Overconfidence of lawyers and litigation outcomes

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h	Harm incurred by the plaintiff
l	Defendant liability
α	Lawyer's share of the payout
s	Settlement demand
e_L	Lawyer effort
e_D	Defendant effort
t	Lawyer overconfidence
π	Probability of plaintiff victory in trial
π_x	Expected probability of plaintiff victory in trial
L_x	Lawyer's expected payout in trial
D_x	Defendant's expected payout in trial
e_L^*	Lawyer equilibrium effort
e_D^*	Defendant equilibrium effort
t^{max}	Level of overconfidence which maximizes effort levels
t^{even}	Level of overconfidence which leads to equal effort as if the lawyer was rational
L_x^*	Ex ante expected trial payout for the lawyer
D_x^*	Ex ante expected trial payout for the defendant
$\hat{l}$	Critical liability
$\Lambda(s)$	Lawyer's perceived payout function for trial and settlement
s^*	Lawyer's perceived optimal settlement demand
$\hat{l}^*$	Critical liability, given that $s = s^*$
π^*	True equilibrium probability of plaintiff victory in trial
P	Plaintiff's expected payout in trial
Π_s	Plaintiff's expected payout for the settlement stage
Π_c	Plaintiff's ex ante expected payout for the trial stage
Π	Plaintiff's expected payout for the entire game
t^{set}	Level of overconfidence which maximizes the plaintiff's payout in settlement
t^{opt}	Optimal level of overconfidence from the point of view of the plaintiff
D_{scep}	Sceptical defendant's payout in case of trial
$\tilde{e}_D$	Sceptical defendant's optimal effort level
$\tilde{\pi}$	True probability of plaintiff victory if the defendant is sceptical

$\tilde{D}$	Ex ante expected trial payout for the sceptical defendant
$\tilde{l}$	Critical liability for the sceptical defendant
$\tilde{l}^*$	Critical liability for the sceptical defendant, given that s=s*
t^{break}	Level of overconfidence which never leads to settlement if the defendant is sceptical
α^{break}	Contingency fee share for which $t^{max} = t^{break}$
$\tilde{t}^{set}$	Level of overconfidence which maximizes the plaintiff's payout in settlement, given the defendant is sceptical
$\tilde{\Pi}_s$	Plaintiff's expected payout for the settlement stage if the defendant is sceptical
$\tilde{\Pi}_c$	Plaintiff's ex ante expected payout for the trial stage if the defendant is sceptical
$\tilde{\Pi}^{max}_{c-break}$	Maximum ex ante expected payout from the trial stage, if the defendant is sceptical and $\alpha \leq \alpha^{break}$
$\tilde{\Pi}_g$	Expected payout if the defendant is sceptical and settlement is possible
$\tilde{t}^{opt}_g$	Level of overconfidence which maximizes $\tilde{\Pi}_g$

1 Introduction

Overconfidence has been extensively studied by economists, psychologists and other social scientists. The literature shows that it affects, among many others, stock traders (Odean, 1999), students (Clayson, 2005), managers (Russo and Schoemaker, 1992) as well as striking laborers (Neale and Bazerman, 1985), poker and chess players (Park and Santos-Pinto, 2010), and most importantly for the purpose of this thesis, lawyers (Delahunty et al. 2010). In fact, according to Werner DeBondt and Richard Thaler (1995, p.389): "Perhaps the most robust finding in the psychology of judgement is that people are overconfident."

This thesis aims to add its small part to the existing knowledge by studying how the overconfidence of lawyers affects litigation outcomes. This is by no means a novel idea. One of the most widespread explanations for why trial even occurs is that oftentimes the parties involved are too optimistic about their chances in court (e.g. Shavell, 1982). Still, this analysis differs from the existing literature in that it combines different approaches that are usually separated.

We specifically want to look at a lawyer's excessive faith in their own ability, their overconfidence, as the source of their optimism. We examine lawyers as agents and explore how their biases might affect their clients. We consider how a lawyer's overconfidence impacts both trial and settlement negotiations, not just one or the other.

To do so, we at first clarify what we mean by overconfidence and explore the concept more broadly to develop some intuitions of how it may affect a lawyer's performance in trial and their behavior while negotiating. We consider how economists have modelled overconfidence in relevant contexts and look at empirical evidence on how overconfidence affects the legal profession. We also survey contributions to the economic theory of litigation, which we will use as the basis of our own model.

In it, we consider a case in which a plaintiff may hire an overconfident lawyer, who believes their efforts in court have a greater impact on the probability of victory than they actually have. Looking at two different belief structures, we find that a plaintiff may generally benefit from their lawyer's overconfidence, that a higher level of overconfidence always leads to lower settlement rates and that overconfidence can help mitigate agency problems introduced by contingency fees.

2 Overconfidence in economics

2.1 Clarifying overconfidence

Given that overconfidence can be found in almost any context, it is unsurprising that the term "overconfidence" itself can seem muddled at times. Psychologists such as Moore and Healy (2008) argue that overconfidence actually refers to three distinct biases. Moore and Schatz (2017) call these the three faces of overconfidence.

Overestimation describes the tendency where a person might overestimate their actual performance, their absolute skill in a given area, and their chance of success. All else being equal, while an unbiased person will on average receive the outcome they anticipated, an overestimator will have had expected to have done better. Examples of overestimation include physicians misjudging the accuracy of their diagnoses (Christensen-Szalanski and Bushyhead, 1981) and CEOs overestimating their ability to increase their company's stock prices (Malmendier et al., 2011).
Overplacement is also known as the "better-than-average" effect. It has been demonstrated that many people erroneously believe that they are better than others at a wide variety of tasks. The most commonly cited study illustrating this tendency is perhaps Svenson (1981). In it, undergraduates were asked how they would rate their driving ability relative to their peers. 83 percent of American subjects thought themselves in the top 30 percent when it comes to driving safety. Thus, while overestimation is concerned with the misjudgement of absolute skill, overplacement refers to people falsely assessing their relative ability.
The third face of overconfidence is called overprecision. People might overestimate the certainty by which they know what is true and underestimate the variance of some outcomes. According to Moore and Schatz (2017), researchers concerned with overprecision will oftentimes ask their subjects to give a confidence interval estimate for a trivia question so that they are 90 percent certain that the right answer will fall into the interval. If asked ten questions, an unbiased participant's intervals are expected to contain 9 correct answers. In truth, consistently more than 50 percent of all participants will reach less than that (Klayman et al. 1999; Soll and Klayman, 2004).

When it comes to studying the effect of overconfidence on litigation outcomes, overestimation and overplacement are arguably of greater concern than overprecision. While the latter might affect the decision of risk-averse or risk-loving actors to proceed to trial, the former two will have a direct impact on a lawyer's performance, as well as their expectation. Thus, in the remainder of this paper, we will mostly focus on overestimation and overplacement.

2.2 Overconfidence and economic behavior

Economists have been concerned with overconfidence in a variety of different ways. A large part of their efforts has been focused on illustrating how overconfidence might affect behavior in the marketplace.
It is easy to intuit, how for example overestimation might lead an individual to take riskier decisions. Someone who has excessive faith in their own ability to affect good outcomes might take on tasks that are more difficult, because they underestimate their own chance of failure. Given the choice between a sure payout and a higher payout that is dependent on their ability and future effort, they are more likely to pick the latter. An individual

who overplaces themselves should be more likely to enter situations in which they have to compete with other people, as they are more likely to believe their own skills to be superior.

To test these and other intuitions empirically, economists mostly have to resort to laboratory experiments, as, in the field, it is difficult to ascertain if and to what degree a subject is overconfident.
Camerer and Lovallo (1999) find that participants in their experiment are more likely to enter a market where they, depending on their rank, might gain a profit or suffer a loss, if their success depends on them being good at sports and knowing trivia, than if their success is determined randomly.
Similarly, Bruhin et al. (2018) find that low skill individuals are more likely to take risks when their chance of winning a gamble depends on their relative skill than they are to take risks on gambles where the probability of winning is exogenously given. This is because they overplace their relative skill. The inverse is true for high skill participants.
Dohmen and Falk (2011) find that, when offered different compensation schemes, subjects are more likely to select competitive schemes, if they overplace their skills.
By putting participants in the role of a manager at an ice-cream stand Herz et al. (2014) come to the conclusion that overestimation is positively associated with innovation, as overestimators were more willing to radically alter their business strategy, taking a greater risk. In doing so they back up field evidence such as Galasso and Simcoe (2011) and Hirshleifer et al. (2012) that show that CEO overconfidence is positively associated with R&D expenditures and citation-weighted patent counts.
Taken together these studies should reinforce the intuition that overconfident actors are more likely to take risks and to seek out situations in which their payout is determined competitively. Interestingly, when considering how overconfidence might affect litigation outcomes, this implies that overconfident actors should be less likely to be conciliatory in negotiations. The simple reason for this is that they are more likely to think that they have more to gain from the alternative. Indeed, Neale and Bazerman (1985), looking at 100 subjects negotiating a contract under controlled conditions, find that overconfidence was negatively associated with conciliatory behavior and success in negotiations. Colzani and Santos-Pinto (2020) have their subjects perform either a hard or an easy task. In pairs, they then have to bargain over a joint production. The authors show that performing the easy task induces overplacement and that those who performed the easy task were significantly less likely to come to an agreement.

For the purposes of this analysis, it is also interesting to contemplate how overconfidence might affect performance and the amount of effort the overconfident actor provides. One might intuit that an overestimator underestimates the amount of effort, they need in order to reach a certain outcome. If they then provide the effort, they thought would be sufficient, they will fall short of the outcome they had anticipated. A student might believe that they can write a satisfactory seminar paper in just a few days. As a result, they only start writing a few days before the deadline. Having overestimated their own ability, they do worse than an unbiased student who planned in the appropriate amount of time.

Alternatively, one could imagine that an overconfident actor aspires to a better outcome than an unbiased actor would in their situation. Falling short of what they aspired to achieve however, would introduce additional costs. Thus, the overconfident actor will provide more effort than they had anticipated, or than an unbiased actor would provide. A student might be overly ambitious in what they think they can achieve in their seminar paper. Realizing that they will need to exert a lot more effort than expected, they pull several all-nighters and manage to accomplish what they wouldn't even have attempted were they rational. Their overconfidence made them over-promise and as a result they over-delivered.

Experimental and field evidence might support the conclusion that overconfident actors are more likely to perform better. Hoffman and Burks (2020) find that overconfident truck drivers provide their firms with higher profits. Chen and Schildberg-Hörisch (2019) find that negative debiasing information on individual ability diminishes effort provision.

2.3 Models of overconfidence

As this thesis is mainly a theoretical analysis of overconfidence and litigation outcomes, it is of course interesting to consider different models of how overconfidence might affect effort. Since we model the trial as a contest between two lawyers, models that focus on contests are especially noteworthy.

Ando (2004) studies a contest between two players. He considers two types of overconfident players. The first type overestimates their monetary value of winning the contest. The second type underestimates their opponent's monetary value of winning the contest. The author views the payout in the case of winning the contest as a function of absolute ability. Thus, an overconfident player of the first type overestimates his absolute ability. An overconfident player of the second type overplaces his relative skill in comparison to his opponent. The model shows that a player of the first type will always play more aggressively. However, in the case of a player of the second type, it depends. A player who believes that their payout in case of winning the context is rather low will play marginally more aggressively if they believe that their opponent's potential payout is closer to their own. A player who thinks that their payout will be rather high might decrease the amount of effort they invest into the contest if they believe that they will be facing an opponent with a lower payout, who will thus invest less themselves.

Ludwig et al. (2011) analyze a Tullock (1980) contest in which one player is rational and the other is overconfident. Generally, in a Tullock contest, players compete for a price. In a basic two player contest, the probability that the first player will win the price is

$\pi = e_1/(e_1 + e_2)$, where e_1 and e_2 are the efforts players 1 and 2 exert.
In Ludwig et al.(2011) the overconfident player is biased to perceive their cost to exert effort to be lower than it actually is. Thus, holding the cost constant, they overestimate the amount of effort they could provide. As a result, they always invest more effort into winning the contest than they would have if they were unbiased. The model also shows that the rational player always invests less into the contest when playing against an overconfident opponent. Indeed, there are circumstances in which the overconfident actor gains absolutely from being overconfident, as the higher chance of winning the contest might be worth more than the additional costs, they accrue from providing a higher amount of effort.
Santos-Pinto and Sekeris (2022) also model overconfidence in Tullock contests, but come to different conclusions. They consider a more general Tullock contest in which the players probability of winning is not only affected by their efforts but also by exogenous factors specific to the player, such as the technology they are using. Taken together these factors determine the player's so-called impact function (Ewerhart, 2015). An overconfident player erroneously assumes that their impact function is multiplied by a linear factor greater than one. Thus, for any (positive) effort, the overconfident player assumes their probability of winning is greater than it actually is. Their rival knows that this is not true. The authors show that, in a two-player contest, in which players have symmetrical impact functions and cost functions, this leads the overconfident player to exert less effort. If both players are overconfident the one who is more overconfident exerts less effort and an increase in the overconfidence of either player reduces the effort of both players. In the case of asymmetrical cost or impact functions their analysis becomes more complicated. They demonstrate that if the expected winning probability of a player is below 1/2, an increase in overconfidence will lead to an increase in effort. The inverse is true if their perceived chance of winning is above 1/2.

