Costly Dispute Resolution Under Limited Commitment: A Mechanism Design Approach*

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Abstract

Why do agents engage in costly dispute resolution such as litigation and arbitration when costless settlement is available? It has been argued that parties are asymmetrically informed about facts and the law surrounding a dispute. This causes the expected payoff from litigation for an agent to be unobservable to her opponent. This unobservability can lead to the breakdown of pre-trial bargaining. This approach leaves two fundamental questions unanswered: How does informational asymmetry between parties survive given the incentives for full disclosure of certifiable information? Does efficient settlement ensue if parties communicate in forms richer than bargaining? To address the first question I argue that pre-trial informational asymmetry could arise from inherently non-certifiable information, in particular through private valuation of the subject matter in dispute. The second question is tackled by adopting a mechanism design framework to show that there are conditions under which litigation must exist in equilibrium. This result arises when parties at the pre-trial stage, lack the ability to fully contract away their right to litigate. This in effect induces agents to exaggerate their true willingness to litigate in order to increase the settlement that their opponents are willing to offer. Consequently the credibility of statements made in pre-trial negotiations is destroyed and costly dispute resolution emerges as an equilibrium phenomenon.

1 Introduction

Underpinning much of the architecture of neo-classical economics lies the assumption of an omniscient judiciary. This judiciary is so efficient that it de-

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ters undesirable behavior by its very existence. From Arrow-Debreu contingent commodities to incentive contracts, agents perform their legal obligations in the knowledge that if they do not, they will be punished. Although invoking the court is costly, this does not lead to an inefficiency since even in the unlikely event of a dispute, there is instantaneous resolution through bargaining as both parties are aware that taking the dispute to court is costly.

This logic creates the paradox of litigation: why do we observe litigation at all when parties are aware of its costliness and costless settlement is available? This is the question that is addressed here. I argue that parties have private valuations of the subject matter in dispute. This causes the expected payoff from litigation to become unobservable to the opponent. At the pre-trial stage parties attempt to negotiate a costless resolution of the dispute in the presence of this informational asymmetry. The outside option to negotiations is the expected payoff from litigation which is increasing in the agent’s valuation of the surplus. This creates an incentive for agents to overstate their valuation since high valuation agents receive greater settlement offers during negotiations. The incentive to exaggerate one’s valuation creates a lack of credibility about statements made during pre-trial negotiations and consequently causes parties to litigate.

In environments where agents are limited in their ability to contract away their right to litigate, low valuation agents are wary of revealing their type truthfully. This is because truthful revelation weakens their position as their opponents use the revealed information to credibly threaten litigation, and consequently get larger shares of the surplus. In section 3.2 I show how litigation is prevented if agents can fully contract away their right to litigate at the pre-trial stage. In section 5.2 I argue that this explanation for the existence of litigation generalises to some other forms of conflict as well.

This paper contributes in two ways to the literature on conflict in general and litigation in particular. Firstly it shows the existence of costly dispute resolution in equilibrium in a mechanism design framework rather than in a more limited bargaining framework, a point discussed in section 1.3. Secondly, the use of non-certifiable information to generate informational asymmetry immunises this model to the full disclosure critique that has plagued the literature on litigation. This point is discussed in greater detail in section 1.2.

1.1 First and Second Generation Literature

The large literature that has arisen in response to the question of why people litigate is now two generations old. The first generation literature started with Landes (1971) who argued that litigation arises when its expected benefit is greater than the expected costs for the parties. Parties do not strategically interact in the pre-trial stage and litigation is avoided when the expected benefit of litigating is lower than the expected cost. Out of court settlement occurs when parties have similar expectations about the outcome of the trial. It is worth explaining this point.
Uncertainty about the outcome of a trial cannot be sufficient to create litigation. With uncertainty, both parties would form expectations about what would happen in court. If the probabilities both associate with winning add up to one, they would settle outside thereby saving themselves the cost of litigation. Litigation arises for instance if both parties overestimate their chances of winning in court. Though this literature acknowledges the role of such overestimation in generating litigation, it stops short of modelling how this overestimation arises and, more importantly, the strategic behaviour of parties when they negotiate in the presence of such overestimation.¹

In response to this unresolved issue, a second generation literature arose starting with P’ng (1983) and Bebchuk (1984). In Bebchuk (1984), the defendant knows the probability of winning whereas the plaintiff only knows the distribution over the probability of winning. The plaintiff makes an offer of settlement which the defendant can accept or reject. If the offer is rejected, the case goes to court. Since this bargaining game is played out between parties in an environment of incomplete information, the inefficiency of litigation arises.²

This is a reflection of the broader theoretical insight that full efficiency is not guaranteed with bargaining under incomplete information. In the next two subsections the two problems with the second generation literature that this paper seeks to address are explained.

1.2 Litigation and Full Disclosure

The first problem concerns the relationship between private information of parties and the unobservability of the opponent’s payoff from litigation. The justification given in this literature for private information leading to litigation payoffs being unobservable is that a party to a dispute may be in possession of information that once revealed in court, increases its probability of winning.³

It is quite plausible that parties would have such information. A defendant in


²This result has been generalised in different ways. Schweizer (1989) allows for both parties to be in possession of private information. Nalebuff (1987) allows for the informed agent to make the settlement offer, thereby considering the signalling implications of the size of the offer and its rejection. Spier (1992) considers more stages to bargaining. Friedman and Wittman (2006) explore pre-trial settlement when parties employ the Chatterjee and Samuelson (1983) protocol for bargaining. Although, as noted in Daughety and Reinganum (1994), the predictions of these models vary in terms of equilibrium allocations for plaintiff and defendant, a non-zero probability of litigation emerges as a robust phenomenon. In fact Spier (1994), using a mechanism design approach, shows that litigation would arise even when parties bargain using the most efficient extensive form. See Cooter and Rubinfeld (1989) and Hay and Spier (1998) for surveys of this literature.

³Although the literature has focused on this channel, there are other channels through which private information can generate unobservability of the payoff from litigation. For example, even if parties have the same priors but have private valuations of the subject matter in dispute, this is sufficient for bargaining to be inefficient. What is required is that the expected payoff from litigation be private information. Overestimating the probability of winning in court is only one of the ways in which this may happen.
a law suit for negligence is likely to have more information than the plaintiff about whether he exercised due care. The plaintiff on the other hand is likely to have private information about the exact amount of damage she has suffered.

However if parties possess information that is assumed to be certifiable in court, parties can choose to reveal it to each other outside court at the pre-trial stage. If parties choose to disclose their private information, they find themselves symmetrically informed and consequently litigation is avoided through bargaining. Do parties have an incentive to reveal their private information before trial? It turns out that in the setting of these models, the answer is yes.

Grossman (1981) shows that when private information is certifiable, there are very strong incentives to reveal it. The intuition for this is that when an agent has information that is favourable to himself, he would always want to reveal it since this leads to better offers from his opponent. This leads to an unravelling in the sense that the agent who chooses not to reveal his information ends up signalling that he has unfavourable information. The existence of litigation in equilibrium in this literature disappears as soon as parties can communicate in forms that are richer than bargaining. This is because parties would divulge their certifiable information and then bargain efficiently in the environment of complete information.

I propose a different approach by assuming that the asymmetry between parties is about information that is inherently non-certifiable. In my model, a party’s valuation of the subject matter is private information. This valuation determines the amount of effort an agent is willing to exert in court, which in turn generates a probability of winning that is private information of the party. Hence the diverging expectations that parties have about the payoff from litigation are endogenously generated. In contrast to private information on evidence which can be certified by the informed agent, declarations of valuation are essentially cheap talk; all types would declare that they have high valuation since this increases the settlement offer they are likely to receive. Unlike evidence that is certifiable, there may not exist an efficient way to credibly display high valuation. High valuation may be credibly revealed only through a costly action, such as spending more in a trial, which an agent with a lower valuation will not find optimal.

1.3 Litigation and Mechanism Design

The second problem with the literature on litigation is its focus on bargaining as a means of resolving disputes outside court. Focusing attention singularly on bargaining implies that parties are restricted to interact through offers and counter offers. This assumption about the nature of pre-trial negotiation is very

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4Okano-Fujiwara et al. (1990) derive conditions sufficient for this argument to work. Shavell (1989) finds that this argument in the setting of litigation leads to certifiable private information washing away before trial through voluntary disclosure. Hay (1995) finds the opposite result while focusing on laws mandating full disclosure but does not consider the possibility of signalling through non-disclosure. In a similar vein Mnookin and Wilson (1988) analyse disclosure in a mechanism design setting under the assumption that the unravelling argument outlined above does not apply.
restrictive since communication between parties usually extends beyond this. Communication between parties can include a sequence of messages exchanged in a rich language that could, in principle, mitigate the informational asymmetry that exists between parties. To give just one example, going back to the argument outlined in the previous subsection, the possibility of communication eliminates entirely any informational asymmetry arising from certifiable pieces of information leading to efficient settlement in the second generation models of litigation. Hence by restricting the form of pre-trial negotiation to be of the bargaining variety, it is possible to miss out on equilibria in which parties settle out of court.

The model presented here is the first to attempt the resolution of this problem using a mechanism design approach. The seminal paper by Myerson (1982) shows that an equilibrium of any Bayesian game can be replicated through a direct mechanism. This result is known as the revelation principle. Using this insight, the result presented here will show that litigation may arise even when no restrictions are made about the nature of communication between parties during pre-trial negotiation. Since bargaining games under incomplete information form a subset of the Bayesian games parties could play, this is subsumed in the model presented here.

