Conflict with Quitting Rights: A Mechanism Design Approach

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Abstract

Why do players engage in costly dispute resolution such as litigation and arbitration when costless settlement is available? I present a model with one sided asymmetric information where the payoff from litigation for both players depends on the beliefs of the uninformed player. Taking these payoffs as their outside options, players negotiate over the allocation of an indivisible object that is in dispute and transfers. It is shown that it is impossible to implement an allocation that satisfies budget balance that guarantees the players their payoff from conflict when players can quit negotiations unilaterally at any stage. Hence it may be impossible for negotiations to replicate even the second best outcome, the outcome of costly dispute resolution, which is itself less efficient than the first best.

JEL: D74, D82, K41

Keywords: Asymmetric Information, Pre-Trial Negotiation, Contests, Conflict, Litigation.

1 Introduction

Underpinning much of the architecture of neo-classical economics lies the assumption of a perfect judiciary. The existence of such a judiciary deters undesirable behaviour. From Arrow-Debreu contingent commodities to incentive contracts, players 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.

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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 paper attempts to contribute to the large literature that address this question. In this model parties have private valuation of the subject matter in dispute. Unlike the standard setting with asymmetric information, there are two additional ingredients that are both necessary in this model for non existence of efficient settlement. First, the beliefs of the uninformed player affect the payoff of both uninformed and the informed player. And second, players have the right to quit negotiations unilaterally.

In this model the uninformed player always has a higher valuation of the surplus. In the presence of quitting rights there is a need to allocate the surplus efficiently to the uninformed player to ensure conflict is avoided for any possible revelation during negotiations. However this constrains the transfers to the informed player to be independent of his type. Litigation is modeled as a Tullock contest. The main result of the paper in proposition 1 shows that it is impossible to find a transfer that is high enough to satisfy the ex-post participation of the informed player for any realization of his type and low enough to satisfy the interim participation constraint of the uninformed player. In other words, there are states when negotiations must make at least one of the two players strictly worse off. Hence it may be impossible for negotiations to replicate even the second best outcome, the outcome of litigation, which is itself less efficient that the first best.

In a nutshell the result will show that it is impossible to design a mechanism that induces the informed player to reveal his type truthfully. Note that truthful revelation is sufficient to avoid litigation since given the inefficiency of courts, players would prefer to settle outside. However, full revelation is not necessary for litigation to be avoided. Hence the result will show that there are conditions under which it will not be always possible to reveal information that will lead to out of court settlement.

In section 3 I move away from the Tullock contest and generalize the main result of the paper by imposing conditions directly on the litigation payoffs. Section 3.3 shows how players avoid litigation in this framework if they can commit not to use their quitting rights unilaterally. Finally I argue (section 4.2.2) 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 large literature that deals with this question. First, it endogenises the informational asymmetry about the players' outside options using non certifiable information about valuations. This contribution is discussed in greater detail in section 1.1.1. Second, it derives conditions under which this type of informational asymmetry causes negotiations to break down even with the best possible mechanism. This is discussed in section 1.1.2. Finally, the novel theoretical contribution of this paper in relation to the mechanism design literature is discussed in section 1.2.

1.1 Relationship to Law and Economics 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 at 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 is not sufficient to create litigation. With uncertainty, both parties would form expectations about their payoff from litigation. 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 Bebchuk (1984) where 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.

1.1.1 Litigation and Full Disclosure

The first problem with the literature is 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.

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 and consequently avoid costly litigation through bargaining under complete information. This is a problem since it turns out that in the setting of these models, parties always have an incentive to disclose their private information.

[1] More examples include Gould (1973), Posner (1973), and Priest and Klien (1984).

[2] The precise sequence of offers, counter offers, and rejection of offers, has been generalised in different ways. A non zero probability of litigation emerges as a robust phenomenon. See Cooter and Rubinfeld (1989) and Hay and Spier (1998) for surveys of this literature.

Grossman (1981) shows that when private information is certifiable, there are very strong incentives to reveal it. This is because an player with information favourable to himself always wants to reveal it to increase the size of the offer from his opponent. This leads to an unravelling since the player who chooses not to reveal his information ends up signalling that he has unfavourable information.[3] One response to this concern is to assume that information is costly to verify and that courts have a comparative advantage in excavating information. Although this may be plausible, it does not explain litigation where for instance opposing parties agree on facts of the case but still dispute the law to be applied.

I propose a different approach that avoids this issue 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. I show (section 2.1) that this valuation determines the amount of effort an player 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 player, 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.

1.1.2 Litigation and Communication

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 of the surplus and transfers are ruled out. This assumption is not restrictive when parties have the same valuation over the surplus. However, in an environment with private valuation this turns out to have a bite since there could be settlement equilibria for instance when an player with high valuation offers transfers to one with low valuation in exchange for the surplus.

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 attempts 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.

[3] Okuno-Fujiwara et al. (1990) derive conditions sufficient for this argument to work.

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.

This paper is part of growing literature that seeks to understand litigation using mechanism design. For instance Mnookin and Wilson (1998) analyse disclosure in a mechanism design setting. In a similar vein Klement and Neeman (2005) also use a mechanism design approach to analyse the effect of different fee shifting rules on balancing the trade-off between minimising litigation and deterring disputes. This paper differs from these in that it attempts to take on board the full disclosure critique by assuming that certifiable information is fully disclosed at the negotiation stage as a result of parties communicating freely with each other.

1.2 Relationship to Mechanism Design Literature

This paper presents a new inefficiency result that is related the one considered in Myerson and Satterthwaite (1983) and related literature. However unlike the literature based on Myerson and Satterthwaite (1983), where the uncertainty of gains from trade is necessary, here the inefficiency of conflict is common knowledge between parties who are consequently aware that out of court settlement is always more efficient. It is also common knowledge that one of the two players values the object more and hence it is efficient to allocate the object to her in exchange for a transfer to the other player. Moreover, unlike Myerson and Satterthwaite (1983) one sided private information is sufficient to generate inefficiency. Since ex-post efficiency is guaranteed in Myerson and Satterthwaite (1983) whenever either one of these two assumptions is relaxed, it is clear that the two results are not equivalent.

