Rent-Seeking and Litigation: The Hidden Virtues of Limited Fee-Shifting

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Abstract: In the past couple of decades, scholars have predominantly employed rent-seeking models to analyze litigation problems. In this paper, we build on the existing literature to show how alternative fee-shifting arrangements (e.g., the American rule and English rule with limited fee-shifting) affect parties’ litigation expenditures and their decisions to litigate. Contrary to the prevailing wisdom, we discover that, when fee shifting is limited, the English rule presents some interrelated advantages over the American rule, including the reduction of litigation rates and the possible reduction of expected litigation expenditures. Our results unveil a hidden virtue of limited fee shifting, showing that an increase in such limit may lead to a desirable sorting of socially valuable litigation.

Keywords: litigation, limited fee-shifting, rent-seeking, English rule, American rule

JEL Classifications: C72, D72, K41.

1 Introduction

It is a great irony that when parties go to court, the cost of litigation may grow equal to or greater than the very object of the dispute.1 Given that litigation costs

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1 See, e.g., Popov v. Hayashi, No. 400545, 2002 WL 833731 (Cal. Super. Dec. 18, 2002). In this justly notorious case, the two litigants claimed ownership of a record-setting home run ball hit by Barry Bonds, of which they had both held possession during a scuffle after the ball flew into the stands. The trial court pronounced the unusual ruling that the ball be auctioned off and the proceeds split among the two litigants. The ball sold for $450,000, of which each party received...
tend to be substantial, it is a serious policy question whether each party should bear its own legal expenses, or whether the litigation costs ought to be rolled into the stake. Jurisdictions around the world diverge on this question and there exist many variations – even within the common-law tradition – in the assignment of litigation costs. Nevertheless, we may reduce the assignment of costs to two main alternatives: (i) the “American rule”, under which each litigant bears her own legal costs, and (ii) the “English rule” (or “Continental rule”, under which the loser pays the litigation costs of the winner.\(^2\) Traditionally, legal scholars justify the English approach – shifting fees on the losing party – primarily on grounds of fairness. That is, if the desired consequence of litigation is to make the winning party “whole,” then this ought to include the costs expended in litigation (Kritzer, 2002).\(^3\)

However, scholars and policymakers have also recognized that, even though the principal goal in a “loser-pays” regime may be to make the winning litigant whole, fee-shifting creates significant secondary effects on the incentives of prospective litigants. In this paper, we explore the choice of fee-shifting policies through the lens of a rent-seeking model. We discuss the effects of alternative fee-shifting rules, considering both total and partial recovery of litigation costs by the winning litigant. Building on the existing literature, we focus on the effects of alternative fee-shifting arrangements on parties’ litigation choices. By looking at the selection of cases under the various regimes, we show that the English rule (possibly complemented by limited – or partial – fee-shifting) can


\(^2\) Although the “loser-pays” rule can be traced back to 13th century English law (hence its name), its use and adoption is mostly associated with Continental European systems. The applications of the “loser-pays” rule in European systems entails fee-shifting in favor of the winning litigant, regardless of whether the winning party is the plaintiff or the defendant. The loser-pays rule represents an important principle of European systems of civil procedure and is expressed in European codes of civil procedure. Bungard (2006) provides an interesting survey of the different incarnations of the loser-pays rule in European systems, as exemplified by 41 of the Austrian code; article 1017 of the Belgian code; 312(1) of the Danish code; article 696 of the French code; 91 of the German code; article 91 of the Italian code; article 56 of the code of Netherlands; 172 of the Norwegian code; ch. 18, 1 of the Swedish code.

\(^3\) Loser-pays rules are not used in criminal cases. Public prosecution bears the cost of its prosecutorial efforts and defendants bear the cost of their defense, regardless of the case outcome. Garoupa and Parisi (2006) and Garoupa and Echazu (2012) observe that a criminal defendant that is found not guilty is not compensated for his or her defense costs, and explore the idea of applying a loser-pays rule in criminal cases.
effectively reduce total litigation while promoting a greater proportion of socially valuable litigation.

The paper is structured as follows. In Section 1, we review the existing literature. In Section 2, we recast the standard rent-seeking model in the context of litigation, under alternative fee-shifting arrangements. In Section 3, we study the American rule. In Section 4, we discuss alternative fee-shifting regimes, providing a novel analysis of the equilibria of the English rule with limited fee-shifting. In Section 5 we unveil a hidden virtue of the English rule with limited fee-shifting: efficient sorting of the cases that are brought to litigation with the adjudication of a higher percentage of disputes involving unsettled legal issues. Litigation of cases with unsettled legal issues is socially valuable, as the decision of those issues will foster clarity in the law. We find that the English rule may lead to an interesting crowding-out effect, reducing less desirable cases and allowing court resources to be used for the decision of socially valuable cases. This is particularly true when the limit to fee-shifting is low and the applied English rule is close to the American rule. However, we also discover that limiting the amount of fee-shifting may lead to an increase in total litigation expenditures for a society, an apparent paradox. In Section 6 we proceed to a comparison of the American and English rules, showing that the overdissipation problem identified by Farmer and Pecorino (1999) is mitigated when courts limit the litigation fees recoverable through fee-shifting. Further, as a bright side to more expensive litigation, we show that litigation becomes less appealing, and litigation rates drop. Therefore, expected litigation costs may be lower under the English rule than under the American rule. In Section 7, we conclude with some policy considerations and suggestions for future research. Appendices A and B contain technical material.

1.1 Related literature

As pointed out by Congleton et al. (2008:41), “civil law proceedings are rent-seeking contests in which the ‘prize’ is dissipated through conflict.” When parties litigate, they normally expend resources to improve their odds of winning. These expenditures include the cost of investigating the case, expert witnesses, and, of course, lawyer fees. Generally, the more a party spends on litigation, the
better its chances of success. Economists describe such situations, where parties expend resources to improve their share of (or probability of winning) a fixed stake as “rent-seeking,” which is how the law and economics literature has predominantly analyzed litigation costs. Braeutigam et al. (1984), Katz (1988), and Hause (1989) laid the groundwork for rent-seeking analysis, modelling court decisions as parties’ success functions with the parties’ expenses as variables. Katz (1987) applied the model to fee-shifting parties’ expenses in a litigation context. Farmer and Pecorino (1999) and Hirshleifer and Osborne (2001) offered refinements to the model, and Kobayashi and Lott (1996) applied the model to plea bargaining in criminal cases. Chen and Wang (2007) and Baik and Kim (2007a, 2007b) introduced moral hazard considerations in the lawyer-client relationship with respect to rules on contingent and conditional fees. Rowe (1982) examined the rationales for alternative fee-shifting schemes, arguing that the justification for the English rule is that the winner should be made whole, and therefore the winner’s litigation costs should be recoverable. Thus, the English rule accomplishes the dual objectives of (i) making a wrongdoer fully internalize the financial consequences of the dispute, and (ii) deterring frivolous litigation.

Notable studies of litigation that utilize rent-seeking models include Tullock (1975), Farmer and Pecorino (1999), Hirshleifer and Osborne (2001), Parisi (2002), Baye et al. (2005), and Luppi and Parisi (2012). Auspiciously, the rent-seeking framework provides a tractable method of endogenizing parties’ litigation decisions and of comparing litigation rates and expenditures under the English and American rules. Farmer and Pecorino (1999) were the first to compare and contrast the effects of the two fee-shifting regimes in a rent-seeking context. However, their analysis relied on the simplifying assumption that the English rule entailed full and unlimited reimbursement of litigation expenditures by the losing party. In their model, the English rule lead to an exacerbation of the litigation incentives, such as to lead parties to exit litigation at the point where returns to rent-seeking efforts \( r > 1/2 \). However, the assumption of full reimbursement is unrealistic as in practice, fee-shifting tends to be only partial. Baumann and Friehe (2010) use a rent-seeking model to compare the American and the English rule – the latter both with unlimited and limited reimbursement – when compensations schemes for lawyers are based on contingent fees. They use a specific model with constant returns to investment in litigation and where both parties have the same merits. Moreover, they do not analyze the parties’

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7 For a comprehensive survey of the applications of rent-seeking models to litigation and fee-shifting arrangements, see Congleton et al. (2008: chapter 3.2), as well as the contributions by Hillman (2012) and Higgins et al. (1985).
participation constraints, namely, they consider that litigants are involved in litigation with no exit options.\(^8\)

In this paper, we consider a refined and more realistic version of the English rule under which courts impose a limit on recoverable litigation expenditures. The English rule with limited fee-shifting has been previously studied by Hyde and Williams (2002) in a model in which parties have divergent beliefs about their probability of victory. They consider the effects of different reimbursement limits on legal expenditures, including the impact of uncertainty. Particularly, they find the conditions under which legal expenditures monotonically increase with the amount of costs that can be shifted and prove that uncertainty about such amount has an ambiguous effect on such expenditures. However, just as Baumann and Friehe (2010), Hyde and Williams (2002) also omit to consider the parties’ participation constraints.\(^9\) In this paper we use their definition of limited fee-shifting, adapting it to the standard Tullock success function. Using the latter function, we reconstruct the argument of Katz (1987). As Farmer and Pecorino (1999), we allow for different degrees of effectiveness of litigation expenditures and for different merits of the case. We begin with an analysis of the American rule and then turn to the English rule, explicitly considering limited fee-shifting. Consistent with Farmer and Pecorino (1999) and Katz (1987),\(^10\) we find that allowing unlimited recovery of litigation expenditures by the winning party may create severe problems of overdissipation, even given moderate returns to effort. We find however that overdissipation problems are mitigated when limited fee-shifting is introduced. We find that limited fee-shifting may still lead to an increase in litigation expenditures when compared to the American rule, but we also find that it generates multiple offsetting advantages. Indeed, we will show that, even in the absence of any regulation of the level of lawyers’ fees, the rule of limited fee-shifting will be desirable for a wide range of scale economies and diseconomies. Particularly, we generate policy considerations completely different from Farmer and Pecorino (1999) and Baumann and Friehe (2010). The former paper states that the English rule will not produce desirable outcomes when returns to effort are relatively high. This is because it is likely that, even if the objective merits of the case favor the

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\(^8\) See Farmer and Pecorino (1999) and Luppi and Parisi (2012).

