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Judge's Gate-Keeping Power and Deterrence of Negligent Acts: An Economic Analysis of *Twombly* and *Iqbal*

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Abstract

Following its landmark decisions in *Bell Atlantic v. Twombly* and *Ashcroft v. Iqbal*, the Supreme Court allows federal judges to dismiss cases when the plaintiff's allegations are conclusory or implausible, thereby increasing the judges' discretionary power in pleading stages of litigation. Using a stylized litigation model, I find the conditions under which the ruling improves upon litigation outcomes by simultaneously raising deterrence and reducing litigation costs and error costs. In particular, I demonstrate the ways in which the ruling's effect depends on the correlation between the potential injurers' primary behavior and the strength of cases filed at trial courts.

Key Words: *Twombly*; *Iqbal*; deterrence; litigation costs; error costs; perfect Bayesian equilibrium.

JEL: C72; D82; K41.

1 Introduction

Many legal scholars and practitioners have raised concerns about the rapidly rising level of litigation costs in American lawsuits, especially in terms of the massive expenditures under discovery.¹ Recently, the Supreme Court addressed this concern when reviewing an antitrust case in *Bell Atlantic Corp. v. Twombly*² in which the Court enhanced federal judges' gate-keeping power by allowing them to dismiss cases when the plaintiff's allegations are "conclusory" or "implausible," thereby establishing a "plausibility" standard for motions to dismiss. In its

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¹There seems to be general consensus that discovery has become unnecessarily expensive. For example, a recent survey of attorneys in the American Bar Association Section of Litigation reported that 82 percent of the respondents agreed that discovery was too expensive (American Bar Association Section of Litigation Member Survey on Civil Practice: Full Report, December 2009, Tables 6.1 and 11.5). This survey also reported that three-quarters of respondents agreed that discovery costs, as a share of total litigation costs, had increased disproportionately due to the advent of e-discovery (Table 7.4).

²550 U.S. 544 (2007).

later decision in *Ashcroft v. Iqbal*,³ which is often referenced with the preceding opinion as “*Twiqbal*,” the Court confirmed that this new law applies to all federal cases.⁴ This decision marked a clear departure from the previous legal regime, *Conley v. Gibson*,⁵ in which the power of federal judges in granting motions to dismiss was quite limited.⁶ These landmark decisions led legal scholars to produce voluminous literature expressing support for the decisions and concerns about the prospect of greatly changing federal litigation in important areas of law.⁷

Although the Court admitted that the ruling was expected to increase error costs because the enhanced role of federal judges in screening cases would keep some meritorious cases from reaching trial, it reasoned that a higher level of error costs could be justified by the avoidance of higher litigation costs. This decision consequently requires federal judges to engage in a cost-benefit analysis and to dismiss cases when gains from avoiding litigation costs loom larger than losses from incurring error costs. Empirical research has presented a somewhat mixed picture of the aftermath of *Twiqbal*: while [Cecil et al. \(2011a,b\)](#), [Curry and Ward \(2013\)](#), and [Hubbard \(2013, 2016\)](#) suggest that the ruling produced no measurable effect on litigation outcomes, [Eisenberg and Clermont \(2014\)](#), [Gelbach \(2012\)](#), and [Reinert \(2015\)](#) hold the opposite view.

While *Twiqbal* has stimulated research attention and led many scholars to investigate its effects on litigation outcomes, as pointed out by [Klerman \(2015\)](#), the ruling’s effect on a potential injurer’s *ex ante* behavior has rarely been studied. To the best of my knowledge, this topic is explored only by [Kaplow \(2013\)](#) and [Campos et al. \(2015\)](#). [Kaplow \(2013\)](#) develops inspiring intuitions about the ways in which each decision-making stage should be structured in multistage adjudication. He studies *Twiqbal*’s effects on the deterrence of harmful acts but does not employ a formal model. Most closely related to the present study is that by [Campos et al. \(2015\)](#). Within a formal game-theoretic model, they show that potential injurers, anticipating that a large number of meritorious cases will be dismissed at pleading stages, may make less effort to comply with the law after *Twiqbal*. This lower level of deterrence is shown to operate to increase litigation costs and error costs in their model.