In contrast with Myerson and Satterthwaite (1983), there are two additional ingredients here. First, the interdependence of outside options of both players on the beliefs of the uninformed player, and second, the ability of parties to quit negotiations unilaterally. The second requires the use of ex-post individual rationality compared to the weaker interim individual rationality required by Myerson and Satterthwaite (1983). The key difference in this paper is in the nature of inefficiency that is analysed. The inefficiency analysed in Myerson and Satterthwaite (1983) and related literature is the impossibility to achieve the first best. In contrast this paper shows how negotiations cannot even replicate the second best outcome, the outcome of litigation, which is itself less efficient than the first best.

Of the papers related to Myerson and Satterthwaite (1983) this paper is most closely related to Compte and Jehiel (2009) in the use of ex-post participation constraints arising from the assumption that parties can quit negotiations unilaterally. There are two key differences. First, the inefficiency showcased here does not require any uncertainty about who values the surplus

more and consequently only requires one sided private information.[4] Second, the inefficiency in this model arises from the dependence of the outside options for both players on the uninformed player's belief about the type of the informed player.

This paper is also related to Celik and Peters (2011) who consider the possibility of signaling through rejection of mechanism. In their paper, parties can design a mechanism before playing a default game that allows the type of the informed player to be revealed, modifying the beliefs under which the default game is played. In that setting, allowing the possibility of rejection of the mechanism increases the set of implementable allocations. In contrast, in my setting, the parties attempt to use a mechanism to avoid playing the default game altogether and the possibility of rejection of the mechanism ex-post eliminates the existence of allocations that allow them to do that. Finally this paper is also related to Aney (2012) which looks at a similar setup and considers the impossibility of attaining the first best. In contrast to this paper, where negotiations are unable to yield an outcome that dominates even the second best outcome from litigation, the focus there is to show how even when commitment is possible, players may fail to reach the first best.

2 Model

There are two players who find themselves in a dispute. The subject matter of the dispute is characterised as an indivisible surplus over which players have competing claims.[5] Both players have a non-negative valuation of the surplus which is their type. Agent 1's (female) valuation is θ_1, which is observable, whereas player 2's (male) valuation is unobservable and can be θ_H with probability q^H and θ_L with probability $1 - q^H$. I assume

Assumption 1.

$$\theta_1 > \theta_H > \theta_L = 0.$$

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 over which parties may have private valuation. The dispute may arise over property where 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. In such a case the party in possession may have private valuation. A dispute could arise about specific as to whether an player has performed his contractual obligation. The plaintiff may have private

[4] In this regard the result is related to lemons result of Akerlof (1970) which also requires informational asymmetry to be one sided. This is because the interdependence of the outside options on the type of both players leads to the problem being one of common rather than private values. However unlike the common values model, the primitives in this model are the valuations of the two players which are assumed to be independent. The common values structure on the litigation payoffs arises endogenously as will be seen in section 2.1.

[5] What is required here is that the sum of the valuations of a party over divisions of the surplus is significantly lower than the valuation over the whole surplus. The assumption of indivisibility guarantees this in stark terms since indivisibility implies a zero valuation over any division of the surplus.

valuation over the benefit accruing from the action. Lastly, when a couple separates and moves to different countries and joint custody of child is very costly, a dispute could arise over which spouse gets the custody over which one of the spouses has private valuation. Private valuation of the subject matter in dispute is plausible when the dispute involves something other than pure monetary compensation. Although the assumption of two-sided private information would also fit the examples described above, the results I present will not be affected if we were to switch to two-sided informational asymmetry.[6]

Timeline:

Stage 1: A dispute arises between the two parties. Parties decide to either litigate or negotiate.

Stage 2: If parties choose to negotiate, they are confronted with a mechanism where player 2 declares a type which is mapped into allocations for both players.

Stage 3: Parties either accept the allocation prescribed by the mechanism in stage 2, or approach the court.

Stage 4: If either player approaches the court, the court makes a final decision.

At this point, we can preview how the result of litigation is established. The satisfaction of ex-post participation constraints imply that the allocations need to be large enough to induce both players not to litigate under the outside options that are modified by the information revealed up to that point. As a consequence of this there is pressure on allocations to be more efficient ex-post and consequently the surplus must be allocated to player 1 who has the higher valuation. To ensure that such an allocation is incentive compatible for player 2, the transfer he receives must be independent of his declaration. However when this happens budget balance is violated since, going back to stage 2 it is impossible to satisfy interim participation constraint for player 1.

Figure 2 illustrates the timing. The litigation payoff for each player at each node acts as the player's outside option to negotiation and settlement. Litigation is triggered when at least one of the players chooses it. To solve the model backwards, l will start with the payoff from litigation in stage 4 in section 2.1. For litigation to be avoided this payoff from litigation must be weakly lower than the allocations prescribed by the mechanism in stage 3 for at least some belief that player 1 holds following the revelations compatible with those allocations. This is discussed in section

[6]In 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) and related papers where two-sided informational asymmetry is a necessary condition. In that world setting the price equal to the publicly observed valuation, in this case θ_1, would always guarantee ex-post efficiency. Since the main result of the paper shows the impossibility of attaining the second best, two sided informational asymmetry would simply strengthen the result as the allocations would need to satisfy an additional constraint, namely the incentive constraint for player 1.

