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Stalling, Conflict, and Settlement

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Abstract

A widely-held assumption in the study of litigation and settlement is that if litigation is costly and settlement bargaining is costless, then in a complete-information setting, all disputes will settle with no need for litigation. This assumption is wrong. Even with complete information, perfectly rational parties may fail to settle out of court, and plaintiffs will spend resources to file suit, only for the parties thereafter to settle in court. This is because, outside of litigation, a strategy of stalling may be optimal for a defendant, and the plaintiff's only alternative is (costly) litigation. In this paper, I present a simple model demonstrating how stalling occurs, derive empirical predictions from the model, show how the model explains categories of litigation that existing models reliant on private information cannot explain (large numbers of debt-collection cases that are litigated, but no issues are contested), and discuss policy implications (including the limits of prejudgment interest as a tool to encourage settlement).

1 Introduction

Does *costless* settlement bargaining and *no* private information make out-of-court settlement more likely or less likely? If you answered, "more likely," you'd be wrong. This paper explains why. As I will show, if pre-suit settlement

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bargaining is costless, then under fairly general conditions, bargaining failure is certain. The claim that costly conflict will occur even between rational parties with complete information has broad applicability:

Imagine a legal claim raised by a potential plaintiff against a potential defendant. If the claimant were to file suit and take the case to trial, she would prevail with some probability and win a judgment. Both parties know the stakes, both know each parties' costs of litigating the claim, and both have estimates of the plaintiff's likelihood of winning. What will happen? They know what to expect from trial, and getting to trial is costly to both of them. The conventional view is that, surely, they will settle.

Next, imagine a territorial claim raised an aggressor state against another state. If the aggressor were to invade and prosecute the war to its conclusion, it would capture the disputed territory with some probability. Both states know the stakes, both know each states' costs of fighting a war, and both have estimates of the aggressor's likelihood of winning. What will happen? They know what to expect from war, and armed conflict is costly to both of them. The conventional view is that, surely, they will settle.

Each of these scenarios describes a simple model of conflict and settlement. In each, the obvious problem is that these models fail to predict trials and wars, which for better or worse are empirical regularities. The political science literature on armed conflict has called this "the puzzle of war," and likewise the law-and-economics literature on litigation and settlement has long dealt with the puzzle of trial.[1]

The intuition that settlement is inevitable in a full-information environment is elegantly captured by Rubinstein (1982), who shows that in a game where parties can alternate offers to split a surplus for an indefinite (even infinite) amount of time, the unique, subgame perfect equilibrium of the game is for the parties to settle immediately, splitting the surplus (approximately) evenly and incurring no real costs.[2] Given the generality of this result—which places no limits on the timing or number of offers or counteroffers—any effort to explain litigation or other inefficiencies in a complete-information environment might seem futile.

The seeming disconnect between these predictions and reality have led scholars to look for answers based on asymmetric information. Both of these literatures have largely turned to asymmetric information or asymmetric beliefs to explain why parties to a dispute would fail to reach a settlement and

[1]There is a meta-puzzle here, if you will, which is why these literatures are separate. It should be clear from the scenarios above that there is a single "puzzle of conflict" rather than separate puzzles of war and litigation. (Perhaps lawyers are uninterested in studying war and international relations scholars are uninterested in studying litigation.) Only recently have Levmore and Porat (2015) begun to apply a common conceptual framework to war and litigation.

[2]A 50/50 split occurs only in the limit as the parties' discount factors approach 1. If this condition does not hold, the split is only approximately 50/50.

avoid the costs of open conflict. The canonical divergent-expectations model in law and economics posits that mutual optimism of the parties may eliminate the range of mutually agreeable settlement values (see, e.g., Priest and Klein [1984]), and models on war and peace have turned to this device as well (see Slantchar and Tarar [2011]). This view, however, has been criticized for lacking foundations in rational behavior—if parties share common information and know conflict is costly, then the fact of bargaining failure should lead parties to update their beliefs about their likelihood of winning, thereby eliminating the mutual optimism problem (see, e.g., Lee and Klerman [2015]; Slantchar and Tarar [2011]).

Consequently, the mainstream approach has been to assume that asymmetric information generates conflict. In law and economics, models in which settlement offers are used by informed parties to signal private information (Reinganum and Wilde [1986]) or by uninformed parties to screen for private information (Bebchuk [1984]) are the workhorses of the theoretical study of litigation and settlement. Existing contributions that specifically study settlement delay, as I do below, also focus on private-information environments; Miceli (1999) presents a model in which settlement delay is costly to plaintiffs, and plaintiffs unobservably differ in their ability to tolerate delay. Likewise, seminal work on war emphasizes asymmetries of information as a basis for armed conflict (see, e.g., Fearon [1995]). Indeed, the view that war is impossible in a complete-information environment is summed up in the title of a famous paper, "War Is in the Error Term" (Gartzke [1999]).

As intuitive as asymmetric information is as an explanation for conflict—and it certainly explains many conflicts, both legal and military—its ability to explain many types of conflict does not survive closer inspection. As Powell (2006) noted, "while asymmetric information may explain the early phases of some conflicts, it does not provide a convincing account of prolonged conflict," because, as Fearon (2004) observed, "after a few years of war, fighters on both sides . . . typically develop accurate understandings of the other side's capabilities, tactics, and resolve." For this reason, scholars such as James Fearon (1995) and Robert Powell (2006) have developed symmetrical-information models in which bargaining failure leads to war, despite the parties' common knowledge that war makes both sides worse off.

The same pivot toward symmetrical-information models has not occurred in law and economics, although several papers (which I discuss below) make important contributions in this context. The relative inattention to this context should be surprising. While asymmetric information is undoubtedly an essential feature (perhaps *the* essential feature) of many litigation contexts, its role can be overstated; indeed, the hallmark of the Federal Rules of Civil Procedure is to create, through discovery, a symmetric-information litigation environment. And for many disputes, even at the time the case is filed, there is little private information. For example, in federal court alone, plaintiffs file thousands of cases seeking judgments to collect on defaulted debt. Neither liability nor damages is disputed, and it is hard to imagine what relevant information either side lacks.

Likewise, claims of frivolous and nuisance-value litigation abound. While the prevalence of such cases is hotly debated, there is no doubt that, to the extent such cases exist, they are driven by *common knowledge* that the plaintiff's claims do not merit a settlement, but the defendant's high litigation costs will induce a settlement regardless. Indeed, the notion that a lawsuit is "frivolous" only makes sense in a symmetric-information environment. If there is private information, then one can't know whether a lawsuit is frivolous or not.

Therein lies the puzzle: these debt collection actions and frivolous lawsuits are *lawsuits*. They weren't resolved out of court, before legal fees started piling up after the filing of a complaint. Most of these cases settle, of course, but they do so during, not before, litigation. The parties sign their peace treaty, so to speak, only after declaring war. Why?

This type of bargaining failure has been virtually unexplored in law and economics. Rather, symmetrical-information models in law and economics have mostly abstracted away from the bargaining process, instead focusing on the extent to which a negative-expected-value (NEV) claim can nonetheless induce a settlement for the plaintiff. See Rosenberg and Shavell (1985); Bebchuk (1996); Croson and Mnookin (1996); and Hubbard (2016). Consistent with the prevailing intuition about settlement in a symmetrical-information environment, in these models backwards induction leads to an efficient settlement in the first period of the game; no real resources are consumed due to delay or litigation activity.