1.4 Alternative Explanation for Litigation

The Bebchuk (1984) framework has been the most widely accepted one for explaining the existence of litigation. However there are other explanations. A possible explanation that has received some attention is one based on the existence of communication costs. If the costs of communication between parties are high, then parties would prefer to simply take the matter to court rather than settle it between themselves. In fact even if the costs are very low, as long as both parties need to pay the costs non-cooperatively to start communication, Anderlini and Felli (2001) show that there always exists an equilibrium where communication will not take place. This explanation may fit a certain class of litigation. For example it may explain divorce battles between spouses where the prospect of communicating with the opponent is so odious that costly litigation is preferred.

In a similar vein Robson and Skaperdas (2008) construct a model where parties need to pay costs non-cooperatively before they can enter the stage of pre-trial settlement. These costs influence the probability of winning the case and hence influence the outcome of pre-trial bargaining. The idea is that parties by committing to litigate may reduce total costs if a substantial part of these costs is paid ex-ante before bargaining takes place. This happens because committing not to settle damps the incentive to make costly effort ex-ante. However just like in Anderlini and Felli (2001) this result disappears if parties are allowed to meet before these costs are incurred. Since the existence of ex-ante costs is the crucial ingredient here, it is difficult to extend this explanation to all litigation unless a micro foundation for these costs is supplied.

The model presented here synthesises the two main approaches used for
analysing litigation. The literature on pre-trial negotiations treats the court process as exogenous. In contrast the literature on conflict treats the failure of pre-trial negotiation as exogenous and models the court process as a complete information contest between two parties where the probability of winning is endogenously determined by the effort exerted by parties. This paper combines these two approaches by modelling the court process as a contest in an environment of incomplete information, with a mechanism design stage preceding litigation where parties can negotiate to avoid costly litigation.

2 Model

There are two agents who find themselves in a dispute. The subject matter of the dispute is characterised as an indivisible surplus over which agents have competing claims. Both agents have a non-negative valuation of the surplus which is their type. Agent 1’s valuation is , which is observable, whereas agent 2’s valuation is unobservable and can be with probability and with probability .

Agents are aware of their own type before the game begins. The model can be easily generalised to the case where the informational asymmetry is two-sided, but uncertainty over the type of one agent is sufficient to generate litigation in equilibrium. The following parametric assumption is made:

Assumption 1.

The assumption that the valuation of a party is unobservable is the key driver of litigation in this model. It is worthwhile to see some examples where litigation can be interpreted as a dispute over surplus. These examples have been chosen to illustrate how the model may apply to a large range of situations. Examples include:

- Dispute over property: A party has private valuation over a piece of property and it is unclear as to who has title over it. The property could be tangible such as a house or intangible such as an invention.

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5See for example, Bebchuk (1984) and Spier (1994).
6See for example, Hirshleifer and Osborne (2001).
7In an earlier draft a model with two sided private information was presented. The assumption of one sided asymmetric information is preferred for two reasons. First, it simplifies the model considerably while delivering a clearer intuition about the result. Second, it demonstrates more clearly how the mechanics that drive the result are not the ones subsumed in Myerson and Satterthwaite (1983). Unlike Myerson and Satterthwaite (1983) where the uncertainty of gains from trade is required, here the inefficiency of conflict is common knowledge between parties who are consequently aware that out of court settlement is always more efficient. In technical terms this implies that the distributions of valuations of the two parties need not intersect and in fact two sided private information is not required. However, in contrast with Myerson and Satterthwaite (1983), the additional ingredient that is needed for this result is the inability of parties to contract away their right to challenge the allocation delivered by the mechanism ex-post.
• Suits for specific performance: There may be a dispute as to whether an agent has performed his contractual obligation. The plaintiff may have private valuation over the benefit accruing from the action or the defendant may have private information about the costs of performing the action.

• Custody battle over a child: When a couple separates, the spouses may have private valuations over the custody of their child.

Private valuation of the subject matter in dispute is plausible when the dispute involves something more than just monetary compensation.

Timeline:

Stage 1: A dispute arises between the two parties.

Stage 2: Parties to dispute start pre-trial negotiation, which is a game that may help them avoid taking the matter to court.

Stage 3: Parties either accept the equilibrium allocation of the game played in stage 2, or approach the court.

Stage 4: If either agent has approached the court, then both non-cooperatively choose their effort levels.

Stage 5: The court observes the effort of each agent and makes a final decision.

It is helpful at this point to preview how the result of litigation in equilibrium is established. At stage 2 in the model, agents undertake pre-trial negotiations which formally is a Bayesian game that will help them avoid litigation. This game yields some equilibrium allocations for the two players. Due to the revelation principle it is possible to characterise the existence of litigation in this equilibrium without specifying the actual game in stage 2. This is because the revelation principle allows for the replication of any equilibrium of a Bayesian game through a direct mechanism.

I will first prove the non-existence of a separating and semi-separating equilibrium. In particular I will show that when agents cannot contract away their right to litigate at the start of stage 2, an incentive to lie for a low valuation agent 2 arises. This is because he anticipates that if he declares his types truthfully, his opponent would force him to renegotiate the allocation from stage 2 with a credible threat of litigation at stage 3. This implies that the only possible equilibrium is the pooling equilibrium where all agents mimic the declaration of the high valuation agent. I will show that in this equilibrium, under certain conditions, litigation arises since agent 1 has a higher expected payoff from litigation than the settlement payoff from stage 2. In section 3.2 I show how litigation disappears in equilibrium if at the start of stage 2, the ability to contract away the right to litigate is introduced.

8For expositional clarity I treat agent 1 as female and agent 2 as male.
This model can be solved starting backwards. In the next subsection a stylised model of litigation is presented. This is meant to crudely capture what happens in court. Since parties know what to expect in a court, the equilibrium allocations from the game they play in stage 2 must at least make parties indifferent between litigating and not litigating in stage 3. I call this a litigation-proofness constraint. This constraint is derived in section 2.2 for the different kinds of equilibria. Going back another step, in section 2.3 the incentive-compatibility constraints for different equilibria are derived. Finally, in section 3 I present the result that shows the existence of litigation in equilibrium.

2.1 Litigation

In line with the large literature on the question of why conflict occurs, the court process is modelled as a static contest where the probability of winning is determined by the effort \( x \) exerted by parties.\(^9\)

Following are the objective functions of the two agents.

\[
\begin{align*}
\theta_1 P(x_1, x_2) - x_1 \\
\theta_2^j (1 - P(x_1, x_2)) - x_2
\end{align*}
\]

where \( \theta_1 \) is the valuation of agent 1 and \( \theta_2^j \) is the valuation of agent 2. Henceforth \( j \) refers to the type of agent 2. This formulation assumes that the payoff of parties is linear in money (effort). Note that what is implicitly assumed here is that parties choose their effort levels simultaneously. This particular game form is not crucial to the results. The actual game of litigation may be sequential and staggered over many periods. More generally, it is not required that litigation should necessarily be a contest. This particular game form is useful since it endogenously delivers certain key conditions on the value functions from litigation. This point is discussed in greater detail in section 4 where the conditions on general value functions are derived. The particular contest function that is assumed here is:

\[
P(x_1, x_2) = \frac{\alpha x_1^\lambda}{\alpha x_1^\lambda + (1 - \alpha)x_2^\lambda}, \quad \lambda, \alpha \in (0, 1).
\]

This contest function has certain desirable properties.\(^10\) One of the parameters that characterises this function is \( \lambda \). This captures how sensitive the probability is to the effort exerted by parties. A higher \( \lambda \) implies a greater sensitivity of the judicial process to the persuasiveness of lawyers. A judicial

\(^9\)See Skaperdas (2006) for surveys of this literature.

\(^10\)Skaperdas (1996) provides the axiomatic foundations of this contest function for the case of \( \alpha = \frac{1}{2} \). Clark and Riis (1998) generalise this to the case where \( \alpha \) takes any value between zero and one. This contest function is unique in that the winning probability depends on the ratio of equilibrium efforts. It differs from the exponential contest function where the winning probability depends on the difference of the efforts exerted by parties. This function is easily parameterised, and allows a closed form characterisation of the value functions for both agents. \( \lambda < 1 \) implies concavity and ensures the uniqueness of equilibrium.
process completely insensitive to the skill of lawyers implies a $\lambda$ equal to 0. Alternatively a high responsiveness of the probability of winning to effort could simply mean that it is cheap and easy to bribe judges. In this interpretation $\lambda$ can be thought of as a parameter capturing how corrupt the judiciary is. In this interpretation $\lambda$ equal to 0 implies an incorruptible judiciary since the decision of the court is insensitive to bribes.

The parameter $\alpha$ captures how strong agent 1’s case is ex-ante relative to agent 2. This parameter is introduced to capture the fact that legal disputes may be skewed towards one side. It is rarely the case that both sides to a dispute have equally strong legal positions. An $\alpha$ equal to 1 implies that agent 1 is certain to win the case; that the case is ‘open and shut’. Similarly $\alpha$ equal to 0 implies that agent 2 is certain to win. Note that in these two corner cases the efforts of parties will not play a role as the probability of winning would be insensitive to effort. Note that if $\alpha$ is either 0 or 1 there would never be any litigation since one of the two parties, regardless of its valuation, would have an observable payoff of 0 from litigation and hence would always settle for 0 outside. For intermediate values of $\alpha$, the efforts of parties would influence the probability of winning. An $\alpha$ equal to one half implies that if both agents were to exert the same effort, the outcome of the case is equiprobable.

