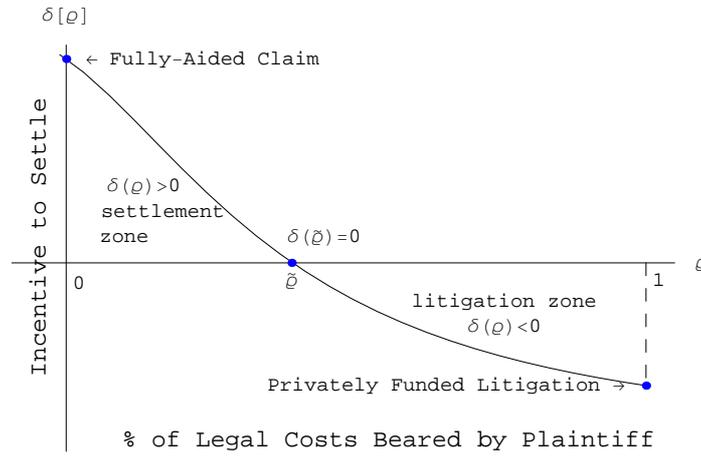


Figure 5.6. Financial Aid Discourages Litigation

Further, suppose that if the plaintiff chooses to litigate a fraction of her cases, some feasible contract $q = \langle \phi^q, x^q, r^q \rangle$ will be chosen in the optimum solution. The corresponding payoff is

$$\pi^q = \int_{\underline{\theta}}^{\theta^q} \{\theta - \varrho k\} f(\theta) d\theta + \int_{\theta^q}^{\bar{\theta}} \{x^q(\theta) - \varrho r^q(\theta)\} f(\theta) d\theta.$$

DEFINITION 5.2 (Incentive to Settle): The plaintiff's *incentive to settle* is defined as

$$\delta(\varrho) \equiv \pi^p - \pi^q.$$

Clearly, when $\delta(\varrho) > 0$ the plaintiff is better off settling all her claims out of court; when $\delta(\varrho) < 0$ the plaintiff would have incentive to force some of her weak cases to trial.

PROPOSITION 5.3. *For any distribution F , there exists $\tilde{\varrho} > 0$ such that for all $\varrho < \tilde{\varrho}$, $\delta(\varrho) > 0$. That is, the plaintiff is (strictly) better off settling all her cases provided that her claim is sufficiently aided, irrespective of the magnitude of risks in litigation.*

Proof. Suppose that $\delta(1) < 0$, i.e., when the plaintiff's claim is privately funded, the plaintiff is strictly better off using contract $\langle \phi^q, x^q, r^q \rangle$. But

$$\delta(0) = \int_{\Theta} x^p(\theta) f(\theta) d\theta - \left\{ \int_{\underline{\theta}}^{\theta^q} \theta f(\theta) d\theta + \int_{\theta^q}^{\bar{\theta}} x^q(\theta) f(\theta) d\theta \right\}.$$

On reflection it is clear that, $x^p(\theta) = x^q(\theta)$ for all $\theta \in [\theta^q, \bar{\theta}]$. Then,

$$\delta(0) = \int_{\underline{\theta}}^{\theta^q} \{x^p(\theta) - \theta\} f(\theta) d\theta.$$

However, there exists a feasible contract p such that $x^p(\theta) > \theta$ by construction. Hence, $\delta(0) > 0$. Since $\delta(\cdot)$ is continuous on $[0, 1]$, by *intermediate value theorem* we can find a $\tilde{\varrho} \in [0, 1]$ such that $\delta(\tilde{\varrho}) = 0$. Further since $\delta(\cdot)$ is monotonically decreasing in ϱ , it follows that $\delta(\varrho) > 0$ for all $\varrho \in [0, \tilde{\varrho}]$ as required (see figure 5.6). ■

Proposition 5.3 implies that for the types of people and legal matters that would be sufficiently

covered by third party financing, settlement will always occur irrespective of the plaintiff's prior information and the direct trial costs. The intuition underlying the comparative statics is as follows. Litigation is costly for the plaintiff. However, in order to effectively monitor her attorney's performance in settlement negotiation when the attorney has more information than her concerning the characteristics of the lawsuit, the plaintiff uses litigation as a device for extracting information. Third party financing mitigates the cost of information asymmetry inherent in representative bargaining. Therefore, plaintiffs receiving financial support, go to court less often than those receiving no financial support. ||

5.3.6. VARYING UNCERTAINTY LEVELS: AN EXAMPLE

I now turn to an example in which the plaintiff's uncertainty about her trial outcome is represented by the spread of a uniform distribution. My purpose here is to show that it is possible for the model to reproduce some key features of the data when we make plausible assumptions about the model's parameters. I use the uniform distribution, since in this case the equilibrium can be derived in closed form. Numerical calculations with other distributions such as a truncated normal distribution, suggest that my distributional assumption is not crucial to the results.