Although most symmetric-information models of suit and settlement purport to describe the litigation process, this is only because the model imposes the assumption that a complaint is filed before anything else happens in the model. But the logic of these models predicts *settlements* but no *suits*. In a symmetrical-information environment, why would the parties wait for a filed complaint before settling, when they could settle the claim pre-complaint and save the cost of filing? Yet millions of lawsuits are filed each year. Are every one of these plagued by asymmetric information or irrational parties?

Rather than imposing *a priori* an inability to bargain pre-suit, my model explicitly models the pre-suit negotiation process and derives conditions under which claims will or will not settle pre-suit. This model shows how a simple but under-studied negotiation tactic—stalling—arises endogenously even in full information settings where the plaintiff is bringing a positive-expected value (PEV) claim.[3] Stalling—by which I mean the strategy of continuing to negotiate not with the goal of reaching a settlement but the goal of delaying

[3]The logic herein applies to NEV suits as well. But I focus on PEV claims because it is obvious why defendants might refuse to settle NEV claims, which by definition are claims such that the cost of going to trial exceeds plaintiff's expected judgment at trial.

action by one's adversary—is a fundamental cause of bargaining failure, even in a complete-information environment with perfectly rational actors. My model explains why parties in a symmetric-information context would ever resort to litigation (which is costly) rather than settle without a suit even being filed. Contrary to intuition, the existence of a symmetric-information (or even full-information) environment does not guarantee pre-suit settlement. Instead, the costly and inefficient filing of suit is the equilibrium outcome in this model for a wide range of realistic parameter values.

This model also provides a theoretical foundation for simpler models of settlement used in many contexts, such as the single, take-it-or-leave-it settlement offer limited by an exogenous bargaining-power parameter. See, e.g., Hubbard (2016). And the fact that in many circumstances pre-suit settlement is impossible means that models that simply ignore the possibility of pre-suit settlement may not be so unrealistic after all. Further, I show that under conditions relevant to the modeling of litigation (i.e., finite-time bargaining with many opportunities for settlement), models with discounting of the future but without bargaining costs (such as the Rubinstein (1982) model), and models with no discounting but with bargaining costs (such as Bebchuk (1996)) are outcome-equivalent. Indeed, many important works on bargaining with repeated offers and counteroffers, including Rubinstein (1982), Binmore, Shaked, and Sutton (1989), Bebchuk (1996), and Schwartz and Wickelgren (2009) nest as special cases of the general model I describe herein.

I have found three papers that focus on settlement bargaining in complete information contexts in litigation. The results in this paper build upon and generalize these papers. Spier (1992) was the first to note the stalling phenomenon in the complete-information context. Further, Spier (1992) is one of the few papers to recognize that litigation is the outside option to pre-suit bargaining and formally model this relationship, although her paper was focused on the incomplete-information setting and addressed the complete-information setting only briefly. Thus, few results emerged.

Schwartz and Wickelgren (2009) showed that even in a full-information environment, an optimal strategy of delay can prevent settlement. Schwartz and Wickelgren (2009) argue that NEV claims can never generate nuisance settlements for plaintiffs. In their model, an indefinite number of offers and counter-offers can be made costlessly during litigation. Because of this, they argue, the plaintiff will not be able to extract a settlement during litigation large enough to make the initial threat to sue credible. This result challenges the claim that nuisance litigation *exists at all*, let alone is a serious problem. While this model is internally valid, it has difficulty gaining traction as a model of *litigation* rather than a model of *negotiation*; it models costly litigation activity as the plaintiff's *outside option*, but this is only true before a suit is filed. Once litigation is filed, the parties incur litigation costs regardless of the progress of negotiations, and the true "outside option" for the plaintiff is dropping the suit. For this reason, my model incorporates Schwartz and Wickelgren (2009) as a model of pre-suit negotiation, rather than as a model of litigation.

The third paper is Anderlini, Felli, and Immordino (2017), which reaches a similar conclusion—settlement failure is possible even in a complete-information context—but via a different path. Anderlini, Felli, and Immordino (2017) show that if bargaining costs for the parties are sufficiently high, and the distribution of costs between the parties does not correspond to their bargaining power in dividing the surplus from settlement, then they will not reach a settlement, and the plaintiff will file a lawsuit. Nonetheless, our models are complementary, in that my model nests their results by endogenizes bargaining power and allowing pre-suit bargaining to be costless.

The remainder of this paper proceeds as follows: In Section 2, I describe the core components of a model game that captures the key elements of bargaining in the shadow of conflict. I show how the model maps cleanly onto litigation (and conflict settings more generally), at least where complete information is a useful approximation of reality. In Section 3, I present results. I show how a simple, flexible model of multi-stage bargaining in and out of litigation can generate distinct and novel predictions that jibe with our intuitions about real-world litigation.

In Section 4, I present two settings where this model might have particular descriptive or prescriptive bite. First, I note that routine debt-collection actions are a sizable portion of courts' dockets, even though such disputes often involve little or no private information. Stalling, however, easily explains why such cases, which otherwise seem like obvious candidates for out-of-court settlement, end up being litigated. Using data from two very different court systems—courts of Taiwan and the US federal courts—I show how empirical patterns in these two jurisdictions are consistent with the predictions of my model. Second, I note an important legal mechanism for discouraging stalling: prejudgment interest. By ensuring that the present value of plaintiff's claim cannot be diminished by stalling, prejudgment interest is a potentially powerful tool for reducing stalling. I survey the wide variation in state law on prejudgment interest in the US, noting ways in which this variation could facilitate empirical testing of the model and ways in which the model may counsel for changing the rules governing prejudgment interest as a remedy. Section 5 concludes.

2 The Model

2.1 Formal Model

The model is a bargaining game with two parts, Stage 1 (in the litigation context, pre-suit) and Stage 2 (post-filing), and two parties, P (i.e., plaintiff) and D (i.e., defendant). In each stage, the parties exchange settlement offers and counteroffers. If at any time a party accepts the other party's offer, the game ends and the parties' payoffs are determined by the terms of the settlement. The first stage of the game may be indefinite in duration or have a finite duration; the second stage has finite duration.

In each stage there is an inside option and an outside option. An outside option is an option that the option-holder can exercise at any time in lieu of making an offer or counteroffer.[4] An inside option is an option that triggers when the parties neither reach a settlement nor exercise an outside option before the end of the stage.

In Stage 1, the inside option results in the end of the game and no transfers. Each party keeps its initial endowments. The outside option is held by P. The outside option is to end Stage 1 and begin Stage 2. Exercising this option may be costly: P must pay a fee of $F \geq 0$ when exercising the option. In Stage 1, bargaining may entail some cost to each party or may be costless. The payoffs from P's outside option will be endogenously determined, based on the equilibrium strategies in Stage 2. Call the equilibrium payment from D to P in the Stage 2 subgame W. Then the payoff to P from exercising the outside option is $W - F$, and the payoff to D is $-W$.

If P exercises her outside option, Stage 2 of the game begins. In Stage 2, the inside option is an event (i.e., trial) that results in an expected transfer of πJ from D to P. The outside option is held by D. The outside option is for D to transfer J to P, at which point the game ends. (Think of this a paying a default judgment to the plaintiff for the full value, J, of her claim.)[5]

In each stage, the players alternate moving first each turn. To be more precise, divide each stage j (for $j \in \{1, 2\}$) into $N_j + 1$ turns, numbered 0 through N_j. Throughout, the parties may (or may not) discount future payoffs. Player i has a per-turn discount factor $\delta_i \in [0, 1]$, or equivalently a per-turn discount rate β_i such that $\delta_i = 1 - \beta_i$.