³556 U.S. 662 (2009).

⁴[Kaplow \(2013\)](#) notes that “[t]hese two decisions are viewed as among the more important of the Roberts Court” (p. 1181). These decisions generated intense reactions, including proposals for congressional override. See, e.g., [Bone \(2010\)](#) who notes proposals of the Notice Pleading Restoration Act, S. 1504, 111th Cong. (2009) and the Open Access to Courts Act, H.R. 4115, 111th Cong. (2009).

⁵355 U.S. 41 (1957).

⁶Until 2007, the federal courts were supposed to allow notice pleading. Under notice pleading, it was enough for the plaintiff to “give the defendant fair notice of what the plaintiff’s claim is and the grounds upon which it rests” (*Conley v. Gibson* 1957, p. 47) to survive a motion to dismiss, and judges were not supposed to dismiss the case “unless it appears beyond doubt that the plaintiff can prove no set of facts in support of his claim which would entitle him to relief” (*Conley v. Gibson* 1957, pp. 45-46). Thus, judges typically granted motions to dismiss only when the plaintiff’s complaint was based on an erroneous interpretation of law.

⁷While some scholars such as [Anderson and Huffman \(2010\)](#) express support for the ruling, others, including [Dodson \(2013\)](#), [Gelbach \(2012\)](#), [Miller \(2010\)](#), and [Spencer \(2013\)](#), raise concerns.

I present a complementary view on the ruling’s effect on deterrence and other litigation outcomes by demonstrating that *Twiqbal* simultaneously raises deterrence and reduces litigation costs and error costs under certain conditions. In particular, I demonstrate the ways in which the ruling’s effect depends on the degree of correlation between the potential injurers’ primary behavior and the strength of cases filed at trial courts. Furthermore, I show that *Twiqbal* could generate desirable changes in those tort cases in which this correlation is strong.

I obtain a result contrary to [Campos et al. \(2015\)](#) under certain conditions, because the potential injurer in my model faces different dismissal rates depending on his choice of act under *Twiqbal*. More precisely, in my model, a case is filed against the injurer when an accident occurs, and the judge decides whether to dismiss the case after taking into account the strength of the claim against the injurer. Under suitable assumptions about the correlation between the injurer’s act and the strength of the complaint, the judge is more likely to dismiss cases involving non-negligent injurers than those involving negligent ones, which could provide the potential injurer with higher incentive to comply with the law after *Twiqbal*.

It is interesting to find that the ruling can *reduce* error costs, in contrast to the concern expressed by the Supreme Court as well as the opponents of the ruling. I obtain this result because, as previously mentioned, *Twiqbal* raises the level of deterrence under certain conditions, which in turn reduces the instances of the court’s mistakes in assigning liability because the cases involving non-negligent injurers induce fewer mistakes. This asymmetry arises from the fact that the dismissal of a case is equivalent to assigning no liability on the injurer, thereby generating no error costs if a non-negligent injurer’s case is dismissed in the pleading stage of litigation. Therefore, a higher level of deterrence under *Twiqbal* operates to reduce error costs by raising the proportion of non-negligent injurers in the population. It is also interesting to find that the ruling can simultaneously raise deterrence and reduce litigation costs, because it is often believed that deterrence increases in the face of threat of high litigation costs under negligent acts. The intuition behind my result rests on the interplay between deterrence and litigation costs: higher litigation costs increase deterrence, but higher deterrence in turn may operate to reduce the amount of expected litigation costs by lowering the number of cases proceeding to trial. Thus, in all these results, I show how the change in the level of deterrence plays a key role in assessing *Twiqbal*’s effects on important litigation outcomes.