\(^9\) Participation constraints are extremely important. Not only their shape determines the range of cases that are litigated, it also determines which claims will be brought to the settle-versus-litigate stage and be settled out of court. See Reinganum and Wilde (1986) on the effect of the allocation of litigation costs on settlement and, more importantly, on the equilibrium probability of trial.

defendant, the latter chooses to give in and settle if the plaintiff files suit. With limited fee-shifting this undesirable outcome is limited. Particularly, high returns to effort are the condition for the occurrence of the positive sorting of cases that are brought to litigation, a feature that exactly offsets the problem highlighted by Farmer and Pecorino (1999). This is especially interesting, since several studies on American data suggest that the empirically relevant range for the returns-to-effort parameters is exactly the range in which the positive sorting we highlight occurs.11 Particularly, Hughes and Snyder (1995) provide some interesting empirical evidence for the English Rule practiced in the US. Using data from Florida (in which the English Rule was applied to medical malpractice cases between 1980 and 1985), they find that the English rule increased the rate of plaintiff success at trial but also out-of-court settlements. They also find that the value of the cases brought to court increased, as proxied by the size of average jury awards. They interpret these results as indicating that the overall quality of the cases that were either settled or litigated improved and this supports out theoretical findings.

Baumann and Friehe (2010) present results that go against a policy of reimbursement of legal fees, whereas not only we find that the English rule might have sound advantages of the American rule, but we also show that these effects become more pronounced when the limits to fee shifting are loosened.

2 Litigation as rent-seeking: setting the stage

Following Katz (1987) and Farmer and Pecorino (1999), we consider a dispute in which a risk neutral plaintiff must decide whether to sue a risk neutral defendant for damages. Let us denote the plaintiff's stake as \( V > 0 \). The plaintiff and the defendant invest \( X \) and \( Y \), respectively, in legal expenditures. The efforts exert a probabilistic influence on the outcome of the case. Let \( \mu \geq 0 \) denote the merit of the plaintiff's complaint in a particular case. Low values of \( \mu \) represent weak claims, while high values represent strong claims. Particularly, if \( \mu = 1 \) both parties’ claims have the same merit, whereas \( \mu \geq 1 \) indicates that the objective merits of the case favor the plaintiff, whereas \( \mu < 1 \) implies a stronger case for the defendant. We treat \( \mu \) as an exogenous parameter, and assume both the factual and legal grounds for the claim are represented in that value.

As in Katz (1988), we use the standard Tullock success-function to denote the probability of either party winning the case. We define the probability that the plaintiff wins by:

\[ P^P(X, Y) = \frac{\mu X^r}{Y^r + \mu X^r} \]  

Similarly, we define the probability that the defendant will win by:

\[ P^D(X, Y) = \frac{Y^r}{Y^r + \mu X^r} \]

where \( r \) determines the effectiveness of legal expenditures.\(^{12}\) It follows trivially from the definitions that if one party refrains from investing in litigation, the other party wins the case.\(^{13}\) In the limiting case, where neither party invests in litigation, let \( P^P(0, 0) = 0 \) and \( P^D(0, 0) = 1 \). This assumption merely indicates that if the plaintiff makes no effort in litigation his probabilities to win the case are null. In other words, the default is in favor of the defendant: an unsuccessful filing for the plaintiff is equivalent to a victory by the defendant.

The choice of the default adjudication rule is immaterial for the purpose of our results. Hence, we could think of different default rules. For instance, the court faced with an unsupported claim and an unsupported defense could adjudicate the case with equal probabilities in favor of plaintiff or defendant.\(^{14}\) Alternatively, if the jurisdiction adopts an inquisitorial procedural system, the court could assess the merits of the claim through independent fact-finding, even in the absence of active involvement by the litigants. Then, the probability for the plaintiff to win the case would reflect the intrinsic merits of the claim, \( P^P(0, 0) = \frac{\mu}{1+\mu} \) and \( P^D(0, 0) = \frac{1}{1+\mu} \).\(^{15}\)

Now, observe that the rent-seeking game played by the plaintiff and defendant is a sequential game. The plaintiff moves first, deciding whether to file the case (we call this the “filing stage”), after which the defendant decides whether


\(^{13}\) If \( X > 0 \) and \( Y = 0 \), then \( P^P(X, 0) = 1 \), and \( P^D(X, 0) = 0 \). Likewise, if \( X = 0 \) and \( Y > 0 \), then \( P^P(0, Y) = 0 \) and \( P^D(0, Y) = 1 \).

\(^{14}\) In standard contests, outside of litigation, the default allocation of rights may vary according to the circumstances. For example, in a competitive contest, two competitors who enter exerting no effort may have an equal chance of winning \( P^P(0, 0) = P^D(0, 0) = \frac{1}{2} \).

\(^{15}\) Note that the same probabilities of success would result when the jurisdiction adopts an adversarial system and both parties expend a positive amount of effort of litigation in equilibrium.
to litigate or to forgo defense and pay the claim amount $V$ ("defense stage"). Finally, the plaintiff and the defendant play a the simultaneous Tullock-Katz game with success functions as defined by eqs [1] and [2] ("litigation stage"). The choices are illustrated in Figure 1.

\[ \Pi_P(X, Y) = \frac{\mu X}{Y + \mu X} V - X \]  
\[ \Pi_D(Y, X) = \frac{\mu Y}{Y + \mu X} V - Y \]

\textbf{3 The American rule}

Under the American rule, both parties bear their own legal expenses, irrespective of the result. Thus, their expected payoffs are:

\[ \Pi_P(X, Y) = \frac{\mu X}{Y + \mu X} V - X \]  
\[ \Pi_D(Y, X) = -\frac{\mu Y}{Y + \mu X} V - Y \]

for the plaintiff and, for the defendant.

\textbf{Footnote:} One should note that we consider the "no defense" option a sort of settlement. This might imply that the defendant accepts some default decree (possibly not even showing up in court) and simply pays $V$. We are aware that, in many legal systems, the judge might already allocate legal fees. However, these would most likely be fixed costs for the parties, not influencing the chances of winning at trial and would not change our results. In order to save on notation and with no loss of generality, we have normalized these costs to zero.
The parties seek to maximize their payoffs by choosing $X$ and $Y$ to maximize [3] and [4] respectively. The first order conditions are:

$$\frac{\partial \Pi_P}{\partial X} = \frac{r X^{r-1} Y^r}{(Y^r + \mu X^r)^2} \mu V - 1 = 0$$  \[5\]

$$\frac{\partial \Pi_D}{\partial Y} = \frac{r Y^{r-1} X^r}{(Y^r + \mu X^r)^2} \mu V - 1 = 0$$  \[6\]

The equilibrium levels of investment are symmetric:\(^{17}\)

$$X^* = Y^* = \frac{r \mu V}{(1 + \mu)^2}$$  \[7\]

The equilibrium payoffs for the plaintiff and the defendant are, respectively:

$$\Pi_P(X^*, Y^*) = \frac{\mu V}{(1 + \mu)} \left( 1 - \frac{r}{1 + \mu} \right)$$  \[8\]

$$\Pi_D(X^*, Y^*) = -\frac{\mu V}{(1 + \mu)} \left( 1 + \frac{r}{1 + \mu} \right)$$  \[9\]

The total cost of litigation under the American rule is

$$L^A = X^* + Y^* = \frac{2r \mu V}{(1 + \mu)^2}$$  \[10\]

Following Farmer and Pecorino (1999), the subgame-perfect Nash equilibrium of the litigation game under the American rule is characterized below. If $r \leq 1$, there is a unique subgame-perfect Nash equilibrium in the litigation game under the American rule, in which the plaintiff always files the case and the defendant always litigates. Regardless of the parties’ relative stakes, equilibrium effort [7] is relatively low. This implies that both parties face relatively low costs of litigation compared to the value of the case and litigation is always a desirable strategy.

For higher $r$ (particularly, when $r > 1$ but less than 2), effort and costs are higher in the litigation equilibrium, hence relative stakes play a role. Particularly, if $\mu$ is very low ($\mu < r - 1$), the plaintiff’s merit in the case is too low to justify filing. In equilibrium, the plaintiff’s effort and costs are high, but the plaintiff also faces a relatively high probability to lose (due to the

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\(^{17}\) See Tullock (1980) and Farmer and Pecorino (1999).
defendant’s high effort and merit). Similarly, if $\mu$ is very high ($\mu > \frac{1}{r^2}$), the defendant’s probability of winning the case is low, so that the defendant might forgo defense and pay $V$ avoiding litigation. The plaintiff would choose to file, and the dispute would be resolved without further litigation.18

In addition, from expression [10] defining $L^d$, it is possible to demonstrate that total litigation expenditures $L^d$ never exceed the amount at stake $V$ under the American rule when $r \leq 2$ and though when $r > 2$, $L^d$ might exceed $V$, recall that the participation constraint of at least one of the parties is violated when $r > 1$.

4 The English rule

We now turn to the English rule, under which the loser pays both his or her own litigation costs as well as those of the winner.

No legal regime currently uses a “pure” English rule. Unlimited fee-shifting does not exist “in the wild,” and any legal system using the English rule sensibly sets limitations on recoverable litigation expenses, based on the reasonableness and proportionality of legal expenditures. Bungard (2006) observes that the most common limitation to fee-shifting is that the winning party is only entitled to reimbursement of those costs that were necessary to assert its rights or defense and to obtain a favorable court decision, thereby discouraging unnecessary and costly litigation. We therefore focus on the more realistic and interesting policy of limited fee-shifting.19

Under a limited fee-shifting regime, the losing party must compensate the winning party’s expenditures, but only up to a given threshold. For simplicity, let’s assume that the fee-shifting limits are symmetrical and equal to $d$.

Plaintiff and defendant’s expected payoff from spending $X$ and $Y$ when the fee-shifting limit is $d$ are given by

$$
\Pi_p(X, Y) = P^p(X, Y)[V - \max\{0, X - d\}] - (1 - P^p(X, Y))[X + \min\{Y, d\}]
$$

[11]

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18 See Appendix A.

19 Limitations on fee-shifting are generally imposed on the basis of the “reasonableness” of the expenditures for the assertion and defense of the legal rights in question. Bungard (2006) offers several examples of limits imposed by European systems on the amounts of recoverable expenses. For example, Sweden disallows recovery for the costs associated with unnecessary motions. Austria, Denmark, England, and Germany and other countries disallow fee-shifting for uneconomical procedural acts.
\[ \Pi_D(Y, X) = P^D(X, Y)[-V - Y - \min\{X, d\}] - (1 - P^D(X, Y)) \max\{0, Y - d\} \]

[12]

In the subsequent subsections we will consider the following equilibria under limited fee-shifting:

1. For very small \(d\), the limited-fee-shifting rule is very similar to the American rule. Both parties spend an amount greater than the upper limit: \(Y, X > d\), only a part of the winner's expenses is paid for by the loser.