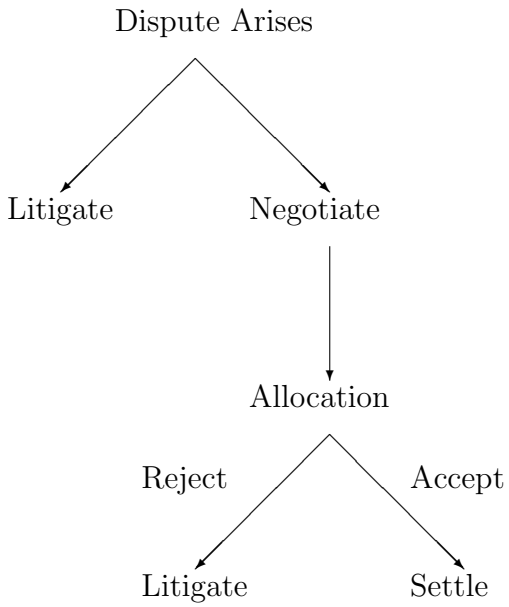

Figure 1: Timing

2.2.1. Finally, going back to the start of stage 2, for players to participate in negotiations, the allocations from stage 3 must be greater than the interim participation constraints arising from litigation at that point. This is discussed in section 2.2.2. The result of the existence of litigation arises when the distribution of valuations of player 2 is such that q_H is low enough. Proposition 2 shows that whenever the posterior belief induced by negotiations is $q \leq q_H$, which must happen with positive probability, player 1 prefers to litigate.

Before we solve the model, note that the only piece of asymmetric information in this model is the type of player 2. The posterior probability that player 1 associates with player 2 being a high type can be represented as

$$q \in [0, 1].$$

If the negotiations reveal the type of player 2 to be high then $q = 1$. Similarly $q = 0$ captures the case when his type is revealed to be low. If negotiations reveal no information about player 2's type then $q = q_H$ as the posterior of player 1 is equal to her prior. Hence all possible posterior beliefs of player 1 can be captured by varying $q \in [0, 1]$. Agent 1's prior q_H, and the information revealed by the end of stage 3 captured by the posterior q are common knowledge. Going forward I treat $q \in [0, 1]$ as the space of all possible beliefs of player 1 in which the prior q_H is one element. As the only source of asymmetric information in this model is about player 2's type, q can be treated as a sufficient statistic for any information that is revealed during negotiations.

2.1 Litigation

The court process is modelled as a static contest where parties choose their effort levels simultaneously, and the probability of winning is determined by the costly effort x exerted by the players.

Assuming that litigation follows a specific contest form rightly appears to be quite restrictive. This concern is addressed in section 3 where litigation payoffs will be modeled in a more general way. For now the objective functions of the two players are

$$\theta_1 E_j\Big(\mathrm{P}(x_1, x_j)\Big) - x_1 \qquad \text{and} \qquad \theta_j(1 - \mathrm{P}(x_1, x_j)) - x_j \qquad j \in \{L, H\}$$

where

$$\mathrm{P}(x_1, x_2) = \begin{cases} 1 & \text{if } x_1 = x_2 = 0 \\ \frac{\alpha {x_1}^{\lambda}}{\alpha {x_1}^{\lambda} + (1-\alpha){x_2}^{\lambda}} & \text{otherwise where } \lambda, \alpha \in (0,1). \end{cases} \tag{1}$$

This contest function has certain desirable properties.[7] The parameters α and λ are common knowledge. λ captures how sensitive the probability is to the effort exerted by parties. A higher λ implies a greater sensitivity of the judicial process to the persuasiveness of lawyers. A judicial process that is less sensitive to the skill of lawyers implies a lower λ. 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 λ can be thought of as a parameter capturing how corrupt the judiciary is.

The parameter α captures how strong player 1's case is ex-ante relative to player 2. This parameter is introduced to capture the fact that legal disputes may be skewed towards one side.[8] It is rarely the case that both sides to a dispute have equally strong legal positions. An α equal to 1 implies that player 1 is certain to win the case; that the case is 'open and shut'. Note that in the two corner cases of $\alpha \in \{0, 1\}$, the efforts of parties will not play a role as the probability of winning would be insensitive to effort since there is complete certainty about how the court will rule. In this case litigation will be always be avoided. For intermediate values of α, the efforts of parties would influence the probability of winning.

Recall that q is the posterior belief of player 1 at stage 3. Using this belief and the contest function specified in equation (1) it is possible to solve out for the Bayesian Nash equilibrium effort levels x_1 and x_j. These are

$$x_1(q) = \underset{x_1 \geq 0}{\operatorname{argmax}} \left(\theta_1 \left(q \frac{\alpha {x_1}^{\lambda}}{\alpha {x_1}^{\lambda} + (1-\alpha)x_H^{\lambda}} + (1-q)\frac{\alpha {x_1}^{\lambda}}{\alpha {x_1}^{\lambda} + (1-\alpha)x_L^{\lambda}} \right) - x_1 \right),$$

and

$$x_j(q) = \underset{x_j \geq 0}{\operatorname{argmax}} \left(\theta_j \frac{(1-\alpha){x_j}^{\lambda}}{\alpha x_1(q)^{\lambda} + (1-\alpha){x_j}^{\lambda}} - x_j \right).$$

[7] This contest function is a variation on the one analysed in Skaperdas (1996) and generalized in Clark and Riis (1998). 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 players. $\lambda < 1$ implies concavity and ensures the uniqueness of equilibrium. The assumption that $\mathrm{P}(x_1, x_2) = 1$ when $x_1 = x_2 = 0$ allows for the existence of equilibrium.

[8] For a discussion on the interpretation of α in a legal context, see Hirshleifer and Osborne (2001) and Skaperdas and Vaidya (2009).