The parameter $\alpha$ is meant to capture both the legal characteristics and the facts of the dispute that are certifiable. The following examples illustrate this.

- In cases involving alleged violations of an unregistered trademark, jurisdictions may differ as to how much weight they place on the strength of a brand name. For example, in common law countries, the law relating to passing off is such that the likelihood of success for the plaintiff is proportional to how well her brand name is recognised in the market. Hence the legal position on how salient the recognition of a brand name is, along with the facts about how well the plaintiff’s brand name is recognised, may together affect $\alpha$.

- In a suit for specific performance if the provisions of the contract make a clear case in favour of the plaintiff then this brings $\alpha$ closer to 1. On the other hand, if for example it can be shown that the contract is in violation of public policy, then the contract would be set aside and the defendant would not be called upon to perform his contractual obligations.

- In a custody battle for a young child, the judiciaries in most countries usually favour the mother. If this is the case then $\alpha$ would be greater than one half when agent 1 is the mother. The value $\alpha$ would depend on the specific laws and judicial practice relating to custody of children of the country in which the dispute takes place. The value of $\alpha$ would also depend on the facts of the particular case. If for example, agent 1 is known to have a history of drug problems then $\alpha$ would be lower.

\footnote{For a discussion on the interpretation of $\alpha$ in a legal context see Hirshleifer and Osborne (2001) and Skaperdas and Vaidya (2009).}
Following the discussion on disclosure in the introduction, even if the facts of the case are private information to begin with, as long as they are certifiable, they would be revealed before litigation takes place and would influence $\alpha$. Hence $\alpha$ like $\lambda$ is common knowledge. In cases where facts are such that there is no room for disagreement about the application of the law, and consequently the outcome of the case is certain, $\alpha$ would always either be 0 or 1. However this is seldom the case since the interpretation of the law is often contentious. Even if the interpretation of individual laws is clear, there may be legal ambiguity about which law is applicable to the case at hand which could introduce a degree of sensitivity of the court process to the skill of a lawyer.\footnote{In addition to the inherent ambiguity about the application of the law, there could be perverse incentives in judicial systems that amplify the uncertainty regarding the outcome of the case. Levy (2005) argues that career concerns could induce judges to contradict previous decisions, consequently increasing uncertainty about the law. This creates a greater role for a lawyer’s skill since courts are open to persuasion, increasing the value of $\lambda$ from 0.}

Apart from the lawyer’s skill in persuading the court on points of law, there is also often room for persuasion on points of fact. What truly happened at a point in the past is often unobservable and exists only as a probability distribution for the court. A lawyer’s skill could therefore play a role in influencing what the court believes to be true about an event. All this creates uncertainty about the outcome of the case, which can lead to a realisation of $\alpha$ that is not 0 or 1 and a value of $\lambda > 0$.

Using this contest function it is possible to solve out for the Nash equilibrium effort levels when agent 1 confronts a type $j$ agent 2.

\begin{align*}
  x_1^j &= \frac{(\theta_2^j \theta_1^j)\lambda\alpha(1 - \alpha)\lambda}{(\alpha(\theta_1^1)\lambda + (1 - \alpha)(\theta_2^1)\lambda)^2}, \\
  x_2^j &= \frac{(\theta_1^j \theta_2^j)\lambda\alpha(1 - \alpha)\lambda}{(\alpha(\theta_1^1)\lambda + (1 - \alpha)(\theta_2^1)\lambda)^2}.
\end{align*}
(2)

The corresponding value functions are:

\begin{align*}
  v_1^j &= \theta_1 \left( \frac{\alpha(\theta_1^1)\lambda}{(\alpha(\theta_1^1)\lambda + (1 - \alpha)(\theta_2^1)\lambda)^2} - \frac{(\theta_2^j \theta_1^j)\lambda\alpha(1 - \alpha)\lambda}{(\alpha(\theta_1^1)\lambda + (1 - \alpha)(\theta_2^1)\lambda)^2} \right), \\
  v_2^j &= \theta_2^j \left( \frac{(1 - \alpha)(\theta_2^j)\lambda}{(\alpha(\theta_1^1)\lambda + (1 - \alpha)(\theta_2^1)\lambda)^2} - \frac{(\theta_1^j \theta_2^j)\lambda\alpha(1 - \alpha)\lambda}{(\alpha(\theta_1^1)\lambda + (1 - \alpha)(\theta_2^1)\lambda)^2} \right).
\end{align*}
(3)

If the valuation of agent 2 was observable, then this would be a game of complete information where equation 2 would supply the Nash equilibrium effort levels of the agents. Here, since his valuation is private information, agent 1 instead plays a Bayesian game where the optimal effort level of agent 1 is

\begin{equation}
  x_1(\theta_1) = \arg\max_{x_1 \geq 0} \sum_{j \in \{H, L\}} q^j \mathbb{P}(x_1, x_2(\theta_2^j)) - x_1.
\end{equation}
(4)
Having computed the Bayesian Nash equilibrium effort levels agent 1, we can work out the expected payoff from litigation for agent 1. This is

\[ v_1(\theta_1) = \theta_1 \left( \sum_{j \in \{H, L\}} q^j P(x_1(\theta_1), x_2(\theta_j^2)) \right) - x_1(\theta_1). \] (5)

Similarly the equilibrium effort level for a type \( j \) agent 2 is

\[ x_2(\theta_j^2) = \arg\max_{x_2 \geq 0} \theta_j^2 \left( 1 - P(x_1(\theta_1), x_2(\theta_j^2)) \right) - x_2 \quad j \in \{H, L\}. \] (6)

Plugging these effort levels back into the objective function, we get the expected payoff from litigation for a type \( j \) agent 2, which is

\[ v_2(\theta_j^2) = \theta_j^2 \left( 1 - P(x_1(\theta_1), x_2(\theta_j^2)) \right) - x_2(\theta_j^1) \quad j \in \{H, L\}. \] (7)

One of the properties of the contest function described in equation (1) is that it guarantees a positive probability of winning if some effort is exerted. This leads to the following question: why do courts allocate the surplus to agent 2 at all when agent 1 is known to have a higher valuation of the surplus? The reason for this is that in reality courts do not base their decisions entirely on the valuations of the parties. Indeed, courts take several factors into consideration while coming to a decision such as the facts of the case and the law. The question of why courts base their decisions on other factors, when it is clearly ex-post efficient to base these entirely on valuations, is an interesting question of optimal institutional design that is not addressed here. Taking the assumption of an inefficient court system as exogenous, what is derived here is the inability of agents to settle their disputes out of courts regardless of how well they negotiate.

Inspecting equation (5) we can already see how private information can lead to agent 1 overestimating her probability of winning in court. This could happen when agent 2 has high valuation. But agent 1, taking expectations over the type of agent 2, would believe him to have an average valuation. The value function can be re-written as

\[ v_1(\theta_1) = \theta_1 \left( \sum_{j \in \{H, L\}} \theta_j^2 \left( 1 - P(x_1(\theta_1), x_2(\theta_j^2)) \right) \right) - x_1(\theta_1). \]

It can be seen that the sum of the expectation over the probability of winning for agent 1 and that of a high valuation agent 2 can be greater than 1.

This is not the only feature that makes the payoff of one agent unobservable to the other. In addition to affecting the probability, the type also enters the payoff function directly as the value placed on the surplus, and indirectly through the equilibrium effort of the agent. The inability of agent 1 to observe agent 2’s expected payoff from litigation, generates the existence of litigation in equilibrium. If this contest was played in an environment of complete information, then the expected payoffs from litigation would be common knowledge. This would allow parties to bargain around costly litigation since the opponent’s outside option to bargaining would be observable. The unobservability of types...
causes the outside option to bargaining being unobservable and consequently, as shown by Spier (1994), full efficiency is no longer attainable with bargaining. At this point one may naturally ask why parties should restrict themselves to bargaining as a pre-trial mechanism to avoid litigating? Why can they not design any other mechanism that will allow agent 2 to reveal his valuation? I address this question in the next sub-section.

2.2 Litigation-Proofness

Before resorting to costly litigation, parties can play any Bayesian game such that the type of agent 2 will stand revealed. This problem of a general game form is tractable using the revelation principle since any equilibrium in a Bayesian game can be replicated by the use of a direct mechanism where the parties reveal their types truthfully to a mediator. To see whether litigation can be avoided, we need to check whether a more efficient allocation that does not require external financing is implementable.\(^{13}\)

The equilibrium allocation that is replicated using a direct mechanism needs to be litigation-proof. This means that the payoff from the equilibrium should be weakly greater than the payoff from litigation. The expected payoff from litigation depends on the nature of equilibrium we try to implement using the direct mechanism. This problem can be tackled by considering different kinds of equilibria separately.