2. For very large \(d\), the limited-fee-shifting rule is similar to the English rule as it is discussed in the literature. Both parties choose equilibrium investment-levels below the upper limit: \(0 < Y, X < d\), the loser completely indemnifies the winner for his legal expenses.

In between these extremes, one or both parties invest exactly as much as they get indemnified for in case of winning the case.

a. For small intermediate \(d\), both parties spend an amount exactly equal to the limit: \(X = Y = d\);

b. For large intermediate \(d\), The party with the weaker case spends less than the limit and the other party spends an amount exactly equal to the limit: \(X < Y = d\) if \(\mu < 1\) and \(Y < X = d\) if \(\mu > 1\).

Note that an equilibrium with one party spending more than the limit and the other spending less than or exactly the amount of the limit does not exist. We provide the proof in Appendix B.1. The careful reader of the following sections will also note that case 2 may only occur if \(r < 1\).

We start our discussion with the equilibria of the litigation stage and then turn to the earlier stages of the game. For the following sections, it may be helpful for the reader to consider Figure 2, which visualizes the ranges of \(r, \mu\) and \(d\) for which the various equilibria are relevant.

### 4.1 Investment is higher than the indemnification limit

In this case, from [11] and [12], the expected payoff functions are given by

\[ \Pi_P(X, Y) = \frac{\mu X^r}{Y^r + \mu X^r} (V + 2d) - X - d \]

[13]

\[ \Pi_D(Y, X) = -\frac{\mu X^r}{Y^r + \mu X^r} (V + 2d) - Y + d \]

[14]
Leaving aside the fixed last terms in both equations, these payoffs are exactly those of the American rule with $V + 2d$ as the claim value. Equilibrium expenditures are thus

$$\hat{X} = \hat{Y} = \frac{r\mu(V + 2d)}{(\mu + 1)^2}$$ \hspace{1cm} \text{[15]}$$

whereas equilibrium payoffs are:

$$\Pi_p(\hat{Y}, \hat{X}) = \frac{\mu(V + 2d)(\mu + 1 - r)}{(\mu + 1)^2} - d$$ \hspace{1cm} \text{[16]}$$

Figure 2: Location of equilibrium types for (a) and (b) $r < 1/2$, (c) $1/2 < r < 1$, (d) $r = 1.25 > 1$. The scale of the vertical axis shrinks from (a) to (d). Solid lines represent $\hat{d}$, $\bar{d}$ and $\bar{d}$ from bottom to top; note that $\bar{d}$ does not exist for $r \geq 1$ (Graph (d)). Dashed and dotted lines are the participation constraints $\mu_p(d)$ and $\mu_p(d)$, respectively. Areas are marked according to subgame perfect equilibria: gray is “litigation”, white is “not file” or “not defend” as marked.
\[
\Pi_D(\hat{Y}, \hat{X}) = -\frac{\mu(V + 2d)(\mu + 1 + r)}{(\mu + 1)^2} + d,
\]

Total litigation expenditure is given by

\[\hat{L}^E = \hat{X} + \hat{Y} = \frac{2r\mu(V + 2d)}{(\mu + 1)^2}\]

By definition, this equilibrium requires that \(\hat{X} = \hat{Y} > d\), which is equivalent to

\[d < \hat{d} = \frac{rV}{\max[(1 + \mu)(1 + 1/\mu) - 2r, 0]}\]

Figure 2 depicts this limit for various \(r < 4\). In Appendix B.2 we also show that \(\hat{X} = \hat{Y} > d\) is the unique equilibrium if \(d \leq \hat{d}\).

The Nash equilibrium of the litigation stage is a subgame perfect equilibrium of the entire litigation game only if the defendant participates, i.e. if he chooses to defend at the defense stage. Obviously, he will do so if and only if \(\Pi_D(\hat{Y}, \hat{X}) \geq -V\), which reduces to the following participation constraint:

\[d < \hat{d}_D = \frac{V}{\max[1 + 1/\mu - r, 0]}\]

Finally, the plaintiff also has to file, knowing that the defendant will defend or not according to eq. [20]. If the defendant will not defend, it is always worthwhile for the plaintiff to file. If the defendant will defend, the plaintiff will file if and only if \(\Pi_P(\hat{X}, \hat{Y}) \geq 0\), which reduces to

\[d < \hat{d}_P = \frac{V}{\max[1 + \mu - r, 0]}\]

We show in Appendix B.2 that \(r \leq 1/2\) implies \(\hat{d}_D > \hat{d}\) and \(\hat{d}_P > \hat{d}\) for all \(\mu\) so that \(\hat{X} = \hat{Y} > d\) is the equilibrium of the entire litigation game whenever it is the equilibrium in the litigation stage. On the other hand, \(r \geq 2\) implies that either \(\hat{d}_D\) or \(\hat{d}_P\) may be positive but not both, so that litigation will not occur, i.e. \(\hat{X} = \hat{Y} > d\) is never an equilibrium. Then, the plaintiff will file whenever \(d \geq \hat{d}_D\) because the defendant will not defend so that the plaintiff wins the case. Between these two limiting cases, i.e. for \(1/2 < r < 2\), there are always some values of \(\mu\) sufficiently close to unity for which both \(\hat{d}_D\) and \(\hat{d}_P\) are positive which implies that \(\hat{X} = \hat{Y} > d\) is an equilibrium of the entire litigation game for sufficiently small \(d\), specifically for \(d \leq \min[\hat{d}, \hat{d}_P, \hat{d}_D]\). Figure 2 visualizes the different cases: in the plots (a) and (b) \(\hat{d}_D\) and \(\hat{d}_P\) do not exist and litigation

\[20\ r < 4\ guarantees that the denominator of \(\hat{d}\) is strictly positive. We will briefly discuss the effect of \(r > 4\) in Appendix B.2.\]
occurs for all $d < \hat{d}$ due to $r < 1/2$; in plots (c) and (d) litigation with $X = Y = X = \hat{Y} > d$ occurs only when $d < \min[d, \hat{d}_p, \hat{d}_D]$.

4.2 Investment is lower than the indemnification limit

In this case there is full fee-shifting, since parties spend less than the limit. The expected payoff functions become

$$\Pi_P(X, Y) = \frac{\mu X'}{(Y + \mu X')} (V + Y + X) - X - Y$$

and

$$\Pi_D(Y, X) = -\frac{\mu X'}{Y + \mu X'} (V + X + Y).$$

Equilibrium expenditures are given by

$$\tilde{X} = \frac{r}{1 - r} V \left(1 + \mu^\frac{1}{r}\right)^{-1}; \quad \tilde{Y} = \frac{r}{1 - r} V \left(1 + \mu^\frac{1}{r}\right)^{-1}$$

for $< 1$ and $\tilde{X} = \tilde{Y} = \infty$ for $r \geq 1$. $\tilde{X}$ is always increasing and $\tilde{Y}$ is always decreasing in $\mu$, if $r < 1$.

As evidenced above, the party favored by the merits spends more and has a higher probability of success, in contrast with the American rule, which has symmetrical equilibrium levels of investment. The parties’ payoffs are

$$\Pi_P(\tilde{X}, \tilde{Y}) = \frac{V}{1 - r} \left[\left(1 + \mu^\frac{1}{r}\right)^{-1} - r\right]; \quad \Pi_D(\tilde{Y}, \tilde{X}) = -\frac{V}{1 - r} (1 + \mu^\frac{1}{r})^{-1}. $$

Total litigation expenditures are given by

$$\tilde{L}^E = \tilde{X} + \tilde{Y} = \frac{r}{1 - r} V$$

Obviously, this Nash equilibrium exists if and only if the indemnification limit is larger than the equilibrium investments, i.e. if and only if $r < 1$ and $d > \hat{d} = \max(\tilde{X}, \tilde{Y})$. Note that $\tilde{X} \geq \tilde{Y} \iff \mu \geq 1$ and thus $\hat{d}$ takes its minimum value of $\frac{r V}{2(1 - r)}$ at $\mu = 1$. If $r \geq 1$, $\tilde{X}, \tilde{Y} < d$ is impossible for finite $d$ and thus this equilibrium fails to exist when $r \geq 1$.

Sub-Game perfection of this equilibrium requires $\Pi_D(\tilde{Y}, \tilde{X}) > -V$ and $\Pi_P(\tilde{X}, \tilde{Y}) > 0$, which is equivalent to $\mu_D^p = (\frac{r}{1 - r})^{1 - r} < \mu < \mu_D^p = (\frac{1 - r}{1 - r})^{1 - r}$. This is possible only for $r < 1/2$. Note that these critical values of $\mu$ are independent of $d$ and are therefore vertical lines in Figure 2, where the reader also finds the graph of $\hat{d}$. 
If $1/2 \leq r < 1$, no such case reaches the litigation stage: As soon as $\mu > (\frac{1-r}{r})^{1-r}$, which is less than one, the defendant will refrain from litigating if the plaintiff files the case because $\Pi_D(\hat{Y},\hat{X}) \leq -V$. Hence, the plaintiff will file if and only if this condition is met.

### 4.3 Investment equals the indemnification limit

Investments equal to the indemnification limit yield expected payoffs of

$$\Pi_P(d, d) = \frac{\mu}{1 + \mu} (V + 2d) - 2d; \quad \Pi_D(d, d) = -\frac{\mu}{1 + \mu} (V + 2d). \quad [27]$$

In order for this to be an equilibrium of the litigation stage, neither of the parties must gain from increasing their investments beyond $d$ or from lowering it below $d$. We show in Appendix B.4 that the first of these conditions is equivalent to $d \geq \bar{d}$. Remember that for small indemnification limits, both parties invest the same amount larger than the limit. If we now increase the limit, investments will grow (because this is equivalent to increasing the claim value) but less than the indemnification limit (cf. equation (15)).

Hence the equal investments will eventually become equal to $d$. Increasing the limit a bit further will lead to an equal increase of investments, because investing less than the limit becomes even less attractive but, as we will argue immediately, investing more than the limit is not attractive either.

As the indemnification limit grows larger, one can easily imagine that the party with the weaker case will eventually cease to invest the full amount of the indemnification limit. In fact, we show in Appendix B.4 that both parties will refrain from lowering their investment below the indemnification limit if and only if

$$d \leq \bar{d} = \begin{cases} 
\frac{rV}{1 + \mu - 2r} & \text{if } \mu \geq \max(1, 2r - 1) \\
\frac{rV}{1 + 1/\mu - 2r} & \text{if } \mu \leq \min(1, \frac{1}{2r-1}) \\
\infty & \text{if } \frac{1}{2r-1} < \mu < 2r - 1 
\end{cases} \quad [28]$$

Note that investments grow faster than the limit if $r > (1+\mu)(1+1/\mu) = 2 \geq 2$, which is equivalent to never have investments equal to or smaller than the limit, $\bar{d} = \infty$. 