Since $\theta_L = 0$, the optimal effort for low type player 2 is $x_L(q) = 0$ for all q. This is because if he exerts positive effort, he can always increase his payoff by reducing his effort to 0. Hence he exerts $x_L(q) = 0$ for all q in equilibrium. Consequently player 1 wins the contest even when she exerts zero effort when facing a low type. The objective function of player 1 therefore simplifies to

$$x_1(q) = \underset{x_1 \geq 0}{\operatorname{argmax}} \left(\theta_1 q \frac{\alpha {x_1}^\lambda}{\alpha {x_1}^\lambda + (1-\alpha) x_H^\lambda} + (1-q)\theta_1 - x_1 \right),$$

The first order conditions for player 1 and high type player 2 give us

$$\frac{q\theta_1}{\theta_H} = \frac{x_1(q)}{x_H(q)}$$

Plugging this back into the first order conditions and solving for $x_1(q)$ and $x_H(q)$ we find that

$$x_1(q) = q\theta_1 \lambda \alpha (1-\alpha) \frac{\theta_H^\lambda (q\theta_1)^\lambda}{\left(\alpha (q\theta_1)^\lambda + (1-\alpha)\theta_H^\lambda\right)^2}$$

and

$$x_H(q) = \theta_H \lambda \alpha (1-\alpha) \frac{\theta_H^\lambda (q\theta_1)^\lambda}{\left(\alpha (q\theta_1)^\lambda + (1-\alpha)\theta_H^\lambda\right)^2}.$$

We are now ready to define the equilibrium payoffs from litigation. For a belief q let the equilibrium litigation payoffs for player 1 and type j player 2 be $v_1(q)$ and $v_j(q)$. We can solve for these by plugging in the optimal effort levels for the two players into equation (1). We find

$$v_1(q) = \theta_1 q \frac{\alpha (q\theta_1)^\lambda}{\alpha (q\theta_1)^\lambda + (1-\alpha)\theta_H^\lambda} \left(1 - \lambda \frac{(1-\alpha)\theta_H^\lambda}{\alpha (q\theta_1)^\lambda + (1-\alpha)\theta_H^\lambda} \right) + \theta_1 (1-q), \tag{2}$$

$$v_L(q) = 0 \qquad \text{and} \qquad v_H(q) = \theta_H \frac{(1-\alpha)\theta_H^\lambda}{\alpha (q\theta_1)^\lambda + (1-\alpha)\theta_H^\lambda} \left(1 - \lambda \frac{\alpha (q\theta_1)^\lambda}{\alpha (q\theta_1)^\lambda + (1-\alpha)\theta_H^\lambda} \right).$$

Note that the value functions of the two players depend on player 1's belief about player 2's type where q is the probability she associates with player 2 being a high type. This is because the equilibrium effort levels depend on player 1's belief and this consequently enters the equilibrium payoffs. We can check from these payoffs that

$$\frac{\partial v_1(q)}{\partial q} < 0 \qquad \text{and} \qquad \frac{\partial v_H(q)}{\partial q} < 0. \tag{3}$$

The payoff of player 1 is decreasing in q since her equilibrium effort is increasing when she expects player 2 to be a high type with a higher probability. Similarly, when q is low and player 1 believes player 2 is more likely to be a low type, a the payoff of a high type player 2 is higher since he reduces his equilibrium effort in anticipation of facing a more complacent player 1.

2.2 Negotiations

Parties negotiate before resorting to costly litigation. Since in principle, negotiation can take the form of any game of incomplete information, any particular game form that we impose will come with a loss of generality. This problem can be solved by 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 that the revelation principle applies in this environment note that regardless of the game form that negotiations take, any equilibrium of any possible negotiation game must generate allocations that satisfy the standard incentive constraints. Consequently when presented with an equilibrium allocation, player 2 can simply report his type truthfully to a mediator who plays the equilibrium actions for him resulting in the allocation. Consequently we can simply focus on a direct mechanism where player 2 reveals his type as long as the allocation satisfies the necessary constraints.

Taking the $v_1(q)$ and $v_j(q)$ from equation (2) as given, agents attempt to allocate the surplus. Since the surplus is indivisible, the final allocation must be such that the surplus is either allocated to player 1 or 2. The players make their decision about whether to litigate after this realization. Although player 1 starts with a prior q_H about the type of player 2, since negotiations could reveal information about player 2's type, at the ex-post stage at the end of the negotiations, the belief of player modifies to some $q \in [0, 1]$. For players to prefer settlement the allocation needs to satisfy the ex-post participation constraints, namely the allocation and transfers to player 1 and 2 must be weakly greater than $v_1(q)$ and $v_j(q)$. Note that since the allocation has already modified the belief of player 1 to q, if the players were to litigate they would do so with the posterior belief q and not the prior q_H.

2.2.1 Ex-Post Participation

Since the surplus is indivisible it must be either allocated to player 1 or 2. Let the payoffs from settlement for the two players be μ_1 and μ_j. Furthermore let the posterior belief induced by these payoffs be q. With some abuse of notation we can incorporate these into the payoffs by denoting them as $\mu_1(q)$ and $\mu_j(q)$. When the surplus is allocated to player 1 and she is made to pay a transfer t_1^j to player 2 we will have

$$\mu_1(q) = \theta_1 - t_1^j \qquad \text{and} \qquad \mu_j(q) = t_1^j$$

In section 2.2.2 I will show how t_1^j must be independent of player 2's declaration. Similarly when the surplus is allocated to player 2 and he pays a transfer t_2^j to player 1 we have

$$\mu_j(q) = \theta_j - t_2^j \qquad \text{and} \qquad \mu_1(q) = t_2^j$$

For each player to prefer settlement we need $\mu_1(q) \geq v_1(q)$ and $\mu_j(q) \geq v_j(q)$. Substituting out for t_1^j and t_2^j the ex-post participation constraints are

$$\begin{aligned} &\theta_1 - v_j(q) \geq \mu_1(q) \geq v_1(q), \\ &\theta_j - v_1(q) \geq \mu_j(q) \geq v_j(q), \qquad \forall j \in \{H, L\}. \end{aligned} \tag{4}$$