2.2.1 Separating Equilibrium

In a separating equilibrium the valuations of agent 2 would stand revealed at the end of stage 2. Consequently parties would find themselves in an environment of complete information. At this stage parties should prefer the allocations that have been prescribed by the mechanism to litigation. If parties choose to litigate at this stage, each of their payoffs would be the Nash equilibrium payoff from litigation under complete information. The Nash equilibrium levels of effort that would be played when an agent 1 meets an agent 2 of type \(j\) can be computed. Let these be \(x_1^j\) and \(x_2^j\):

\[
\begin{align*}
x_1^j &= \arg\max_{x_1 \geq 0} \theta_1 \cdot P(x_1, x_2^j) - x_1 \\
x_2^j &= \arg\max_{x_2 \geq 0} \theta_2^j \cdot (1 - P(x_1^j, x_2)) - x_2.
\end{align*}
\]

These may not be unique.\(^{14}\) Using these optimal effort levels we can calculate \(v_1^j\), the expected payoff from litigation when agent 1 confronts a type \(j\) agent 2.

\(^{13}\)It is reasonable to impose the restriction of no external financing since parties in the real world cannot expect outside subsidies for the settlement of private disputes. If budget balance is not imposed then the problem would disappear since a Groves mechanism would always ensure incentive-compatibility. See Groves (1973) and the generalisation in Arrow (1979) and d’Aspremont and Gerard-Varet (1979).

\(^{14}\)In the results when a functional form for the contest function is specified, conditions that ensure uniqueness are presented.
Although parties would never actually litigate in an environment of complete information, \( v_1 \) and \( v_2 \) become credible threat points that parties would use to force the renegotiation of allocations ex-post. In other words, bargaining would ensue in states of the world where parties find that they are guaranteed a higher expected payoff by litigating rather than accepting the allocations specified by the mechanism. While being completely agnostic about the extensive form that such bargaining would take, we know that \( v_1 \) and \( v_2 \) will be the outside options to such bargaining. If parties anticipate that such bargaining will take place ex-post, this destroys the existence of a separating equilibrium unless the allocations are designed to ensure that parties cannot credibly threaten litigation in stage 3. Hence to avoid a credible threat of litigation, the transfers from the mechanism must satisfy litigation-proofness constraints. These are

\[
\begin{align*}
\theta_1 - t_1^j &\geq v_1^j, \\
\theta_2^j &- t_2^j \geq v_2^j,
\end{align*}
\]

for \( j \in \{H, L\} \) where \( t_1^j \) is the net transfer paid by agent 1 to type \( j \) agent 2 in the event the mechanism allocates the surplus to agent 1. Similarly \( t_2^j \) is the net transfer paid by type \( j \) agent 2 to agent 1 in the event the mechanism allocates the surplus to agent 2. The constraints state that the payoff from negotiations should be greater than the payoff from litigating. This should be true for both agents regardless of who receives the surplus, and for all realisations of agent 2’s type.

### 2.2.2 Pooling Equilibrium

In a pooling equilibrium agent 1 learns nothing about the type of agent 2 at stage 3. Hence their expected payoff from litigation remains the Bayesian Nash equilibrium payoff \( v_1(\theta_1) \) and \( v_2(\theta_2^j) \) defined in equations (5) and (7). Let the \( \mu_1 \) and \( \mu_2 \) be the transfers made by agents 1 and 2 respectively, to their opponents when the surplus is allocated to them. The litigation-proofness constraints are

\[
\begin{align*}
\theta_1 - v_1(\theta_1) &\geq \mu_1 \geq v_2(\theta_2^j), \\
\theta_2^j - v_2(\theta_2^j) &\geq \mu_2 \geq v_1(\theta_1).
\end{align*}
\]

What defines a pooling equilibrium is that the declaration of agent 2 conveys no information about his type. Consequently there is no change in agent 1’s prior about the type of agent 2. Note that in terms of the declarations that agent 2 makes, there are various ways in which a pooling equilibrium can arise. It arises when agent 2 makes the same declaration regardless of his type. More generally, it arises whenever agent 2 has the same probability distribution over declarations regardless of his type. What is important here is that the constraints defined in (10) are unaffected by which pooling equilibrium we consider. This is because...
the payoff from litigation $v_2(\theta_2^j)$, which is the outside option to $\mu_2$, remains constant.

2.2.3 Semi-Separating Equilibrium

Just like in the case of pooling equilibria, there are infinitely many semi-separating equilibria that can arise. A semi-separating equilibrium is defined by the fact that there is some information conveyed to agent 1 through the declaration of agent 2. Hence the payoff from litigation thereafter is modified since agent 1 uses updated probabilities when deciding her optimal effort level in court. Let the optimal effort of agents 1 and 2 be $\tilde{x}_1$ and $\tilde{x}_2$ where

$$\tilde{x}_1 = \arg\max_{x_1 \geq 0} \theta_1 \left( \frac{q^H(1 - \gamma)}{q^H(1 - \gamma) + q^L \gamma} P(x_1, \tilde{x}_2^H) + \frac{q^L \gamma}{q^H(1 - \gamma) + q^L \gamma} P(x_1, \tilde{x}_2^L) \right) - x_1, \quad (11)$$

$$\tilde{x}_2^H = \arg\max_{x_2 \geq 0} \theta_2^H (1 - P(\tilde{x}_1, x_2)) - x_2, \quad (12)$$

and

$$\tilde{x}_2^L = \arg\max_{x_2 \geq 0} \theta_2^L (1 - P(\tilde{x}_1, x_2)) - x_2. \quad (13)$$

The value of $\gamma \in (0, 1)$ is determined by the posterior probability that agent 1 associates with agent 2 being a low type. Note that $\gamma$ is a short hand for the amount of information that is revealed to agent 1 by agent 2’s declaration. If the declaration reveals nothing then $\gamma = \frac{1}{2}$ and we are back in a pooling equilibrium. When $\gamma = 0$, agent 1 knows that agent 2 is a high type with certainty and we are in a separating equilibrium. Similarly $\gamma = 1$ implies that we are in a separating equilibrium where agent 2 has been revealed to be a low type. The intermediate value of $\gamma$ strictly between 0 and 1 but not equal to one half are ones that would arise in a semi-separating equilibrium.

Using the semi-separating equilibrium effort levels calculated above, we can back out the litigation value functions for agent 1 and 2. These are $\tilde{v}_1$, $\tilde{v}_2^H$ and $\tilde{v}_2^L$ respectively.

$$\tilde{v}_1 = \theta_1 \left( \frac{q^H(1 - \gamma)}{q^H(1 - \gamma) + q^L \gamma} P(\tilde{x}_1, \tilde{x}_2^H) + \frac{q^L \gamma}{q^H(1 - \gamma) + q^L \gamma} P(\tilde{x}_1, \tilde{x}_2^L) \right) - \tilde{x}_1, \quad (14)$$

$$\tilde{v}_2^H = \theta_2^H (1 - P(\tilde{x}_1, \tilde{x}_2^H)) - \tilde{x}_2^H, \quad (15)$$

and

$$\tilde{v}_2^L = \theta_2^L (1 - P(\tilde{x}_1, \tilde{x}_2^L)) - \tilde{x}_2^L. \quad (16)$$

We are now ready to characterise the litigation-proofness constraints in a semi-separating equilibrium. These are

$$\theta_1 - \tilde{v}_1 \geq \tilde{\mu}_1 \geq \tilde{v}_2^j \quad (17)$$
\[ \bar{\theta}_2^j - \bar{\delta}_2^j \geq \bar{\mu}_2 \geq v_1 \]

where \( \bar{\mu}_1 \) and \( \bar{\mu}_2 \) are the transfers made to the opponent when the surplus is allocated to agents 1 and 2 respectively.

### 2.3 Negotiation

Consider a direct mechanism where agent 2 declares a type \( j \) where \( j \in \{H, L\} \). If the declaration of agent 2 is \( \theta_2^j \), then agent 1 is allocated the surplus with probability \( \delta^j \) and agent 2 is allocated the surplus with probability \( 1 - \delta^j \).

Following are the incentive-compatibility constraints for agent 2 in a separating equilibrium.\(^{15}\)

\[
H_2 : \delta^H t_1^H + (1 - \delta^H)(\theta_2^H - t_2^H) \geq \delta^L t_1^L + (1 - \delta^L)(\theta_2^L - t_2^L) \\
L_2 : \delta^L t_1^L + (1 - \delta^L)(\theta_2^L - t_2^L) \geq \delta^H t_1^H + (1 - \delta^H)(\theta_2^H - t_2^H)
\]

The exercise here is to find an allocation composed of transfers \( t_1^j, t_2^j \) along with probability \( \delta^j \) that satisfies incentive-compatibility and litigation-proofness for all \( j \). If such an allocation exists then parties would reveal their types truthfully knowing that for any possible realisation of types, the allocation guarantees that the opponent cannot credibly threaten litigation ex-post.\(^{16}\)

Since \( \delta^j \) can be less than one, there will be states when the surplus is allocated to agent 2 even though agent 1 always has a greater valuation of the surplus than agent 2. To simplify things I will rule this out using the following parametric assumption:

**Assumption 2.**

\[
\frac{\theta_1 - \theta_2^H}{\theta_1 + \theta_2^H} > \lambda \frac{(1 - \alpha)\theta_2^H \lambda}{\alpha \theta_1^H + (1 - \alpha)\theta_2^H \lambda}
\]

**Lemma 1.** If \( v_1^H + v_2^H > \theta_2^H \), then the surplus must always be allocated to agent 1 at the end of the negotiation, that is \( \delta^H = \delta^L = 1 \).