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21 Note that investments grow faster than the limit if $r > (1+\mu)(1+1/\mu) = 2 \geq 2$, which is equivalent to never have investments equal to or smaller than the limit, $\bar{d} = \infty$. 

Obviously, the last case may only occur if \( r > 1 \). Since \( \bar{d} \) increases in \( \mu \) if \( \mu < 1 \) and decreases in \( \mu \) if \( \mu > 1 \), \( \bar{d} \) reaches its maximum at \( \mu = 1 \). The value of this maximum is \( \frac{rV}{2(1-r)} \), i.e. equal to the minimum value of \( \bar{d} \).

For \( X = Y = d \) being a subgame perfect equilibrium of the entire game, we also need \( \Pi_D(d, d) \geq -V \) and \( \Pi_P(d, d) \geq 0 \) which reduces to

\[
\bar{d} \leq \bar{d}_D = \frac{V}{2\mu} \quad \text{and} \quad d \leq \bar{d}_P = \frac{V\mu}{2} \tag{29}
\]

Comparing eqs (28) and (29) immediately shows that \( r \leq 1/2 \) implies \( \bar{d} \leq \min[\bar{d}_P, \bar{d}_D] \) so that if \( X = Y = d \) is the Nash equilibrium of the litigation stage, it is also a subgame perfect equilibrium of the entire litigation game. However, if \( 1/2 < r < 1 \), we have \( \bar{d} > \min[\bar{d}_P, \bar{d}_D] \) and thus litigation with \( X = Y = d \) only takes place if \( \bar{d} \leq d \leq \min[\bar{d}_P, \bar{d}_D] \). Note that \( \min[\bar{d}_P, \bar{d}_D] \) reaches its maximum \( V/2 \) at \( \mu = 1 \). The indemnification limit being less than half of the claim value is thus a necessary and sufficient condition for the existence of a range of \( \mu \) for which litigation with \( X = Y = d \) is subgame perfect when \( 1/2 < r < 1 \). Since for \( r \leq 1/2 \) we have \( \bar{d} \leq \bar{d}_D = \frac{rV}{2(1-r)} \leq \frac{V}{2} \), the same condition is also necessary (though not sufficient) for the existence of a range of \( \mu \) for which litigation with \( X = Y = d \) is subgame perfect when \( r \leq 1/2 \). The intuition of this insight is straightforward: if both parties invested exactly the amount of the indemnification limit and this limit were more than one half of the claim value, then at least one of the parties would plausibly prefer to give up rather than litigating.

Finally, for \( r \geq 1 \) we always get \( \min[\bar{d}_P, \bar{d}_D] \leq \bar{d} \) for all \( \mu \), which implies that litigation with \( X = Y = d \) is never a subgame perfect equilibrium of the entire game.

When \( X = Y = d \) is a Nash equilibrium of the litigation stage but not a subgame perfect equilibrium of the entire game,\(^{22}\) then the plaintiff will file and the defendant settle whenever \( d > \bar{d}_D \), since the defendant will not defend.

### 4.4 Investment of one party equals the indemnification limit and investment of the other party is lower

Eventually, as \( d \) grows further, the party with the weaker case, i.e. the defendant if \( \mu > 1 \) and the plaintiff if \( \mu < 1 \), will cease to invest the entire amount of the indemnification limit. This occurs when \( d > \bar{d} \), as we show in Appendix B.5.

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\(^{22}\) Recall that this is true when \( \min[\bar{d}_P, \bar{d}_D] < d < \bar{d} \) — i.e. for large enough \( d \) when \( 1/2 < r < 1 \) — and always when \( r \geq 1 \)
For $r < 1$, the weaker party’s investment will then be the unique solution of $(\partial \Pi_D(d,Y))/(\partial Y) = 0$ for $Y$ and $(\partial \Pi_P(X,d))/(\partial X) = 0$ for $X$.\footnote{We prove existence and uniqueness of these solutions in Appendix B.5} We label these investments $\tilde{Y}(d)$ and $\tilde{X}(d)$, respectively.\footnote{The abuse of notation is less severe than it seems on first sight since $\tilde{Y} = \tilde{Y}(\tilde{X})$ and $\tilde{X} = \tilde{X}(\tilde{Y})$.} We note that these investments converge to zero as $r$ grows towards one. For $r \geq 1$ we have $(\partial \Pi_D(d,Y))/(\partial Y) < 0$ for all $0 \leq Y \leq d$ and $\mu > 1$ and $(\partial \Pi_P(X,d))/(\partial X) < 0$ for all $0 \leq Y \leq d$ and $\mu < 1$. The weaker party will thus invest nothing in this case. We therefore define $\tilde{Y}(d) = 0$ and $\tilde{X}(d) = 0$ for $r \geq 1$.

In Appendix B.5, we show that $d$ is the stronger party’s best reply to $\tilde{X}(d)$ or, $\tilde{Y}(d)$, respectively, for the entire range $\tilde{d} < d \leq d$. Hence in this range one party investing an amount equal to the indemnification limit and the other party spending less is the Nash equilibrium of the litigation stage.

We show in the Appendix that the resulting payoffs can only be determined as functions of $\tilde{Y}(d)$ and are given by

$$\Pi_P(d, \tilde{Y}(d)) = V - \frac{1}{r} \tilde{Y}(d) \quad \text{and} \quad \Pi_D(\tilde{Y}(d), d) = (V + d) + \frac{1 - r}{r} \tilde{Y}(d) \quad [30]$$

for $\mu > 1$ and by

$$\Pi_P(\tilde{X}(d), d) = \frac{1 - r}{r} \tilde{X}(d) - d \quad \text{and} \quad \Pi_D(\tilde{X}(d), d) = -\frac{1}{r} \tilde{X}(d) \quad [31]$$

for $\mu < 1$.

For $r \leq 1/2$, we show in Appendix B.5 that the stronger party will not abstain from litigation, i.e. that $\mu > 1$ implies $\Pi_P(d, \tilde{Y}(d)) > 0$ and $\mu < 1$ implies $\Pi_D(\tilde{X}(d), d) < -V$. Hence, the defendant will defend if $\Pi_D(\tilde{Y}(d), d) > -V$ and the plaintiff will file if $\Pi_P(\tilde{X}(d), d) > 0$, which simplifies to

$$d \leq \frac{rV}{\mu} \left( \frac{1 - r}{r} \right)^{1-r} \quad \text{and} \quad d \leq rV\mu \left( \frac{1 - r}{r} \right)^{1-r} \quad [32]$$

respectively. Note that for $r = 1/2$ these conditions coincide with $d = \tilde{d}$, i.e. litigation with one party investing $d$ and the other less does not occur any more.

For $1/2 < r < 1$, the weaker party always prefers not to file or, respectively, not to defend to litigation, because $\Pi_D(\tilde{Y}(d), d) > -V$ would imply $\tilde{Y}(d) > d$ and $\Pi_P(\tilde{X}(d), d) > 0$ would imply $\tilde{X}(d) > d$ which contradicts the assumption of this equilibrium. Hence the defendant’s decision will be litigation if and only if $\Pi_D(d, \tilde{X}(d)) > -V$ and the plaintiff would file if he could expect the defendant to litigate if and only if $\Pi_P(d, \tilde{Y}(d)) > 0$. Since these inequalities fail to have
explicit solutions for $d$, we restate the conditions in terms of $\mu$: the defendant will defend and the plaintiff would file if, respectively,

$$\mu \leq \frac{1}{r} \frac{rV}{d + rV} \left( \frac{d}{rV} \right)^r \quad \text{and} \quad \mu \geq r \frac{d + rV}{rV} \left( \frac{rV}{d} \right)^r. \quad [33]$$

Note that the defendant will stop litigating before $\mu$ grows large enough to induce the plaintiff to file even if the defendant litigates.

Finally, if $r \geq 1$, the weaker party will invest nothing in the Nash equilibrium of the litigation stage and thus the weaker party will always avoid litigation: if $\tilde{d} < d$ and $\mu < 1$, the plaintiff will not file and if $\tilde{d} < d$ and $\mu > 1$, the defendant will settle.

### 4.5 Litigation under limited fee shifting: a summary

Putting together the results obtained in the four preceding Sections, we see that parties’ choices about whether to litigate and how much to invest are directly influenced by the indemnification limit $d$ and by the relative strength of their cases $\mu$. This influence strongly depends on the level of the effectiveness of legal expenditures $r$. Figure 2 illustrates four different levels of $r$: two less than one half, one between one half and one, and one larger than one.

The solid lines in the figure represent $\hat{d}$, $\tilde{d}$ and $\tilde{d}$ from bottom to top. Hence, below the lowest solid line, the equilibrium investments at the litigation stage are $\tilde{X}$ and $\tilde{Y}$ (Section 4.1). Between the lowest and the second line from the bottom, equilibrium investments at the litigation stage are $d$ (Section 4.3). If we move above the second solid line, we enter the parameter range where only one party would invest $d$ in the litigation stage and the other invests less (Section 4.4). Finally, above the highest of the three solid lines, which does not exist for $r > 1$, the equilibrium investments are both less than the indemnification limit $d$, namely $\tilde{X}$ and $\tilde{Y}$ (Section 4.2). It becomes apparent from the figures that the Nash equilibrium of the litigation stage is unique for all parameter sets. The proof of uniqueness is in the appendix.

We also observe that the sequence of types of the Nash equilibrium resulting from increasing the indemnification limit $d$ is always the same: low $d$ entail $\tilde{X}$ and $\tilde{Y}$ as equilibrium investments, somewhat larger $d$ result in both parties investing the full amount of the indemnification limit, and if we further increase $d$, we will eventually end up in an equilibrium in which the party with the stronger case still invests $d$, while the party with the weaker case invests less – a strictly positive amount if $r < 1$ and zero else. Only if $r < 1$, the equilibrium investment of the stronger party rests below $d$, too, if $d$ becomes very large.
Then both parties’ Nash-equilibrium investments, $\tilde{X}$ and $\tilde{Y}$, are independent of $d$. Careful inspection of the Nash-equilibrium expenditures show that the stronger party’s investments monotonously grow in $d$, with monotonicity being strict except for very high $d$. The weaker party’s investments however only grow in the first two types of equilibria, i.e. in those equilibria where both parties invest the same amount in the litigation-stage Nash equilibrium. If the weaker party spends less than the stronger party, her investments decline in $d$.