The first row of constraints arises when the surplus is allocated to player 1 and the second row of inequalities arise when the surplus is allocated to player 2. Note that q is the posterior belief of player 1 about player 2 being a high type. As long as there exists a q such that these constraints, along with the incentive constraints that are to follow in section 2.2.2, are satisfied there would be a possibility of avoiding litigation as long as the allocation can induce a belief q under which both players prefer to settle. The results will establish the conditions under which this will not be possible. Going forward I assume that

$$\frac{\theta_1 - \theta_H}{\theta_1 + \theta_H} > \lambda \frac{(1-\alpha)\theta_H^\lambda}{\alpha\theta_1^\lambda + (1-\alpha)\theta_H^\lambda} \tag{5}$$

Lemma 1. *If the inequality in* (5) *is satisfied then the ex-post participation constraints are satisfied only if the surplus is always be allocated to player 1.*

Proof. The second row of the ex-post constraints from (4) apply when the surplus is allocated to player 2. These can never be satisfied when $v_1(q) + v_H(q) > \theta_H$ for all q. I will now show that this is true holds when inequality in (5) holds.

The derivatives in (3) imply that if $v_1(1) + v_H(1) > \theta_H$ then $v_1(q) + v_H(q) > \theta_H, \forall q \in [0, 1]$. Let $\frac{\alpha\theta_1^\lambda}{\alpha\theta_1^\lambda + (1-\alpha)\theta_H^\lambda} = \hat{\alpha}$. Substituting $q = 1$ and rearranging we find

$$\begin{aligned} v_1(1) + v_H(1) &> \theta_H \\ \theta_1\hat{\alpha}(1 - \lambda(1-\hat{\alpha})) + \theta_H(1-\hat{\alpha})(1-\lambda\hat{\alpha}) &> \theta_H \\ (\theta_1 - \theta_H)\hat{\alpha} - (\theta_1 + \theta_H)\lambda\hat{\alpha}(1-\hat{\alpha}) &> 0 \\ \frac{\theta_1 - \theta_H}{\theta_1 + \theta_H} &> \lambda(1-\hat{\alpha}). \end{aligned} \tag{6}$$

The last term is the inequality in (5). □

Note that this proof implicitly assumes that the two players do not receive any subsidy from a third player. If a third party is willing to subsidize negotiations, it is possible to satisfy the constraints in (4) even when inequality in (6) holds. It is however reasonable to rule this out since budget balance is a reasonable in this application.

2.2.2 Incentive Compatibility

To induce player 2 to declare his type truthfully the allocation must satisfy his incentive compatibility constraints. Lemma 1 shows that when inequality in (5) is satisfied the surplus must be allocated to player 1. Consequently the allocation for player 2 is just composed of a transfer. This implies $\mu_j(q) = t_1^j$. To ensure incentive compatibility this transfer must be independent of player 2's declaration and we have

$$t_1 = \mu_L(q) = \mu_H(q). \tag{7}$$

This is because if the transfer varies with the declared type, player 2 will always declare the type that gets him the higher transfer.

2.3 Result

Proposition 1. *Assuming the inequality in* (5) *holds, there exists a prior belief* $q_H \in (0,1)$ *such that no implementable allocation that satisfies balanced budget exists that yields a payoff at least as high as the payoff from litigation for the two players.*

Proof. When a dispute arises in stage 1, for both players to prefer negotiation it must be the case that what they expect from negotiations must exceed their expected payoff from litigation. This implies that $\mu_1(q_H) \geq v_1(q_H)$ and $\mu_j(q_H) \geq v_j(q_H)$ must be satisfied. Now note that lemma 1 shows that when when the inequality in (5) holds, for an allocation to satisfy the ex-post participation constraints, the surplus must be allocated to player 1 at the end of the negotiations, and the transfer t_1 to player 2 must be constant in his declaration to ensure incentive compatibility (equation (7)). This transfer must satisfy

$$t_1 \geq \max v_j(q) \qquad \iff t_1 \geq v_H(q_H) \qquad \text{since} \qquad v_H(q_H) > v_L(q_H).$$

to ensure that player 2's ex-post participation constraint is satisfied. Similarly we need player 1's allocation to satisfy her interim participation constraint. That is

$$\theta_1 - t_1 \geq v_1(q_H)$$

However

$$v_1(0) = \theta_1 \qquad \text{and} \qquad v_H(0) = \theta_H \qquad \implies \qquad v_1(0) + v_H(0) > \theta_1.$$

Since the value functions are continuous in q, there must exist a $q_H > 0$ such that

$$v_1(q_H) + v_H(q_H) > \theta_1, \tag{8}$$

Consequently for a prior q_H that satisfies the inequality in (8), it will not be possible to satisfy

ex-post participation. Note further that the signs of the partial derivatives in (3) imply that

$$v_1(q) + v_H(q) > \theta_1 \qquad \forall q \leq q_H,$$

Consequently for a posterior $q \leq q_H$ it will not be possible to satisfy ex-post participation. Negotiations may lead to a posterior $q \neq q_H$. Let Q be the random variable denoting the posterior belief after negotiations. Then the correctness of priors implies that $\mathrm{E}(Q) = q_H$. For this to be the case, the support of Q must include some point $\hat{q} \leq q_H$. As a result Q will sometimes take this value $\hat{q}$, that is, negotiations will sometimes induce posterior beliefs that are low enough to result in violations of the ex-post participation constraints. □

If the sum of the expected payoffs from litigation for player 1 and high type player 2 are high enough for all possible beliefs, the surplus must always go to player 1 and the total surplus with settlement is θ_1. In this case the transfer to player 2 must be independent of his type. Consequently the lowest transfer that must be made to player 2 to ensure that his ex-post participation is $v_H(q)$, for any q that is induced by negotiations. For some prior beliefs player 1 is unwilling to treat player 2 as if he were a high type and make this high transfer.