**Proof.** Consider a state where the surplus is allocated to agent 2. In such a state the transfer from agent 2 to agent 1 must satisfy the following litigation-proofness constraints from (9):\(^{15}\)

\(^{15}\)Note that a direct mechanism captures equilibria of any game played at the negotiation stage as a consequence of the revelation principle. See ? for an extension of the revelation principle to environments without commitment where there is a single agent with private information.

\(^{16}\)This is where the assumption on the indivisibility of the surplus is required. If the surplus was divisible, the following allocation would be incentive compatible and litigation-proof: Low type agent 2 is offered 0 and high type agent 2 is offered a share \( (1 - \delta^H) \) of the surplus which is equal to the probability with which he wins if he litigates agent 1 in an environment of complete information. With this allocation it is incentive compatible for agent 2 to declare his type truthfully and both agents receive a payoff that is weakly more than the litigation payoff for any realisation of agent 2 type.
θ^j_2 - v^j_2 \geq t^j_2 \geq v^j_1. \quad (19)

However if

v^j_1 > θ^j_2 - v^j_2, \quad j \in \{H, L\}; \quad (20)

then it is not possible to have transfers that are litigation-proof. This implies that the surplus must always be allocated to agent 1: δ^j = 1. Equation (20) is composed of two constraints, one for each possible agent 2 type. Using the value functions defined in (3) we can check that the constraints for the state where agent 2 has low valuation is subsumed by the state where his valuation is high. That is \(v^H_1 > θ^H_2 - v^H_2\) implies \(v^L_1 > θ^L_2 - v^L_2\). In fact this condition turns out to be sufficient to ensure that \(δ^j = 1\) even when we consider pooling and semi-separating equilibria. To see this, note that the corresponding constraint for these is

\[\bar{v}_1 > θ^j_2 - \bar{v}^j_2.\]

Since \(\bar{v}_1 + \bar{v}^H_2 \geq v^H_1 + v^H_2 > θ^H_2\), condition (19) is sufficient to ensure \(δ^j = 1\) for all equilibria since the pooling equilibrium in subsumed in the treatment of the semi-separating equilibrium for the case \(γ = \frac{1}{2}\).

Equation (19) reduces to

\((θ_1 - θ^H_2) P(x^H_1, x^H_2) > x^H_1 + x^H_2.\)

Substituting the equilibrium effort levels into the objective function of the agents, the final constraint we get on the parameter space is stated in assumption 2.

This lemma shows that when assumption 2 holds it will not be possible for agents to play a game at the negotiation stage that yields an equilibrium allocation with a positive probability of the surplus being transferred to agent 2. This is because in the event the surplus is allocated to agent 2, agents would find that even the maximum possible transfer to agent 1 does not satisfy her litigation-proofness constraints. Therefore, ex-ante, agents hoping to avoid litigation would only contract on a mechanism that always allocates the surplus to agent 1.

Going forward, I will assume that assumption 2 is satisfied. As a consequence of this lemma we have \(δ^{HH}_1 = δ^{HL}_1 = δ^{LL}_1 = δ^{LH}_1 = 1\). This simplifies the incentive-compatibility constraint of agent 2 to

\[t^H_1 = t^L_1. \quad (21)\]

The intuition for this condition is the following: since agent 2 knows that finally the surplus will always go to agent 1, he has an incentive to make the declaration that guarantees him the maximum possible transfer. The only way to incentivise him to tell the truth is to make the transfer independent of his declaration. The results will show how this restriction placed on the range of transfers may be
inconsistent with the range for transfers in the litigation-proofness constraints derived in section 2.2.

3 Results

In this section the result regarding the existence of litigation in equilibrium is proven. In the next two sub-sections the existence of litigation in two extreme cases of full commitment and complete non-contractability is derived. Thereafter the implications of partial contractibility on the existence of litigation are analysed.

3.1 Litigation under Non-Contractability

In this sub-section the main result of this paper is established. First I show that pre-trial negotiation cannot yield a separating equilibrium where the type of agent 2 is revealed. Next I show that pooling and semi-separating equilibria that would lead to successful negotiations with probability 1, do not exist.

3.1.1 Non-Existence of a Separating Equilibrium

Using the value functions defined above, it is now possible to prove the non-existence of a separating equilibrium. Litigation-proofness constraints impose restrictions on the transfer of the mechanism that parties design for pre-trial settlements of dispute. The following result shows that these restrictions may be inconsistent with the restrictions imposed by incentive-compatibility.

Proposition 1. Assuming that $P(x_1, x_2)$ in equation (1) is the contest function that characterises litigation, a separating equilibrium does not exist if Assumption 1 holds.

Proof. Recall that Assumption 1 states that $θ_1 > θ_H^2 > θ_L^2 = 0$. We have $θ_1 - v_L^1 ≥ t_L^1 ≥ v_H^2$ from equation (9). Using this with equation (3) we get $t_L^1 = 0$ since $v_L^1 = θ_1$ and $v_H^2 = 0$.

However from equation (3) we can see that $v_H^2 > 0$. Hence to satisfy the litigation-proofness constraint in (9), $t_H^1 > 0$. Hence $t_H^1 = t_L^1$ is not feasible and a separating equilibrium does not exist.

The intuition for this result is straightforward. If the minimum transfer that a high type agent 2 receives from agent 1 is large enough, then the incentive for a low type agent 2 to tell the truth is destroyed. With the contest function specified in (1), this happens as $θ_L^2$ goes to 0. This is because the effort levels depend on the ratio of the valuations. As $θ_L^2$ goes to 0 the payoff from litigation for a low type agent 2 also goes to zero and the likelihood that agent 1 wins
in court goes to 1. This in turn restricts the transfers a low type agent 2 can expect from the mechanism.

### 3.1.2 The Existence of Litigation in the Pooling Equilibrium

Proposition 1 shows that a separating equilibrium cannot exist when Assumption 1 is satisfied. This leaves open the possibility of the existence of a pooling and a semi-separating equilibrium. In this sub-section it will be shown that a litigation-free pooling equilibrium cannot exist. For litigation to exist, agent 1 should prefer litigating when offered the alternative of allowing agent 2 to pool across his types. The next result shows that this is indeed the case when \( q^L \), the probability of agent 2 being a low type, is greater than some threshold.

**Proposition 2.** There exists a threshold \( q^L_* < 1 \) such that for any \( q^L \in (q^L_*, 1) \) a pooling equilibrium with a zero probability of litigation cannot exist.

**Proof.** In a pooling equilibrium, the optimal effort for agent 1 when she litigates is:

\[
x_1(\theta_1) = \arg\max_{x_1 \geq 0} \left( \sum_{j \in \{H, L\}} q^j \frac{\alpha x_1^\lambda}{\alpha x_1^\lambda + (1 - \alpha)x_2(\theta_2^L)^\lambda} \right) - x_1.
\]

Note that the objective function is concave in \( x_1 \) since it is a sum of two concave functions. Hence the first order condition yields the optimum. Plugging in the optimal effort levels we get the expected payoff from litigation for agent 1:

\[
v_1(\theta_1) = \theta_1 \left( \sum_{j \in \{H, L\}} q^j \frac{\alpha x_1(\theta_1)^\lambda}{\alpha x_1(\theta_1)^\lambda + (1 - \alpha)x_2(\theta_2^L)^\lambda} \right) - x_1(\theta_1).
\]

Now note that:

\[x_2(\theta_2^L) = 0 \quad \text{since} \quad \theta_2^L = 0.\]

This is true because if \( x_2(\theta_2^L) \) is a positive constant then the expected payoff from litigation for this agent would be negative. This is a contradiction of \( x_2(\theta_2^L) \) being an optimum since the agent could reduce \( x_2 \) and increase his payoff to 0.

Now note that
\[
\lim_{q^L \to 1} v_1(\theta_1) = v_1^L = \theta_1
\]

This is true because the first order condition for the Bayesian game converges to the first order condition of the game with complete information where agent 2 is a low type:

\[
\lim_{q^L \to 1} \sum_{j \in \{H, L\}} q^j \frac{\alpha(1 - \alpha)x_1^{\lambda - 1}x_2(\theta_2^L)^\lambda}{(\alpha x_1^\lambda + (1 - \alpha)x_2(\theta_2^L)^\lambda)^2} - \frac{1}{\lambda \theta_1} = \frac{\alpha(1 - \alpha)x_1^{\lambda - 1}(x_2^L)^\lambda}{(\alpha x_1^\lambda + (1 - \alpha)(x_2^L)^\lambda)^2} - \frac{1}{\lambda \theta_1}.
\]

This implies that the optimal effort in the game with incomplete information converges to the optimal effort in the game with complete information as \( q^L \to 1. \)
Consequently, the expected payoff under incomplete information also converges to the expected payoff under complete information as $q^L \to 1$.

The minimum transfer that a high type agent 2 must be offered as settlement outside court to avoid litigation is $v_2(\theta_2^H)$ in any pooling equilibrium. Therefore to ensure 0 probability of litigation, the minimum transfer from agent 1 to agent 2 must be $v_2(\theta_2^H)$. Consequently the payoff for agent 1 from playing the mechanism and accepting its allocation is $\theta_1 - v_2(\theta_2^H) < \theta_1$.

Now note that $v_2(\theta_2^H) > 0$ and is increasing in $q^L$ since $\frac{\partial v_1(\theta_1)}{\partial q^L} < 0$. Finally, agent 1 prefers litigation to settlement under a pooling equilibrium when $v_1(\theta_1) > \theta_1 - v_2(\theta_2^H)$.