However, to fully understand the effects of the indemnification limit, we have to incorporate the first two stages of the litigation game as well. Since the participation constraints could not be solved explicitly for $d$ for all four cases, we rephrase them as inverted functions $\mu_D^p(d)$ and $\mu_p^p(d)$ where the superscript $p$ denotes the participation constraint. To capture the various cases, we write $\tilde{\mu}_D^p(d)$ and $\tilde{\mu}_p^p(d)$ as inverse functions of $\tilde{d}_D$ and $\tilde{d}_p$. Similarly, we write $\hat{\mu}_D^p(d)$ and $\hat{\mu}_p^p(d)$ as inverse functions of $\hat{d}_D$ and $\hat{d}_p$. Recall that these functions do not exist for $r \leq 1/2$.

Defining $\tilde{\mu}_D^p(d)$ and $\tilde{\mu}_p^p(d)$ for $\tilde{d} < d < \hat{d}$ is more complex. We have to differentiate the three cases we discussed in Section 4.4. For $r \leq 1/2$, $\tilde{\mu}_p^p(d)$ for $\tilde{d} < d < \hat{d}$ are defined by the inverses of the two expressions in eq. [32]. For $1/2 < r < 1$, $\tilde{\mu}_p^p(d)$ for $\tilde{d} < d < \hat{d}$ are equivalent to the right-hand sides of eq. [33]. Finally, for $r > 1$, $\tilde{\mu}_p^p(d)$ for $\tilde{d} < d < \hat{d}$ are the upper and the lower branch of the inverses of $\tilde{d}$.

With $\tilde{\mu}_D^p = \left(\frac{r}{1-r}\right)^{1-r}$ and $\tilde{\mu}_p^p = \left(\frac{1-r}{r}\right)^{1-r}$, we then get

\[
(\mu_D^p(d), \mu_p^p(d)) = \begin{cases} 
(\tilde{\mu}_D^p(d), \hat{\mu}_p^p(d)) & \text{if } r > 1/2 \text{ and } d \leq V \frac{1}{2-2r} - 1 \\
(\tilde{\mu}_D^p(d), \tilde{\mu}_p^p(d)) & \text{if } r > 1/2 \text{ and } V \frac{1}{2-2r} - 1 < d \leq rV \\
(\mu_D^p(d), \tilde{\mu}_p^p(d)) & \text{if } \left\{ \begin{array}{l} r \leq 1/2 \text{ and } d \leq rV \\
1/2 < r < 1 \text{ and } rV < d \leq \frac{r^2V}{1-r} \\
r \geq 1 \text{ and } d > rV \end{array} \right. \\
(\hat{\mu}_D^p, \hat{\mu}_p^p) & \text{if } r < 1 \text{ and } d > \max\left(rV, \frac{r^2V}{1-r}\right) 
\end{cases}
\]

The conditions on $d$ reflect that the different variants of $\mu_D^p(d)$ and $\mu_p^p(d)$ are valid only for the corresponding types of equilibria. It turns out that these functions are continuous with kinks at the critical values of $d$.

As discussed earlier, filed cases are defended only if $\mu \leq \mu_D^p(d)$. Knowing this, the plaintiff exploits his first-mover advantage and files if $\mu \geq \min(\mu_D^p(d), \mu_p^p(d))$. Hence only cases with $\mu_p^p(d) \leq \mu \leq \mu_D^p(d)$ will be filed and defended, and thus litigated. We shaded the corresponding range in Figure 2. Only for these cases the Nash equilibrium investments are marked in the figure.
If $r < 1/2$, only the extreme cases are not litigated. This is true even when the indemnification limit is very large, because the parties will invest an amount which is smaller than (and independent of) the limit, if the latter is large enough. If $r \geq 1/2$, parties will litigate those cases in which they both invest the same amount (at least equal to the indemnification limit). However, not even all of these cases are litigated in the subgame perfect equilibrium: if the indemnification limit is below $\min \left( \frac{V}{2}, \frac{r(2-r)}{2r} \right)$, parties will litigate only cases with relatively equal merits, with the symmetric range of values of $\mu$ which are litigated declining in $d$, down to zero when $d$ reaches the aforementioned critical level. If the indemnification limit is larger, no case will be litigated. Cases with rather similar merits and cases in which the plaintiff’s merits are stronger will be filed but not defended, the remaining cases will not be filed.

5 Selection of cases and crowding-out of undesirable litigation

In this Section we unveil a hidden virtue of the English rule. It will be shown that reducing overall litigation costs may not be the only effect of the English rule, but another important effect might be that of encouraging litigation that promotes certainty in the legal system. The effect is non-trivial. Particularly, under the English rule, an increase in the fee-shifting limit $d$ produces a desirable sorting of litigated cases.

Under the English rule with limited fee-shifting, we have to distinguish between a high indemnification limit ($d > d_{\text{max}} = \min[rv, \frac{V}{2}, \frac{r(2-r)}{2r}]$) and a low one ($d < d_{\text{max}}$). When $d > d_{\text{max}}$, parties always spend less than the limit. They litigate if and only $r < \frac{1}{2}$ (implying that $d_{\text{max}} = rv$) and participation constraints are satisfied, so $\left( \frac{r}{1-r} \right)^{1-r} < \mu < \left( \frac{1}{1-r} \right)^{1-r}$. If they litigate, their equilibrium expenditures are given by $X, Y < d$. In such a case, a change in the indemnification limit has no impact on the extent of litigation, since neither $\mu_{P}(d)$ nor $\mu_{D}(d)$ depend on $d$.

The case with $d < d_{\text{max}}$ is however rather interesting. As is apparent from Figure 2, and may easily be proven by taking derivatives of the relevant sections of $\mu_{P}(d)$ and $\mu_{D}(d)$ with respect to $d$, an increase in $d$ reduces the extent of litigation. Starting from $d = 0$, which is the American rule, increasing $d$ up to $d_{\text{max}}$ monotonously shrinks the range $\mu_{P}(d) < \mu < \mu_{D}(d)$ where litigation takes place. If $r < 1/2$, the range eventually (at $d = d_{\text{max}} = rv$) is reduced to $\mu_{P}(d) = \left( \frac{r}{1-r} \right)^{1-r} < \mu < \mu_{D}(d) \left( \frac{1}{1-r} \right)^{1-r}$. If $r \geq 1/2$, the range of litigation vanishes at $d = d_{\text{max}} = \min[\frac{V}{2}, \frac{r(2-r)}{2r}]$. To visualize the effect in Figure 2, the reader may
imagine moving a horizontal line that stretches across the entire gray area upwards from zero to \( r \) or the upper tip of the gray area.

Figure 3 below shows the crowding out effect of an increase in fee-shifting under the English rule when \( d < \frac{V}{2} \) and in the special case \( r = 1 \). In that case, parties spend more than the limit \( d \). The solid lines represent the parties’ payoffs when \( d = 0.2 \) and \( V = 1 \). Parties litigate when payoffs are positive. The plaintiff’s payoff is represented by the increasing function: the greater the merit of her case \( \mu \), the larger her expected gains from litigation. The plaintiff files the case for \( \mu > \hat{\mu}_P \). The decreasing line represents the difference between the defendant’s loss in case of no-defense, \( V \), and the expected loss in case of litigation (\(-\hat{\Pi}_D\)). When that difference is positive, the defendant prefers to litigate (i.e., when \( \mu < \hat{\mu}_D \)). Hence, litigation occurs for \( \hat{\mu}_P < \mu < \hat{\mu}_D \), which, in our example, is equal to \( \hat{\mu}_P = 0.61 \), while \( \hat{\mu}_D = 1.64 \). The dashed lines represent the parties’ payoffs for higher levels of fee-shifting, \( d = 0.4 \). The region in which litigation occurs shrinks considerably as \( d \) increases (now \( \hat{\mu}_P = 0.89 \) and \( \hat{\mu}_D = 1.12 \)). Moreover, the defendant’s incentives to litigate decreases more than the plaintiff’s. In fact, \( \hat{\mu}'_D - \hat{\mu}_D = -0.52 \), whereas \( \hat{\mu}'_P - \hat{\mu}_P = 0.28 \).

These results are summarized in the following Proposition.

**Proposition 1** Under the English rule, an increase in the amount of recoverable legal fees, \( d \), reduces the extent of litigation as long as \( d < d_{\text{max}} \) for cases characterized by very low or very high merit. Litigation persists in the medium range, where parties’ claims have comparable merits and where adjudication and legal precedents can reduce legal uncertainty. When \( d \geq d_{\text{max}} \), litigation is restricted to cases with nearly equal merits for plaintiff and defendant if \( r < 1/2 \) and does not take place if \( r \geq 1/2 \).
Thus, we find that increasing the cap on recoverable legal fees may decrease the total number of cases contested, but increases average expenditures in those cases that do end up being litigated. The question now, with respect to total litigation expenditures across a society, is which of the two opposing currents prevails, i.e., whether higher per-case litigation costs are offset by the lower volume of litigation.

In general, the effect of an increase in $d$ depends on the distribution of $\mu$ in the population of litigants. If the values of $\mu$ that are still litigated after the increase in $d$ are also the most frequent in the population, it is highly likely that an the increase in expenditure for each single litigated case dominates the reduction in contested cases. However, for $r \geq 0$ the number of litigated cases and thus the total expenditure on litigation is reduced to zero when $d \geq d_{\text{max}}$. Thus long before the indemnification limit reaches this level, total litigation expenditures must start to decline in $d$.

Conversely, close to $d = d_{\text{max}}$, reducing the limit to fee shifting increases total litigation expenditures – an effect entirely contrary to the very purpose of lowering the cap on recoverable litigation costs. This interesting and counter-intuitive result suggests that the proper policy might be to increase the cap on recoverable legal fees, $d$ if the reduction of litigation expenditures is a policy goal. This is especially true in close cases ($\mu \approx 1$) and when a high $r$ induces large expenditures.

6 Comparing the American and the English rule with limited fee-shifting

Building on the analysis presented above, in this Section we consider the main effects of the two fee-shifting regimes under consideration. Thus far we have discussed the effect of an increase in $d$ in a regime with limited fee-shifting. It is interesting to analyze what happens when we move from an American to an English regime, i.e. from an indemnification limit of $d = 0$ to some strictly positive limit.