Santos-Pinto and Sekeris (2022) argue that the way they model of overconfidence, as an overestimation of the productivity of effort, is consistent with studies that look at the impact of overconfidence on contracts. They cite Bénabou and Tirole (2002), Gervais and Goldstein (2007), Santos-Pinto (2008 and 2010), and de la Rosa (2011). Their specification of overconfidence also fits both overestimation and overplacement. An individual who believes their absolute expected utility from performing a certain action to be higher than it actually is, overestimates their ability. Someone who falsely believes that their skill will give them an advantage over someone else competing for the same price, overplaces themselves relative to others. Their specification is also computationally easier than that of Ludwig et al. (2011). Additionally, in Ludwig et al. (2011), to an outside observer, there is no difference between an overconfident player and one whose cost of effort simply is lower. This is why we decided to adopt a simplified form of Santos-Pinto's and Sekeris' (2022) specification in our own model.

3 Overconfidence of lawyers

However, before moving on to discuss said model, it is relevant to examine to what degree and under which circumstances lawyers may be overconfident.
There is some evidence that lawyers may overestimate the prospects of their cases before court. Kiser et al. (2008) study over 4000 California cases in which settlement failed. They find that lawyers are often wrong in their decision to reject a settlement offer or demand by the other party and move on to trial. They define a so-called decision error as an instance in which either the plaintiff rejects a settlement offer that would have been higher than or equal to their award in trial, or the defendant rejects a settlement demand that would have been lower than or equal to their loss in trial. Their lawyer's opinion is naturally decisive in this decision. Plaintiffs commit a decision error in 61 percent of all cases the authors consider, defendants in 24 percent of the cases. However, the cost of making a decision error was far higher for defendants than it was for plaintiffs. While these findings show that many lawyers and their clients go to trial with undue optimism, they are not evidence for the conclusion that lawyers in general overestimate their chances. It could simply be that those lawyers who are overconfident in their chances, reject settlements far more often.

It would be interesting to find out how being involved with a case influences one's opinion of the likely outcome. Spamann (2020) provides an overview of the literature that tries to answer this very question. In his own study he analysis a classroom exercise in a law school. Students had to take part in a mock oral argument for a case that was argued before the US Supreme Court. They were later asked which side they would expect to win at the actual Supreme Court. Students significantly favored their own side.
Babcock et al. (1993) randomly assigned undergraduates a side in a legal dispute. They were to take the role of either the plaintiff or the defendant and had to try to reach a settlement agreement. If they didn't reach the agreement their payout would depend on the decision of a judge who had received the case by the researchers and made a verdict. After learning all relevant facts, they had to estimate the actual ruling of the judge. After just 30 minutes of preparation, plaintiffs already overestimated the amount of money the plaintiff would receive in the ruling, defendants underestimated it. This rendered settlement negotiation less successful. Babcock et al. (1995) conduct a similar experiment with graduate and law students. However, only some were told whether they will take on the role of the plaintiff or the role of the defendant before receiving the information on the case. The difference between the estimation of the plaintiff and the estimation of the defendant was only significant if they were told their role before reading about the case. Hippel and Hoeppner (2019) later replicate their findings. But as Spamann (2020) and Eigen and Listokin (2012) both stress, these studies put students in the role of plaintiffs and defendants, not in the role of their lawyers. A real lawyer taking on a real case

might have a stronger incentive to better calibrate their judgement than participants in an experiment. They also might be trained to better predict the outcome of a case.
Delahunty et al. (2010) surveyed 481 attorneys, both civil and criminal. The researchers asked the lawyers for the minimum goal they would like to achieve in their current, unresolved case, either through trial or through settlement. Also, the lawyers were supposed to state the likelihood with which they thought they would be able to achieve said minimum goal. 56 percent of lawyers achieved or exceeded their minimum desired outcome. 44 percent fell below it. The authors show that significantly more lawyers overestimated their probability of success than underestimated it. They also found that neither the amount of time that remains til trial nor the experience of the lawyer had any significant relationship to the lawyer's propensity to overstate their chances.
Instead of surveying practicing lawyers, Eigen and Listokin (2012) study moot court competitions. These are competitions, wherein participating law school students are randomly assigned an existing court case, for which, after weeks of preparation, they will have to argue in a mock trial. For the students, the stakes are high, as doing well in a moot court competition is very prestigious. The authors asked the participants, if they thought that the legal merits favored the position they argued. They found that students were on average too optimistic about the merits of their case. They also found that more optimistic students were less likely to do well in moot court, even after controlling for possible confounders such as the perceived ease of arguing the case or preexisting subject area expertise.

But while these studies supply evidence for the claim that lawyers are often overly optimistic about the cases they are associated with, this does not necessarily mean that lawyers overplace their own abilities. There are a variety of reasons why the lawyers in Delahunty et al. (2010) might believe their cases to be stronger than they actually are. As Eigen and Listokin (2012) argue, selection bias might be present. If a lawyer is biased to think that, for example, cases in which the plaintiff is above the age of sixty are much easier to win, they will take on more cases in which the plaintiff is more than sixty years old. In that case, the lawyer's optimism about their case's prospects is driven by the specific circumstances of the case, and not the lawyer's faith in their own ability compared to others. Similarly, and obviously, the subjects in Babcock et al. (1993 and 1995), as well as Hippel and Hoeppner (2019), know that the decision the judge already made, is completely independent of the arguments they will be making. The same goes for Spamann (2020) and the Supreme Court decision. Thus, while there is strong evidence for overestimation within the legal profession, the same isn't true for overplacement.

4 Theories of litigation

The model developed in this thesis builds on a vast prior literature. Economists have studied litigation from a variety of different angles. Models that consider how different expectations for trial affect settlement outcomes and models that study how the amount of effort and the costs invested in trial arises from the decision of the actors involved are especially interesting for our purposes.

Litigation processes are usually conceptualized as a multi stage game in which a prospective plaintiff first decides whether or not they want to pursue a case against a possible defendant. If so, they try to negotiate a settlement. If this fails, they proceed to court. The latter might happen because the plaintiff, the defendant and their legal representatives have different expectations of what will happen in court. Shavell (1982) assumes these believes are exogenously given. He shows that settlement negotiations will fail if both parties are excessively optimistic about their chances. This of course matches our findings in section 2.2. Bebchuck (1984) takes a different approach. Different expectations arise because the parties in the legal dispute have access to different sets of private information. A defendant might know the probability with which they will be found guilty. The plaintiff might only know its distribution.

Interestingly for our purposes, Farmer and Pecorino (2002) extend this model to account for a self-serving bias on either side of the dispute. While a defendant might observe their probability of losing the case, they interpret it to be lower than it actually is. The plaintiff thinks any defendant within the distribution has a higher chance of being found guilty than they really have. The authors show that, normally self-serving bias increases the probability of trial, but under specific conditions, the bias of a defendant who receives the settlement offer can reduce it.

In contrast to what our model tries to examine, the studies above do not consider how biases might affect the actual outcome of trial. The literature that investigates theoretically what determines success and effort in the case of trial, usually does so by modelling it as a two player contest (e.g. Braeutigam et al.1984; Katz, 1988; Hirshleifer and Osborne, 2001). Insights from section 2.3 should thus also apply to the question of how overconfidence will affect effort, performance and, through this, the decision in court.

There is a relatively small but increasing number of studies that looks at how an endogenous outcome in court might affect settlement and vice versa (e.g. Choné and Linnemer, 2010; Poitras and Frasca 2011; Farmer and Pecorino 2013). In our own analysis we will adopt a framework that most closely resembles Chen and Wang (2007) who combine endogenous expenditure in trial and a settlement decision with incomplete information to study the impact of different fee-shifting rules on the legal process.

Perhaps the analysis the closest to our own approach is Yang (2020). The author studies how optimism affects the choice between a bargaining game and a contest game, as well as how it affects equilibrium efforts in both games. The games are meant to be more gen-

eral representations of trial and settlement respectively. Optimism is expressed through a rank-dependent expected utility model. In both games, efforts were at their highest when one party was moderately optimistic. If a player was very optimistic this had a negative effect on their effort provision. Expectedly, her model predicts that optimistic players are more likely to choose the contest game. She does not model a lawyer separate from a plaintiff. However, this thesis is especially concerned with how a plaintiff might benefit or be worse off as a result of hiring an overconfident lawyer.
Bar-Gill (2006) can help address this question. He studies how market forces might lead to a prevalence of optimism in the legal profession. He comes to the conclusion that an optimistic lawyer can credibly threaten to move on to trial, thus being able to extract a higher settlement from the other party. He shows that over time the population of lawyers converges into being moderately optimistic. In his analysis a lawyer is assumed to be optimistic if they expect a higher probability of victory than there actually is. This probability is exogenously given. Once again, the outcome of the case is assumed to be independent of the bias of the lawyer. While the author does consider lawyers to be his reference point, he assumes they are perfect agents of their clients.
To the best of our knowledge, there are no studies which examine how the overconfidence of a lawyer, who does not have the same incentives as their client, affects the outcome of both trial and settlement simultaneously.

5 The model

5.1 Setup and assumptions

To study exactly this, we consider the following scenario: The plaintiff (she) was harmed by the defendant (he), both assumed to be risk-neutral, and incurs damage worth $h > 0$. For simplicity's sake, we assume that the defendant's liability l is evenly distributed, with $l \in [0;1]$. The defendant knows his actual liability. If the case is won by the plaintiff in trial, the compensatory payment due would be $h \cdot l$. But, in the initial stages of the game, the plaintiff only knows the liability distribution, not the actual liability.
The plaintiff hires a lawyer (they) who receives full discretionary power over the case. In the settlement stage, they propose a take-it-or-leave-it settlement offer s to the defendant. We assume settlement negotiations to be costless. We also assume no agency issues on the side of the defendant. If the defendant takes the offer he has to pay s to the plaintiff and her lawyer. If the defendant doesn't take it, the game moves on to the trial stage. As in Chen and Wang (2007), we assume that the defendant's true liability l will be revealed at the end of the settlement stage.
In any case, the lawyer is compensated via a contingency fee using the share$\alpha \in]0;1[$. In other words, they receive whatever they can extract from defendant, multiplied by α. However, if the case is decided in court, they will have to bear their own effort costs.

We assume the lawyer is also risk-neutral and, like in Chen and Wang (2007), only cares about their own payout.
This cost regime offers two distinct advantages. Firstly, it makes it so that the plaintiff will always have an incentive to pursue the case. Their payout from either the settlement or the trial will never be negative. The decision to drop the case is dominated [1]and we can ignore it. Secondly, contingency fees normally induce too much settlement, at least from the point of view of the plaintiff. If the lawyer faces the cost of the trial alone, there will be cases in which the plaintiff might prefer moving on to trial while the lawyer doesn't (Polinsky and Rubinfeld, 2003). From what we saw in sections 2.2, 3 and 4, overconfidence is expected to make a lawyer more prone to take a case to trial, moderating the effect of the contingency fee.

If the game reaches the trial stage, who wins the case is decided by a two-player Tullock (1980) contest. Thus, the plaintiff's chance of winning is

$$\pi = \frac{e_L}{e_L + e_D}, \tag{1}$$

where e_L denotes the effort exerted by the lawyer and e_D stands for the effort invested on behalf of the defendant. As is normally assumed in Tullock contests, if both exert zero effort, the plaintiff wins with a 50 percent chance. The plaintiff's lawyer and the defendant each face costs that exactly correspond to their efforts. In the case of trial, these effort levels will be chosen simultaneously.
However, the plaintiff's lawyer may be overconfident. Similarly to Santos-Pinto and Sekeris (2022), in our model this means that the lawyer believes their efforts will be multiplied by a factor of $1 + t$, where t denotes their level of overconfidence and $t \geq 0$. Thus, the lawyer expects, they will win the trial with a probability of

$$\pi_x = \frac{(1+t)e_L}{(1+t)e_L + e_D}. \tag{2}$$

As discussed in section 2.3, this specification fits both overestimation and overplacement. Intuitively, the lawyer believes that, given the same effort as their opponent, they will be able to make a better argument, improving their chances to win in court.

Various questions arise from the mismatch between the lawyer's expectations and their actual ability. How does overconfidence affect the efforts of both the lawyer and the defendant? How does it affect the plaintiff's winning chances in trial? Can the plaintiff's side extract a higher settlement offer because of the lawyer's overconfidence? In what way does a lawyer's overconfidence affect the probability of a case ending up in court? And,

[1]Technically speaking, "drop the case" is only weakly dominated, as there is an infinitesimally small chance that l is equal to zero. If and only if this is the case, the plaintiff will drop the case after the settlement phase.

under which circumstances might a plaintiff prefer an overconfident lawyer?
We examine these question in two different belief structures. First, we will assume, the defendant believes the lawyer's t to reflect their true ability. Then, we will consider the case in which the defendant looks through the lawyer's overconfidence but the lawyer is oblivious to that.