Since the left hand side of this equation is greater than the right hand side as $q^L \to 1$, there exists a threshold $q^{L*}$ such that this holds with an equality. For any $1 > q^{L*} > q^L$, litigation has a higher expected payoff for agent 1 when agent 2 is made the transfer of $v_2(\theta_2^H)$.

In a pooling equilibrium, to avoid the possibility of a high type agent 2 ever going to court ex-post, he must be made a minimum transfer of $v_2(\theta_2^H)$. Faced with this transfer, agent 1 has two options; she can either accept the pooling equilibrium allocation from the negotiations or she can litigate. If the likelihood that the opponent she faces is a low type is high enough, she will always prefer to litigate as her payoff from litigation is close to $\theta_1$ whereas her payoff from settling outside court through negotiations is at most $\theta_1 - v_2(\theta_2^H)$.

### 3.1.3 The Existence of Litigation in a Semi-Separating Equilibrium

I will now show that the logic that creates the existence of litigation in a pooling equilibrium generalises to create the existence of litigation in a semi-separating equilibrium.

**Proposition 3.** There exists a threshold $\tilde{q}^{L*}$ such that for $q^L \in (\tilde{q}^{L*}, 1)$ a semi-separating equilibrium with a 0 probability of litigation cannot exist.

**Proof.** Note that in a semi-separating equilibrium the transfer to agent 2 must be independent of his declaration. If not the agent would have an incentive to make the declaration that gets him the higher transfer. This transfer is $\tilde{\mu}_1$ and it must satisfy the litigation-proofness constraints defined in (17). This implies

$$\theta_1 - \tilde{\mu}_1 \geq \tilde{v}_1$$

and

$$\tilde{\mu}_1 \geq \tilde{v}_2^H \geq \tilde{v}_2^L.$$

Let $\frac{q\theta_1(1-\gamma)}{q\theta_1(1-\gamma)+qL\gamma} = 1 - \hat{\gamma}$. The objective function for agent 1 is

$$\theta_1 \left( \frac{1-\hat{\gamma}}{\alpha x_1^L + (1-\alpha)\hat{x}_2^H} \right) = x_1,$$
since $\tilde{x}_2^L = 0$. The corresponding objective function for a high type agent 2 is

$$\frac{\theta_2^H}{\alpha x_1^H} (1 - \alpha) x_2^H - x_2.$$

Solving for the optimal effort levels and plugging them back into the objective function of agent 2 we get

$$\tilde{v}_2^H = \theta_2^H \left( \frac{(\theta_2^H)^\lambda}{((1 - \gamma)\theta_1)^\lambda + (\theta_2^H)^\lambda} - \frac{((1 - \gamma)\theta_1 \theta_2^H)^\lambda \alpha (1 - \alpha)^\lambda}{(\alpha (1 - \gamma)\theta_1)^\lambda + (1 - \alpha)(\theta_2^H)^\lambda)^2} \right).$$

Note that $\tilde{v}_2^H = v_2^H$ for $\gamma = 0$, where $v_2^H$ is the separating equilibrium litigation payoff for a high type agent 2 defined in (3). Furthermore $\tilde{v}_2^H > v_2^H$ since $\frac{\theta_2^H}{\theta_1^H} < 0$.

Keeping $\tilde{\mu}_1 \geq \tilde{v}_2^H \geq v_2^H > 0$ there exists a threshold $q^L$ such that for $q^L > q^L$ agent 1 would prefer to litigate than to settle with a transfer of $\tilde{\mu}_1$ to agent 2. This is true since $\tilde{v}_1 \to \theta_1$ as $q^L \to 1$. Hence the maximum transfer that agent 1 is willing to make to avoid litigation is lower than the minimum needed to satisfy the litigation-proofness constraint of a high type agent 2 and litigation arises in equilibrium.

The intuition for this result is similar to the previous result. In a semi-separating equilibrium agent 2 must receive a transfer independent of his declaration. This transfer must be greater than the minimum transfer required for keeping a high type agent 2 indifferent between litigation and settlement. However, as the likelihood of agent 2 being a low type increases, agent 1 prefers to litigate and ‘take his chances’ rather than pay out a high settlement.

Propositions 1, 3, and 2 taken together establish the existence of litigation in equilibrium. In a nutshell Proposition 1 shows that under certain conditions agent 2 would always lie about his type in any negotiation for pre-trial settlement. Hence it would not be possible for agents to resolve their informational asymmetry. Propositions 2 and 3 show that since agent 1 knows about this, she would prefer litigation to settling outside court. The results hold when the probability of agent 2 being a low type is large enough.

A potential problem with this result is the implicit assumption that litigation payoffs are final. If on the other hand parties are allowed to negotiate after the court decides on the allocation of surplus, then this may affect the results. In such a case a low type agent 2 would have a higher valuation since he can sell the surplus back to agent 1 in case he wins in court. The extent to which this affects litigation payoffs and consequently affects pre-trial negotiations depends on the game form in which agents bargain after litigation. Let us assume that agent 2 wins in court. Assume further that agent 1 has sufficient bargaining power and $q_L$ is high enough. In such a case it is possible to imagine an equilibrium where agent 2 is offered zero for the surplus and this offer is accepted. In a case like this, an ex-post trade of the surplus does not affect the results since a low type agent 2 anticipates that even if he wins in court and sells the surplus, his payoff would still be zero. Consequently the litigation payoffs and negotiation outcomes are unaffected.
3.2 Full Waiver of the Right to Litigate

As we would expect, if parties can contract away their right to litigate then this turns out to be sufficient to avoid litigation.

**Proposition 4.** There always exists an unsubsidised and incentive compatible allocation that Pareto dominates the equilibrium allocation under litigation.

**Proof.** Litigation is a Bayesian game, where the allocation is composed of the probabilities of the surplus being transferred to the two agents for the two possible types of agent 2 and the corresponding transfers. Using the revelation principle, any equilibrium allocation under litigation can be replicated by a direct mechanism that specifies the probabilities of acquiring the surplus $\beta_1$ for agent 1 and $\beta_2^j$ for a type $j$ agent 2 and transfers $x_1(\theta_1)$ and $x_2(\theta_2^j)$, which are the litigation costs for agents 1 and 2 (see equation (6)). Note that $\beta_2^L = 1 - \text{P}(x_1(\theta_1), x_2(\theta_2^L))$ is the probability with which agent 2 expects to win in court. The incentive-compatibility constraints for agent 2 are

$$\theta_2^H (\beta_2^H - \beta_2^L) > x_2(\theta_2^H) - x_2(\theta_2^L) > \theta_2^L (\beta_2^H - \beta_2^L)$$

Note that $x_2(\theta_2^H) > 0$ since a high valuation agent 2 exerts a positive effort. Similarly $x_1(\theta_1)$, the cost of litigation for agent 1, is also positive. Consider an allocation where the probabilities $\beta_2^j$ are preserved and litigation costs are replaced by the following transfers from agent 2 to 1

$$t_2^H = \theta_2^L (\beta_2^H - \beta_2^L) - x_1$$

$$t_2^L = -x_1$$

By construction we have

$$\theta_2^H \beta_2^H - t_2^H > \theta_2^L \beta_2^L - x_2(\theta_2^L).$$

This allocation is unsubsidised by a third party, incentive compatible, and preferred by both agents over litigation since the expected transfers they make are strictly lower than the costs of litigation.

Note that the phrase ‘Pareto dominance’ is used here in the interim sense. Since litigation is simply a Bayesian game, applying the revelation principle, the equilibrium allocation of litigation can be replicated using a direct mechanism. Proposition 4 states that in fact, using a direct mechanism, a superior allocation can be implemented without having to subsidise the implementation externally. Given litigation is costly for all parties, it is easy to see why this result obtains. The probabilities with which agents expect to win in court can be replicated in a direct mechanism. Compared to litigation, this allocation reduces the amount of resources that are burnt for separation of types.

Proposition 4 implies that under full contractability, litigation would never occur since it would be individually rational for agents to contract on a mechanism that guarantees a better allocation. In a world with full commitment,
agents could write a contract wherein they commit to sticking with the allocation that the mechanism specifies. In such a world it would not be possible for an agent to credibly threaten their opponent with litigation ex-post to force the renegotiation of the allocation. Hence these separating equilibrium allocations need not satisfy the additional constraints of litigation-proofness.

This proposition is obvious when seen in the light of the well understood theoretical insight that the possibility of renegotiation ex-post makes it more difficult to supply incentives ex-ante. When commitment is possible, allocations need not be ex-post efficient. Indeed we can see that the surplus is allocated to agent 2 with a positive probability since \( \beta_2 > 0 \). However, the loss of efficiency in allocating the surplus to agent 2 is lower than what is gained through avoiding litigation. The possibility of trading off some ex-ante inefficiency for greater ex-post efficiency becomes feasible only when agents can commit to allocations ex-ante.

### 3.3 Litigation Under Partial Waiver

Consider the following ‘no litigation’ clause that parties contract on at the start of pre trial negotiations, “We agree to accept the allocations that the mechanism specifies. If one of us challenges the allocation ex-post in court she should be made to pay a large fine.” Proposition 4 shows that in this setting, if such a clause is upheld by courts with probability 1, then litigation will not arise.