To illustrate our optimal solution, let us continue from example 5.1. Suppose that θ is uniformly distributed on $[\mu - d, \mu + d]$ so θ has a mean of μ and a variance of $d^2/3$. Thus, by varying d , I can vary the level of uncertainty without changing the mean of the distribution. In particular, the standard deviation increases linearly from 0 as d increases from 0. I refer to d as the *level of uncertainty*. Further I assume that $k + d \leq \mu \leq 1 - d$.

My last proposition states a comparative-static result about how bargaining and litigation outcomes change with changes in the level of uncertainty. This comparative static is consistent with the literature.

PROPOSITION 5.6. *In the equilibrium with uniform uncertainty with $t(x, \theta) = \ln(k + 1) - \ln(\theta + 1 - x)$,*

(i) *The equilibrium probability of trial is*

$$F(\theta^*) = \begin{cases} 0 & \text{if } 0 \leq d \leq \frac{1}{2}k^2, \\ 1 - \frac{k^2}{2d} & \text{if } \frac{1}{2}k^2 < d \leq \frac{1}{2} - k, \\ 1 - \frac{k^2}{1-2k} & \text{if } d > \frac{1}{2} - k. \end{cases}$$

(ii) *The equilibrium settlement amount is $x^*(\theta) = \theta - \sqrt{\mu + d - \theta}$, for $\theta \in [\theta^*, \mu + d]$, where $\theta^* = \mu + d - k^2$ if $d > \frac{1}{2}k^2$ and $\theta^* = \mu - d$ if $d \leq \frac{1}{2}k^2$.*

(iii) *In the incidence of a trial, the plaintiff wins with probability $\omega^* = \mu - k^2$.*

Proof. It follows from result (ii) of Proposition 5.1 that the optimal cutoff level is given by $\theta^* = \mu + d - k^2$. $\frac{d}{dx}t(x^*(\theta), \theta) = 1/(1 - x^*(\theta) + \theta)$. $\frac{\partial^2}{\partial x \partial \theta}t(x^*(\theta), \theta) = -1/(1 - x^*(\theta) + \theta)^2$. $1 - F(\theta)/f(\theta) = \mu + d - \theta$. Substituting into equation (50), and we obtain (ii). (i) and (iii) follow by construction. ■

One critical parameter that cannot be estimated directly from the data is the level of uncertainty d . It is important, therefore, to look at how the bargaining outcome changes with the level of uncertainty increases from 0. A remarkable feature of this model is that likelihood of settlement depend only on

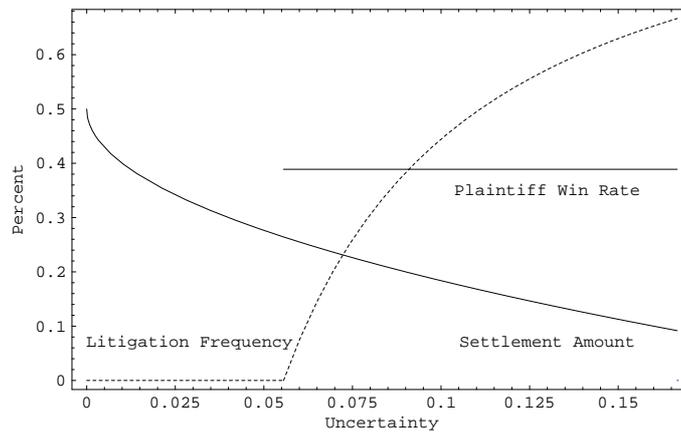


Figure 5.6. Varying Uncertainty Levels ($\mu = 0.5$, $k = 0.33$, $\theta = 0.5$)

d and k but not on the expected trial outcome or any other parameters of the model. Assume trial costs of 0.33 and mean prior probability winning of 50 percent. The likelihood of litigation increases from 0 to 67 percent as we move from little uncertainty to maximal uncertainty (see figure 5.6).

The equilibrium settlement amount is decreasing in the mean and dispersion of probability, increasing in θ (holding constant the distribution of probability) but invariant to trial costs k . With higher risk it is more expensive for the plaintiff to negotiate settlement payment via her attorney, implying that the plaintiff will demand less in settlement.