5.2 The basic model

In short, the game is structured as follows:

Stage 0: Nature determines h, α, as well as l.
Stage 1: The plaintiff selects her lawyer based on their t[2].
Stage 2: The plaintiff's lawyer chooses a settlement offer s, which the defendant can either accept or deny. If the offer is accepted, the game ends. The plaintiff receives $(1-\alpha)\cdot s$, her lawyer receives $\alpha \cdot s$, the defendant loses s. If it is denied, the participants move on to the trial stage.
Stage 3.1 The true liability is revealed to the plaintiff's lawyer.
Stage 3.2 The plaintiff's lawyer and the defendant simultaneously select their effort levels. This determines π.
Stage 3.3 The plaintiff and her lawyer receive $(1-\alpha)\cdot h \cdot l$ and $\alpha \cdot h \cdot l$ with a probability of π respectively. With the same probability, the defendant loses $h \cdot l$. The defendant and the lawyer always lose e_D and e_L. The game ends.

6 Scenario 1: An overconfident lawyer, a fooled defendant

6.1 Preliminary thoughts

Usually, models of overconfidence assume that the other party, either a principal (de la Rosa, 2011; Heller, 2014) or a competitor (Ludwig et al. 2011, Santos-Pinto and Sekeris, 2022), is aware of the overconfident actor's true ability and adjusts their behavior accordingly. This however doesn't have to be the case. One of the main benefits of overconfidence may well be that one can better convince others of one's own ability (Solda et al. 2019). Fooling yourself makes it easier to fool others.
Indeed, Ludwig and Nafziger (2007) supply experimental evidence that people usually do not think that others are overconfident. One could of course argue, that litigation lawyers

[2]It is of course not self-evident that the plaintiff would know the lawyer's level of overconfidence. In reality she might make inferences based on the lawyer's attitude and reputation. She might also choose a lawyer with the optimal t without knowing their level of overconfidence, by looking at the outcomes they provide to their clients.

face each other over and over again. Thus, one would expect them to learn about the other's level of overconfidence eventually, especially since the legal profession doesn't place a premium on naiveté. Still, if the defendant is represented by a relatively inexperienced lawyer, a lawyer who simply doesn't know the plaintiff's lawyer very well, or even by himself, it is entirely reasonable to assume that they wouldn't know about the plaintiff's lawyer's overconfidence. In any case, it is a scenario worth considering.

For simplicity, we will be referring to the plaintiff's lawyer as "the lawyer". Since we do not explicitly model the defendant's lawyer, we will be referring to anyone who acts on behalf of the defendant as "the defendant".

6.2 Efforts in the case of trial

Like one would almost any multi-stage game, we solve our model, beginning with the last stage: The trial.

As the lawyer has full responsibility for victory in court, only they and the defendant have any influence over the outcome of the trial. The lawyer determines their effort level by maximizing:

$$L_x = \pi_x \alpha hl - e_L \tag{3}$$

which is equal to their perceived chance of winning the case, multiplied with their payout in case of victory, minus their effort costs. The defendant also believes, the plaintiff will win with a probability of π_x. Thus, he minimizes his loss:

$$D_x = -\pi_x hl - e_D \tag{4}$$

with respect to e_D.

The defendant and the lawyer determine their efforts simultaneously. As both their payouts depend on the other's choice (remember how π_x is a function of both e_D and e_L), they decide on their effort level, as a firm would in a Nash-Cournot duopoly.

Following this, it can be shown that, in equilibrium, the players choose the efforts[3]:

$$e_L^* = \alpha \frac{\alpha hl(1+t)}{(1+\alpha+\alpha t)^2} \tag{5}$$

and

$$e_D^* = \frac{\alpha hl(1+t)}{(1+\alpha+\alpha t)^2} \tag{6}$$

which are both strictly positive[4]. It is immediately obvious that, in equilibrium, the defendant always exerts more effort than the lawyer. Their equilibrium efforts are identical, except for the lawyer's being multiplied by $\alpha < 1$. This has nothing to do with the lawyer's overconfidence, the contingency fee simply lowers the relative stakes for the

[3]Proof in the appendix

[4]provided l isn't zero

lawyer, decreasing their incentive to exert effort. Both effort levels scale linearly with h and l.

If we determine the perceived chance of plaintiff victory using the equilibrium efforts, we get:

$$\pi_x^* = \frac{\alpha + \alpha t}{1 + \alpha + \alpha t} \tag{7}$$

As expected, this expression always increases with t, as the difference between the denominator and the numerator always decreases if t grows.

The effect of overconfidence on both effort levels, however cannot be told at a glance. As can be seen in the first figure, both sides' effort levels rise with t until they start falling, when t reaches very high levels.

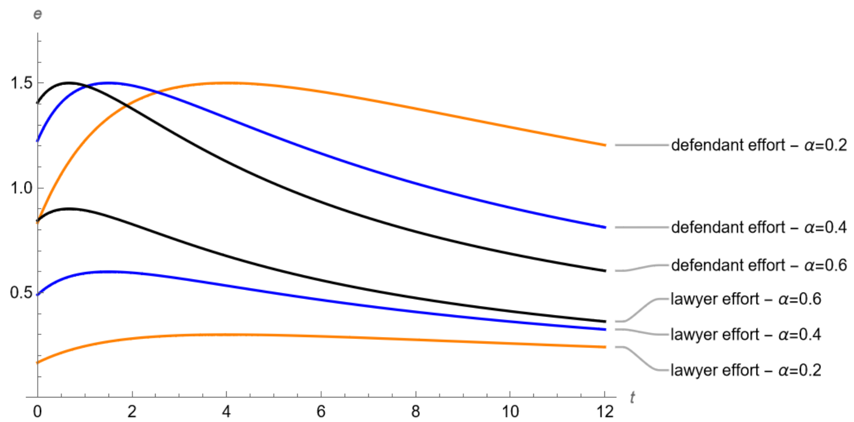

Figure 1: Efforts, dependent on t

$h = 10, l = 0.6$

In fact, both the defendant's and the lawyer's effort levels reach a single maximum at $t^{max} = \frac{1-\alpha}{\alpha}$[5]. Solving $e_L^*(t=0) = e_L^*$ and $e_D^*(t=0) = e_D^*$, we find that if $t^{even} = \frac{1-\alpha^2}{\alpha^2}$ both players expend the same effort as if $t = 0$. This means, if the lawyer's overconfidence reaches a very high point both players will start to expend less effort than if the lawyer were rational.

If we calculate the equilibrium efforts with t^{max} and use them to determine the perceived probability of victory for the plaintiff we get:

$$\pi_x^{*\ max} = 1/2 \tag{8}$$

Thus, an increase in lawyer overconfidence will lead both players to increase their effort levels, as long as they think the lawyer will win less than 50 percent of the time. If the players believe the lawyer to be the favorite to win, an increase in lawyer overconfidence leads to lower efforts by both sides. This shouldn't be too surprising. In fact, if we

[5] Proof in the appendix

remember section 1.3, it is extremely similar to what Santos-Pinto and Sekeris (2022) demonstrate. Generally, it is well known within the Tullock contest literature that an increase in the chances of the ”underdog”, as Katz (1988) calls them usually raises efforts by both parties, while rising chances for the ”favorite” do the opposite (e.g. Katz, 1988; Nti, 1999).

In short, overconfidence initially increases the efforts of both parties, however once they believe the overconfident lawyer to be the favorite, this reverses. Do note that this result depends on the cost regime we chose. If we assume that the lawyer and the defendant face symmetrical payouts in trial, for example if $\alpha = 1$, overconfidence immediately decreases efforts. Still, if we consider the trial stage outside of the context of our larger model, α could reflect a number of asymmetries between both parties at trial, not just the contingency fee. If we allowed α to go above 1, our model could offer some insight into how differences in opinion on the true damage or liability interact with overconfidence.

6.3 Overconfidence and settlement

In the settlement stage, the lawyer and the defendant form expectations for the trial stage using their expected equilibrium efforts. Hence, if we plug e_L^* and e_D^* into equations 3 and 4, we get:

$$L_x^* = \frac{\alpha^3 hl(1+t)^2}{(1+\alpha+\alpha t)^2} \tag{9}$$

and

$$D_x^* = hl\left(\frac{1}{(1+\alpha+\alpha t)^2} - 1\right) \tag{10}$$

As the defendant is risk neutral, he would take any settlement offer that amounts to less than what he expects to lose in trial. Remember, however, that neither the plaintiff, nor the lawyer knows the defendant’s true liability in the settlement stage. Thus, the lawyer can only estimate what the defendant expects to lose in the case of trial, based on the distribution of l.

Still, they know that the defendant will be indifferent between providing the settlement demand s or going to trial, if: $D_x^* = -s$. We rearrange this equation to get:

$$\hat{l} = \frac{s}{h\left(1 - \frac{1}{(1+\alpha+\alpha t)^2}\right)} \tag{11}$$

,where $\hat{l}$ is the critical liability. That is, the level of liability where the defendant is indifferent between going to trial or paying the settlement demand.

As we can trivially see the, critical liability rises with t. This means that, the more overconfident the lawyer, the less liable a defendant has to be to accept a given settlement demand s. An overconfident lawyer can thus, in our current belief structure, extract a higher settlement demand from the defendant, than a rational lawyer could. This also tells us that a fooled defendant will always expect less from the trial stage if their opponent's overconfidence rises. Even though they will invest less effort if overconfidence is very high. The effect of overconfidence on the perceived probability of plaintiff victory is stronger than its effect on the effort level.

The critical liability is especially important for the lawyer. Since we assumed that l is evenly distributed between zero and 1, this means that any critical liability less than one and greater than zero, directly reflects the probability that a settlement demand will be rejected by the plaintiff. A randomly drawn defendant will accept an s, that corresponds with a critical liability of 0.40, 60 percent of the time[6]

Knowing this the lawyer can determine their settlement demand by maximizing the following function with respect to s, where $F(l)$ is the (uniform) probability distribution of l.

$$\Lambda(s) = (1 - F(\hat{l}))\alpha s + \int_0^{\hat{l}} L_x^* dF(l) \tag{12}$$

The first term reflects the lawyer's payout in case the settlement demand is accepted. The integral describes their payout if the defendant rejects their demand. We derive the following optimal settlement demand[7]:

$$s^* = \frac{\alpha h(1+t)(2+\alpha+\alpha t)^2}{(\alpha+\alpha+\alpha t)^2(4+\alpha+\alpha t)} \tag{13}$$

This demand always increases with t[8]. Hence, an overconfident lawyer will always demand a higher settlement amount than a less overconfident lawyer would.

If we substitute s in $\hat{l}$ with s^* we get the critical liability when the lawyer demands their optimal settlement amount. This is equivalent to the probability of trial occurring[9]:

$$\hat{l^*} = 1 - \frac{2}{(4+\alpha+\alpha t)^2} \tag{14}$$

Through this equation we can plainly see that the probability of trial continuously rises with t[10]. The reason behind this can be explained by the graph below.

While both the lawyer's optimal settlement demand and the highest settlement demand the defendant would accept rise with t, the lawyer's optimal demand does so more

[6]An s associated with a critical liability greater than one will never be accepted. If the lawyer, for some reason, chooses a negative settlement demand, $\hat{l}$ will be negative. s will then always be accepted.

[7]Proof in the appendix

[8]Proof in the appendix

[9]$\hat{l^*}$ is always between zero and one, as the term to the right of the minus cannot exceed one or fall below zero, given that *alpha* and t are both positive.

[10]It also increases with α. As the literature predicts, a higher contingency fee makes trial more likely.

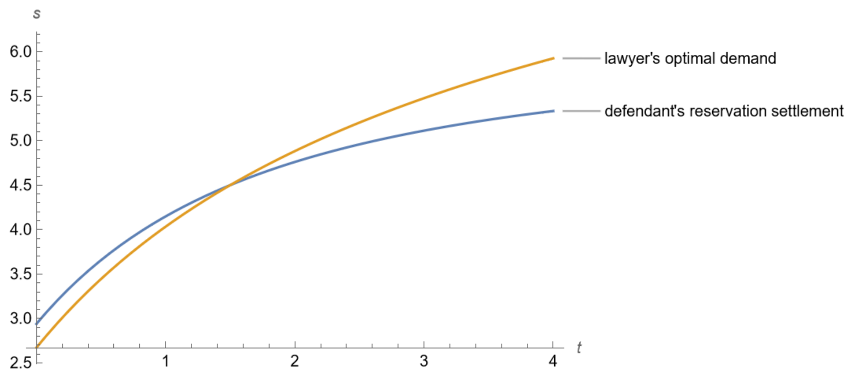

Figure 2: Lawyer's optimal settlement demand vs. defendant's reservation settlement

$h = 10, l = 0.6, \alpha = 0.4$. At the point where the lines cross, a defendant with a liability of 0.6 would be indifferent between paying the settlement demand and going to trial. If t rises so does the settlement demand, he would choose trial.

quickly. The intuition being that an overconfident lawyer perceives themself to be more likely to win in trial. As a result, they would more readily take the (presumably small) chance of losing the case in court, rather than risk demanding too little off a highly liable defendant.

Thus, as one would expect, an overconfident lawyer will be more likely to end up in trial. If their opponent is fooled by their overconfidence, they will also be able to extract a higher settlement offer.