From the preceding analysis we know that parties always litigate under the American rule if $r \leq 1$, and they litigate if $r - 1 < \mu < \frac{1}{r - 1}$ for $1 < r \leq 2$.

Assume that there is a change in regime and that the prevailing rule becomes an English rule with a fee-shifting limit, $d$. In this case we know that less litigation occurs, that litigation is more concentrated on cases with more equal merits, and that total expenditures of the two parties are larger.

Are these effects of moving from the American to an English rule with a specific, strictly positive fee-shifting limit $d$ desirable or undesirable per se? If we
only look at extremely large (or non-existing) limits and concentrate on cases in which \( r \geq 1/2 \), it seems that they are undesirable. In that case litigation is not merely reduced in numbers, it is driven to zero and – what is more disturbing – the plaintiff controls much of the outcome of each controversy. If the plaintiff’s relative merit is high enough, the defendant does not defend the case, whereas if \( \mu \) is low, the plaintiff does not file. Since \( \mu^p_d(d) < 1 \) whenever litigation is excluded for all \( \mu \), the plaintiff wins the case without going to trial even if the merits of her case are somewhat weaker than the merits of the defendant’s case. The plaintiff gains from having the first-mover advantage, as Farmer and Pecorino (1999) rightly stress.

However, it should be noted that when the indemnification limit is not so extreme (or if \( r < 1/2 \)) the cases that do not reach trial under the English rule (and that would reach trial under the American rule), are those for which there is little legal uncertainty, because they are characterized by either very low or very high \( \mu \).

In general, all cases for which there is no legal uncertainty are better resolved outside of court for two reasons. First, contesting the claim will be a waste of resources for the weaker party. Second, litigating claims that have little legal merit may create uncertainty. This is particularly true in cases where the point of contention is legal rather than factual. Suppose that the party with weaker case wins. This creates a new precedent contrary to established law, and the outcome of subsequent litigation becomes more uncertain.\(^{25}\)

We should therefore conclude that socially valuable litigation involves cases for which legal uncertainty is already high, so that legal expenditure, even if higher as it is under the English rule, is worthwhile – adjudicating close cases is valuable, because it clarifies the state of the law. Therefore, a good rule should favor litigation of those cases with \( \mu \) close to 1 and discourage litigation the farther we move away from 1.

Serendipitously, the English rule (as compared with the American rule) possesses precisely this characteristic. Fewer cases with high or low \( \mu \) make it to the court, and therefore it may be more desirable than prior researches have indicated.\(^{26}\)

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\(^{25}\) Clearly, the creation of legal uncertainty leading to legal innovation is desirable in those cases in which the precedent is obsolete, but we reckon that at any moment in time, the number of cases with this characteristic is relatively small.

\(^{26}\) A rather common idea is that a litigation rule is efficient if it favors the objective merits, i.e., it induces the plaintiff to file only when he is favored by the objective merits (\( \mu > 1 \)) and the defendant to defend if and only if \( \mu < 1 \). This result is attained by the American rule when \( r = 2 \) and by the (unlimited) English rule when \( r = \frac{1}{2} \). Thus, either rule can have attractive properties in this respect. Moreover, if there were fixed costs of proceeding to trial (that do not affect the probability of success) then the type of efficiency referred to above might be reached for lower
7 Conclusions

In addition to resolving particular disputes, litigation often generates the secondary benefit of creating precedents and clarifying legal principles. New litigation allows judges to decide novel issues and to settle vagueness and ambiguity in prior case law.

In the context of this lawmaking function, the social value of litigation is greatest when the state of the law is obscure: a new court precedent can establish clarity and certainty in the law. Miceli (2010) recently articulated the conundrum that litigants' incentives to litigate are driven by private cost-benefit considerations, and therefore contested cases are not necessarily those that yield the most social value.27

In this paper we have extended the rent-seeking model of litigation to show that the adoption of the English rule will often promote a “favorable selection” of cases, crowding out of less desirable cases. The adoption of the loser-pays principle reduces the wedge between the private and social incentives to litigate, promoting the adjudication of close cases, where the existing law is either unsettled or ambiguous. Our results provide a more solid foundation to the claim that moving from an American to an English rule reduces overall litigation but increases litigation costs per case. An increase in \( d \) can in fact be considered a continuous shift from the American \((d = 0)\) to the pure English rule \((d \text{ unlimited})\). The higher \( d \), the further away we move from the American towards the English rule.

Moreover, within a fee-shifting regime, we have shown that, in order to reduce litigation, it may be preferable to increase the limit to fee shifting rather than decrease it, which, at first sight, might seem quite paradoxical. It is often advocated that a more stringent definition of reasonable legal expenditure would be a good instrument to discourage frivolous litigation. We have proven that not only a less stringent definition may be preferable but also that, for very low values of \( r \) or an already high \( d \), a change in the fee-shifting limit may simply be ineffective, so policy makers should recur to different instruments.

27 Shavell (1982), Menell (1983) and Kaplow (1986) first raised the question on whether plaintiffs have the socially efficient incentives to use the legal system to resolve a dispute. See also, Shavell (1997) and Miceli (2009).
We have developed a full-fledged model of various fee-shifting regimes and analyzed their performance for all the admissible values of $r$, thus providing the most complete analysis of alternative fee-shifting regimes to date.

Admittedly, the sorting effect of the English rule may undermine the access to justice of low-probability cases that would bring to the court new, progressive issues. Any new legal claim faces the inertia of an incumbent legal system. At the outset, any new legal right is born through the filing of a low probability claim. Discouraging low-probability litigation may therefore have the undesirable side effect of trimming out and inhibit the filing of claims that might be conducive to the creation of new legal rights. This may explain the reason why several legal systems that belong to the English-rule procedural tradition disapply the loser-pays rule when litigation – successful or unsuccessful as it might have been in the specific case – is representative of an attempt to challenge an established legal rule, with potential benefits in terms of legal progress and evolution. Future extensions of our model may therefore consider possible variations of the loser-pays rule to facilitate access to justice and to foster the advancement of new legal claims that may advance the evolution of legal system. Further, our results also explain the practice, adopted by many legal systems employing the English rule, of carving out an exception to the fee-shifting policy when the court deems a case socially valuable for establishing case law or when the settled legal precedents become obsolete.

Finally, our paper does not consider litigation opportunism (or “predatory litigation”), where one party takes another to court even if he knows that the other has fulfilled his obligations (see Kirstein and Schmidtchen, 1997). It would be extremely interesting, as a future research development, to analyze the impact of various fee-shifting regimes, with and without fee-shifting limits, on the incentives to keep such opportunistic behavior.

Appendix A: Subgame-Perfect Nash Equilibrium Under the American Rule

Following Farmer and Pecorino (1999), we show first that for $r < 1$, if the parties reach the litigation stage, investment levels $X^*$ and $Y^*$ in [7] are a Nash equilibrium since neither party is willing to deviate. This occurs when exerting the equilibrium effort is at least as good as not exerting any effort (either $X = 0$ or $Y = 0$). The plaintiff is not willing to deviate if $\Pi_P(X^*, Y^*) \geq 0$, i.e., from [8],

$$\frac{\mu}{1+\mu} \left( 1 - \frac{r}{1+\mu} \right) \geq 0,$$

which reduces to $\mu \geq r - 1$. 

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Similarly, the defendant is not willing to deviate if \( \frac{\mu V}{(1+\mu)^2}(1 + \mu + r) < V \), i.e., if and only if \( 1 + \mu(1 - r) > 0 \), that is if and only if \( \mu < \frac{1}{r-1} \).

**Case 1.** \( r \leq 1 \). It is possible to see that \( 1 + \mu(1 - r) > 0 \) always and that \( r - 1 < 0 \) if \( r \leq 1 \). Hence neither parties are willing to deviate and, in case of litigation, payoffs will be \( \Pi_P(X^*, Y^*) \) and \( \Pi_D(X^*, Y^*) \). If the plaintiff files, the defendant will defend. Knowing that the defendant always litigates, the plaintiff chooses to file.

Thus, when \( r \leq 1 \), the litigation game has a unique subgame perfect equilibrium in which litigation always occur.

**Case 2.** \( r > 1 \). In this case, both \( r - 1 \) and \( \frac{1}{r-1} \) are positive, and neither party is willing to deviate if and only if \( r - 1 < \mu < \frac{1}{r-1} \). We now need to distinguish between \( 1 < r \leq 2 \) and \( r \geq 2 \).

**Case 2.1:** \( 1 < r \leq 2 \). In this case, \( r - 1 < \frac{1}{r-1} \). Hence, there exists a range of values for \( \mu \) such that \( r - 1 < \mu < \frac{1}{r-1} \) and the Nash Equilibrium \( X^*, Y^* \) exists. In stage 2, the defendant defends if the plaintiff files and, in stage 1, the plaintiff prefers to file.

If \( \mu < r - 1 < \frac{1}{r-1} \), the plaintiff is willing to deviate in the litigation game, hence the Nash equilibrium does not exist. Following Farmer and Pecorino (1999), we assume that the player willing to play the Nash equilibrium solution has a first-mover advantage in a Stackelberg litigation game. If litigation occurs, the player with the first mover advantage sets her legal expenditure at a preemptive level, which is the lowest expenditure that induces the other party to invest 0. In this case, given that the plaintiff is willing to deviate, in the litigation game the defendant has a first-mover advantage. Since \( P^P(0, Y) = 0 \), the plaintiff's payoff is zero, hence, in stage 1, she chooses not to litigate.

Finally, if \( \mu > \frac{1}{r-1} \), the defendant is willing to deviate in the litigation game. Here the plaintiff would have a first-mover advantage and the defendant would get \(-V\). Then the defendant would not defend and in stage 1 the plaintiff would file.

**Case 2.2:** \( r > 2 \). In this case, \( r - 1 > \frac{1}{r-1} \). Again we can have three cases.

If \( \mu > r - 1 > \frac{1}{r-1} \), the defendant is willing to deviate from the litigation Nash equilibrium whereas the plaintiff does not. The plaintiff therefore has a first-mover advantage. As in the previous case the defendant chooses not to defend and, in stage 1, the plaintiff files.

If \( \mu < \frac{1}{r-1} \), the defendant has a first-mover advantage in the litigation game. At stage 1, the plaintiff does not file.

The last case is the most problematic. If \( \frac{1}{r-1} < \mu < r - 1 \), both the plaintiff and the defendant are willing to deviate from the Nash equilibrium strategies in the litigation game. Therefore it is difficult to determine which player might have the
first-mover advantage in a Stackelberg game. In this case, one of the players
might be able to commit to a preemptive level of expenditure (so that we are in
one of the scenarios described above).