[4]Note that for simplicity of notation, I assume that a plaintiff indifferent between exercising an outside option and not exercising it will not. I assume that a party indifferent between settling and not settling will settle. These assumptions dealing with knife-edge conditions allow me to define equilibrium conditions precisely (with equalities rather than inequalities), but otherwise do not affect the analysis.

[5]It is not relevant in the complete-information context, but in the incomplete information context it is worth noting that the plaintiff in litigation has an outside option as well, which is to drop the suit. This option is valuable if discovery reveals that the claim has negative settlement value. See Cornell (1992) and Grundfest and Huang (2006).

In Stage 1, P moves first. In Stage 2, D moves first.[6] P makes a settlement offer, or, in Stage 1, exercises her outside option (e.g., files suit). The offer to settle made in turn n is labeled S_n and proposes a payment from D to P of S_n. If P makes an offer, then D may accept or reject it. If the offer is accepted, the game ends and D pays S_n to P. If the offer is rejected, the next turn begins and the parties switch roles; D makes an offer, which P will either accept or reject, or, in Stage 2, D exercises his outside option (i.e., accepts a default judgment). The exception is that if the offer in the final turn (turn N_j) is rejected, the game ends and the parties receive payoffs given by the inside option for the relevant stage of the game. Players have an equal number of opportunities to make an offer; thus, $N_j + 1$ is even.[7]

In each stage, there is some cost to continuing to negotiate. In the first stage, this bargaining cost is $b_{ni} \geq 0$ for turn n and party i. If the parties have neither settled nor triggered an outside option at the end of turn n, each party i pays the cost b_{ni} for continuing to bargaining in the next turn. For simplicity, the results below assume constant per-turn bargaining costs, such that costs for party i are $b_{ni} = b_i$ for all $n \in \{0, \ldots, N_1\}$.

In the second stage, costs are strictly positive because the parties bear the ongoing costs of litigation.[8] In the second stage, per-turn litigation costs are c_{ni} for turn n and party i. The total *remaining* cost to party i as of turn n is

$$C_{ni} = \sum_{k=n}^{N_2} \delta^{k-n} c_{ki} \tag{1}$$

Thus, the total cost of litigating through to trial (i.e., Stage 2 ends with the inside option triggering) for party i is $C_i \equiv C_{0i}$. Thus, the cost parameters of this model can be made comparable to litigation costs in other models by noting that total litigation costs are $C \equiv C_p + C_d$, and C represents the maximum surplus from settlement during litigation. For simplicity, except where otherwise noted, the results below assume constant per-turn litigation costs, such that costs for party i are $c_{ni} = c_i$ for all $n \in \{0, \ldots, N_2\}$.

A comparison of the parties' inside and outside options in the two stages of the game appears in Table 1. A simplified representations of the game tree appears in Figure 2. I note here that although the model has been tailored to

[6] This is to ensure that the player with the outside option can exercise it right away. The stalling dynamic, however, does not depend on who moves first.

[7] The structure of this sub-game reflects the logic of Schwartz and Wickelgren (2009). They argue that a plaintiff who has made a settlement demand cannot decide whether or not to invoke her outside option until she hears defendant's response, and in real life, defendant's response need not be limited to "I accept" or "I reject"; instead, the defendant's response could be a counteroffer. For this reason, I employ a version of an alternating offer game is one in which the plaintiff can only invoke the outside option in *every other* period—only after the periods in which the defendant has the right to make a settlement proposal.

[8] Otherwise, however, there is no restriction on the relationship between b_i and c_i in the model.

the litigation context (which is isomorphic with some other conflict settings, as I note below), it is easy to generalize this model to a game in which both parties have outside options in both stages, and payoffs from inside and outside options can take any values. Such a generalized version of the model would allow one to represent any bargaining environment with repeated offers and counteroffers in the presence of inside and outside options. The goal here, however, is to show how a fairly basic model can unify distinct models used in the law and economics literature and generate new results and predictions on bargaining outcomes and bargaining behavior in the specific context of litigation.

2.2 The Game as Litigation

This structure has a natural interpretation in the context of litigation. The first stage of the game is the pre-litigation environment. The (potential) plaintiff P and (potential) defendant D have a finite amount of time ($N_1 + 1$ turns) in which to reach a settlement before the statute of limitation period for plaintiff's claim expires. During this time, the parties may settle, or plaintiff may exercise her outside option, which is to initiate a lawsuit by filing a civil action (which entails costs F associated with initiating suit and filing a complaint). If neither of these outcomes occurs before the expiration of the limitations period, plaintiff's claim is extinguished, and the game ends.

The filing of the complaint triggers the second stage of the game. During this stage, the parties continue to bargain, but bargaining is more costly because litigation costs accrue as long as bargaining continues. At any time, the defendant can exercise her outside option, which is to default and pay the plaintiff the entire judgment demand J. If neither settlement nor default occurs, the inside option of trial occurs. With some probability π, plaintiff wins and the defendant pays the judgment demand. Thus, the parties know that the expected judgment at trial is πJ.

2.3 The Game as International Conflict

Although the discussion throughout this paper focuses on the setting of litigation and settlement, the structure of the model also has a natural interpretation in the context of international conflict. The first stage of the game is the period without open war. The powerful aggressor state P and the defending state D have a period of time in which to settle ($N_1 + 1$ turns). During this period, the parties may reach a settlement, or the aggressor state may exercise its outside option, which is to invade. An invasion requires costly mobilization efforts (F) by the aggressor. If neither of these outcomes occurs, the inside option (if the game has a finite duration) is for the game to end without conflict.

The invasion triggers the second stage of the game. During this stage, the parties continue to bargain, but bargaining is more costly because costs of armed conflict accrue as long as the war continues. At any time, the defender can exercise its outside option, which is to capitulate and transfer to the aggressor its entire territorial claim (J). If neither settlement nor capitulation occurs, the inside option of a military victory occurs. With some probability (π), the aggressor wins the war and the defender cedes the territorial claim.

2.4 Key Features of the Model

This model captures key elements of the process of bargaining in the shadow of conflict and incorporates fundamental concepts of multi-period games, including alternating offers, outside options, and inside options. Combining these characteristics allows me to capture several real-world features of bargaining in the shadow conflict:

First, the model allows for parties to exchange offers. Each party in the model has an opportunity to make a settlement offer, and the other party has the opportunity to accept the offer or reject it and make a counteroffer. The number of opportunities to make and respond to offers may not be unlimited, but this model allows for many—possibly indefinitely many—settlement offers. The mechanics of offer and counteroffer in the game above are identical to the canonical alternating-offer game in Rubinstein (1982), in which parties negotiate to split a bargaining surplus between them.

Second, settlement negotiation may occur inside or outside of litigation. The model's structure is sufficiently flexible to account for key differences in the two settings.

Third, each party is free to exercise whatever alternatives to negotiation are available. In other words, the model must account for *outside options*, or what is often referred to in the negotiation literature as each party's BATNA (best alternative to negotiated agreement). In the pre-suit setting, the defendant has no meaningful outside option, but the plaintiff has one: initiating litigation (although filing suit may itself be costly).[9] Indeed, it is the threat to invoke this outside option that often frames real-life attempts at pre-suit settlement.

In the post-filing context, the parties' roles are flipped. The plaintiff has no meaningful outside option (other than abandoning the suit, which is equivalent to accepting a settlement offer of zero), but the defendant has one: paying a default judgment. This may be preferable to settlement in contexts where litigation costs affect settlement values; see Hubbard (2016) for a discussion and formal treatment of this phenomenon.