In general, [Posner \(1973\)](#) argues that the pleading stage in litigation is beneficial for society because it reduces litigation costs by keeping low-merit cases from proceeding to trial. For other related theoretical work, see [Hylton \(2008\)](#), [Issacharoff and Miller \(2013\)](#), and [Reilly \(2015\)](#). For empirical work on motions to dismiss, see [Klerman \(2015\)](#) for an excellent survey on this topic. For extensive surveys on the economics of procedural law, see [Bone \(2003\)](#) and [Sanchirico \(2012\)](#).

The remainder of this paper proceeds as follows. Section 2 introduces the basic model studied in this paper. In particular, I define two different games, one describing the *Conley*

regime and the other describing the *Twigbal* regime. Section 3 derives an equilibrium from each game and investigates the effects of *Twigbal* on deterrence, litigation costs, and error costs. Section 4 concludes with a discussion. All proofs can be found in the Appendix.

2 Model

This section develops a stylized model to investigate the ways in which a judge's gate-keeping power influences an injurer's precautionary behavior. Formally, I develop a dynamic game of incomplete information with two stages, the Precaution Stage and the Pleading Stage, and two players, the injurer and the judge.

Before proceeding to the details of the basic model, it is instructive to elaborate on the judge's gate-keeping power and her preference. In *Bell Atlantic v. Twombly* and *Ashcroft v. Iqbal*, the Supreme Court gave federal judges the power to dismiss cases when the plaintiff's allegations are conclusory or implausible. Although the Court admitted that the judge's enhanced gate-keeping power could result in the dismissal of some meritorious cases, which could lead to higher error costs, it reasoned that the avoidance of high litigation costs justifies the possible increase in error costs.

To investigate the effect of the Court's decision on the injurer's precautionary behavior, I compare equilibrium outcomes from two different games in terms of the judge's discretionary power in her dismissal decision:

1. Game-C: the judge is required to send every case to trial
2. Game-T: the judge has discretion to dismiss cases

Game-C describes the *Conley* regime in which the judge plays a limited role in dismissing cases, and Game-T portrays the *Twigbal* regime with the judge's enhanced discretionary power in deciding whether a case is worth a trial.

In Game-C, the judge has no other option than choosing to send cases to trial. In contrast, in Game-T, the judge is required by the Court's ruling to engage in the cost-benefit analysis and to dismiss cases if litigation costs loom larger than error costs and vice versa. To model this behavior, I assume that the judge in my model considers two types of costs in her dismissal decision: litigation costs and error costs. Litigation costs are the costs expensed at trial, such as attorney fees and court administration expenses. Error costs are the costs arising from inaccurate decisions. For example, if an injurer who incurred a certain amount of loss on a third party is mistakenly exonerated, we can imagine that the error costs are proportional to the uncompensated loss suffered by the third party.

If a case moves to trial, it incurs both litigation costs and error costs. Note that error costs may arise at trial because a jury may erroneously find a non-negligent injurer liable and

vice versa. In contrast, if a case is dismissed before reaching trial, it could generate error costs but no litigation costs. Therefore, if the judge has discretion to dismiss a case, she compares the litigation costs and error costs of the case at hand, and dismisses a case if the total cost from trial is larger than the error costs from dismissal.

To be more precise, I denote by δ the measure of error costs, and by c the litigation costs at trial. Thus, if a case moves to trial, the judge's payoff is given by

$$\pi_J = -\theta\delta_{\text{trial}} - c$$

where θ is the relative importance of error costs to litigation costs. In contrast, if a case is dismissed before reaching trial, the judge's payoff is given by

$$\pi_J = -\theta\delta_{\text{dismiss}}$$

because litigation costs are not expensed. Note that the error costs at trial could be different from the error costs from dismissal. This point will be clarified below.