Now consider how the plaintiff's *ex post* probability of winning varies with the level of her uncertainty. The plaintiff's win rate is insensitive to her uncertainty. Figure 5.6 shows that for trial costs of 0.33 and mean *prior* probability of winning of 50 percent, the plaintiff's equilibrium win rate is fixed at 38.9 percent. This occurs because a proportional increase in likelihood of litigation following an increase in the plaintiff's uncertainty results in an equal proportional increase in the strength of litigated cases.

5.4. CONCLUSION

My main observation is that when the plaintiff has an informational disadvantage *vis-à-vis* her attorney concerning the strength of her lawsuit and her chance of winning at trial, the plaintiff can use litigation as an instrument for extracting information. But, counterintuitively, litigation will occur only when the plaintiff is pessimistic about her prospects at trial. The plaintiff is more likely to sue if she is more pessimistic about winning the case. This is because, the attorney “passes the buck” to the court provided that his client may not believe him if he says “times are hard” and that he may be blamed for a poor performance. This, in turn, is a rational strategy for the plaintiff to pursue because if she does not *commit* to litigating her weak cases she may encourage “selling out” by her attorney. In this way, pretrial settlement selects likely plaintiff winners from the filed pool, causing a tendency towards low plaintiff win rates at trial.

Two factors are crucially important in determining the plaintiff's settlement-litigation decision: the level of uncertainty associated with the legal outcomes and the financing of litigation. Predictability of legal outcome improves the plaintiff's ability to monitor her attorney's performance, and therefore mitigates the principal-agent problem inherent in representative negotiation and facilitates successful settlement. Hence, more experienced plaintiffs go to court less often. There is another

aspect of attorney-client relationship regarding the financing of litigation that can affect a plaintiff's incentive to litigate: legal aid reduces the costs inherent in representative bargaining thereby promoting efficient settlement. Therefore, plaintiffs receiving legal aid in litigation, go to court less often than those receiving no legal aid.

There are four important extensions to this research. The first is to introduce renegotiation possibilities into the analysis. After a report from the attorney on the strength of her case, the plaintiff usually has option to change her litigation-settlement decision while proposing a change in the attorney's compensation scheme. Since the attorney will take these into account, renegotiation may erode the commitment effect of litigation.

The second extension is to introduce moral hazard on the part of the attorney in the litigation stage. In my analysis, the trial outcome is not influenced by the settlement-attorney's effort. This might not be a plausible assumption for the some systems. For instance, in the American legal system the trial outcome is usually a function of effort by the attorneys who handle both pretrial negotiation and litigation. Then it will be efficient to have a division of rents between the plaintiff and the attorney for litigated cases. This might erode the effect of litigation as a tool for the plaintiff to monitor her attorney's performance in settlement negotiation.

The third extension is to consider the principal-agent problem on both sides of the bargaining table. In my model, information asymmetry only exists on the plaintiff side. In principle, this setting can be extended by allowing also the defendant to have informational disadvantage *vis-à-vis* the defense lawyer. In this case, however, the characterization of the equilibrium becomes more complicated because two-sided delegation leads to a four-person bargaining game. This poses a challenge for future research.

Finally there is more research to be done to account for the relatively rigid payment systems in Europe and not general availability of contingency fees. An attorney paid by an hourly fee may, for instance, postpone settlement until the last moment in order to make more money or simply to get his day in court in order to accumulate practical litigation experience.¹⁹⁰ Given the difference in legal rules and methods of payment of legal fees between the UK and continental Europe, it would be interesting to see how these differences would affect the process and outcome of bargaining, and where compensation is better structured to tie the interests of lawyers and clients. More analysis could be done in this avenue by using the mechanism-design approach to litigation and settlement. Since such an approach permits the analysis of litigation and settlement outcomes without the specification of a particular game-form, it may be possible to find general properties for the pattern of settlement under an hourly fee arrangement and how policies can be designed to encourage efficiency and fairness in the system.

¹⁹⁰See, e.g., Hadfield (2000) for evidence on the limited opportunity for lawyers to gain access to trial and discussions on the lawyers' incentives to accumulate litigation experience.

5.5. APPENDIX

APPENDIX A

Proof of Proposition 5.1 (i).