[9]It may be possible to treat capitulation—paying the entire J to P—as D's outside option in Stage 1, but note that outside of litigation, D has no way to force P accept. Thus, while a pre-suit settlement for the full J is possible, there is no outside option for D in this context.

Fourth, bargaining failure triggers inside options distinct from the parties' outside options. As Schwartz and Wickelgren (2009) point out, one can distinguish between outside options, which parties invoke instead of negotiating, and inside options, which trigger when parties negotiate but fail to settle. In the pre-suit negotiation context, if the parties neither settle nor invoke an outside option, the result (upon the expiration of the statute of limitations) is an effective settlement of zero. In the post-filing context, however, the inside option is trial.[10]

Identifying real-world inside and outside options as such is doubly revealing. First, as shown above, it lays bare the identical basic structure of litigation and war as a two-stage bargaining game with virtually identical patterns of inside and outside options. Second, inside and outside options affect bargaining very differently. Neither the literature on war and peace nor the literature on litigation and settlement has recognized that in the first stage of the game, conflict is the *outside* option, but in the second stage of the game, conflict is the *inside* option. This difference is subtle—but it is why stalling can prevent settlement in the pre-suit context but not in the post-filing context.

Finally, and crucially, negotiations may be protracted but cannot go on forever. Pre-suit negotiations, for example, must lead to settlement or a lawsuit before the statute of limitations period for the plaintiff's claim expires. Post-filing negotiations are bounded by deadlines for dispositive motions or trial (although of course such deadlines are, in practice, themselves movable based on the progress of negotiations).

Here, the model offers a novel approach that allows me to capture both the extensive back-and-forth of bargaining and the time-constrained nature of "bargaining on the courthouse steps" in a simple way, something that existing approaches do not do. Existing approaches present a dilemma. On the one hand, it seems natural to employ a bargaining model that allows an arbitrarily large number of offers and counteroffers. Elegant limiting results (as the number of turns goes to infinity), such as the equilibrium division of surplus in Rubinstein (1982), are well established.

On the other hand, these limiting cases imply that the parties have infinite time during which to bargain, which is clearly unrealistic. *Jarndyce v.*

[10]Inside and outside options are absent from the basic Rubinstein model, but of course in reality they set the parameters for bargaining. (See Binmore, Shaked, and Sutton (1989) for an application of the Rubinstein model to a context where an outside option was available to a party.) Models of war and litigation abound with inside and outside options, although they are rarely labeled as such. Exceptions include Schwartz and Wickelgren (2009), who introduce the formal distinction between inside and outside options to the study of litigation and settlement, and Cornell (1992) and Grundfest and Huang (2006), who note that for the plaintiff in litigation, the ability to drop the suit is a valuable outside option. (For simplicity, my model ignores the plaintiff's outside option during litigation, given that under complete information this option is never exercised. But in a richer model with incomplete information, the existence of this option affects the settlement value of the plaintiff's claim. See Cornell (1992) and Grundfest and Huang (2006) for discussion.)

Jarndyce[11] aside, most legal disputes must end in finite time; an unfiled legal claim expires when the statute of limitation period runs, while a filed lawsuit is subject to all manner of deadlines. Further, infinite time to negotiate implies that inside options are worthless, since their present discounted value is zero. This is a serious problem, given that the parties' inside option in litigation is trial! In short, understanding bargaining outcomes—and bargaining failure—in realistic settings requires a more realistic time horizon for bargaining.

To escape this dilemma, I offer a small but consequential innovation in my modeling. As the length of the game in *turns* goes to infinity, I hold the length of the game in *time* constant, so that even with an infinite number of turns, the game ends in finite time. The formal move is to hold the present value of payoffs in the final turn of a stage fixed (i.e., $\delta_i^{N_j}$) fixed as N_j goes to infinity.

Note that holding $\delta_i^{N_j}$ constant ensures that the model captures the fact that future payoffs may be discounted, even though δ_i goes to 1 as $N_j \to \infty$. Further, note that even as $\delta_i \to 1$, it remains the case that one party's discount rate β_i may be much higher, relatively speaking, than the other party's. To allow for this possibility even as $\delta_i \to 1$ for each party, I define $\alpha \equiv \frac{\beta_d}{\beta_p + \beta_d}$, which is the relative "impatience" of D compared to P.

My next move here is to recognize that as N goes to infinity, the game can be represented in continuous, rather than discrete, time. The discrete-time discount factor δ corresponds to the continuous time discount rate ρ, such that $\rho = -\ln(\delta)$. We can thus define T to be the maximum time in *years* for bargaining, and thus ρ_i is the per-year discount rate for party i. For example, if a lawsuit will last T years until trial, then the present value of the inside option of trial for the plaintiff is $e^{-\rho_p T}\pi J$. Note that this also requires that total costs be expressed as a continuous function of time: rather than a per-turn litigation cost function of c_i, we define costs as a function of time $c_i(t)$ such that total litigation costs do not change as the number of turns goes to infinity, and likewise for Stage 1 bargaining costs.[12]

This move to continuous time yields several benefits: (1) it allows arbitrarily many bargaining periods while ensuring that parameters of the model (time in years T; annual discount rate ρ) are expressed in quantities that, as a practical matter, can be empirically measured; (2) it simplifies the characterization of results; and (3) it permits solving for interior solutions for the timing of the exercise of outside options in the midst of Stage 1 or Stage 2 (which arises in equilibrium when bargaining or litigation costs vary over time for the parties).

* * *

[11] Charles Dickens, *Bleak House* (1853).

[12] Thus, we have $c_i(t)$ such that $\int_0^T e^{-\rho_i t} c_i(t) dt = C_i$, with changes for b_i *mutatis mutandis*.

In sum, this paper advances our understanding of dispute resolution through its attention to so many features of bargaining. The model is able to capture so many aspects of bargaining in a simple way by means of a small but useful methodological innovation: allowing the number of offers and counteroffers to approach infinity in finite time. As I show below, this identifies important sources of bargaining failure even in the complete-information context and generates empirical predictions that help explain otherwise unexpected patterns in court data.

3 Results

The intuitions for the solutions to the model are simple, while the formal proofs are tedious, so I present intuitions here and relegate proofs to the Appendix. The solution concept is subgame perfect sequential equilibrium, and the game is solved by backwards induction. As noted in Binmore, Shaked, and Sutton (1989), a key result in alternating-offer games is that outside options do not affect equilibrium settlements unless the option-holder prefers the outside option to the equilibrium that would exist in the absence of the option. Thus, our first step is to examine post-filing (Stage 2) settlement negotiations in the absence of an outside option.

Our first result is that if we ignore Stage 1 and the outside option of default by D, the model replicates standard results in the bargaining literature.

Proposition 1: Equilibrium with inside option and no outside option, as the number of bargaining opportunities goes to infinity in finite time. Let $W_i = (0, 0)$ for $i \in \{p, d\}$; i.e., ignore outside options. Let the number of turns N go to infinity, but hold constant the amount of time that elapses between turn 0 and turn N. (To do this, define $\delta \equiv \frac{\delta_p+\delta_d}{2}$ and hold δ^N constant.) The unique subgame perfect equilibrium is that P offers and D accepts settlement S_0 in turn 0, such that:

$$S_0 = \frac{1}{2}\int_0^T e^{-\rho t}(c_d(t) - c_p(t))dt + e^{-\rho T}\pi J \tag{2}$$

where $\rho \equiv \frac{\rho_p+\rho_d}{2}$.