Player 1 overestimates his payoff when player 2 is a high type. Overestimation in this model is when $v_1(q_H) + v_H(q_H) > \theta_1$. The contest function delivers this overestimation endogenously since the equilibrium payoffs are such that the overestimation by the player 1 must arise for some prior belief $q_H \in (0, 1)$. This result shows that under such prior beliefs it would be impossible for the two players to always avoid litigation. When $v_1(q_H) + v_H(q_H) > \theta_1$, the result shows that the sum of the expected payoffs from negotiation for player 1 and high type player 2 will always be lower than the sum of their litigation payoffs under the prior. Consequently one of these two agents would prefer to litigate.

Note that since negotiations are modeled in a general way without reference to any particular extensive form of offers and counter offers, it is not possible to say which player actually chooses litigation. It could be either player 1 or the high type player 2. Predictions about this can only be derived when the extensive form of the negotiation game is known. In this paper I avoid making assumptions about the structure of negotiations since this comes with a loss of generality. Instead the result shows when a dispute arises, players realize that regardless of how well they negotiate, the payoffs for at least one of them would be higher with litigation. Since there is no game form that is imposed in terms of which player makes the first move in proposing litigation implies that it is not possible to pin down whether litigation always arises at stage 1 of the timing or whether it arises after negotiations are unsuccessful. It would be possible to specify extensive forms that would give rise to one or the other possibility. This result merely shows that regardless of how the actual negotiation game proceeds, a positive probability of litigation must arise in any equilibrium.

3 General Litigation Payoffs

Section 2.1 was concerned with supplying a game theoretic structure to litigation. In particular we showed how litigation payoffs arise endogenously when litigation is modeled as a generalised Tullock contest. This constrains the litigation game to be a one-shot game where players choose their efforts simultaneously. However the actual litigation game may be simultaneous or sequential, one shot or staggered over multiple periods. Parties may bear their own costs as is the case under the US fee shifting rules (as is the case in the contest that we saw) or the court may allocate the costs to the loser as with the English rule. The game may have a unique equilibrium or multiple equilibria. In this section I attempt to address this question by taking the litigation payoffs as exogenous and directly imposing conditions on them.

3.1 Litigation Payoffs

The payoffs from litigation are taken as exogenously given. They can be thought of as arising in equilibrium from a game of incomplete information that players play in court. In such a game player 1 would choose her actions based on her belief about player 2's type while player 2 would choose his action based on his true type and on player 1's belief about his type. In principle, this game can be one of simultaneous or sequential moves, static or staggered over multiple periods. We can remain entirely agnostic about these issues and focus directly on the payoffs of the two players that we assume would arise in equilibrium of such a game. Another issue that could arise is one of multiple equilibria if litigation is a game. This paper has nothing to say about how players compute their expected payoffs in the face of multiple equilibria. The goal here is to take the expected payoffs as exogenous and place conditions on them such that we can derive our result about the unavoidability of litigation.

As before we can denote the litigation payoffs for player 1 and 2 as

$$v_1(q) \qquad \text{and} \qquad v_j(q). \tag{9}$$

These represent the value of the surplus to each player times the probability with which the court allocates the surplus to her, net of the costs that she incurs in court. The value functions of the two players depend on player 1's belief about player 2's type where q is the probability she associates with player 2 being a high type. At this stage we have nothing to say about how the dependence of the payoffs on q arises. In section 2.1 we already saw how belief q enters the equilibrium payoffs through the choice of equilibrium efforts by the two players when litigation is modeled as a game.

To capture the fact that litigation is inefficient we may focus on the case where the following assumption holds:

Assumption 2.

$$\theta_1 > v_1(q) + \mathrm{E}(v_j(q)) \qquad \forall q \in (0,1),$$

and

$$\theta_1 \geq v_1(1) + v_H(1) \qquad \textit{and} \qquad \theta_1 \geq v_1(0) + v_L(0)$$

with the inequality being strict for at least one of the two.

The first part of assumption (2) applies to the case where the type of player 2 is uncertain. It states that sum of the surplus generated in litigation in expectation is less than what will arise if the surplus was simply allocated to player 1 potentially in exchange for a transfer to player 2. The second part of assumption (2) extends this to the complete information case with $q \in \{0, 1\}$. With complete information, litigation must be strictly inefficient for at least one realization of player 2 type.

Although this assumption is not necessary for the results that follow, it is important to make it nonetheless. In the absence of assumption (2), there would be no puzzle for this paper to explain since it would be efficient for parties to pursue litigation for some belief q as the expected surplus for that q would be higher with litigation. However we will find that the results of the paper arise even in the face of litigation being inefficient, that is when litigation payoffs satisfy this assumption. As we saw see in section 2.1, this assumption is naturally satisfied when the court process is modeled as a Tullock contest since contests are inherently inefficient.

One of the properties of these payoffs is that it admits the possibility that player 2 is allocated the surplus with a positive probability at the end of litigation. This leads to the following question: why do courts allocate the surplus to player 2 at all when player 1 is known to have a higher valuation of the surplus? This question is not answered in the paper. In reality courts typically base their decisions on other factors such as the claims of the parties regarding property rights over the surplus. 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 players to settle their disputes out of court regardless of how well they negotiate.

Assumption 3.

$$v_1(q) + v_H(q) > \theta_H, \qquad \forall q \in [0, 1].$$

Lemma 2. *If assumption* (3) *is satisfied and budget balance is imposed, the surplus must always be allocated to player 1, and the transfer to player 2 must be constant in his declaration.*

Proof. Let δ_H and δ_L be the probabilities with which the surplus is allocated to a high and low type player 2. The condition $\delta_H \geq \delta_L$ for incentive compatibility to be satisfied. Hence $\delta_H = 0$ implies $\delta_L = 0$.