6.4 The true outcome of trial

However, an overconfident lawyer may be mistaken to think that trial is the more worthwhile option for them. Like the studies in section 2.1 demonstrate, there is a difference between (self-)perception and reality. The perceived probability of winning the case is not the same as the true probability of winning the case. If we calculate this true probability using the equilibrium efforts, we get:

$$\pi^* = \frac{\alpha}{1+\alpha}. \tag{15}$$

We find that overconfidence has no impact on the plaintiff's chance of victory in court. Given what we know about the equilibrium efforts, this again shouldn't be surprising. The only difference between the two effort levels is that the lawyer's is multiplied by α once more than the defendant's. The ratio of their efforts is completely independent of t, only α has any impact. Hence, the plaintiff's chance of victory only depends on α.

The plaintiff's expected payout from the trial,

$$P = \pi^*(1-\alpha)hl \tag{16}$$

is thus also independent from t.

The same isn't true for the defendant and the lawyer. Their true expected payouts still depend on t through their effort levels. As these initially increase with t their payouts initially become lower. Both are worst off if $t = t^{max}$. They start being better off than if the lawyer were rational if $t \geq t^{even}$.

In any case, since $\pi^* < \pi_x^*$[11], the lawyer will receive a lower payout than they had anticipated, while the defendant will lose less than expected.

6.5 Optimal overconfidence from the point of view of the plaintiff

As the lawyer's overconfidence doesn't have any impact on their performance in trial, the greatest part of the benefit it might bring to the plaintiff should be through a higher payout in the settlement stage.

Her expected payout in the settlement stage is:

$$\Pi_s = (1-\hat{l^*})(1-\alpha)s^* \tag{17}$$

Where $(1-\hat{l^*})$ is the probability that s^* will be accepted[12]. In this case the plaintiff receives a share of $(1-\alpha)$. There are two effects worth considering in this equation. First, the defendant's chance of accepting the settlement demand continuously decreases as t grows. However, the settlement demand itself, s^*, always increases with t. As does the amount the defendant would be willing to accept. Intuitively, the effect of overconfidence on the plaintiff's settlement payout is thus inconclusive. In the graph below we can see that the settlement payout initially increases with t, but the effect from the higher settlement amount the defendant would accept is eventually overpowered by lawyer's tendency to make very high offers, decreasing the probability of acceptance. Indeed, we can see that Π_s reaches a (single) maximum if $t^{set} = \frac{2-\alpha}{\alpha}$[13]. This is not to be confused with $t^{max} = \frac{1-\alpha}{\alpha}$. The plaintiff, in the settlement stage, continues to gain from the lawyer's overconfidence, even after both parties start to decrease their efforts in trial. Still, we can see that t^{set}, negatively depends on α. This isn't too remarkable, as the literature on contingency fees predicts that a lower contingency fee for the lawyer will lead a higher settlement rate (Polinsky and Rubinfeld, 2003).

[11] If t>0

[12] Since $\hat{l^*}$ is always between zero and one, it is equivalent to $F(\hat{l^*})$

[13] Proof in the appendix

The plaintiff's ex ante expected payout in court can be expressed through this equation:

$$\Pi_c = \int_0^{\hat{l^*}} P dl \tag{18}$$

There is no ambiguity here with regards to the effect of t. The higher t, the closer $\hat{l^*}$ is to one and the more cases will end up in trial. Also, as the lawyer's overconfidence increases, the defendants who opt for trial will be, on average, more liable, further increasing the ex ante expected payout for the trial stage.
However, even if t were to somehow approach infinity and $\hat{l^*}$ would, as a result, approach one, the plaintiff's ex ante expected payout would never exceed $\frac{\pi^*(1-\alpha)h}{2}$. This is equal to the expected trial payout P if l is equal to 1/2, the expected liability. As has been shown in Section 6.4. overconfidence has no influence on the trial's outcome.

If we combine the two equations we just discussed, we can determine the plaintiff's expected payout for the entire game.

$$\Pi = (1 - \hat{l^*})(1 - \alpha)s^* + \int_0^{\hat{l^*}} P dl \tag{19}$$

As can be seen in the graph below, if the lawyer becomes more overconfident, the plaintiff's total payout increases up to a certain point. But if t reaches a very high level, her payout decreases. The overconfident lawyer's ability to extract a higher settlement payment is increasingly overpowered by their propensity to make very high demands, that more and more often result in trial. There, the lawyer's actual abilities become relevant and their expectations don't match reality. As a result, they will extract less from the defendant than a less overconfident lawyer, who would have made a lower settlement demand.

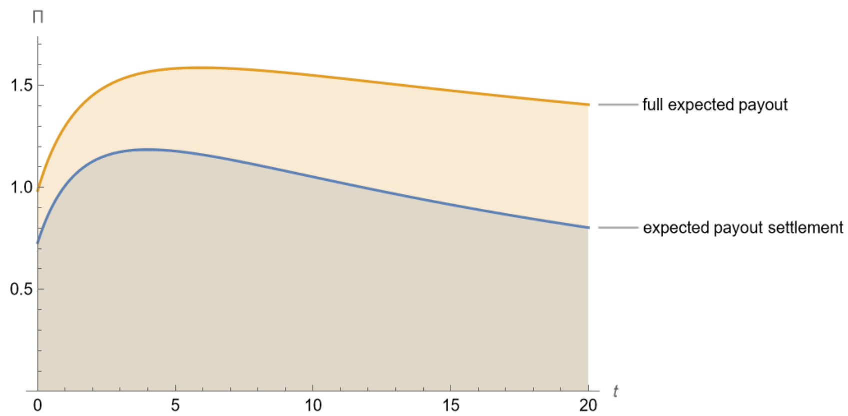

Figure 3: Expected payouts for the plaintiff, by t

$h = 10$, $\alpha = 0.4$

Given the equation above, we can also derive the optimal t from the point of view of the plaintiff[14].

$$t^{opt} = -\frac{\alpha^3+\alpha^2}{3\alpha^3} + \frac{\sqrt[3]{8\alpha^9+33\alpha^8+123\alpha^7+98\alpha^6+3\sqrt{3}\sqrt{47\alpha^{16}+241\alpha^{15}+684\alpha^{14}+833\alpha^{13}+343\alpha^{12}}}}{3\alpha^3} - \frac{-4\alpha^6-11\alpha^5-7\alpha^4}{3\alpha^3\sqrt[3]{8\alpha^9+33\alpha^8+123\alpha^7+98\alpha^6+3\sqrt{3}\sqrt{47\alpha^{16}+241\alpha^{15}+684\alpha^{14}+833\alpha^{13}+343\alpha^{12}}}} \quad (20)$$

The following graph can help us interpret this unwieldy equation:
As we can see, t^{opt} closely matches t^{set}. Similarly to t^{set}, t^{opt} also increases if α decreases.

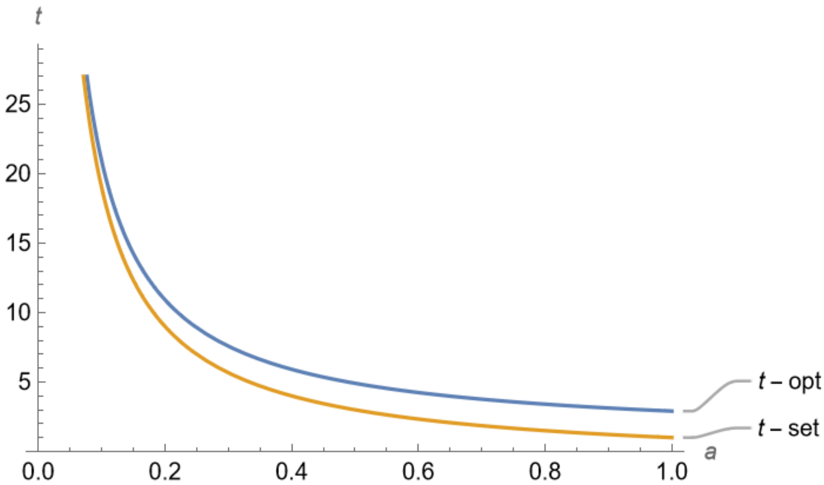

Figure 4: Optimal overconfidence in relation to the contingency fee

If the contingency fee is low, a rational lawyer would prefer too much settlement from the point of view of the plaintiff. To compensate, the plaintiff would prefer a more overconfident lawyer.
Also, in the interval]0;1[, t^{opt} is greater than t^{set}[15]. This tells us, immediately after the lawyer's overconfidence starts to lower the plaintiff's expected payout in the settlement stage, she would still prefer an even more overconfident lawyer for a short while. For these values of t, the higher ex ante expected payout from the trial stage more than compensates for the lost payout in the settlement stage.

For any α, we can see that t^{opt} is rather high. If α is equal to a third, the plaintiff would prefer a t of about 6.9. This means she would prefer a lawyer who believes themself to be about 8 times more effective in trial than their opponent is, and than they actually are. While there probably are lawyers who are this overconfident, they are likely exceedingly

[14]Proof in the appendix
[15]Proof in the appendix

rare. A plaintiff would thus almost always prefer the most overconfident lawyer available.

This is in large part because of two assumptions our model makes. First, the contingency fee is exogenously given. However, a lawyer who is very overconfident in their own abilities would be very likely to demand a higher price for their services, especially if their overconfidence actually does benefit their clients.
Second, the defendant always believes in the lawyer's abilities. This grants the lawyer a great advantage in the settlement stage, as the defendant's expectations for the trial stage are too low. But especially if the lawyer is very overconfident, it might be unrealistic to assume that the defendant will always (fully) believe in their abilities. As a counterweight, we will assume just the opposite in the next section.

7 Scenario 2: A sceptical defendant, an oblivious lawyer

7.1 Preliminary thoughts

If the defendant doesn't believe in the lawyer's ability, this begs an important question: Does the lawyer know that the defendant believes they are overconfident? In this section, we will assume they don't. The lawyer isn't just overconfident in their own abilities, they also believe that others have a more favourable opinion on them than they actually have. In the settlement stage this seems to be a reasonable assumption. As for example Sharot (2011) posits, overestimation might arise because of self-serving bias, people in part believe what they want to believe and more readily ignore evidence to the contrary. People also generally want to believe that others think they are competent. Following this, overestimation of one's own abilities should go hand in hand with thinking one is perceived better than one actually is. An overconfident lawyer should likely think that others believe in their ability.
However, this assumption runs into a problem in the trial stage. If the lawyer's and the defendant's expectations for the trial don't match, but the lawyer is unaware of this, the defendant will sometimes reject settlement demands, which, from the point of view of the lawyer, he should have accepted. Given that l is revealed at the beginning of the trial stage, the lawyer will be confronted with evidence that the defendant is optimizing a different function than the lawyer had thought.
To mitigate this problem, we could assume that the lawyer learns about the defendant's true opinion at the beginning of the trial stage. The lawyer would then know the defendant's true function and optimize accordingly. The parties in trial would essentially agree to disagree about the lawyer's true ability. However, this specification leads to exceed-

ingly complicated results[16]. We weren't able to use it as the basis of a larger model. Instead, we will simply assume that the lawyer sticks with their prior judgement. They will continue to think the defendant believes in their ability. At first this might seem unlikely. Why would the lawyer refuse to update their beliefs? Would we have to assume that the lawyer is oblivious to the fact that they might even be perceived as overconfident? It turns out there might be other reasons why, in the lawyer's mind, the defendant would reject the offer. Especially if the lawyer's self-concept depends on what they believe others think of them, they might prefer these other explanations. As Hirshleifer and Osborne (2001, p. 170) write, the defendant might have a "taste for belligerence". He may also place a premium on winning in court and being exonerated, rather than paying for a settlement and admitting some fault. This should lead to higher defendant efforts. The lawyer might conclude that the defendant is overconfident himself, which could lead to both higher and lower efforts on his part[17]. Given these different explanations, the defendant's decision to reject the offer might have ambiguous implications for the lawyer.
In the face of this uncertainty, it isn't too unreasonable to assume that the lawyer would stick with their priors. Also, if the defendant isn't highly liable the lawyer won't even be surprised if their settlement demand is rejected.

7.2 Efforts and outcomes in trial

If the lawyer thinks their opponent believes their ability, they will have the exact same expectations as in the first scenario. Thus, they will act just like in section 6. As a result, the defendant can anticipate the lawyer's effort in case of trial and optimizes this function[18]:

$$D_{scep} = -\frac{e_L^*}{e_L^* + e_D} hl - e_D \tag{21}$$

The effort level which maximizes his payout, or rather minimizes his loss, is[19]:

$$\tilde{e_D} = \frac{\alpha hl \left(\alpha(t+1)\left(\sqrt{t+1}-1\right)+\sqrt{t+1}\right)}{(\alpha+\alpha t+1)^2} \tag{22}$$

Comparing this equation with e_D^* can offer some interesting insights. In the graphic below we can see that both effort levels rise with t, the defendant in scenario one expending more effort, until they both reach a maximum in $t^{max} = \frac{1-\alpha}{\alpha}$. This is also the point where the relative difference between e_D^* and $\tilde{e_D}$ is the largest [20]. The effort levels cross in $t^{even} = \frac{1-\alpha^2}{\alpha^2}$, so that the defendant who believes in the lawyer's ability ("the believer") now exerts less effort than the defendant who doesn't ("the sceptic").