If $\rho = \rho_p = \rho_d$, The unique subgame perfect equilibrium is that P offers and D accepts S_0 such that:

$$S_0 = \frac{1}{2}(C_d - C_p) + e^{-\rho T}\pi J \tag{3}$$

Remark. Here we see the expected result: the parties split the surplus, and party D transfers the present value of P's inside option to P.[13]

Corollary 1.1: Shares of surplus when parties' discount rates differ. If the parties' discount rates differ, the split of the surplus favors the more patient party. Plaintiff's share σ_p of the surplus can be expressed as

$$\sigma_p = \left(\frac{\rho_d}{\rho_p + \rho_d}\right)\left(1 + \frac{\rho_p(c_d e^{\frac{-\rho_d T}{2}} + c_p e^{\frac{-\rho_p T}{2}})(e^{\frac{-\rho_d T}{2}} - e^{\frac{-\rho_p T}{2}})}{c_p\rho_p(1 - e^{\frac{-\rho_p T}{2}}) + c_d\rho_p(1 - e^{\frac{-\rho_d T}{2}})}\right) \tag{4}$$

How does this result in continuous but finite time relate to the limiting case in discrete but infinite time for a fixed surplus, as in Rubinstein (1982)? The limit as $T \to \infty$ is

$$\sigma_p = \frac{\rho_d}{\rho_p + \rho_d} \approx \alpha \tag{5}$$

which is the limiting result for surplus shares in Rubinstein (1982).

The limit as $T \to 0$ is

$$\lim_{T \to 0} \sigma_p = \frac{1}{2} \tag{6}$$

which is the result for games, such as Bebchuk (1996), where the parties alternate making offers and there is no time discounting. The general case of positive discount rates and finite time, therefore, nests these existing results as limiting cases.

Remark. One can interpret α to be the equilibrium or "observed" bargaining power of Player P. Although the alternating offer game in some sense gives equal bargaining power to each player—each player has an equal number of opportunities to make offers—the relative impatience of the parties has the effect of endongenously determining what can be interpreted as the relative bargaining power of the parties.

* * *

Given this outcome, we can now consider the impact of an outside option of default by defendant.

Proposition 2: Optimal Timing of Default. In Stage 2, default will occur immediately or not at all. Cases without default will settle immediately. The value of the settlement will depend on whether default after period 0, but before trial, would have been optimal for D in the absence of settlement.

Remark. In the absence of settlement, the optimal timing of default is not obvious. Earlier default saves litigation costs, but if $\rho > 0$, later default

[13]Proof of Proposition 1 is omitted. The primary proof is by induction and is tedious and unilluminating. Elegant proofs for infinite-horizon games that nest in this framework for $N \to \infty$ appear in Rubinstein (1982) and Binmore, Shaked, and Sutton (1989). The result in Proposition 1 is identical to Conclusion 2 in Rubinstein (1982), with the exception that it allows for the inside option.

reduces the present value of the judgment that must be paid; in principle, the judgment could be so large that delay is ideal.

* * *

The post-filing subgame looks very much like familiar models of settlement. The parties avoid litigation costs and settle at the earliest opportunity. The pre-suit portion of the game (Stage 1), while very similar in structure, has entirely different equilibrium behavior. This is because litigation and trial are no longer the inside option, but the outside option.

Proposition 3: Pre-Suit No-Settlement Conditions. Assume that the outside option is sufficiently valuable to the plaintiff that the plaintiff is willing to invoke it if bargaining fails. There will be no settlement in Stage 1, and plaintiff will immediately file suit without attempting to settle, if

$$(1-\delta_p\delta_d)(W-F)+\delta_d b_{1p}-b_{0d}>0 \tag{7}$$

For $N_1 \to \infty$, taking limits and using continuous time, the condition for pre-suit bargaining failure becomes

$$\rho(W-F)+\left(\frac{1}{2}\right)b_p>\left(\frac{1}{2}\right)b_d \tag{8}$$

The left side of Expression (8) represents the cost to P (and the benefit to D) of delay, in terms of diminished present value of the outside option, plus P's cost of continuing to negotiate. (Note that the bargaining cost is halved because settlement means that the parties split their cost savings.) The right side of Expression (8) represents the benefit to P (and the cost to D) of delay, in terms of D's cost of continuing to negotiate.

Expressed as a relationship between the discount rate ρ and the relative bargaining costs of the parties, this condition is

$$\rho>\left(\frac{1}{2}\right)\frac{b_d-b_p}{W-F} \tag{9}$$

The relationship between ρ, $\frac{b_d-b_p}{W-F}$, and bargaining failure is illustrated in Figure 3.

Remark. This model generates several clear, empirical predictions.The first and most fundamental prediction of this model is that filed lawsuits will arise even in disputes between rational parties in an environment of complete information. In other words, war is *not* always in the "error term." In addition, we can draw from Expression (8) the following predictions:

- *Bargaining Costs.* If the parties' costs of continuing to bargain are symmetrical ($b_p(t)=b_d(t)$), and discount rates are positive, settlement never occurs in Stage 1. P files suit immediately. In pratice, if there are no penalties (reputational or otherwise) to stalling, such that the bargaining costs of defendants do not exceed the bargaining costs of plaintiffs, then settlements should occur in the context of filed litigation only. A lack of reputational penalties to stalling is likely to exist in "one-shot" interactions between parties. Conversely, the presence of reputational and repeat-play factors should predict pre-filing settlement.

- *Discount rates and settlement value.* Because ρ and W are sources of the benefit from stalling, as ρ or W rise, the equilibrium may shift from pre-suit settlement to stalling. Thus, high-expected-settlement-value claims and high discount rates should be associated with immediate filing rather than pre-suit settlement. If, say, liquidity constrained parties have higher effective discount rates, then liquidity constraints would (counterintuitively) predict litigation.

- *Filing Costs.* Note that although the presence of F, which means that there is surplus from settling pre-suit, does not prevent bargaining failure from precipitating suit even in an environment of complete information, the value of F is not irrelevant to the model. A higher F makes it more likely that the parties will reach a settlement in Stage 1. Thus, higher filing fees have a double effect on litigation rates: first, the effect of discouraging plaintiff with low-settlement value claims from asserting those claims at all, and second, the effect of shifting settlements from litigation to pre-litigation. Nonetheless, a rise in F means that pre-suit settlements have lower payoffs for plaintiffs than they would have received in litigation with a lower F.

Corollary 3.1: Bargaining Failure when Bargaining Is Costless. Assume that negotiation costs are zero and the parties discount the future ($b_i = 0$ and $\delta_i < 1$ for $i \in \{p, d\}$). In this game, the surplus from settlement in Stage 1 is the savings from plaintiff avoiding the fee F for filing suit. Nonetheless, the subgame perfect equilibrium is for plaintiff to exercise the outside option immediately at a cost of F, at which point D pays W to P.

Remark. The intuition that costless bargaining necessarily facilitates settlement is wrong. If bargaining is costless, then delay cannot hurt the defendant, and if the parties discount the future, delay reduces the value of the plaintiff's outside option. If plaintiff were to offer to accept $S_0^{pre-suit} = W - F$ as a settlement rather than filing suit immediately, the defendant would be strictly better off refusing settlement, and then in turn 1 counteroffering $S_1^{pre-suit} = \delta(W - F)$, which is the present value of plaintiff invoking her outside option in turn 2. Given that plaintiff can do no better than this, she will accept. But this, of course, is worse than if she simply exercised her outside option in turn 0. For this reason, pre-suit settlement is impossible.