Consider the ex-post state where the surplus is allocated to a high type player 2. In this case the ex-post participation constraints from row two in inequalities from (4) apply. This implies that player 1 must get a transfer of at least $v_1(q)$ and $\mu_H(q)$ can be at most $\theta_H - v_1(q)$. If however

assumption (3) holds then no transfer t_1 from player 1 to player 2 is feasible under budget balance such that $t_1 \geq v_H(q)$. Hence $\delta_H = \delta_L = 0$ and the surplus must always be allocated to player 1. Consequently player 2 only receives a transfer t_2. To satisfy his incentive constraints the transfer must be independent of his declaration. □

This lemma shows that when assumption (3) holds, it will not be possible for players to play a game at the negotiation stage that yields an equilibrium allocation with a positive probability of the surplus being transferred to player 2. This is because in the event the surplus is allocated to player 2, players would find that even the maximum possible transfer to player 1 that player 2 is willing to make does not satisfy her ex-post participation constraint. Therefore, ex-ante, if players are to avoid litigation we must restrict attention to allocations where the surplus goes to player 1 with certainty and the transfer to player 2 is constant. Since player 2 knows that the surplus will always go to player 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. Note that assumption (3) is simply the analogue of inequality in (5) and lemma 2 is the analogue of lemma 1 for general litigation payoffs.

3.2 Result

In this section we will establish the result of unavoidability of litigation. The result will show how no implementable allocation exists that yields a payoff to the players that is at least as high as $v_1(q_H)$ and $v_j(q_H)$, the expected payoffs from litigation. Finally we need

Assumption 4.

$$v_1(q) + v_H(q) > \theta_1 \qquad \forall q \leq q_H.$$

This condition guarantees overestimation. In an environment of complete information, the litigation payoffs of the two opposing players must always add up to less than θ_1 due to the inefficiency of litigation captured in assumption (2). When types are unobservable and q is small, player 1 expects player 2 to be a low type. However in the event player 2 is actually a high type, assumption (4) guarantees that player 1 overestimates his expected payoff from litigation and that this rational overestimation is large enough to generate litigation. Indeed for any posterior belief $q \leq q_H$ induced by negotiations, the sum of the payoffs $v_1(q) + v_H(q)$ will be strictly larger that θ_1. We are now ready to prove the main result of the paper.

Proposition 2. *If the litigation payoffs satisfy assumptions* (3) *and* (4) *then no implementable allocation exists that yields a payoff at least as high as the payoff from litigation for the two players.*

Proof. First note that lemma 2 shows that when assumption (3) holds, for an allocation to satisfy the ex-post participation constraints, the surplus must be allocated to player 1, and the transfer

to player 2 must be constant in his declaration. This transfer t_2 must satisfy

$$t_2 \geq \max v_j(q) \qquad \implies t_2 \geq v_H(q)$$

to ensure that player 2's ex-post participation constraint is satisfied. Similarly we need player 1's allocation to satisfy her interim participation constraint. That is

$$\begin{aligned} \theta_1 - t_1 \geq & v_1(q) \\ \implies \theta_1 \geq & v_1(q) + v_H(q) \end{aligned}$$

However assumption(4) states that for $q \leq q_H$

$$v_1(q) + v_H(q) > \theta_1.$$

Consequently for a posterior $q = q_H$ it will not be possible to satisfy ex-post participation. Now consider the case when the posterior $q \neq q_H$. Let Q be the random variable denoting the posterior belief after negotiations. Then the correctness of priors implies that $\mathrm{E}(Q) = q_H$. For this to be the case, the support of Q must include some point $\hat{q} \leq q_H$. As a result Q will sometimes take this value $\hat{q}$, that is, negotiations will sometimes induce posterior beliefs that are low enough to result in violations of the ex-post participation constraints. □

This result is the analogue of the result in proposition 1 when litigation payoffs arise in an unspecified way. The only additional ingredient here is that with general litigation payoffs we need to explicitly assume that there is overestimation in the form of assumption (4) whereas with the Tullock contest, the equilibrium payoffs always satisfy this assumption.

3.3 No Veto Rights

As we would expect, if parties can be prevented from quitting negotiations unilaterally, then this is sufficient to avoid litigation. This can happen if contracts where parties waive their right to litigate are enforceable. In this section I will show that once we take away an player's right to veto allocations ex-post, it is possible to come up with an implementable allocation that the players would prefer over litigation.

Proposition 3. *As long as $v_1(q)$ and $v_j(q)$ arise from a Bayesian game, there always exists a budget balanced and incentive compatible allocation that weakly Pareto dominates the equilibrium allocation under litigation.*

Proof. Let the payoffs to player 1 and type j player 2 from litigation be $v_1(q_H) = \alpha_1(q_H)\theta_1 - x_1(q_H)$ and $v_j(q_H) = \alpha_j(q_H)\theta_j - x_j(q_H)$. At the negotiation stage let δ_1 and δ_j be the probabilities with which the surplus is allocated to player 1 and type j player 2 and t_1 and t_j be the corresponding

transfers. Following are standard the incentive-compatibility constraints for agent 2 that δ_j must satisfy

$$\delta_H\theta_H - t_H \geq \delta_L\theta_H - t_L$$
$$\delta_L\theta_L - t_L \geq \delta_H\theta_L - t_H,$$

which can be rewritten as

$$(\delta_H - \delta_L)\theta_H \geq t_H - t_L \geq (\delta_H - \delta_L)\theta_L. \tag{10}$$

Moreover since the litigation is unsubsidised by a third player it also satisfies budget balance. Hence we can simply set $\delta_1 = \alpha_1(q_H), t_1 = x_1$ and $\delta_j = \alpha_j(q_H), t_j = x_j$. These allocations satisfy the interim participation constraints for player 1 and both types of player 2 trivially. Moreover as $\alpha_1(q_H), \alpha_j(q_H), x_1$, and x_j arise from an equilibrium of a Bayesian game they must satisfy incentive compatibility. Expecting this allocation, in stage 1 players would commit not to litigate ex-post once the outcome is realized. Given the indivisibility, the ex-post outcome would involve the surplus being allocated to one of the two players. Since players commit to abide by the negotiation allocation, the ex-post allocation need not satisfy ex-post participation constraints. □

The proof of proposition 3 is constructive. It shows that when players are prevented from quitting negotiations unilaterally, negotiations can always at least guarantee them their payoffs from conflict. When ex-post constraints no longer need to be satisfied it is possible to set $\delta_H > 0$. This implies that $t_H = t_L$ is no longer necessary for incentive compatibility ensuring that it is possible to guarantee player 1 $v_1(q_H)$ for all possible q_H.