This raises the question of whether litigation would arise if a limited ability to contract away their right to litigate was available to agents; in other words if courts upheld ‘no litigation’ clause with a probability between 0 and 1. The degree of commitment available to parties can be thought of as a point in a continuum that is bounded by full contractibility on one end and complete non-contractibility on the other. A natural way to capture the partial commitment in the contest function specified in (1) is through \( \alpha \). Once agents sign a contract to stick to the allocations specified by the mechanism it affects \( \alpha \) when the case reaches court ex-post. In the world with complete contractibility, when agent 1 considers approaching the court ex-post, she would find that \( \alpha \) equals 0. This means that agents would know that approaching the court in violation of the commitment to stay out of court would invite a certain ruling in favour of the opponent. The world with imperfect commitment would be one where the value of \( \alpha \) would change but the change would still not be sufficient to bring about complete certainty about the outcome of the case, that is, \( \alpha \) ex-post would still be between 0 and 1. The result in Proposition 1 shows that with a low enough valuation for the low type, as long as \( \alpha \) is strictly between 0 and 1, it would not be possible to satisfy incentive-compatibility. Hence as long as complete commitment is not available, it is possible to still apply propositions 1 and 2, and consequently justify the existence of litigation.

One practical problem that a party may face while trying to enforce the allocations of a mechanism is the fact that these allocations may not be observable to the court. If negotiations are conducted privately between parties
then this may disable courts from observing the final allocations.\textsuperscript{17} If parties believe that a ‘no litigation’ clause mentioned at the start of this section cannot be enforced due to informational reasons or will not be enforced for legal reasons, then parties find themselves in a situation where it is best for both parties to renegotiate. The issue of whether rational parties can contract away the possibility of ex-post renegotiation has been extensively debated in Maskin and Tirole (1999) and Hart and Moore (1999) in the context of incomplete contracts. The issues that contracting away the possibility of renegotiation raises are similar to ones that are salient in this setting. If the ability to contract away the right to litigate is limited then it follows a fortiori that the ability to avoid ex-post renegotiation is also limited since in the first case the clause rests on the action of litigation which is easily verifiable.

The area of law that governs the right of parties to contract away their rights, in this case the right to judicial remedy, is called waiver. Whether a waiver is valid is in itself a contentious issue in law. Among other things, the court would verify whether “functional equivalence”, that is some other form of judicial process was available to the agents. If the mechanism for resolving disputes looks fairly close to a judicial process, then a court would be more likely to uphold the allocations. For example arbitral awards in most jurisdictions are open to appeal on very limited grounds. The problem with arbitration however is that in terms of the technology of decision making it is identical to the court. Therefore designing a settlement mechanism comes with the following tradeoff: the allocation it specifies is more likely to be upheld the more the mechanism resembles a court but this makes the mechanism costly in itself. This model does not explain when parties would choose arbitration or litigation but provides an explanation for why dispute resolution can be inherently costly.

The court would also look into the bargaining power between parties when it decides whether to uphold the mechanism designed by parties.\textsuperscript{18} Since bargaining power is not verifiable, the decision of the court on the validity of waiver itself is subject to the same technology of decision making. This would mean that parties would have to take into account litigation-proofness constraints even when they add clauses waiving their right to litigate.

There could be several institutional reasons why courts do not always enforce what contracting parties agree on ex-ante. Such contracts may be seen as being against public policy. There could be behavioural reasons for not allowing agents to tie themselves into contracts that are detrimental to them in the future. For example it is easy to understand why a court would void contracts where an agent sells himself into slavery.

Reasons for non-enforcement of contracts could also be rooted in efficiency considerations. Anderlini et al. (2006) argue that by committing to void certain

\textsuperscript{17}One may argue that parties may choose to negotiate publicly in order to avoid this problem. However it is often seen that parties find it undesirable to negotiate publicly for a variety of other reasons such as protection of trade secrets in the case of intellectual property, safe guarding the privacy of children in the case of custody battles, etc.

\textsuperscript{18}An exposition of factors that courts usually take into account in the US while deciding on the legitimacy of waivers is discussed in Note (1978).
contracts the court increases ex-ante efficiency. It is possible that similar consider-
erations induce judges to void contracts where agents contract away their right
to litigate. For example, consider a stage 0 that occurs in the timeline before
the dispute arises. In this stage one of the two parties can take an action that
is privately costly but which stops the dispute from arising. Now assume that
a dispute comes with some inherent costs for both parties once it arises even if
it is resolved efficiently. In the case of property disputes these can be thought
of as the opportunity cost of sitting down to negotiate with the other agent. In
case of a custody battle, one can think of this as the impact on the child of a
dispute between parents. If the costs of the dispute are borne by both parties
but the cost of the action that prevents the dispute are borne by just one agent,
then there would be a tendency for too many disputes to arise. This would be
mitigated if parties anticipated an inefficient settlement of disputes since that
would increase the private costs of the dispute, and thereby increase the incen-
tives for dispute prevention ex-ante. If these actions that prevent a dispute from
arising are non-verifiable, then by committing to be inefficient ex-post, courts
increase efficiency ex-ante.

4 Extension: Using General Value Functions

So far the results have relied on the ligation game taking a particular form,
namely that of a contest. One reason for taking this approach is that it allows
us to see more clearly the link between the literature on pre-trial negotiation
and the literature on conflict. The literature on pre-trial negotiation takes
the actual litigation game as exogenous. On the other hand the literature on
conflict usually assumes the players’ inability to avoid conflict and then goes
about investigating the implications of the game form of conflict on the effort
choices and equilibrium payoffs of the players. Studying these two questions in
a unified framework allows for the investigation of how the parameters of the
actual litigation game affect the existence of equilibria in the game played at
the pre-trial negotiation stage.

However, using the contest function approach comes with some loss of gen-
erality. For instance the game form requires agents to choose their effort levels
simultaneously. If on the other hand the plaintiff chooses her lawyer first and the
defendant follows then the game would change and so would the value functions.
More generally if litigation is conducted over many periods, some information
is revealed as the game progresses, possibly leading to settlement during trial.19
This causes the ex-ante expected value from litigation to be modified as parties
expect to settle at some point during trial.

Another problem with the contest function approach is that it models the
court merely as an agency that allocates surplus. However, in reality, courts are
capable of doing more. For instance courts can order one of the parties to make
transfers to the other. These transfers may be conditional on the valuations

19See for example Sánchez-Pagés (2009) where parties engage in costly confrontation with
the aim of improving their bargaining position through information revelation.
that the court perceives the parties place on the surplus. This complicates the

game since it may lead to parties distorting their effort choices in court. Once

again this modifies the value functions from litigation.

In light of these concerns it is unclear whether the violation of assumption

2 would still lead to litigation. This is because the sufficiency of assumption 2

for the results relies on the value functions taking the particular form specified

in equation (3). In this section I attempt to address this concern by directly

imposing conditions of the value function rather than modeling the litigation

game. The strength of this approach is that it leaves the actual game form of

litigation unspecified. I show that when certain conditions are imposed on the

value functions, the result of litigation in equilibrium goes through.

First, we need to assume that the value functions of both agents are contin-

uous in $\gamma$ which is the probability that agent 1 associates with agent 2 being a

low type. The contest function delivers this endogenously when the contest is

played as a Bayesian game under the assumption that the type of agent 2 is not

fully revealed during negotiations. Second, we need

$$\lim_{\gamma \to 1} v_1(\theta_1) + v_2(\theta_2^H) > \theta_1.$$  (22)

This condition guarantees overestimation. In an environment of full information

the litigation payoffs of the two opposing agents must always add up to less than

$\theta_1$. When types are unobservable, and $\gamma$ is large, agent 1 expects agent 2 to

be a low type. However in the event agent 2 is actually a high type, agent

1 overestimates his expected payoff from litigation. Equation (22) guarantees

that this rational overestimation is large enough to generate litigation.

Next we need

$$v_L^L + v_H^H > \theta_1.$$  (23)

This condition guarantees the non-existence of a separating equilibrium.20 Finally we need

$$v_1^L + v_2^L > \theta_2^L.$$  (24)

This assumption guarantees that the surplus is always allocated to agent 1.

Proposition 5. If the value functions of agents satisfy equations (22), (23) and (24), and are continuous in $\gamma$, then there exists a $q_L^*$ such that for $q_L \geq q_L^*$ agents must litigate with positive probability.

Proof. The proof will proceed in three parts. First it will demonstrate the non-

existence of a separating equilibrium. Next the non-existence of the pooling

equilibrium, and lastly the non-existence of a semi-separating equilibrium.

First note that equation (24) rules out any negotiation outcome that is a

separating equilibrium and the surplus is allocated to agent 2. This is because

the maximum transfer that agent 2 can make in such a state will be lower than

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20Equations (22) and (23) are delivered endogenously by the contest function. It is easy to

check that using the contest function specified in equation (1) we get $\lim_{\gamma \to 1} v_1(\theta_1) = \theta_1$ and

$\lim_{\gamma \to 1} v_2(\theta_2^H) > 0$ which implies that equation (22) holds. Furthermore since $v_L^L = \theta_1$ and

$v_H^H > 0$ equation (23) also holds. Equation (24) is analogous to assumption 2.

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the minimum required to satisfy agent 1’s litigation-proofness constraint. Hence
if a separating equilibrium arises, the surplus must be transferred to agent 1.