4 Applications

4.1 Debt Collection

Stalling may explain an otherwise puzzling pattern in court data. A substantial share of courts' civil dockets is composed of debt collection actions. Many debt collection actions involve situations where there is a debt of (usually) undisputed amount that the debtor has failed to pay. Thus, these cases are good candidates for a category of litigation involving little private information. To be sure, many contract actions may involve information asymmetries for which litigation and discovery are a predictable outcome. But this possibility is undermined by the fact that for some categories of debt collection cases, rates of default judgment are sky-high—and recall that default judgment is a final judgment in favor of the plaintiff that the court enters when the defendant fails to respond to the complaint or otherwise defend the case *at all*.[14]

This pattern appears in US federal court data on cases brought by the US government to collect defaulted student loans and to recover overpayments of government benefits—two categories of cases that are separately designated in administrative data provided by the Administrative Office of the US Courts. (See Hubbard [2017] for details on this data set.) Among these cases, thousands of which are filed per year, 48% end in a default judgment (compared to 3% of other cases). To reiterate, *half* of all filed cases in these categories end with the defendant contesting neither liability nor damages. Why didn't they simply settle out of court?

Nor is this phenomenon unique to the US. For example, administrative data from the courts of Taiwan (described in detail in Chang and Hubbard [2018]) replicates this pattern: loan contract and debt payment dispute categories comprise a surprisingly large set of cases and have extremely high rates of default judgments (about 41% of all actions end in default judgment, four times the rate for other actions). See Figure 4. Thus, it is unlikely that particular features of US law or legal practice explain what we see in the US data.

These facts don't fit existing explanations. If these disputes are becoming filed lawsuits, it is not because they are "close" cases, as we might expect from divergent expectations models, or because discovery is necessary for revealing private information. The juxtaposition of routine litigation *and* routine default means that debt collection cases provide a context where the usual explanations for settlement failure in US litigation don't apply.

But the logic of the model above explains this pattern easily. In a case where a debt is owed and it's undisputed—*especially* when it's disputed—the defendant can benefit from delay: the outcome is certain to be unfavorable,

[14] See, e.g., Federal Rule of Civil Procedure 55.

and anything that delays the inevitable allows the defendant to retain use of whatever assets are in jeopardy of being used to satisfy the debt. Attempts by the plaintiff to negotiate an out-of-court settlement simply play into the defendant's strategy of delay. So the plaintiff must sue and expend real resources. Once haled into court, the defendant not longer benefits from delay; answering the complaint and responding to discovery or a motion for summary judgment is costly. And since the facts are undisputed, default is cheaper even than settlement (and may buy the defendant a few more months time).

4.2 Prejudgment Interest

Prejudgment interest is a potential component of a damages award that compensates the plaintiff for the loss of the time value of money due to the delay between the plaintiff's injury and the award of damages. If it works perfectly to compensate the plaintiff in this way, it should eliminate any discounting of the expected trial award πJ by the parties.[15] This poses the question: Doesn't the existence of prejudgment interest render concerns about stalling moot?

The answer is a resounding "sometimes." This is a function of both legal doctrine and the implications of the model above.

As a matter of doctrine, rules governing the award of prejudgment interest vary dramatically from jurisdiction to jurisdiction, with only certain categories of cases, involving certain circumstances, brought under the law of certain states, being subject to fully compensatory prejudgment interest. In some states, not all categories of claims are eligible for prejudgment interest. For example, in Illinois, only breach of contract claims involving liquidated damages are entitled to prejudgment interest. And in some states, prejudgment interest does not accrue during periods in which stalling might occur. For example, in California, prejudgment interest for unliquidated damages in contract actions accrues only *after* suit is filed.[16]

Thus, we might expect that pre-suit settlement is less likely in disputes governed by law that either does not provide for prejudgment interest or does not provide for prejudgment interest during the pre-suit stage. As a prescriptive matter, if we deem pre-suit settlement desirable (and we might not), one tool for promoting it is to apply prejudgment interest to the entire pre-suit period.

But an important implication of the model is that even if prejudgment interest perfectly counteracts parties' discounting of a future judgment, pre-

[15] It should also eliminate the possibility of the defendant strategically delaying default during litigation. If prejudgment interest perfectly preserves the present value of the judgment, default occurs immediately or never.

[16] For discussion, see *Business & Commercial Litigation in the Federal Courts* §§44:31, 50:50 (3d ed.). For a 50-state survey, see *Post Judgment Interest / Prejudgment Interest / Punitive Damages / United States and Canada 2010* (Munich Re 2010).

judgment interest may not eliminate bargaining failure due to stalling. This is because the settlement value of a filed action (W) is not solely a function of the expected judgment when the parties' litigation costs are asymmetrical. Prejudgment interest eliminates discounting of the expected judgment but not litigation costs. If we take this into account and substitute Expression (3) into Expression (8), we obtain the following condition for bargaining failure:

$$\rho > \frac{b_d - b_p}{C_d - C_p} \tag{10}$$

Take a plausible scenario, where bargaining costs are equal ($b_d = b_p$)but litigation cost asymmetries favor the plaintiff ($C_d > C_p$). Under these conditions, even with prejudgment interest, the plaintiff will file suit in equilibrium. Thus, even perfectly compensatory prejudgment interest cannot eliminate the effect that a stalling strategy has on pre-suit bargaining failure.

5 Conclusion

There is a crucial difference between the plaintiff P and the defendant D in litigation: when a settlement or trial occurs, it is D who pays, and P who receives. This means that, if the parties discount the future, then all else equal, D benefits from delay and P suffers. It is only the presence of continuation costs that creates a tradeoff for D: the benefit from delaying payment against the costs from continuing to negotiate.

This asymmetry between plaintiffs and defendants means that the existence of an outside option affects settlement differently depending on who holds the option. In Stage 1, bargaining failure may occur even though it imposes real costs on the parties: plaintiff incurs the cost F of filing suit, even though both parties would prefer to split the surplus from saving F. The reason that they may not is that if the plaintiff attempts to bargain to a settlement, defendant gains by stalling if the benefits of delay exceed the costs of continued bargaining. Settlement, in other words, is not subgame perfect, even though it is first-best.

In Stage 2, the presence of the option to default does not lead to bargaining failure, except in the uninteresting sense that D may default immediately, rather than settle immediately. If D does not benefit from defaulting, the parties settle immediately for an amount that reflects the present value of the inside option and splits saved litigation costs. If D benefits from defaulting, but does not benefit from delay, he will default right away. And if D benefits from delaying exercise of his outside option, he will do so in the absence of settlement; but knowing this, the parties will settle immediately for an amount that reflects the present value of D's future default.

This paper's analysis of the stalling phenomenon is not purely academic.

The model predicts that for wide ranges of realistic parameter values (for example, for every case with equal pre-suit bargaining costs for P and D), bargaining failure and immediate and costly filing of litigation is the equilibrium outcome. The model explains the prevalence of categories of litigation, such as uncontested debt collection actions, that cannot be explained by prevailing models of suit and settlement. In this way, it prompts us to reconsider the possible tools for encouraging the more efficient settlement of cases out of court.