Proposition 3 shows that under full contractability, at the very least it is always possible to replicate the litigation payoffs through negotiations. Hence litigation would never occur since it would be (at least weakly) individually rational for players to contract away their quitting rights at the start of negotiations. Consequently it would not be possible for an player to credibly threaten their opponent with litigation ex-post to force the renegotiation of the allocation. Hence the allocation from negotiations need not satisfy the additional constraints of ex-post participation. 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. Commitment alleviates the tension between ex-ante and ex-post incentives. Note that the contest described in (1) is a Bayesian game. This implies that this result will apply in case of the payoffs we saw in equation (2).

4 Discussion

In section 4.1, I discuss the possibility of partial commitment to the negotiation allocations. In section 4.2, I discuss some testable implications and applications of the theory presented in the paper.

4.1 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, then that party must pay a large fine." Proposition 3 shows that in this setting, if such a clause is upheld by courts with probability one, 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 players; in other words if courts upheld a 'no litigation' clause with a probability between zero and one. 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 α. Once players sign a contract to stick to the allocations specified by the mechanism, it affects α when the case reaches court ex-post. In a world with complete contractibility, when player 1 considers approaching the court ex-post, she would find that α equals zero. This means that players 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 α would change but the change would still not be sufficient to bring about complete certainty about the outcome of the case, that is, α ex-post would still be between zero and one. Consequently the result presented here would be preserved.

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.[9] If parties believe that a 'no litigation' clause 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 arising from the possibility of contracting away the right to renegotiate are similar to ones that are salient in this

[9]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.

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 such 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 players. If the mechanism for resolving disputes looks fairly close to a judicial process, then a court is more likely to uphold the allocations.[10] For example, arbitral awards in most jurisdictions are open to appeal only on very limited grounds. The inefficiency of arbitration however is qualitatively similar to that of a court since the technology of decision making resembles a contest in both cases. This model does not explain why parties choose arbitration or litigation but provides an explanation for why players are unable to negotiate costlessly when their outside options arise from costly games such as arbitration and litigation. As long as the outside options of both players are affected by the beliefs of player 1 about player 2's type, through for example the choice of equilibrium effort levels in the litigation or arbitration game, the inefficiency modeled here would arise.

Why don't the courts enforce waiver clauses if they enhance efficiency? Apart from obvious behavioural and public policy arguments there may also be convincing efficiency arguments for non-enforcement of waiver clauses in contracts. Anderlini et al. (2011) argue that by committing to void certain contracts the court increases ex-ante efficiency. It is possible that similar considerations induce judges to void contracts where players contract away their right to litigate. By ensuring costly settlement of disputes courts could dis-incentivise behaviour that leads to disputes arising. This model only shows that conditional on a dispute already having arisen it is efficient for courts to enforce waiver clauses.

4.2 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 players 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.

4.2.1 Intellectual Property Litigation

In this model, litigation arises due to the 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 more litigation should be observed in sectors where disputes are

[10] See *Fairness, Flexibility, and the Waiver of Remedial Rights by Contract* (1978) for a discussion on how courts treat waiver of judicial remedy.

about objects over which players are likely to have private valuation. In relation to patents this would imply more litigation in sectors where expected profits from a patent are unlikely to be publicly known.

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 section 2.1 we saw how litigation arises only when the difference between each of θ_1, θ_H, and θ_L is within the right magnitude. 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, it is possible to empirically test the relationship 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 where they have measures for the market value of the patent. Together, these data 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 the inequality in (5). This inequality is more easily satisfied when the case is biased in favour of one of the two parties, that is, the value of α is close to 0 or 1. This is because equilibrium efforts are lower when α is close to 0 or 1. This implies that litigation is more likely when α 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.

4.2.2 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, ... if they are concerned that revelation would make them militarily (and hence politically) vulnerable..."

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 player 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 (See White (1964)). 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.[11]

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 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.

These accounts indicate that both the Russians and the Japanese valued the control rights over Manchuria and Korea. Furthermore, the Russians believed that the Japanese declarations before the war were cheap talk. This example fits well with the idea that 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 players with genuinely high valuation are left with no option but to fight.

5 Conclusion

This paper has attempted to offer a solution to the puzzle of existence of conflict between rational players. Rational explanations of conflict are based on the existence of informational asymmetry between players. This informational asymmetry is preserved by restricting communication between

[11] See Nish (1985) for a rich account of the negotiations between Russia and Japan preceding the conflict.

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 asymmetry 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 paper uses the theoretical insight that requiring the ex-post participation constraints to be satisfied, can significantly reduce the set of implementable allocations. I find that this is especially the case when the outside options vary with the belief of the uninformed player about the type of her opponent. Using these two ingredients I show a new inefficiency result emerges that resembles the breakdown in negotiations leading up to litigation. I have argued that this insight crosses over to other types of costly conflict where players can quit negotiations unilaterally. In contrast to usual inefficiency results that show the impossibility of attaining the first best, the result here shows how negotiations cannot even replicate the second best outcome, the outcome of litigation, which is itself less efficient than the first best.

In further work it may 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 deter undesirable behaviour by ensuring that parties cannot efficiently negotiate themselves out of disputes once they arise.

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