Given that the plaintiff chooses $\langle \phi, x, r \rangle$, if the case strength is θ , and if the attorney reports θ truthfully, its expected profit $u(\theta)$ is $u(\theta) = r(\theta) - t(x(\theta), \theta)\phi(\theta)$; if the attorney were to misrepresent the strength of the case and report $\hat{\theta}$, when θ is the true strength of the case, its expected payoff is $u(\hat{\theta}, \theta) = r(\hat{\theta}) - t(x(\hat{\theta}), \theta)\phi(\hat{\theta})$. Condition (α) requires that

$$u(\theta) \geq u(\hat{\theta}, \theta) = u(\hat{\theta}) + \phi(\hat{\theta})[t(x(\hat{\theta}), \hat{\theta}) - t(x(\hat{\theta}), \theta)]. \quad (65)$$

Thus,

$$\phi(\hat{\theta})[t(x(\hat{\theta}), \hat{\theta}) - t(x(\hat{\theta}), \theta)] \leq u(\theta) - u(\hat{\theta}) \leq \phi(\theta)[t(x(\theta), \hat{\theta}) - t(x(\theta), \theta)], \quad (66)$$

where the second inequality follows from the analogue of (11) with the roles of θ and $\hat{\theta}$ reversed. Then $\theta > \hat{\theta}$ implies that $t(x(\hat{\theta}), \hat{\theta}) > t(x(\hat{\theta}), \theta)$ and $t(x(\theta), \hat{\theta}) > t(x(\theta), \theta)$ since $\frac{d}{d\theta} \frac{1-F(\theta)}{f(\theta)} < 0$, for all $\theta \in \Theta$; now suppose in negation that $\phi(\theta) < \phi(\hat{\theta})$. By construction of the characteristic function, we must have that $\phi(\theta) = 0$ and $\phi(\hat{\theta}) = 1$. But then

$$\phi(\hat{\theta})[t(x(\hat{\theta}), \hat{\theta}) - t(x(\hat{\theta}), \theta)] = t(x(\hat{\theta}), \hat{\theta}) - t(x(\hat{\theta}), \theta) > 0 = \phi(\theta)[t(x(\theta), \hat{\theta}) - t(x(\theta), \theta)]$$

which is a contradiction to (46). Therefore, there exists a $\theta^* \in \Theta$ such that for all $\theta \geq \theta^*$, $\phi^*(\theta) = 1$ and for all $\theta < \theta^*$, $\phi^*(\theta) = 0$. ■

APPENDIX B

Proof of lemma 5.1.1.

Since $F_1(\theta) \neq 1$ and $F_2(\theta) \neq 1$ for all $\theta \in (\underline{\theta}, \bar{\theta})$, it follows that

$$\frac{f_1(\theta)}{1 - F_1(\theta)} < \frac{f_2(\theta)}{1 - F_2(\theta)} \quad \text{if and only if} \quad \frac{d}{d\theta} \ln(1 - F_1(\theta)) > \frac{d}{d\theta} \ln(1 - F_2(\theta)) \quad \text{for all } \theta \in (\underline{\theta}, \bar{\theta}).$$

Integrate both sides of the inequality, we have

$$\int_{\underline{\theta}}^{\theta} \frac{d}{d\tilde{\theta}} \ln(1 - F_1(\tilde{\theta})) d\tilde{\theta} > \int_{\underline{\theta}}^{\theta} \frac{d}{d\tilde{\theta}} \ln(1 - F_2(\tilde{\theta})) d\tilde{\theta}, \quad \text{for all } \theta \in (\underline{\theta}, \bar{\theta}). \quad (67)$$

But $\int_{\underline{\theta}}^{\theta} \frac{d}{d\tilde{\theta}} \ln(1 - F_1(\tilde{\theta})) d\tilde{\theta} = \ln(1 - F_1(\theta))$, $i = 1, 2$. Inequality (54) thus becomes

$$\ln(1 - F_1(\theta)) > \ln(1 - F_2(\theta)) \quad \text{for all } \theta \in (\underline{\theta}, \bar{\theta}).$$

Since $\ln(\cdot)$ is monotone increasing, it follows that $1 - F_1(\theta) > 1 - F_2(\theta)$ or equivalently $F_1(\theta) < F_2(\theta)$ for all $\theta \in (\underline{\theta}, \bar{\theta})$. ■

APPENDIX C

Dropping the suit.

Let's now assume that $\theta < k$ for some $\theta \in \Theta$ and allow the plaintiff to drop her claim upon receiving report from the attorney on the case strength.