[16]The formulas for the equilibrium efforts would fill half a page each and analyzing the effects for the plaintiff wasn't possible for us.

[17]Lower defendant efforts if the defendant is already considered the favorite, higher if the lawyer is considered the favorite. See Section 6.2

[18]Note that it includes the lawyer's equilibrium effort from the first scenario

[19]Proof in the appendix

[20]Proof in the appendix for both statements

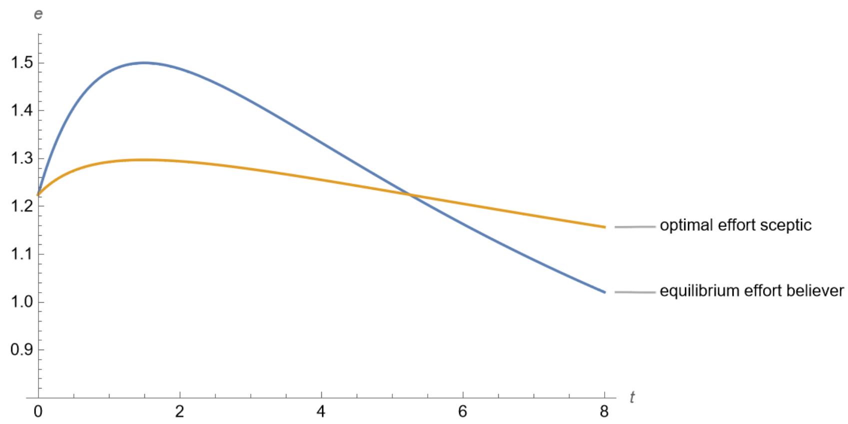

Figure 5: Comparison of defendant effort levels

h=10, $\alpha = 0.4$, $l = 0.6$ as l and h are linear factors they do not have any influence over the shapes of the curves

Intuitively this makes sense. As in the first scenario, the defendant responds to the lawyer's rising effort level by increasing their own efforts. However, the sceptic sees the lawyer's efforts as not as much of a threat to their payout as the believer does. Thus, they don't respond as strongly. But if the lawyer becomes the perceived favorite to win the dispute, the believer is demotivated by further overconfidence. He decreases his efforts. The sceptic also decreases his efforts in response to the falling lawyer efforts, who now believes himself to be the favorite. But unlike the believer, he isn't additionally demotivated by a perceived low chance of victory. He doesn't decrease his efforts as much and eventually passes the believer.

This also has consequences for the plaintiff's chance of victory. π depends on the ratio of efforts of the lawyer and the defendant. In the first scenario this ratio is constant in t. Thus, for any given contingency fee the plaintiff's chance of victory will always be the same. But while the lawyer chooses the same effort level in both scenarios, the sceptic differs from the believer. The ratio of their efforts varies in t. Of course, the same will be true for the sceptic and the lawyer. As a result, in this scenario the plaintiff's chance of victory depends on the lawyer's overconfidence. It can be expressed through this formula:

$$\tilde{\pi} = \frac{e_L^*}{e_L^* + \tilde{e_D}} = \frac{\alpha\sqrt{t+1}}{\alpha + \alpha t + 1} \tag{23}$$

We can, of course, plainly see that $\tilde{\pi} < \pi_x^*$, for any $t > 0$. The sceptic is always more optimistic about his prospects than the believer. $\tilde{\pi}$ also expectedly follows a similar arc to the difference between the sceptic's and the believer's effort levels. The probability of plaintiff victory rises until $t = t^{max}$, when the sceptic's effort is at its relatively lowest compared to the believer's and the lawyer's. It then starts to fall. If $t = t^{even}$, the lawyer exerts as much effort as if they were rational. As a result, so does the sceptic.

$\tilde{\pi}(t = t^{even}) = \tilde{\pi}(t = 0)$. If t rises beyond this level, the plaintiff's chance of victory will be lower than if they hired an unbiased lawyer.
As the plaintiff's payout in case of trial ($\tilde{P}$) is simply her probability of victory multiplied by h, l and $1 - \alpha$, it will also follow the same trend.

In short, given some asymmetry between the lawyer and the defender that makes a rational lawyer think the defender is the favorite to win, the plaintiff can gain a benefit in trial from hiring a moderately overconfident lawyer. However, a very overconfident lawyer might get complacent while at the same time not discouraging the sceptical defendant enough. The plaintiff would be worse off.

7.3 Settlement

As we have already established, the lawyer doesn't change his behavior compared to the first scenario. They make the exact same settlement demand s^*. The defendant's expectations for the trial stage however, are different. Plugging $\tilde{e}_D$ into D, we get:

$$\tilde{D} = -\frac{\alpha hl\left(\alpha(t+1)\left(2\sqrt{t+1}-1\right)+2\sqrt{t+1}\right)}{(\alpha+\alpha t+1)^2} \tag{24}$$

We already know that the defendant's expectations negatively depend on his expected effort and the plaintiff's probability to win. We also know that t has the same impact on both of these variables. Thus, we can conclude that $\tilde{D}$ will be at its lowest if $t = t^{max}$. The lawyer could extract the highest settlement demand. If the defendant faces a lawyer who is more overconfident than t^{even}, he will expect to lose less than if he was facing a rational opponent and would hence be willing to pay less. Indeed, the defendant would begin to expect to lose nothing, if t were to somehow approach infinity. However, in any case[21], the sceptic expects to lose less than the believer[22]. The lawyer will thus be able to extract less from the defendant than they anticipate. The critical liability is:

$$\tilde{l} = \frac{s(\alpha+\alpha t+1)^2}{\alpha h\left(\alpha(t+1)\left(2\sqrt{t+1}-1\right)+2\sqrt{t+1}\right)} \tag{25}$$

Substituting s with s^*, we get:

$$\tilde{l}^* = \frac{(t+1)(\alpha+\alpha t+2)^2}{(\alpha+\alpha t+4)\left(\alpha(t+1)\left(2\sqrt{t+1}-1\right)+2\sqrt{t+1}\right)} \tag{26}$$

Like the critical liability in the first scenario, $\tilde{l}^*$ is never negative, it also always increases with t[23]. But, unlike $\hat{l}^*$, $\tilde{l}^*$ does not converge to one, instead it passes it, if the lawyer is overconfident enough. Some very overconfident lawyers will make settlement demands,

[21] unless if t or l are equal to zero
[22] Proof in the appendix
[23] Proof in the appendix

which no defendant, not even fully liable ones, will accept.
We call the level of overconfidence, which always leads to trial t^{break}. By solving $\tilde{l}^* = 1$ for t, we weren't able to find an explicit solution. However, we were able to show that t^{break} is greater than t^{max}, if[24]:

$$\alpha^{break} > \frac{1}{5}\left(31 - 4\sqrt{55}\right) \approx 0.2670 \tag{27}$$

If $t > t^{break}$ the plaintiff will never gain anything from the settlement stage. Her entire expected payout will have to come from the trial stage. Given that $\tilde{\pi}$ always decreases if $t > t^{max}$, the plaintiff's probability to succeed in trial will be decreasing in any $t > t^{break}$ if $t^{break} > t^{max}$. If $t \geq t^{break}$, all defendants will already take the dispute to court. Taken together, this means that if $t^{break} > t^{max}$, no $t > t^{break}$ will be optimal for the plaintiff. In our analysis, we can therefore ignore the possibility of a lawyer making a settlement demand no defendant would accept for any $\alpha > \alpha^{break}$.

7.4 Optimal overconfidence from the point of view of the plaintiff

Still, when we consider all cases, we cannot treat $\tilde{l}^*$ as a probability, like we did $\hat{l}^*$ in the first scenario. If we model the plaintiff's expected payout in the settlement, we therefore get:

$$\tilde{\Pi}_s = (1 - F(\tilde{l}^*))(1 - \alpha)s^*. \tag{28}$$

There are several effects to consider. We know that the sceptic's willingness to settle rises until $t = t^{max}$. But we also know that he will never be as willing to settle as the believer. In contrast, the lawyer will be as aggressive as in the first scenario and the probability of settlement will fall even faster with an increase in t.
We can easily conclude that $\tilde{t}^{set}$[25] always has to be smaller than t^{max}. All effects which would lead to more settlement, the defendant's lower chance of victory and their higher effort level, start to lessen if $t > t^{max}$. For cases in which $\alpha^{break} \geq \alpha$, $\tilde{t}^{set}$ will of course also be smaller than t^{break}.
We do know that $\tilde{\Pi}_s$ has a maximum[26], but we couldn't find an explicit solution to the first order condition, only a root term. If we compare its values dependent on α with t^{max} in the graphic below, we do find they are rather small. $\tilde{t}^{set}$ for $\alpha = 0.4$ is approximately 0.0974. The plaintiff's tendency to demand high settlements quickly overpowers the defendant's rising efforts and lower probability of victory.

[24]Proof in the appendix
[25]the level of overconfidence which maximizes the plaintiff's payout in trial, given the defendant is sceptical
[26]Proof in the appendix

The plaintiff's ex ante expected payout in court can be explained with this equation:

$$\tilde{\Pi}_c = \int_0^{\tilde{l}^*} \tilde{P} dF(l) \tag{29}$$

As we have seen, the probability that a defendant chooses trial always rises with $t<t^{break}$. So does the defendant's average level of liability. But, for a given level of liability, $\tilde{P}$ only rises if $t < t^{max}$ and falls if $t > t^{max}$. For any $\alpha > \alpha^{break}$, we thus know that the plaintiff's ex ante expected payout in the trial stage will be maximized by $t \in [t^{max}; t^{break}]$.
Indeed, considering $\tilde{\Pi}_c$ within $t \in [0; t^{break}]$, we find that no t satisfies the first order condition. As $\tilde{\Pi}_c$ is of course higher if $t = t^{break}$ than if $t = 0$, we know that the slope of $\tilde{\Pi}_c$ is always positive and that t^{break} maximizes the plaintiff's ex ante expected payout in the trial stage if $\alpha > \alpha^{break}$. In the case that $\alpha \leq \alpha^{break}$, t^{max} maximizes both the plaintiff's payout in trial and the probability that a defendant would choose to reject the settlement demand. For any $\alpha \leq \alpha^{break}$, the maximum ex ante expected payout for the plaintiff in trial is therefore

$$\tilde{\Pi}^{max}_{c-break} = \tilde{P}(t = t^{max}, l = 0.5) = -\frac{(\alpha - 1)h}{4\sqrt{\frac{1}{\alpha}}}. \tag{30}$$

This is relevant when examining which level of t would maximizes the plaintiff's full expected payout. For cases in which $\alpha > \alpha^{break}$, we know that this $\tilde{t}_g^{opt}$ will be within $[0, t^{break}]$. We can determine it by using this equation[27]:

$$\tilde{\Pi}_g = (1 - \tilde{l}^*)(1 - \alpha)s^* + \int_0^{\tilde{l}^*} \tilde{P} dl \tag{31}$$

We do find that $\tilde{\Pi}_g$ has a maximum [28], but we once again, and unsurprisingly, couldn't find an explicit solution, only a root term.
If $\alpha <= \alpha^{break}$, we have to distinguish between two cases. It could be that the plaintiff can gain a higher payout by choosing a lawyer who will never make a settlement demand, a defendant could accept. The higher payout in the trial stage would more than compensate for any lost payout that could come out of settlement. In this case she would prefer a lawyer with an overconfidence level of t^{max}. Otherwise she would prefer a lawyer with $t = \tilde{t}_g^{opt}$. By solving $\tilde{\Pi}^{max}_{c-break}(t = t^{max}) = \tilde{\Pi}_g(t = \tilde{t}_g^{opt})$ for α, we may find the contingency fee for which the plaintiff would be indifferent between t^{max} and $\tilde{t}_g^{opt}$. However, given the complexity of $\tilde{t}_g^{opt}$, we weren't able to find a solution analytically. Instead we can graphically infer that the plaintiff is indifferent between $\tilde{t}_g^{opt}$ and t^{max}, if α is approximately 0.1[29]. Contingency fees smaller than that lead to the plaintiff preferring lawyers who never

[27]Note that, since we only consider $t \in [0, t^{break}]$, we can treat $\tilde{l}$ as a probability again.
[28]Proof in the appendix
[29]see appendix

make a demand which leads to settlement.
Given that, we can plot the optimal level of overconfidence from the point of view of the plaintiff in $\alpha \in]0,1[$. In figure 7, we can see how a rising level of overconfidence affects the payout of a plaintiff if $\alpha = 0.4$ and $h = 10$. [30]

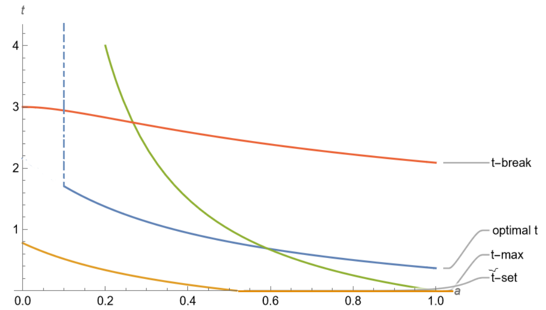

Figure 6: Various important overconfidence levels in case of a sceptical defendant

t^{max} and the optimal t are equivalent, if $\alpha \approx< 0.10$

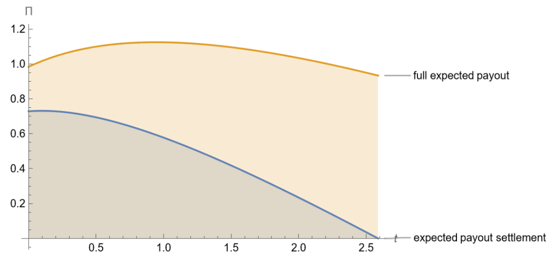

Figure 7: Full expected payout for the plaintiff in case of a sceptical defendant

$h = 10$ and $\alpha = 0.4$.