Appendix B: Subgame-Perfect Nash
Equilibria Under the English Rule with
Limited Fee – Shifting

B.1 Proof of impossibility of $Y \leq d < X$

We show the impossibility by contradiction. For this, we first assume that
both inequalities hold true. Based on the consequential definitions of the parties’
payoffs, we then show that these investments cannot be a Nash equilibrium.

Suppose $Y \leq d < X$. Then

$$
\Pi_p = V + d - X - \frac{Y'(V + d + Y)}{Y' + \mu X'} \\
\Pi_D = -\frac{\mu X'(d + V + Y)}{Y' + \mu X'}
$$

With these payoffs, we get the following first order condition for the defendant:

$$
0 = \frac{\mu X'(d + V + Y)r Y'^{-1}}{(Y' + \mu X')^2} - \frac{\mu X'}{Y' + \mu X'}
= \frac{\mu X'}{Y' + \mu X'} \left( \frac{(d + V + Y)r Y'^{-1}}{(Y' + \mu X')} - 1 \right)
$$

which simplifies to

$$
1 = \frac{r Y'^{-1}(d + V + Y)}{Y' + \mu X'} \quad [35]
$$

It is useful to write this as:

$$
\mu X' = Y'^{-1+r}(dr + rV - Y + rY), \quad [36]
$$

The defendant’s second order condition is:

$$
0 \leq \frac{\mu X'(d + V + Y)r ((r - 1)Y'^{-2}(Y' + \mu X') - 2r Y^{2(r-1)})}{(Y' + \mu X')^3} + \frac{2\mu X'r Y'^{-1}}{(Y' + \mu X')^2}
= \frac{\mu X' Y'^{-2}}{(Y' + \mu X')^3} \left[ r(d + V + Y)(-Y' + \mu X') - (d + V - Y)(Y' + \mu X') \right]
$$
If we replace $\mu X^r$ as suggested by eq. [36] inside the brackets, this turns into:

$$0 \leq \frac{\mu r X^r Y^{r-2}}{(Y^r + \mu X^r)^3} \left[ r(d + V + Y)(-Y^r + Y^{-1+r}(dr + rV - Y + rY)) 
- (d + V - Y)(Y^r + Y^{-1+r}(dr + rV - Y + rY)) \right]$$

$$= \frac{\mu r X^r Y^{r-3}}{(Y^r + \mu X^r)^3} (r-1)r(d + V + Y)^2$$

Hence, $Y \leq d < X$ can only be an equilibrium if $r < 1$.

We now turn to the plaintiff’s foc. It is given by:

$$0 = -1 + \frac{r Y^r (d + V + Y) \mu X^{-1+r}}{(Y^r + X^r \mu)^2}$$

Inserting eq. [36] yields:

$$0 = -1 + \frac{Y \mu X^{-1+r}}{Y^r + \mu X^r} = -1 + \frac{Y}{X} - \frac{Y}{r(d + V + Y)}$$

Then by our initial assumption we have:

$$d < X = Y \left( 1 - \frac{Y}{r(d + V + Y)} \right)$$

which implies

$$0 < -r d^2 - drV + rVY - Y^2 + rY^2$$

As we already know that $r < 1$, inequality [38] also implies

$$0 < -r d^2 - drV + rVY$$

or

$$Y > d \frac{d + V}{V} > d$$

which contradicts the initial assumption. Hence, there is no equilibrium with $Y \leq d < X$. By symmetry, we also cannot have an equilibrium with $X \leq d < Y$. q.e.d.

**B.2 Equilibrium with $X, Y > d$**

We first check whether investment levels $\hat{X}, \hat{Y} > d$ defined by the first-order conditions of maximizing $\Pi_P(X, Y)$ and $\Pi_D(X, Y)$ as defined by eqs [13] and [14] constitute a Nash equilibrium of the litigation game. We know from standard rent-seeking theory that it is not sufficient to consider the first-order
conditions but that investing nothing may be a better alternative. However, the plaintiff is not willing to deviate if exerting effort \(X\) when the defendant invests \(Y\) yields a higher payoff than exerting no effort \(X = 0\). This happens when \(\Pi_P(X, Y) > -d\), that is, when \(1 + \mu - r > 0\). The latter inequality is always satisfied for \(r \leq 1\). For \(r > 1\), it is required that the case presents \(\mu > r - 1\).

Similarly, the defendant does not deviate if and only is \(\Pi_D(Y, X) > -V - d\), which implies \(1 + \mu(1 - r) > 0\), which is always satisfied for \(r < 1\) and requires \(\mu < \frac{1}{r - 1}\) if \(r > 1\).

Knowing that his payoff will be \(\Pi_D(Y, X)\) in the litigation stage, the defendant is willing to defend in court if and only if \(\Pi_D(X, Y) > -V\), i.e., if and only if \(d < \hat{d}_D\) which we can invert to

\[
\mu < \hat{\mu}_D(d) = \frac{(1 - r)V - 2dr + \sqrt{(2dr + (r - 1)V)^2 + 4d(d + V)}}{2d}
\]  

Equations [39] and [40] represent respectively the defendant’s and the plaintiff’s participation constraints. When they are satisfied, investment levels \(X, Y > d\) constitute a subgame-perfect Nash equilibrium of the litigation game.

To see that for \(r \leq 1/2\) we have \(\hat{d}_D > \hat{d}\) we note that the denominator of \(\hat{d}\) is always positive and the same is true for the denominator of \(\hat{d}_D\) if and only if \(\mu > \sqrt{1 + r^2} - r < 1\). Hence, if the latter condition is violated, \(\hat{d}_D = \infty > \hat{d}\). If the condition holds true, \(\hat{d}_D > \hat{d}\) is equivalent to

\[
r(\mu - 1/\mu + 2r) = (1 + 1/\mu - r)((1 + \mu)(1 + 1/\mu) - 2r)
\]  

which after some algebra reduces to \(r < \frac{1}{2} + \frac{1}{2\mu}\) which is satisfied by assumption. Since \(\hat{d}_P\) is the same as \(\hat{d}_D\) with \(\mu\) replaced by \(1/\mu\) and \(\hat{d}\) does not change when we replace \(\mu\) by \(1/\mu\), exactly the same argument also proves that \(\hat{d}_P > d\) if \(r \leq 1/2\).

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28 It is possible to show that, whenever a case is characterized by \(\hat{\mu}_P < \mu < \hat{\mu}_D\) (participation constraints are both satisfied), \(X, Y\) is a Nash equilibrium in the litigation stage. In fact, \(X, Y\) constitute a Nash equilibrium when \(r \leq 1\). When \(r > 1\), \(\mu_P > r - 1\), whereas \(\mu_D < \frac{1}{r - 1}\), which implies that whenever participation constraints are satisfied, \(\hat{X}, \hat{Y} > d\) constitute a Nash equilibrium.
Obviously, if \( r > 1/2 \), the argument fails if \( \mu \) or, respectively \( 1/\mu \) is large enough. And if \( r > 1 \), the argument for \( \hat{d}_D \) is reversed for all \( \mu \geq 1 \) and the argument for \( \hat{d}_P \) is reversed for all \( \mu \leq 1 \), whence \( \min[\hat{d}_D, \hat{d}_P] < \hat{d} \) for all \( \mu \).

**B.3 Equilibrium with \( X, Y < d \)**

We prove first that, for \( r < 1 \), investment levels \( \tilde{X} \) and \( \tilde{Y} \) obtained in [24] are always Nash equilibria of the litigation game. Following the same procedure adopted for the American rule in Appendix A, the plaintiff does not deviate from the equilibrium \( \tilde{X}, \tilde{Y} \) if and only if \( \Pi_P(\tilde{X}, \tilde{Y}) > -\tilde{Y} \), which follows from the fact that the plaintiff has to pay the defendant’s legal fees even if her own expenditures are \( X = 0 \). This implies that the plaintiff does not deviate if and only if \( \mu^{1-r}(1-r) > 0 \), which is always true if \( r < 1 \). Similarly, the defendant does not deviate if and only is \( \Pi_D(\tilde{Y}, \tilde{X}) > -V - \tilde{X} \), which implies \( \mu^{1-r} < 1 + \mu^{1-r} \), which is always satisfied for \( r < 1 \). However, as shown in the text, the equilibrium fails to exist if \( r \geq 1 \).

The rest of the argument is in the text.

**B.4 Equilibrium with \( X = Y = d \)**

To prove the conditions under which \( X = Y = d \) is an equilibrium, we first show that increasing the expenditures beyond \( d \) reduces the plaintiff’s payoff if \( d \geq \hat{d} \). We then turn to the condition \( d \leq d \). The argument for the defendant is symmetric and need not be made explicit here.

To see that the plaintiff will not increase \( X \) above \( d \) when \( d \geq \hat{d} \), we first consider her payoff

\[
\Pi_P(X, d)|_{X \geq d} = \frac{\mu X}{Y + \mu X} (V + 2d) - X - d
\]

for \( X \geq d \) and its first derivative of at \( X = Y = d \):

\[
\left. \frac{\partial \Pi_P(X, Y)}{\partial X} \right|_{X = Y = d} = \frac{r \mu V - d(1 + \mu)^2 - 2 \mu r}{d(1 + \mu)^2} \leq 0 \text{ due to } d \geq \hat{d}
\]

with equality only for \( d = \hat{d} \). The plaintiff will thus not increase his expenditures marginally above \( d \).

To show that the plaintiff will not invest any much higher amount, we consider the second derivative of her payoff:
\[
\frac{\partial^2 \Pi_p(X, Y)}{\partial X^2} = -\frac{r\mu(2d + V)X'^{-2}Y'}{(Y' + \mu X')^3}((1 - r)Y' + (1 + r)\mu X')
\]

Obviously, this is strictly negative if \( r \leq 1 \). If \( r > 1 \), the second derivative is positive for \( X = 0 \) and eventually becomes negative as \( X \) increases. Leaving aside the restriction that the definition in eq. [42] only is valid for \( X \geq d \), one can easily check that the right-hand side of [42] becomes \(-d\) when \( X = 0 \). Hence this right-hand side must have been increasing in some range before \( X \) reaches \( d \). Since the first derivative is negative at \( X = d \), the derivative must have been decreasing, i.e. the second derivative must have been negative somewhere in the range \( 0 < X < d \). However, a negative second derivative for any value of \( X \) implies that the second derivative is negative for all larger values of \( X \) too. As a consequence, \( (\partial^2 \Pi_p(X, d))/\partial X^2 < 0 \) for all \( X \geq d \) which also implies that \( (\partial \Pi_p(X, d))/\partial X < 0 \) for all \( X \geq d \). Hence \( \Pi_p(X, d) < \Pi_p(d, d) \) for all \( X > d \) whence the plaintiff will never increase his investments above \( d \) when \( d \geq \hat{d} \). We can make a corresponding argument for the defendant to show that he will never increase her investments above \( d \) when \( d \geq \hat{d} \).