A Proofs and Additional Results

Corollary 1.2: Shares of surplus when parties' discount rates differ. Given that total surplus from settlement is

$$C_p + C_d = \int_0^T e^{-\rho_p t} c_p(t)dt + \int_0^T e^{-\rho_d t} c_d(t)dt \tag{11}$$

we have that the plaintiff's share of the total surplus is

$$\sigma_p = \frac{\frac{1}{2}\int_0^T e^{-\rho t}(c_d(t) - c_p(t))dt + \int_0^T e^{-\rho_p t} c_p(t)dt}{\int_0^T e^{-\rho_p t} c_p(t)dt + \int_0^T e^{-\rho_d t} c_d(t)dt} \tag{12}$$

If costs arise at a fixed rate, such that $c_p(t) = c_p$ and $c_d(t) = c_d$, then plaintiff's share of the surplus can be expressed as

$$\sigma_p = \left(\frac{\rho_d}{\rho_p + \rho_d}\right)\left(1 + \frac{\rho_p(c_d e^{\frac{-\rho_d T}{2}} + c_p e^{\frac{-\rho_p T}{2}})(e^{\frac{-\rho_d T}{2}} - e^{\frac{-\rho_p T}{2}})}{c_p\rho_p(1 - e^{\frac{-\rho_p T}{2}}) + c_d\rho_p(1 - e^{\frac{-\rho_d T}{2}})}\right) \tag{13}$$

The remainder of the corollary follows from Expression (13), with the aid of L'Hospital's rule to calculate the limit as $T \to 0$.

Proposition 2: Proof. The present-value payoffs when a defendant who defaults on turn n are $(\delta^n J - (C_p - \delta^n C_{np}), -\delta^n J - (C_d - \delta^n C_{nd}))$.

In continuous time, which is suitable as the number of turns goes to infinity, the defendant's payoff from default at time n is

$$V_d(n) = -e^{-\rho n} J + \int_n^T e^{-\rho t} c_d(t)dt \tag{14}$$

The first-order condition for the optimal time to default is

$$\rho J = c_d(n^*) \tag{15}$$

The second-order condition for the optimal time to default is

$$c_d'(n^*) > 0 \tag{16}$$

When the first-order condition, and its corresponding second-order condition, are satisfied, then n^* is the optimal time to default so long as

$$V_d(n^*) > S_{n^*} = \frac{1}{2}\int_{n^*}^{T} e^{-\rho t}(c_d(t) - c_p(t))dt + e^{-\rho T}\pi J \tag{17}$$

where S_{N^*} is the equilibrium settlement in the subgame without outside options beginning in turn n^*. In other words, default at n^* must be preferable to what would otherwise be the equilibrium settlement at n^*. Given the prospect of a future default, the parties will settle at time 0 for

$$S_0^{def} = \frac{1}{2}\int_{0}^{n^*} e^{-\rho t}(c_d(t) - c_p(t))dt + e^{-\rho n^*} J \tag{18}$$

Remark. Note that if prejudgment interest perfectly preserves the present value of the judgment, then $\rho = 0$, and we have

$$V_d(n) = -J + \int_{n}^{T} e^{-\rho t} c_d(t)dt \tag{19}$$

and the first-order condition for the optimal time to default is

$$\frac{\partial V_d}{\partial n} = -e^{-\rho n} c_d(n) < 0 \tag{20}$$

so default occurs immediately or never. (And if default does not occur immediately, it is never optimal, and thus has no effect on settlement.) Given that default concedes the amount demanded, the award of prejudgment interest may be a reasonable assumption here.

Proposition 3: Proof. As before, we begin our consideration of the pre-suit context by considering the equilibrium in the absence of an outside option. The inside option in Stage 1 has payoff zero for both parties. Thus, there is nothing to gain from P attempting to negotiate a settlement other than the nuisance value to D of avoiding negotiations:

$$S_0^{ps-zoo} = (\alpha B_d - (1-\alpha)B_p, -\alpha B_d + (1-\alpha)B_p) \tag{21}$$

$$S_0^{ps-zoo} = \frac{1}{2}\int_0^T e^{-\rho t}(b_d(t) - b_p(t))dt \tag{22}$$

Where I define the total *remaining* cost to party i as of turn n is

$$B_{ni} = \sum_{k=n}^{N_1} \delta^{k-n} b_{ki} \tag{23}$$

such that the cost to party i of bargaining through the end of Stage 1 (i.e., bargaining until the inside option triggers) is $B_i = B_{0i}$.

If the value of the outside option to plaintiff is less than this amount, the outside option is irrelevant, and the parties settle for this amount. But so long as the settlement value of plaintiff's claim in litigation is larger than this, the equilibrium strategies and outcomes in Stage 1 will depend on the value of the plaintiff's outside option. Call the pair of payoffs from the exercise of this option $W_p = (W-F, -W)$. The payoffs from the exercise of plaintiff's outside option are determined by the post-filing subgame and the plaintiff's cost F of exercising the option.

The highest defendant will ever offer in turn 1 is $S_1^{pre-suit} = \delta_p(W-F) - b_{1p}$, which plaintiff will accept. Given this, the highest settlement demand that plaintiff can make in turn 0 is $S_0^{pre-suit} = \delta_p\delta_d(W-F) - \delta_d b_{1p} + b_{0d}$. But if plaintiff forgoes negotiation and invokes the outside option of suit right away, she receives $W - F$. Thus, the parties will fail to settle, and plaintiff will immediately file suit, if the latter is a higher payoff for the plaintff:

$$W - F > \delta_p\delta_d(W-F) - \delta_d b_{1p} + b_{0d} \tag{24}$$

or rearranging:

$$(1-\delta_p\delta_d)(W-F) + \delta_d b_{1p} - b_{0d} > 0 \tag{25}$$

For $N_1 \to \infty$, we can explicitly consider the optimal amount of time plaintiff is willing to negotiate before filing suit. Taking limits and using continuous time, if plaintiff invokes her outside option at time $n > 0$, this will lead to a settlement at time 0 where plaintiff demands, and defendant pays

$$S_0^{pre-suit}(n) = e^{-\rho n}(W-F) + \frac{1}{2}\int_0^n e^{-\rho t}(b_d(t) - b_p(t))dt \tag{26}$$

Thus, plaintiff's optimal period during which plaintiff is willing to bargain is given by the solution to the following problem:

$$\max_n S_0^{pre-suit}(n) = e^{-\rho n}(W - F) + \frac{1}{2}\int_0^n e^{-\rho t}(b_d(t) - b_p(t))dt \tag{27}$$

The first order condition is

$$\frac{\partial S_0}{\partial n} = e^{-\rho n}\left[\frac{1}{2}(b_d(n) - b_p(n)) - \rho(W - F)\right] = 0 \tag{28}$$

The second order condition is

$$\left.\frac{\partial^2 S_0}{\partial n^2}\right|_{n=n^*} = \frac{1}{2}e^{-\rho n}(b_d'(n) - b_p'(n)) > 0 \tag{29}$$

In the simplest case, $b_i(t) = b_i$ for $i \in \{p, d\}$. If so, only corner solutions are relevant. If $\frac{\partial S_0}{\partial n}$ is negative, plaintiff gains nothing from bargaining, and thus sues immediately. If $\frac{\partial S_0}{\partial n}$ is positive, plaintiff is willing to bargain through period T, and thus plaintiff will reach a settlement at time 0 of $S_0(T)$. Thus, the condition for pre-suit bargaining failure is

$$\rho > \left(\frac{1}{2}\right)\frac{b_d - b_p}{W - F} \tag{30}$$

B Appendix: Extensions

Risk Aversion and Non-Monetary Costs. The model can accommodate risk aversion and non-monetary litigation costs with no changes to the substance of the model. The value of non-monetary litigation costs, such as reputational harms or bad publicity during litigation or anxiety over appearing in court, can be incorporated into C_p and C_d. Conversely, benefits from the process of litigation itself, such as the utility a plaintiff receives from having her day in court, can be incorporated as negative costs.