Comparing figure 7 with figure 3, we can tell that the plaintiff is worse off than in the first scenario. Unsurprisingly, she gains an advantage from her opponent falling for her lawyer's overconfidence. We can also see that the optimal level of overconfidence is lower in the second scenario than in the first. This holds true even if $\alpha < \alpha^{break}$, as $t^{max} < t^{set} < t^{opt}$. This is a reflection of the fact that the plaintiff in scenario one can make much greater gains from overconfidence in the settlement phase, as the sceptic has better expectations for the trial stage than the believer.
In any case, the optimal level of overconfidence rises if the contingency fee falls. Like in the first scenario this is because overconfidence can help mitigate the fact that contingency fees induce a tendency for too much settlement. However, in this scenario overconfidence can also help counter the negative effect a low contingency fee has on the plaintiff's

[30] As h is a linear factor, it doesn't affect the shape of the curve.

probability to win in trial, because it can help increase the lawyer's effort level relative to the defendant's. If the contingency fee is low enough this leads to a scenario in which the benefits of overconfidence on the plaintiff's payout in trial are great enough that she would prefer a lawyer who is so overconfident that settlement always fails.

8 Conclusion

In this thesis, we attempted to add to the literature by considering a model in which a lawyer's overconfidence affects both trial and settlement. We examined two different belief structures.

In both scenarios we found that the plaintiff benefits from her lawyer's overconfidence. In fact, the optimal level of t is always greater than zero. While prior literature, like Bar-Gill (2006) and Yang (2020), predicts that litigants might gain an advantage if they are moderately optimistic, our results endorse overconfidence to a much greater extend. This is especially true in the first scenario. As has been stated at the end of section 6.5, this is, of course, in part a result of the assumptions our model makes. Our chosen cost regime and risk neutrality both make trial a more favorable option for the plaintiff. This will naturally make the plaintiff prefer higher overconfidence levels, especially since we find that overconfidence always increases the likelihood of trial.

For simplicity's sake, we considered both belief structures separately although it might be interesting to combine them. The easiest way to do this would be to imagine a probability q with which the overconfident lawyer will face the believer. By multiplying the plaintiff's payout functions with q and $1-q$ respectively we could derive the optimal level of overconfidence if the beliefs of the defendant are not known. However this still assumes that the defendant can either believe in the lawyer's abilities entirely or not at all. A more realistic, but also computationally difficult assumption could be that defendant might belief the lawyer's efforts are multiplied with $t^{belief} \leq t$. Ideally, we would also be able to model the different beliefs endogenously. A lawyer who, unlike the lawyer in scenario two, is self aware enough to know that some members of the population don't believe in the their ability might make a settlement demand that a believer would accept but a sceptic would reject. As a result they would find out about their opponent's beliefs. Analyzing this scenario would necessitate modelling the case in which both the defendant and the lawyer know about the other's beliefs. While we were unable explicitly determine the effects of overconfidence on the plaintiff in this scenario, from what we have seen, in the trial stage the lawyer and the defendant behave similarly to the way they behave in the second scenario. However it is reasonable to assume that the lawyer would not behave as aggressively in the settlement stage if they know the defendant's true expectations. Further analyzing this scenario should be the task of further research.

A Proofs and inferences

A.1 e_L^* and e_D^* are mutual best responses

The first order condition for the lawyer is:

$$\frac{\delta L_x}{\delta e_L} = -\frac{\alpha e_L hl(t+1)^2}{(e_L(t+1)+e_D)^2} + \frac{\alpha hl(t+1)}{e_L(t+1)+e_D} - 1 \stackrel{!}{=} 0. \tag{32}$$

For the defendant, it is:

$$\frac{\delta D_x}{\delta e_D} = -\frac{\alpha e_L hl(t+1)^2}{(e_L(t+1)+e_D)^2} + \frac{\alpha hl(t+1)}{e_L(t+1)+e_D} - 1 \stackrel{!}{=} 0. \tag{33}$$

In mutual best responses, both have to be true. Solving the above system of equations we find a single solution: $e_L = e_L^*$ and $e_D = e_D^*$. If $e_L = e_L^*$ and $e_D = e_D^*$ constitute a maximum for both players,

$$\frac{\delta^2 L_x}{\delta e_L^2} = \frac{2\alpha e_L hl(t+1)^3}{(e_L(t+1)+e_D)^3} - \frac{2\alpha hl(t+1)^2}{(e_L(t+1)+e_D)^2} < 0 \tag{34}$$

$$\frac{\delta^2 L_x}{\delta e_L^2} = -\frac{2e_L hl(t+1)}{(e_L(t+1)+e_D)^3} < 0 \tag{35}$$

have to be true. Substituting e_L and e_D with $e_L = e_L^*$ and $e_D = e_D^*$, we get:

$$-\frac{2(\alpha+\alpha t+1)}{\alpha hl} < 0 \tag{36}$$

$$-\frac{2\alpha+2\alpha t+2}{\alpha hl+\alpha hlt} < 0. \tag{37}$$

Since $\alpha > 0$, $h > 0$ and $t \geq 0$, both are true. Both players have no incentive to change their effort level if $e_L = e_L^*$ and $e_D = e_D^*$. They are mutual best responses.

A.2 t^{max} is the single maximum for e_L^* and e_D^*

For e_L^*:
The first order condition is:

$$\frac{\delta e_L^*}{\delta t} = -\frac{\alpha^2 hl(\alpha+\alpha t-1)}{(\alpha+\alpha t+1)^3} \stackrel{!}{=} 0 \tag{38}$$

Which can be simplified to:

$$t \stackrel{!}{=} \frac{1-a}{a} = t^{max} \tag{39}$$

Putting t^{max} into the second order condition we get:

$$\frac{\delta^2 e_L^*}{\delta t^2} = \frac{2\alpha^3 hl(\alpha + \alpha t^{max} - 2)}{(\alpha + \alpha t^{max} + 1)^4} = -\frac{1}{8}\alpha^3 hl < 0 \tag{40}$$

this is obviously true, given that α,h and l are greater than zero.

For e_D^*:
The first order condition is:

$$\frac{\delta e_D^*}{\delta t} = -\frac{\alpha hl(\alpha + \alpha t - 1)}{(\alpha + \alpha t + 1)^3} \overset{!}{=} 0 \tag{41}$$

Which can be simplified to:

$$t \overset{!}{=} \frac{1-a}{a} = t^{max} \tag{42}$$

Putting t^{max} into the second order condition we get:

$$\frac{\delta^2 e_D^*}{\delta t^2} = \frac{2\alpha^2 hl(\alpha + \alpha t^{max} - 2)}{(\alpha + \alpha t^{max} + 1)^4} = -\frac{1}{8}\alpha^2 hl < 0 \tag{43}$$

this is obviously true, given that α,h and l are greater than zero.
t^{max} is thus the sole maximum of e_D^* and e_L^*
This also means that both e_D^* and e_L^* have a negative slope in $t^{even} > t^{max}$

A.3 s^* maximizes $\Lambda(s)$

We know that $0 \leq \hat{l}^* = \hat{l}(s = s^*) \leq 1$. We can treat $\hat{l}$ as a probability when evaluating $s*$. $s*$ thus maximizes $\Lambda(s)$ if it maximizes:

$$S = (1-\hat{l})\alpha s + \int_0^{\hat{l}} L_x^* dl = \alpha s - \frac{s^2(\alpha + \alpha t + 1)^2(\alpha + \alpha t + 4)}{2h(t+1)(\alpha + \alpha t + 2)^2} \tag{44}$$

The first order condition is:

$$\frac{\delta S}{\delta s} = \alpha - \frac{s(\alpha + \alpha t + 1)^2(\alpha + \alpha t + 4)}{h(t+1)(\alpha + \alpha t + 2)^2} \overset{!}{=} 0 \tag{45}$$

Substituting s with s^*, we get:

$$0 \overset{!}{=} 0 \tag{46}$$

The second order condition is:

$$\frac{\delta^2 S}{\delta s^2} = -\frac{(at + a + 1)^2(at + a + 4)}{h(t+1)(at + a + 2)^2} < 0 \tag{47}$$

Which, given $\alpha > 0$, $h > 0$ and $t \geq 0$, is always satisfied.
s^* maximises $\Lambda(s)$.

A.4 s^* always increases with t

s^* always increases with t if the first order derivative of s^* with respect to t is always positive.

$$\frac{\delta s^*}{\delta t} = \frac{2\alpha h(\alpha + \alpha t + 2)(\alpha(t+1)(\alpha + \alpha t + 2) + 4)}{(\alpha + \alpha t + 1)^3(\alpha + \alpha t + 4)^2} > 0 \tag{48}$$

This is always true, since $\alpha > 0$, $h > 0$ and $t \geq 0$.

A.5 t^{set} maximizes Π_s

The first order condition is given by:

$$\frac{\delta \Pi_s}{\delta t} = \frac{2(\alpha - 1)\alpha h(\alpha + \alpha t - 2)(\alpha + \alpha t + 2)(\alpha(t+1)(\alpha + \alpha t + 3) + 4)}{(\alpha + \alpha t + 1)^3(\alpha + \alpha t + 4)^3} \stackrel{!}{=} 0 \tag{49}$$

Solving for t, we get the real solutions $t = \frac{2-\alpha}{\alpha} = t^{set}$ and $t = -\frac{2-\alpha}{\alpha}$. The second solution is always negative, if $\alpha \in]0;1[$. Since we defined t as greater or equal to zero, we can ignore it.
Putting t^{set} into the second order condition, we get:

$$\begin{aligned} \frac{\delta^2 \Pi_s}{\delta t^2} &= \\ &- \frac{4(\alpha - 1)\alpha^2 h(\alpha(t^{set}+1)(\alpha(t^{set}+1)(\alpha(t^{set}+1)(\alpha + \alpha t^{set} - 2)(\alpha + \alpha t^{set} + 4) - 48) - 108) - 96)}{(\alpha + \alpha t^{set} + 1)^4(\alpha + \alpha t^{set} + 4)^4} \\ &= \frac{14}{729}(\alpha - 1)\alpha^2 h \\ &< 0 \end{aligned} \tag{50}$$

Given that $\alpha < 1$ this is true.
t^{set} maximizes Π_s.

A.6 t^{opt} maximizes Π

Solving the first order condition

$$\frac{\delta \Pi}{\delta t} = \frac{2(\alpha - 1)\alpha h(\alpha + \alpha t + 2)\left(\alpha\left(\alpha(t+1)\left(\alpha\left(t^2 - 1\right) + t - 4\right) - 2t - 11\right) - 8\right)}{(\alpha + 1)(\alpha + \alpha t + 1)^3(\alpha + \alpha t + 4)^3} \stackrel{!}{=} 0, \tag{51}$$

we get the real solutions $t = t^{opt}$ and $t = -\frac{\alpha^2 + \alpha^3}{3\alpha^3}$. Since the second one is always smaller than zero and t is defined as greater or equal to zero, we can ignore it.
We substitute t in the second order condition $\frac{\delta^2 \Pi}{\delta t^2} < 0$ with t^{opt}. Using the Reduce command in Wolfram Mathematica, we find that the second order condition is true, if $0 < \alpha < 1$ and $h > 0$, which are both always true.
t^{opt} maximizes Π.

A.7 t^{opt} is greater than t^{set} in $\alpha \in]0;1[$

In $]0;1[$ t^{opt} and t^{set} are both continuous.
The equation: t^{opt}=t^{set} is always false[31].
If α=0.5, then $t^{opt} = 4.90948 > t^{set} = 3$. Since t^{opt} and t^{set} are never equal, both are continuous and there is a point in which $t^{opt} > t^{set} = 3$, $t^{opt} > t^{set} = 3$ for every $\alpha \in]0;1[$

A.8 $\tilde{e}_D$ maximizes D_{scep}

The first order condition is:

$$\frac{\delta D_{scep}}{\delta e_D} = \frac{\alpha^2 h^2 l^2 (t+1)(\alpha+\alpha t+1)^2}{\left(e_D(\alpha+\alpha t+1)^2+\alpha^2 hl(t+1)\right)^2} - 1 \stackrel{!}{=} 0 \tag{52}$$

Solving for e_D, keeping in mind that $h > 0, l \geq 0, 1 > a > 0, t \geq 0$, we get:

$$e_D = \frac{\alpha hl \left(\alpha(t+1)\left(\sqrt{t+1}-1\right)+\sqrt{t+1}\right)}{(\alpha+\alpha t+1)^2} = \tilde{e}_D \tag{53}$$

The other solution

$$e_D = -\frac{\alpha hl \left(\alpha(t+1)\left(\sqrt{t+1}+1\right)+\sqrt{t+1}\right)}{(\alpha+\alpha t+1)^2} \tag{54}$$

is always negative, we can ignore it.
The second order condition is:

$$\frac{\delta^2 D_{scep}}{\delta e_D^2} = -\frac{2\alpha^2 h^2 l^2 (t+1)(\alpha+\alpha t+1)^4}{\left(e_D(\alpha+\alpha t+1)^2+\alpha^2 hl(t+1)\right)^3} < 0 \tag{55}$$

Substituting with $\tilde{e}_D$ and simplifying, we get:

$$-\frac{2(\alpha+\alpha t+1)}{\alpha hl\sqrt{t+1}} < 0, \tag{56}$$

which we can plainly see is true.