Equation (23) rules out the existence of a separating equilibrium. To see this
note that in a separating equilibrium agent 2 must reveal his type truthfully.
Since the surplus is transferred to agent 1, truthful revelation is only possible if
the transfer made to agent 2 is independent of his declaration. The maximum
transfer that agent 1 is willing to make a low type agent 2 is $\theta_1 - v_{1L}$. The
minimum transfer a high type is willing to accept is $v_{2H}$. If equation (23) is
satisfied, then it is not possible to make these simultaneously.

Equation (22) rules out the existence of a pooling equilibrium. In a pooling
equilibrium the surplus must be allocated to agent 1 to satisfy equation (22).
Given the surplus is allocated to agent 1, the transfer made to high and low
type agent 2 must be the same. Equation (22) requires that the maximum
transfer a high type agent is willing to make $\theta_1 - v_1(\theta_1)$ is less than $v_2(\theta_2^H)$,
the minimum transfer a high type agent 2 is willing to accept. This rules out a
pooling equilibrium for distributions of valuation where $q_L \geq \gamma^\ast$.

Equation (22) also rules out the existence of semi-separating equilibria. First
note that in a semi-separating equilibrium the surplus must be allocated to
agent 1 to satisfy equation (22). In a semi-separating equilibrium either of
two following states must arise: the declaration leads to agent 1 associating a
posterior probability $\gamma$ where $1 > \gamma > q_L$ with agent 2 being a high type, or
leads to agent 1 associating a probability $\gamma$ where $q_L > \gamma > 0$. Both these
states could arise with some probability depending on the true type of agent
2. Litigation must arise in the former case since by continuity of the value
function in $\gamma$, it is the case that equation (22) is satisfied for all $1 > \gamma > q_L$ if
$q_L \geq \gamma^\ast$. This implies that litigation arises with a strictly positive probability
for distribution with $q_L$ such that $q_L \geq \gamma^\ast$.

This result shows that the main result of this paper regarding the existence of
litigation as an equilibrium phenomenon does not rely on the specific assumption
about the game form of litigation. As long as the value functions from litigation
satisfy certain conditions it will be impossible for parties to avoid litigation.
This result acts as a robustness check to the theory presented in the paper.

5 Applications

In this section I discuss the application of the model to different kinds of conflict.
I argue that the model sheds some light on the forces at work that prevent agents
from effectively avoiding conflict. I also bring out some testable implications
and discuss evidence that seems to be consistent with the predictions of the
model.
5.1 Intellectual Property Litigation

In this model, litigation arises due to unobservability of valuations. The model therefore predicts that the incidence of litigation should be negatively correlated with the degree of observability of valuations. This implies that less litigation should be observed in sectors where disputes are about objects over which agents are unlikely to have private valuation.

The model predicts that litigation over intellectual property would be expected in industries where a firm is likely to have private information on what the expected profits would be if it succeeds in securing the patent in court. Conversely in an industry where the profitability of a patent is observable, litigation would be rare.

A related prediction regarding the incidence of litigation is that the rate of litigation should be positively correlated with the range of the distribution of valuation. In the model we saw how litigation arises only when the two values $\theta_2$ take are sufficiently apart. In the limit as the range goes to 0 we are back in the world where valuations are observable. Depending on the use of the patent, firms are likely to have different valuations of the patent. Under the assumption that the range of valuations increases with the possible uses a patent has, we should expect a positive correlation between the scope of a patent and the incidence of litigation.

Lerner (1994) uses a data set where an index for the scope of a patent is constructed. Lanjouw and Schankerman (2004) studies the determinants of patent suits using data from the US patent office, the federal courts and industry sources. In their data set they have measures for the market value of the patent. Together these data sets could be used to test the theory presented here. If the theory is correct, we would expect to find a positive correlation between the scope of a patent and the incidence of litigation even after controlling for things such as the market value of the patent.

Another testable implication about the incidence of litigation arises directly from assumption 2. Assumption 2 is more easily satisfied when the case is biased in favour of one of the two parties, that is, the value of $\alpha$ is close to 0 or 1. This is because equilibrium efforts are lower when $\alpha$ is close to 0 or 1. This implies that litigation is more likely when $\alpha$ is close to 0 or 1. The intuition for this is that if facts and law in a given case are heavily loaded in favour of one of the parties, then parties spend less in court because the marginal impact of effort on the probability of winning is lower. This makes litigation less inefficient and consequently more likely.

5.2 War

Fearon (1995) argues that miscalculation of the opponent’s willingness to fight is one of the causes of war. While discussing the incentives of states to reveal their true willingness to fight he states:

“While states have an incentive to avoid the costs of war, they also wish to obtain a favourable resolution of the issues. This latter desire can give them an
incentive to exaggerate their true willingness or capability to fight, \ldots if they are concerned that revelation would make them militarily (and hence politically) vulnerable.\ldots"

The model presented here supplies the micro-foundations for this idea. Here the willingness to fight is determined by the valuation parties place on the subject matter in dispute. A low valuation agent takes into account the ex-post incentive of the opponent to threaten litigation once she finds out that he has low valuation. This vulnerability created by truthful revelation destroys the incentives for truthfully declaring one’s valuation.

A historical example that seems to fit the argument formalised in this model is the Russo-Japanese conflict of 1904-05 over Korea and Manchuria. A significant ingredient that led to the conflict was the desire for exclusive economic control over Korea and Manchuria given the investment both nations had made in these regions.\textsuperscript{21} For instance, in early 1903 the Russians started lobbying for rights to construct a railway line between Seoul and Uiju. The Japanese, being in the process of constructing a line between Seoul and Fusan, were opposed to this. In Manchuria, Russia wanted exclusive control to protect the large investments in the Chinese-Eastern railway that was to facilitate transit of goods from ports on the Pacific Ocean into Russia. Furthermore the Russians were planning to build a port in Dalny for getting access to sea for the Chinese-Eastern Railway. The Japanese who controlled the port of Niuchuang were worried about the loss of trade resulting from the construction of a rival port.

There were several negotiations between the two countries in the time leading to the conflict. The first communication happened in 1901 in the aftermath of the boxer rebellion which presented the Russians with an opportunity to increase their influence over Manchuria. In early 1901 the Russians entered into an agreement with China that consolidated their power in Manchuria. Historical accounts indicate that the Japanese were strongly opposed to this agreement but the Russians failed to take this into account, believing that the Japanese would never go to war against a strong western power.

In late 1901 Ito Hirobumi, a Japanese minister, travelled to Russia. Accounts of his negotiations indicate how he attempted to convey to the Russians the Japanese desire for exclusive control over Korea. The Russians however were only willing to make concessions to the extent of sharing control over Korea. This position was continued in the final negotiations in December of 1903 when the Russians refused to accede to the Japanese demand for a neutral zone on the banks of the Yalu river in Korea. Furthermore the Russians refused to discuss the issue of Manchuria and maintained their stand that the Manchurian issue was not on the table.\textsuperscript{22}

These accounts indicate that both the Russians and the Japanese valued the control rights over Manchuria and Korea. Furthermore, the Russians were unwilling to believe that Japanese sabre-rattling before the war was anything

\textsuperscript{21}See White (1964).
\textsuperscript{22}See Nish (1985) for a rich account of the negotiations between Russia and Japan preceding the conflict.
more than cheap talk and believed that Japan would be in a weak position in the event of a war. This example illustrates how the incentives of parties to always overstate their willingness to fight creates an informational asymmetry that can lead to conflict. The opponent disbelieves any declaration about the willingness to fight and consequently agents with genuinely high valuation are left with no option but to fight.

6 Conclusion

This paper has attempted to offer a solution to the puzzle of existence of conflict between rational agents. Rational explanations of conflict are based on the existence of informational asymmetry between agents. This informational asymmetry is preserved by restricting communication between parties in some way. The model presented here tries to establish the existence of conflict in a setting where communication between parties is not restricted. In doing so this paper has attempted to solve two longstanding problems in the literature on why people litigate.

The first problem tackled here is the problem of microfounding the presence of litigation through the existence of private information in a way that is consistent with full disclosure theorems. The model proposed here allows all certifiable information to be disclosed at the pre-trial stage. Private information that creates informational asymmetries between parties is purely of the non-certifiable kind, which is modelled as the valuation that parties place on the subject matter in dispute. This influences the amount spent in court which consequently influences the expected payoff from litigation thereby making it unobservable.

The second problem that this paper tackles is the restriction that the literature has placed on the pre-trial interaction between parties. The literature so far has assumed that parties can only interact in a bargaining framework where communication is limited to offers and counteroffers. By studying negotiations in a framework of mechanism design, this paper allows for richer communication between parties.

The main insight that emerges here is that if the possibility of staying faithful to the outcome of any negotiation protocol is limited and circumscribed sufficiently by the outside option of litigation, then this dilutes the incentives for truth telling during the negotiation stage. Agents exaggerate their true valuation in order to secure better settlement outcomes leading to lack of credibility of statements made during negotiations. Consequently litigation arises as an equilibrium phenomenon. I have argued that this insight crosses over to other types of costly conflict as well.

In further work it would be interesting to develop a normative theory of the judiciary that seeks to explain how a seemingly inefficient judiciary may be globally optimal. Perhaps the possibility of inefficient litigation ex-post may create incentives for efficient behaviour ex-ante. This ties back to the conception of courts in neo-classical economics with a slight twist: courts by their very
existence deter undesirable behaviour that leads to disputes by ensuring that parties cannot efficiently negotiate themselves out of disputes once they arise.

References