We now turn to the claim that neither of the parties will reduce expenditures below \( d \) if \( d \leq \hat{d} \). For this proof it is helpful to transform the plaintiff’s first-order condition for a payoff maximum with \( X, Y < d \)

\[
\frac{\partial \Pi_p(X, Y)}{\partial X} = \frac{\mu Y'X'^{-1}(V + X + Y) - Y'(Y' + \mu X')}{(Y' + \mu X')^2} = 0
\]

[43]

into

\[
Y' = \mu X'^{-1}(r(V + X + Y) - X).
\]

[44]

Inserting this into the second derivative

\[
\frac{\partial^2 \Pi_p(X, Y)}{\partial X^2} = \frac{r\mu X'^{-2}Y'}{(Y' + \mu X')^3}(-r(V + X + Y)(-Y' + \mu X') + (-V + X - Y)(Y' + \mu X'))
\]

[45]

implies

\[
\frac{\partial^2 \Pi_p(X, Y)}{\partial X^2} = \frac{r\mu X'^{-2}Y'}{(Y' + \mu X')^3}(-1 + r)\mu X'^{-1}(V + X + Y)^2
\]

[46]

Hence, for \( r < 1 \), there is no payoff minimum for the plaintiff in \( 0 \leq X < d \) if \( Y \leq d \).
Since for equal investments the derivative
\[
\left. \frac{\partial \Pi_p(X, Y)}{\partial X} \right|_{X=Y} = \frac{r\mu V - Y(1+\mu - 2\mu)}{Y(1+\mu)^2}
\]  \[47\]
is positive for \( Y \leq d \leq \tilde{d} \) and strictly so, if \( Y < d \), the derivative is also strictly positive for all \( X < Y \) and thus the plaintiff will always invest more than the defendant if \( Y < d \) and not less than the defendant if \( Y = d \) if \( r < 1 \).

If \( r \geq 1 \), any extremum in \( 0 \leq X < d \) cannot be a maximum. Due to \( Y \leq d \leq \tilde{d} \) we get after some algebra \( \Pi_p(0, Y) = -Y \leq \Pi_p(Y, Y) = \frac{\mu}{1+\mu} (V + 2Y) - 2Y \). Hence the plaintiff will again invest not less than the defendant and due to inequality \[47\] she will invest more unless \( Y = d \).

By a symmetric argument for the defendant, we find that he also invests more than the plaintiff if \( X < d \) and the same amount if \( X = d \).

Suppose that the defendant invests \( Y \leq d \). Then for \( X \leq d \) we have
\[
\left. \frac{\partial \Pi_p(X, Y)}{\partial X} \right|_{X=Y} = \frac{\mu rY'X^{-1}(V + X + Y - Y'(Y' + \mu X'))}{(Y' + \mu X')^2}
\]  \[48\]
which for \( X = Y \) simplifies to
\[
\left. \frac{\partial \Pi_p(X, Y)}{\partial X} \right|_{X=Y} = \frac{rV - Y(1+1/\mu - 2\mu)}{Y(1+\mu)(1+1/\mu)}
\]  \[49\]
which is obviously positive if \( 1 + 1/\mu - 2\mu \leq 0 \) and positive due to \( Y \leq d \leq \tilde{d} \) if \( 1 + 1/\mu - 2\mu > 0 \) by the following argument:

\( \mu \geq \max[1, 2_1 - 1] \) implies that \( Y \leq \frac{rV}{1+1/\mu - 2\mu} \leq \frac{rV}{1+1/\mu - 2\mu} \) which implies that the derivative is positive and strictly so, if \( Y < d \).

\( 2_1 - 1 > \mu > \frac{1}{2_1 - 1} \) implies that \( 1 + 1/\mu - 2\mu < 0 \) whence the derivative is positive.

\( \mu \leq \min[1, \frac{1}{2_1 - 1}] \) implies that \( Y \leq \frac{rV}{1+1/\mu - 2\mu} \) which implies that the derivative is positive and strictly so, if \( Y < d \).

By a corresponding argument, we also get
\[
\left. \frac{\partial \Pi_d(Y, X)}{\partial Y} \right|_{Y=X} = \frac{rV - Y(1+\mu - 2\mu)}{Y(1+\mu)(1+1/\mu)} \geq 0
\]  \[50\]
with strict inequality for \( X < d \).

**B.5 Equilibrium with** \( X < Y = d \) **for** \( \mu < 1 \) **or** \( Y < X = d \) **for** \( \mu > 1 \)

To prove the various claims of Section 4.4, we first recall that according to eq. \[48\] \((\partial \Pi_p(X, d))/\partial X\)|\(X=d\) is positive if \( d \leq \tilde{d} \). This sufficient condition was also necessary, if \( \mu < 1 \), i.e. if the plaintiff is the weaker party (cf. the last
alternative in the discussion of eq. [48]). Hence if \( d > \tilde{d} \) and the plaintiff is the weaker party, we have \( (\partial \Pi_P(X, d))/(\partial X)|_{X=d} < 0 \) and thus the best reply of the plaintiff to the defendant’s choice of \( d \) is some \( X < d \) (\( X > d \) is excluded by Appendix B.1). The first-order condition for the optimal \( X \) is given by

\[
\frac{\partial \Pi_P(X, d)}{\partial X} = \frac{d'}{X(d' + \mu X')^2} \left[ \mu X'(V + X + d) - X(d' + \mu X') \right] = 0
\]

We call this solution \( \bar{X}(d) \).

Since \( (\partial \Pi_P(X, d))/(\partial X)|_{X=d} < 0 \) and \( \lim_{X \to 0} (\partial \Pi_P(X, d))/(\partial X) = +\infty \) and the derivative does not display any discontinuity between zero and \( d \), \( \bar{X}(d) \) exists.

To make sure that \( (\bar{X}(d), d) \) is a Nash equilibrium, we have to prove that \( d \) is the defendant’s best reply to \( (\bar{X}(d)) \). We know from the previous appendix, that \( \mu < 1 \) implies

\[
\frac{\partial \Pi_D(Y, d)}{\partial Y} \bigg|_{Y=d} > 0 = \frac{\partial \Pi_P(X, d)}{\partial X} \bigg|_{X=d} \quad \text{if } d = \hat{d} = \frac{rV}{1 + 1/\mu - 2r}
\]

By continuity, the inequality prevails if \( d \) slightly increases above \( \hat{d} \). We thus have

\[
\frac{\partial \Pi_D(Y, X)}{\partial Y} = \frac{\mu X' (rY'r^{-1}(V + X + Y) - Y' - \mu X')}{(Y' + \mu X')^2} > 0
\]

Hence we have \( X' < (rY'r^{-1}(V + X + Y) - Y')/\mu \). Inserting this into the second derivative

\[
\frac{\partial^2 \Pi_D(Y, X)}{\partial Y^2} = \frac{Y'r^{-1}\mu X'}{(Y' + \mu X')^2} \left( \frac{r(-V - X + Y)}{Y} - \frac{r^2(V + X + Y)(Y' - \mu X')}{Y(Y' + \mu X')} \right),
\]

which strictly increases in \( X' \), yields

\[
\frac{\partial^2 \Pi_D(Y, X)}{\partial Y^2} < \frac{Y'r^{-2}\mu X'}{(Y' + \mu X')^2} (-1 + r)(V + X + Y) < 0
\]

Hence, reducing \( Y \) slightly results in a larger and thus still positive first derivative. Reducing \( Y \) further step by step always results in ever larger first derivatives and thus negative second derivatives by exactly the argument of eqs [53] through [54]. Hence, the defendant always gains by increasing his investment until he invests \( d \), which completes the proof of \( d \) being the best reply to \( \bar{X}(d) \).
The symmetric argument works for $\mu > 1$ and thus the plaintiff being the stronger party.

To prove the payoffs of eqs [30] and [31], note that eq. [51] implies $d^r + \mu [\tilde{X}(d)]^r = \mu r [\tilde{X}(d)]^{r-1} (V + \tilde{X}(d) + d)$. Inserting this into the plaintiff’s payoff for $\mu < 1$, yields:

$$\Pi_P(\tilde{X}(d), d) = \frac{\mu [\tilde{X}(d)]^r}{d^r + \mu [\tilde{X}(d)]^r} (V + \tilde{X}(d) + d) - \tilde{X}(d) - d = \frac{1 - r}{r} \tilde{X}(d) - d$$  \[55\]

The other expressions in eqs [30] and [31] can be derived accordingly.

Finally, we show that for $r \leq 1/2$, $\mu < 1$ implies $\Pi_D(d, \tilde{X}(d)) > -V$. Suppose the reverse were true, i.e. $\frac{1 - \tilde{X}(d)}{r - d} \leq -\frac{V}{d}$. We could then insert this into

$$0 = \mu \left(\frac{V}{d} + 1\right) - \mu (1 - r) \frac{\tilde{X}(d)}{d} - \left(\frac{\tilde{X}(d)}{d}\right)^{1-r}$$  \[56\]

which is but a rewritten form of eq. [51] and obviously declines in $\frac{\tilde{X}(d)}{d}$. Hence, this would imply

$$0 \leq \mu \left(\frac{V}{d} + 1\right) - \mu (1 - r) \frac{rV}{d} - \left(\frac{rV}{d}\right)^{1-r}$$  \[57\]

and thus

$$\mu > \frac{1}{r} \frac{d}{d + rV} \left(\frac{rV}{d}\right)^{r} > \frac{1}{r} \frac{d}{d + rV}$$  \[58\]

where the last inequality follows from the fact that for $r \leq 1/2$ the equilibrium with $(\tilde{X}(d), d)$ may only occur for $d < rV$. However we know from $d > \tilde{d}$ that $\mu < 1/(\frac{rV}{d} + 2r - 1)$. Some simple algebra shows that this is compatible with inequality [58] only if $d > rV$. Hence $\Pi_D(d, \tilde{X}(d)) > -V$ must be true. The proofs for the other claims in the same paragraph follow the same structure and are omitted here.

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