A.9 t^{max} maximizes $\tilde{e}_D$ as well as the relative difference between e_D^* and $\tilde{e}_D$

For $\tilde{e}_D$:
The first order condition is:

$$\frac{\delta \tilde{e}_D}{\delta t} = \frac{\alpha hl(\alpha+\alpha t-1)\left(\alpha\left(t-2\sqrt{t+1}+1\right)+1\right)}{2\sqrt{t+1}(\alpha+\alpha t+1)^3} \stackrel{!}{=} 0 \tag{57}$$

[31] Running the Reduce command on it in Wolfram Mathematica returns ”False” meaning there are no solutions

Solving for t, we get one solution in real numbers

$$t = \frac{1-a}{a} = t^{max} \tag{58}$$

The second order condition is:

$$\frac{\delta^2 \tilde{e}_D}{\delta t^2} = \frac{\alpha hl \left(\alpha(t+1)\left(\alpha\left(-\alpha(t+1)\left(-3t+8\sqrt{t+1}-3\right)-3t+16\sqrt{t+1}-3\right)-7\right)-1\right)}{4(t+1)^{3/2}(\alpha+\alpha t+1)^4} < 0 \tag{59}$$

Substituting t^{max} we get:

$$-\frac{1}{8}\left(\sqrt{\frac{1}{\alpha}}-1\right)\alpha^3 hl < 0 \tag{60}$$

Which, given that $\alpha < 1$, we can plainly see is true.

For the difference between e^*_D and $\tilde{e}_D$ ($e_{ratio} = e^*_D/\tilde{e}_D$):
The first order condition is:

$$\frac{\delta e_{ratio}}{\delta t} = -\frac{\sqrt{t+1}(\alpha+\alpha t-1)}{2\left(\alpha(t+1)\left(\sqrt{t+1}-1\right)+\sqrt{t+1}\right)^2} \stackrel{!}{=} 0 \tag{61}$$

For which t^{max} is the only solution.
Substituting t^{max} into the second order condition we get:

$$\frac{\delta^2 e_{ratio}}{\delta t^2} = -\frac{1}{2\left(1-2\sqrt{\frac{1}{\alpha}}\right)^2\sqrt{\frac{1}{\alpha}}} < 0 \tag{62}$$

which is true, given that $\alpha \in]0;1[$. Thus t^{max} maximizes the difference between e^*_D and $\tilde{e}_D$.

A.10 $\tilde{D}$ is greater than D^* if $t > 0$ and $l > 0$

In both $\tilde{D}$ and D^* h and l are constant factors, if we want to prove that $\tilde{D}$ is greater than D^*, they don't play a role, unless they are equal to zero. h is always positive. As we only want to prove that $\tilde{D}$ is greater than D^* if $t > 0$ and $l > 0$, l also doesn't play a role. Thus, let $hl = 1$. We will prove:

$$-\frac{\alpha\left(\alpha(t+1)\left(2\sqrt{t+1}-1\right)+2\sqrt{t+1}\right)}{(\alpha+\alpha t+1)^2} > \frac{1}{(at+a+1)^2} - 1. \tag{63}$$

This can be simplified to:

$$\frac{\alpha^2(t+1)\left(2\sqrt{t+1}-1\right)+2\alpha\sqrt{t+1}+1}{(\alpha+\alpha t+1)^2} < 1 \tag{64}$$

This can be shown to be true[32], if $0 < \alpha \leq 8$ and $t > 0$. These are both conditions we specified that always apply for the purposes of this proof.

A.11 t^{break} is greater than t^{max} if $\alpha < \frac{1}{5}\left(31 - 4\sqrt{55}\right)$

We get t^{break} by solving $\tilde{l}^* = 1$ for t. Under the constraint that $1 > \alpha > 0$, we find only one real solution. However, we weren't able to express it explicitly . Instead, t^{break} is the first root of the polynomial:

$$\begin{aligned}
&-8\alpha^3 - 52\alpha^2 - 96\alpha + \alpha^4 x^5 + \left(3\alpha^4 + 8\alpha^3\right) \\
&x^4 + \left(3\alpha^4 + 8\alpha^3 + 24\alpha^2\right) \\
&x^3 + \left(\alpha^4 - 16\alpha^3 - 20\alpha^2 + 32\alpha\right) \\
&x^2 + \left(-24\alpha^3 - 96\alpha^2 - 64\alpha + 16\right) x - 48.
\end{aligned} \tag{65}$$

Meaning that if we substitute x for t^{break} in the above expression, it is equal to zero.
As we can see, no other variable other than α could have an influence on $t^b reak$. The same is true for t^{max}. Solving $t^b reak$=t^{max} for α, we get α^{break} as the positive solution. It can be shown that $t^m ax$ has a steeper, negative slope in $alpha^{break}$ than $t^b reak$. Thus, if $\alpha > 0$, $t^b reak$ is greater than $t^m ax$ if $\alpha > \alpha^{break}$. The inverse is true if $\alpha < \alpha^{break}$.

[32]We used the Reduce Command in Wolfram Mathematica

A.12 $\tilde{\Pi}_s$ has a maximum

We couldn't find an explicit solution for the first order condition[33], $\frac{\delta \tilde{\Pi}_s}{\delta t} \overset{!}{=} 0$. If, $0 < \alpha < 1$ it is solved by the first root of the polynomial:

$$
\begin{aligned}
&6\alpha^{11} + 189\alpha^{10} + 1964\alpha^{9} + 10733\alpha^{8} + 36372\alpha^{7} \\
&+ 81564\alpha^{6} + 122112\alpha^{5} + 115184\alpha^{4} + 52288\alpha^{3} \\
&- 10944\alpha^{2} - 23040\alpha + \alpha^{12}x^{13} + \left(12\alpha^{12} + 36\alpha^{11}\right) \\
&x^{12} + \left(66\alpha^{12} + 406\alpha^{11} + 506\alpha^{10}\right) \\
&x^{11} + \left(220\alpha^{12} + 2086\alpha^{11} + 5297\alpha^{10} + 3720\alpha^{9}\right) \\
&x^{10} + \left(495\alpha^{12} + 6450\alpha^{11} + 25096\alpha^{10} + 35604\alpha^{9} + 16905\alpha^{8}\right) \\
&x^{9} + \left(792\alpha^{12} + 13350\alpha^{11} + 70985\alpha^{10} \right.\\
&\left.+ 152924\alpha^{9} + 145717\alpha^{8} + 52308\alpha^{7}\right) \\
&x^{8} + \left(924\alpha^{12} + 19452\alpha^{11} + 133084\alpha^{10} \right.\\
&\left.+ 388000\alpha^{9} + 557652\alpha^{8} + 398912\alpha^{7} + 116492\alpha^{6}\right) \\
&x^{7} + \left(792\alpha^{12} + 20412\alpha^{11} + 173474\alpha^{10} + 643664\alpha^{9} \right.\\
&\left.+ 1243268\alpha^{8} + 1332080\alpha^{7} + 767012\alpha^{6} + 191808\alpha^{5}\right) \\
&x^{6} \\
&+ \left(495\alpha^{12} + 15492\alpha^{11} + 160216\alpha^{10} + 729064\alpha^{9} + 1779038\alpha^{8} \right.\\
&\left.+ 2543872\alpha^{7} + 2170588\alpha^{6} + 1052864\alpha^{5} + 234544\alpha^{4}\right) \\
&x^{5} + \left(220\alpha^{12} + 8400\alpha^{11} + 104666\alpha^{10} + 570584\alpha^{9} \right.\\
&+ 1693830\alpha^{8} + 3038520\alpha^{7} + 3423636\alpha^{6} \\
&\left.+ 2417024\alpha^{5} + 1017008\alpha^{4} + 209472\alpha^{3}\right) \\
&x^{4} + \left(66\alpha^{12} + 3150\alpha^{11} + 47290\alpha^{10} + 304384\alpha^{9} \right.\\
&+ 1072612\alpha^{8} + 2324288\alpha^{7} + 3251684\alpha^{6} + 2974080\alpha^{5} \\
&\left.+ 1759968\alpha^{4} + 654080\alpha^{3} + 130368\alpha^{2}\right) \\
&x^{3} + \left(12\alpha^{12} + 766\alpha^{11} + 14029\alpha^{10} + 105800\alpha^{9} \right.\\
&+ 435412\alpha^{8} + 1111792\alpha^{7} + 1860268\alpha^{6} + 2071616\alpha^{5} \\
&\left.+ 1522272\alpha^{4} + 732032\alpha^{3} + 241600\alpha^{2} + 50688\alpha\right) \\
&x^{2} + \left(\alpha^{12} + 106\alpha^{11} + 2448\alpha^{10} + 21604\alpha^{9} + 102753\alpha^{8} \right.\\
&+ 304000\alpha^{7} + 593716\alpha^{6} + 775616\alpha^{5} + 659952\alpha^{4} \\
&\left.+ 339712\alpha^{3} + 100288\alpha^{2} + 27648\alpha + 9216\right) x - 7168
\end{aligned} \tag{66}
$$

Substituting t in the second order condition with this first root, $\frac{\delta^2 \tilde{\Pi}_s}{\delta t^2} < 0$, it can be shown[34] that it is fulfilled if $0 < \alpha < 1$, which is true by assumption. However, it can be shown that the first root is smaller than zero if:

$$\alpha > \frac{1}{3}\left(-3 - \frac{1}{\sqrt[3]{54 + \sqrt{2917}}} + \sqrt[3]{54 + \sqrt{2917}}\right) \approx 0.5175 \tag{67}$$

[33]It is solved by $\frac{-2-a}{a}$, which is always smaller than -1, meaning the lawyer's effort would have a negative effect on the trial outcome. We ignore this solution

[34]We once again used the Reduce command in Wolfram Mathematica.

As no other t satisfies the first order condition, if $t \geq 0$ and $\alpha \in]0,1[$, $t = zero$ maximizes $\tilde{\Pi}_s$ if the above inequality is true.
$\tilde{\Pi}_s$ thus has a maximum, however it is $t = 0$, if α is greater than approximately 0.5175.

A.13 $\tilde{\Pi}_g$ has a maximum

We couldn't find an explicit solution for the first order condition, $\frac{\delta \tilde{\Pi}_g}{\delta t} \stackrel{!}{=} 0$. If, $0 < \alpha < 1$ it is solved by the first root of a polynomial, which is too long to include in this document. Substituting t in the second order condition with this first root, $\frac{\delta^2 \tilde{\Pi}_g}{\delta t^2} < 0$, it can be shown[35] that it is fulfilled if $0 < \alpha < 1$, which is true by assumption. This first root is thus a maximum. We call it t_g^{opt}.
Solving $t_g^{opt} = t^{break}$ for α, we get $\alpha \approx 11.7929$ as the sole solution. Given that α is assumed to be greater than zero and smaller than one, for our purposes this means that t_g^{opt} and t^{break} are never equal. Assuming that both are continuous in $\alpha \in]0;1[$ and given that, if $\alpha = 0.5$, t^{break} is approximately 2.4822, while t_g^{opt} is approximately 0.7981, we can infer that $t^{break} > t_g^{opt}$ for all $\alpha \in]0;1[$. Thus, even if $\alpha < alpha^{break}$, the plaintiff can choose a lawyer with an overconfidence level, that would sometimes lead to settlement, which would (locally) maximize her full expected payout.

A.14 Graphical inference about $\tilde{\Pi}^{max}_{c-break}(t = t^{max})$ and $\tilde{\Pi}_g(t = \tilde{t}_g^{opt})$

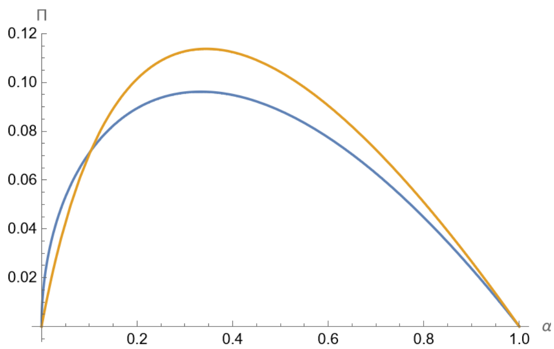

Figure 8: Comparing $\tilde{\Pi}^{max}_{c-break}(t = t^{max})$and $\tilde{\Pi}_g(t = \tilde{t}_g^{opt})$

The blue line is, $\tilde{\Pi}^{max}_{c-break}(t = t^{max})$ the orange one is $\tilde{\Pi}_g(t = \tilde{t}_g^{opt})$. h=1, which doesn't affect the shape of the curves. As we can see $\tilde{\Pi}^{max}_{c-break}(t = t^{max}) > \tilde{\Pi}_g(t = \tilde{t}_g^{opt})$ if $\alpha \approx< 0.1$.