Risk aversion is simply a species of litigation cost, given that litigation is risky and settlement eliminates the risk. Formally, the difference between the expected judgment and the certainty equivalent of a future judgment for each party can be incorporated into each party's litigation costs and thus is part of the surplus from settlement. To the extent that the parties differ in their risk aversion, this is equivalent to a difference in their litigation costs.

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Figures

Figure 1: Summary of Inside and Outside Options

Feature	Pre-Suit	Post-Filing
Per-turn costs	b_i	c_i
Inside Option	(0,0)	$(\pi J, -\pi J)$
P Outside Option	$(W - F, -W)$	
D Outside Option		$(J, -J)$

Notes: P outside option involves transfer of W and real cost of F; W is determined endogenously.

Figure 2: Simplified Game Tree

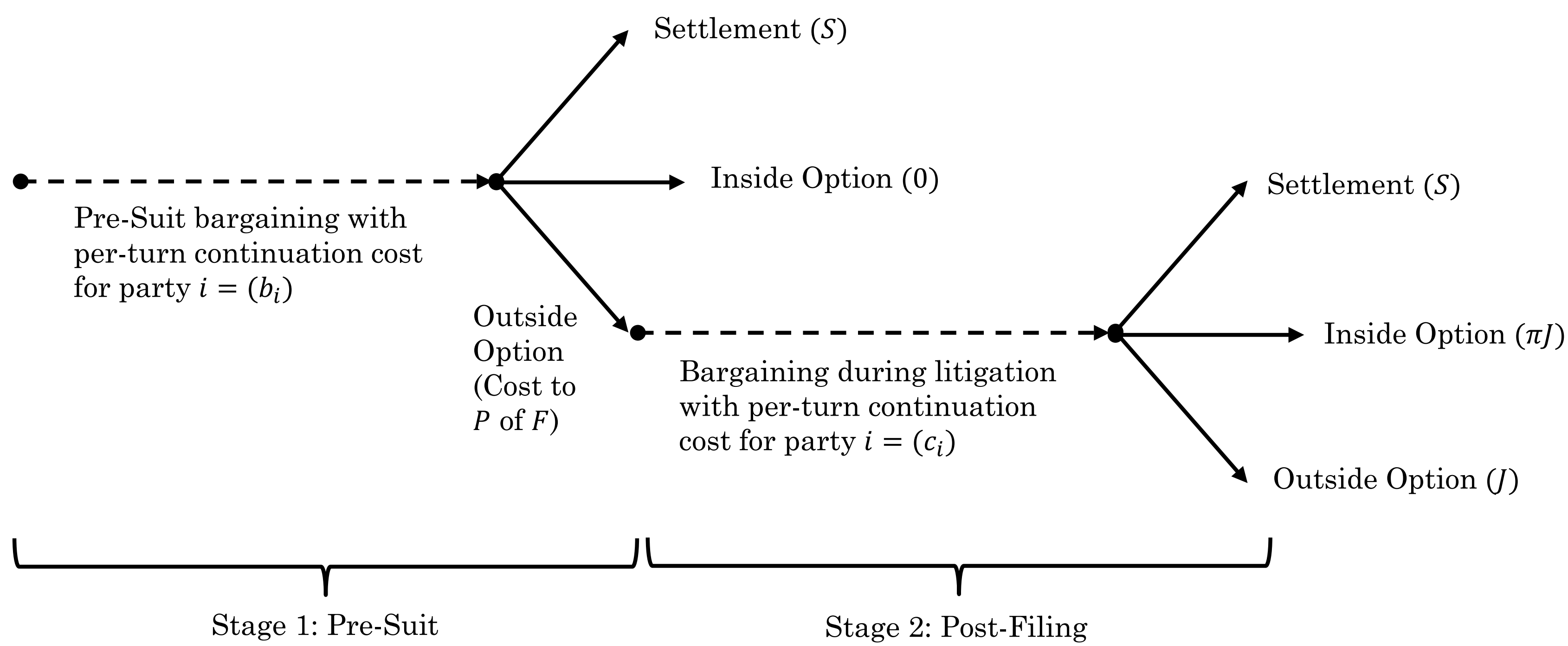

Figure 3: Pre-Suit Bargaining Failure as a Function of Discount Rate, Bargaining Costs, and Outside Option Value

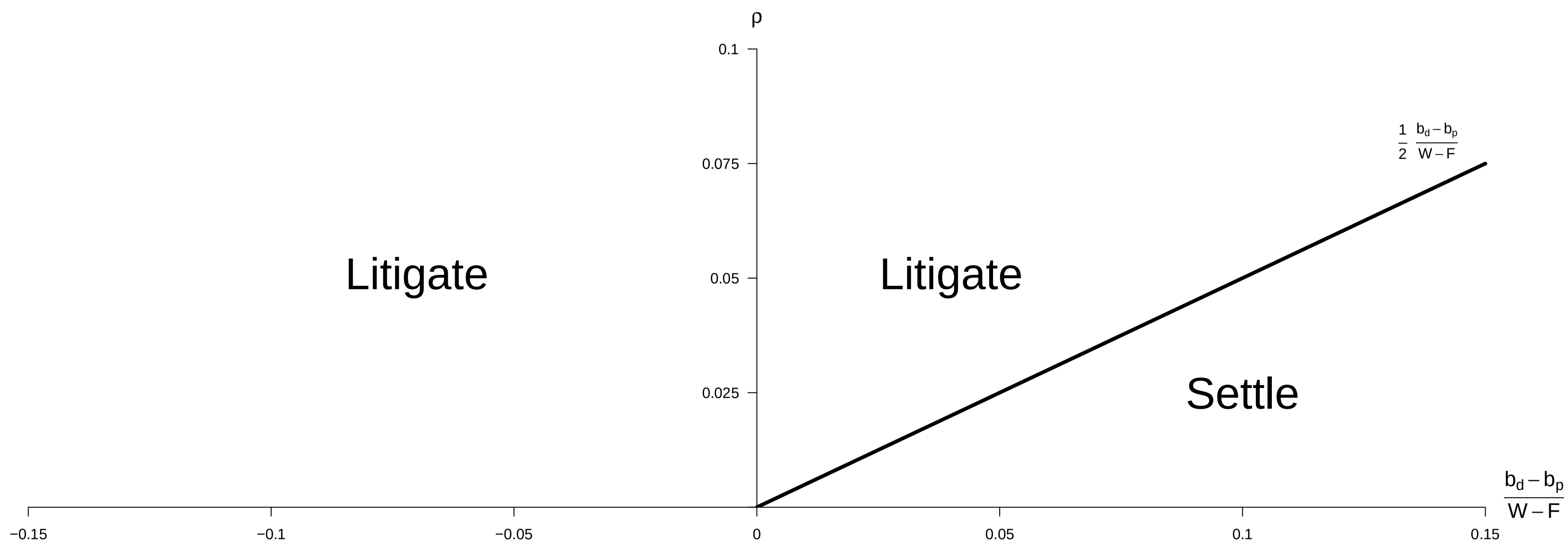

Figure 4: Litigation and Default in Debt Collection Cases

	Total Terminations	Default Judgments as % of Terminations	Full Trials as % of Terminations
Taiwan, Ordinary Procedure			
All Cases	215,022	16.4	41.4
Debt Collection Cases	46,125	40.5	17.4
Non Debt Collection Cases	168,897	9.8	48.0
US Federal Courts			
All Cases	588,110	4.1	0.8
Debt Collection Cases	13,659	48.3	0.3
Non Debt Collection Cases	574,451	3.0	0.8