DEFINITION 5.3 (settlement-litigation-dropping decision): For any $\hat{\theta}$ in Θ , provided that the attorney reports that the strength of the claim is $\hat{\theta}$, a *settlement-litigation-dropping decision* $\varphi : \Theta \rightarrow \{-1, 0, 1\}$ is a function that is defined to be

$$\varphi(\hat{\theta}) = \begin{cases} 1 & \text{if the plaintiff instructs her attorney to negotiate;} \\ 0 & \text{if the plaintiff litigates without negotiation;} \\ -1 & \text{if the plaintiff drops her case.} \end{cases}$$

Further, let

$$\theta^{**} := \max_{\theta} \left\{ \int_k^{\theta} (\tilde{\theta} - k) f(\tilde{\theta}) d\tilde{\theta} + \int_{\theta}^{\bar{\theta}} \left\{ x^{**}(\tilde{\theta}) - t(x^{**}(\tilde{\theta}), \tilde{\theta}) - \frac{1-F(\tilde{\theta})}{f(\tilde{\theta})} \frac{d}{d\tilde{\theta}} t(x^{**}(\tilde{\theta}), \tilde{\theta}) \right\} f(\tilde{\theta}) d\tilde{\theta} \right\}. \quad (68)$$

If the plaintiff drops her lawsuit, she will receive no damage award. The net expected gain for the plaintiff from dropping the case would be

$$\int_{\underline{\theta}}^{\bar{\theta}} r(\theta) \varphi(\theta) f(\theta) d\theta.$$

All other definitions and assumptions remain unchanged. Figure 5.7 illustrates the game.

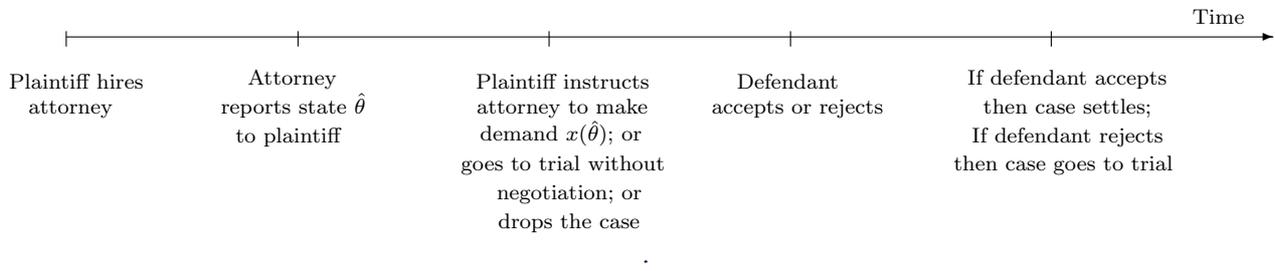


Figure 5.7. Timing of Litigation with Attorney (dropping cases)

The equilibrium takes a simple form. If θ is sufficiently low (below k), the plaintiff decides to drop the case; if θ is sufficiently high (greater than a cutoff level θ^{**} , the plaintiff decides to settle; otherwise ($k < \theta \leq \theta^{**}$))

The following proposition is an extension of proposition 5.2.

PROPOSITION 5.5. *The plaintiff's optimal contract $\langle \phi^{**}, x^{**}, r^{**} \rangle$ entails*

- (i) *The plaintiff will bargain with the defendant and settle the dispute if $\theta \geq \theta^{**}$, where θ^{**} is given by*

$$\theta^{**} = x^{**}(\theta^{**}) - t(x^{**}(\theta^{**}), \theta^{**}) + \frac{1-F(\theta^{**})}{f(\theta^{**})} \frac{d}{d\theta} t(x^{**}(\theta), \theta^{**}) + k.$$

with $x^{**}(\cdot)$ given by $\frac{d}{dx} t(x^{**}(\theta), \theta) - \frac{1-F(\theta)}{f(\theta)} \frac{\partial^2}{\partial x \partial \theta} t(x^{**}(\theta), \theta) = 1$. *She will go to trial if $k \leq \theta \leq \theta^{**}$. She will drop the case if $\theta < k$.*

- (ii) $u(\theta) = 0$ and $\{x^{**}(\theta), r^{**}(\theta)\} = \{0, 0\}$ for $[\underline{\theta}, \theta^{**}]$;
 (iii) $u(\theta) = - \int_{\theta^{**}}^{\theta} \left\{ \frac{d}{d\tilde{\theta}} t(x^{**}(\tilde{\theta}), \tilde{\theta}) \right\} d\tilde{\theta}$ for $\theta \in [\theta^{**}, \bar{\theta}]$.

Proof. I only give the proof of (i) of the proposition. The proofs of (ii) and (iii) are similar to those in proposition 5.2. Suppose in negation that will go to trial at some $\theta_1 < k$ in state θ_1 . Then, the plaintiff earns net payoff $\theta_1 - k < 0$. But she could earn 0 by dropping the case at θ_1 while setting $x(\theta_1) = 0$ and $r(\theta_1) = 0$ without violating conditions (α) and (β) . Therefore, going to trial at $\theta_1 < k$ cannot occur in equilibrium. So we have arrived at a contradiction. ■

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