[35] Reduce command in Wolfram Mathematica.

Bibliography

Ando, M. (2011). Overconfidence in Economic Contests. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.539902

Babcock, L., Loewenstein, G. F., Issacharoff, S., & Camerer, C. (1995). Biased judgments of fairness in bargaining. *The American Economic Review*, *85*(5).

Bar-Gill, O. (2006). The evolution and persistence of optimism in litigation. In *Journal of Law, Economics, and Organization* (Vol. 22, Issue 2, pp. 490–507). Oxford Academic. https://doi.org/10.1093/jleo/ewj016

Bebchuk, L. A. (1984). Litigation and Settlement under Imperfect Information. *The RAND Journal of Economics*, *15*(3), 404. https://doi.org/10.2307/2555448

Bénabou, R., & Tirole, J. (2002). Self-confidence and personal motivation. In *Quarterly Journal of Economics* (Vol. 117, Issue 3, pp. 871–915). https://doi.org/10.1162/003355302760193913

Braeutigam, R., Owen, B., & Panzar, J. (1984). An economic analysis of alternative fee shifting systems. *Law and Contemporary Problems*, *47*(1), 173–185. https://www.jstor.org/stable/1191439

Bruhin, A., Santos-Pinto, L., & Staubli, D. (2018). How do beliefs about skill affect risky decisions? *Journal of Economic Behavior and Organization*, *150*, 350–371. https://doi.org/10.1016/j.jebo.2018.01.016

Camerer, C., & Lovallo, D. (1999). Overconfidence and excess entry: An experimental approach. *American Economic Review*, *89*(1), 306–318. https://doi.org/10.1257/aer.89.1.306

Chen, K. P., & Wang, J. S. (2007). Fee-shifting rules in litigation with contingency fees. In *Journal of Law, Economics, and Organization* (Vol. 23, Issue 3, pp. 519–546). https://doi.org/10.1093/jleo/ewm011

Chen, S., & Schildberg-Hörisch, H. (2019). Looking at the bright side: The motivational value of confidence. *European Economic Review*, *120*. https://doi.org/10.1016/j.euroecorev.2019.103302

Choné, P., & Linnemer, L. (2010). Optimal litigation strategies with observable case preparation. *Games and Economic Behavior*, *70*(2), 271–288. https://doi.org/10.1016/j.geb.2010.03.001

Christensen-Szalanski, J. J., & Bushyhead, J. B. (1981). Physicians' use of probabilistic information in a real clinical setting. *Journal of Experimental Psychology: Human Perception and Performance*, *7*(4), 928–935. https://doi.org/10.1037/0096-1523.7.4.928

Clayson, D. E. (2005). Performance overconfidence: Metacognitive effects or misplaced student expectations? *Journal of Marketing Education*, *27*(2), 122–129. https://doi.org/10.1177/0273475304273525

Colzani, P., & Santos-Pinto, L. (2021). *Does Overconfidence Lead to Bargaining Failures?* http://www.hec.unil.ch/lspinto/Papers & CV/Overconfidence and Bargaining 20200605.pdf

De Bondt, W. F. M., & Thaler, R. H. (1995). Financial Decision-Making in Markets and Firms: A Behavioral Perspective. In *Handbooks in Operations Research and Management Science* (Vol. 9, Issue C, pp. 385–410). https://doi.org/10.1016/S0927-0507(05)80057-X

de la Rosa, L. E. (2011). Overconfidence and moral hazard. *Games and Economic Behavior*, *73*(2), 429–451. https://doi.org/10.1016/j.geb.2011.04.001

Dohmen, T., & Falk, A. (2011). Performance Pay and Multidimensional Sorting: Productivity, Preferences, and Gender. *American Economic Review*, *101*(2), 556–590.

https://doi.org/10.1257/AER.101.2.556

Eigen, Z. J., & Listokin, Y. (2012). Do lawyers really believe their own hype, and should they? a natural experiment. *Journal of Legal Studies*, *41*(2), 239–267. https://doi.org/10.1086/667711

Ewerhart, C. (2015). Mixed equilibria in Tullock contests. *Economic Theory*, *60*(1), 59–71. https://doi.org/10.1007/s00199-014-0835-x

Farmer, A., & Pecorino, P. (2002). Pretrial bargaining with self-serving bias and asymmetric information. *Journal of Economic Behavior and Organization*, *48*(2), 163–176. https://doi.org/10.1016/s0167-2681(01)00236-0

Farmer, A., & Pecorino, P. (2013). Discovery and disclosure with asymmetric information and endogenous expenditure at trial. *Journal of Legal Studies*, *42*(1), 223–247. https://doi.org/10.1086/667932

Galasso, A., & Simcoe, T. S. (2011). CEO overconfidence and innovation. *Management Science*, *57*(8), 1469–1484. https://doi.org/10.1287/MNSC.1110.1374

Gervais, S., & Goldstein, I. (2007). The positive effects of biased self-perceptions in firms. *Review of Finance*, *11*(3), 453–496. https://doi.org/10.1093/rof/rfm022

Goodman-Delahunty, J., Granhag, P. A., Hartwig, M., & Loftus, E. F. (2010). Insightful or wishful: Lawyers' Ability to Predict Case Outcomes. *Psychology, Public Policy, and Law*, *16*(2), 133–157. https://doi.org/10.1037/a0019060

Heller, Y. (2014). Overconfidence and diversification. *American Economic Journal: Microeconomics*, *6*(1 D), 134–153. https://doi.org/10.1257/mic.6.1.134

Herz, H., Schunk, D., & Zehnder, C. (2014). How do judgmental overconfidence and overoptimism shape innovative activity? *Games and Economic Behavior*, *83*, 1–23. https://doi.org/10.1016/j.geb.2013.11.001

Hippel, S., & Hoeppner, S. (2019). Biased judgements of fairness in bargaining: A replication in the laboratory. *International Review of Law and Economics*, *58*, 63–74. https://doi.org/10.1016/j.irle.2019.02.001

Hirshleifer, D., Low, A., & Teoh, S. H. (2012). Are Overconfident CEOs Better Innovators? *Journal of Finance*, *67*(4), 1457–1498. https://doi.org/10.1111/J.1540-6261.2012.01753.X

Hirshleifer, J., & Osborne, E. (2001). Truth, effort, and the legal battle. *Public Choice*, *108*(1–2), 169–195. https://doi.org/10.1023/A:1017520505573

Hoffman, M., & Burks, S. V. (2020). Worker overconfidence: Field evidence and implications for employee turnover and firm profits. *Quantitative Economics*, *11*(1), 315–348. https://doi.org/10.3982/QE834

Katz, A. (1988). Judicial decisionmaking and litigation expenditure. *International Review of Law and Economics*, *8*(2), 127–143. https://doi.org/10.1016/0144-8188(88)90001-4

Kiser, R. L., Asher, M. A., & McShane, B. B. (2008). Let's not make a deal: An empirical study of decision making in unsuccessful settlement negotiations. In *Foundations of Dispute Resolution* (Vol. 1, pp. 251–291). Taylor and Francis. https://doi.org/10.1111/j.1740-1461.2008.00133.x

Klayman, J., Soll, J. B., González-Vallejo, C., & Barlas, S. (1999). Overconfidence: It depends on how, what, and whom you ask. *Organizational Behavior and Human Decision Processes*, *79*(3), 216–247. https://doi.org/10.1006/obhd.1999.2847

Loewenstein, G., Issacharoff, S., Camerer, C., & Babcock, L. (1993). Self-Serving Assessments of Fairness and Pretrial Bargaining. *The Journal of Legal Studies*, *22*(1), 135–159. https://doi.org/10.1086/468160

Ludwig, S., & Nafziger, J. (2007). Do You Know That I Am Biased? An Experiment. *Bonn Econ Discussion Papers*, *11*. https://difusion.ulb.ac.be/vufind/Record/ULB-DIPOT:oai:dipot.ulb.ac.be:2013/9387/Details

Ludwig, S., Wichardt, P. C., & Wickhorst, H. (2011). Overconfidence can improve an agent's relative and absolute performance in contests. *Economics Letters*, *110*(3), 193–196. https://doi.org/10.1016/J.ECONLET.2010.11.040

Malmendier, U., Tate, G., & Yan, J. (2011). Overconfidence and Early-Life Experiences: The Effect of Managerial Traits on Corporate Financial Policies. *Journal of Finance*, *66*(5), 1687–1733. https://doi.org/10.1111/j.1540-6261.2011.01685.x

Moore, D. A., & Healy, P. J. (2008). The Trouble With Overconfidence. *Psychological Review*, *115*(2), 502–517. https://doi.org/10.1037/0033-295X.115.2.502

Moore, D. A., & Schatz, D. (2017). The three faces of overconfidence. *Social and Personality Psychology Compass*, *11*(8). https://doi.org/10.1111/spc3.12331

Neale, M. A., & Bazerman, M. H. (1985). The Effects of Framing and Negotiator Overconfidence on Bargaining Behaviors and Outcomes. *Academy of Management Journal*, *28*(1), 34–49. https://doi.org/10.5465/256060

Nti, K. O. (1999). Rent-seeking with asymmetric valuations. *Public Choice*, *98*(3–4), 415–430. https://doi.org/10.1023/a:1018391504741

Odean, T. (1999). Do investors trade too much? *American Economic Review*, *89*(5), 1279–1298. https://doi.org/10.1257/aer.89.5.1279

Park, Y. J., & Santos-Pinto, L. (2010). Overconfidence in tournaments: Evidence from the field. *Theory and Decision*, *69*(1), 143–166. https://doi.org/10.1007/s11238-010-9200-0

Poitras, M., & Frasca, R. (2011). A unified model of settlement and trial expenditures: The Priest-Klein model extended. *International Review of Law and Economics*, *31*(3), 188–195. https://doi.org/10.1016/j.irle.2011.07.006

Polinsky, A. M., & Rubinfeld, D. L. (2003). Aligning the Interests of Lawyers and Clients. *American Law and Economics Review*, *5*(1), 165–188. https://elibrary.ru/item.asp?id=9975946

Russo, E. J., & Shoemaker, P. J. (1992). Managing Overconfidence. *Sloan Management Review*, *33*(2), 7–17. https://www.researchgate.net/profile/Paul-Schoemaker-2/publication/306940378_Managing_Overconfidence/links/58977637aca2721f0dae13a7/Managing-Overconfidence.pdf

Santos-Pinto, L. (2008). Positive self-image and incentives in organisations. *Economic Journal*, *118*(531), 1315–1332. https://doi.org/10.1111/j.1468-0297.2008.02171.x

Santos-Pinto, L. (2010). Positive self-image in tournaments. *International Economic Review*, *51*(2), 475–496. https://doi.org/10.1111/j.1468-2354.2010.00589.x

Santos-Pinto, L. P., & Sekeris, P. (2022). Overconfidence in Tullock Contests. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4113891

Sharot, T. (2011). The optimism bias. In *Current Biology* (Vol. 21, Issue 23, pp. R941–R945). Cell Press. https://doi.org/10.1016/j.cub.2011.10.030

Shavell, S. (1982). Suit, Settlement, and Trial: A Theoretical Analysis under Alternative Methods for the Allocation of Legal Costs. *The Journal of Legal Studies*, *11*(1), 55–81. https://doi.org/10.1086/467692

Soldà, A., Ke, C., Page, L., & von Hippel, W. (2020). Strategically delusional. *Experimental Economics*, *23*(3), 604–631. https://doi.org/10.1007/s10683-019-09636-9

Soll, J. B., & Klayman, J. (2004). Overconfidence in Interval Estimates. In *Journal of Experimental Psychology: Learning Memory and Cognition* (Vol. 30, Issue 2, pp. 299–314). https://doi.org/10.1037/0278-7393.30.2.299

Spamann, H. (2020). Extension: Lawyers' role-induced bias arises fast and persists despite intervention. *Journal of Legal Studies*, *49*(2), 467–485. https://doi.org/10.1086/710306

Svenson, O. (1981). Are we all less risky and more skillful than our fellow drivers? *Acta Psychologica*, *47*(2), 143–148. https://doi.org/10.1016/0001-6918(81)90005-6

Tullock, G. (1980). Efficient rent seeking. In *Toward a theory of the rent-seeking society* (pp. 97–112). https://mpra.ub.uni-muenchen.de/44469/

Wolfram Research, I. (2022). *Mathematica* (13.1). Wolfram Research, Inc. https://www.wolfram.com/mathematica

Yang, E. (2020). Optimism and pessimism in bargaining and contests. *International Review of Law and Economics*, *64*, 105935. https://doi.org/10.1016/j.irle.2020.105935

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