Formally, I lay out the details of the basic model as follows. In the first stage, Precaution Stage, the injurer chooses his act, $a \in \{0, 1\}$, where $a = 0$ stands for a non-negligent act and $a = 1$ a negligent act. The negligent act generates a private benefit $b \in [0, \bar{b}]$ to the injurer according to the distribution function $F(b)$, but causes an accident to a third party. If the injurer chooses the non-negligent act, he obtains no benefit from his act but he can reduce the likelihood of an accident: an accident to a third party occurs with probability $q \in (0, 1)$ under $a = 0$. In case of an accident, a third party suffers a loss of $L > 0$. If no accident occurs, the game ends, and both the injurer and the judge obtain a payoff of 0, $\pi_I = 0$ and $\pi_J = 0$, respectively. If an accident occurs, the injurer is brought to the court, and the game proceeds to the next stage.

In the second stage, Pleading Stage, a complaint is filed against the injurer, and the judge observes the strength of the case, which is summarized by $x \in \mathbb{R}$. For instance, from a sparse complaint, the judge could infer that the victim lacked favorable facts and could conclude that the case was exceedingly weak. Presumably, the strength of the case at hand could be primarily influenced by the injurer's act, and thus I assume that x is realized according to the conditional distribution function $G(x|a)$ with the conditional density function $g(x|a)$,⁸ which satisfies the following monotonicity properties:

Assumption 1. $\phi(x) < \phi(x')$ for $x < x'$ where

$$\phi(x) = \frac{g(x|1)}{g(x|0)}$$

⁸For simplicity, I assume that the occurrence of an accident and the realization of x are independent conditional on a .

Assumption 2. $\lim_{x \rightarrow -\infty} \phi(x) = 0$ and $\lim_{x \rightarrow \infty} \phi(x) = \infty$

Assumption 1 requires that the distribution satisfy the *monotone likelihood ratio property*. This property guarantees a positive association between x and a : a higher value of x is associated with a higher value of a , and vice versa. Intuitively, one can expect the case to be strongly against the negligent injurer because a strong complaint can be filed against him based on unfavorable initial evidence. Assumption 2, as shown in the analysis, guarantees an interior solution.

After observing x , depending on whether the game is Game-C or Game-T, the judge could exercise discretion in choosing whether to send the case to trial or dismiss the case. Although an ideal system may reveal the truth perfectly at trial, actual legal procedures are sometimes far from the ideal because the fact-finder must make a decision in the face of uncertainty. If the degree of uncertainty is large, the final verdict from the trier of fact may deviate from the truth, harming blameless parties and providing people with poor guidance for their primary behavior. This problem is especially pronounced in the case of jury trials in which laypeople participate in deciding the facts of the case.⁹

Accordingly, let d denote the jury’s decision regarding the injurer’s act and e denote the probability of errors at trial such that

$$P(d = 1|a = 0) = P(d = 0|a = 1) \equiv e \in (0, 1/2).$$

Thus, the jury at trial may erroneously find that the non-negligent injurer was negligent (i.e., $d = 1$ when $a = 0$) and vice versa.

To determine the trial payoffs of the players, I assume that δ takes the following expression:

$$\delta = |aL - t| \tag{1}$$

where aL is the lawful amount of compensation required to be made to the third party, and t is the actual amount of compensation made to the third party. Thus, the expression (1) means that error costs are proportional to the difference between the lawful and the actual amount of compensation, with a positive level of error costs unless these two amounts of compensation are the same.

In Game-C, the judge is required to send every case to trial. Thus, if an accident occurs,

⁹See, e.g., Kalven and Zeisel (1966) and Simon (1975) for the controversy over the merits of using lay juries. In *Skidmore v. Baltimore and Ohio R.R.*, 116 F.2d 54 (1947), Judge Jerome Frank wrote: “While the jury can contribute nothing of value so far as the law is concerned, it has infinite capacity for mischief, for twelve men can easily misunderstand more law in a minute than the judge can explain in an hour.” Dean Griswold of Harvard Law School argued (Guinther, 1988): “The jury trial at best is the apotheosis of the amateur. Why should anyone think that 12 persons brought in from the street, selected in various ways, for their lack of general ability, should have any special capacity for deciding controversies between persons?”

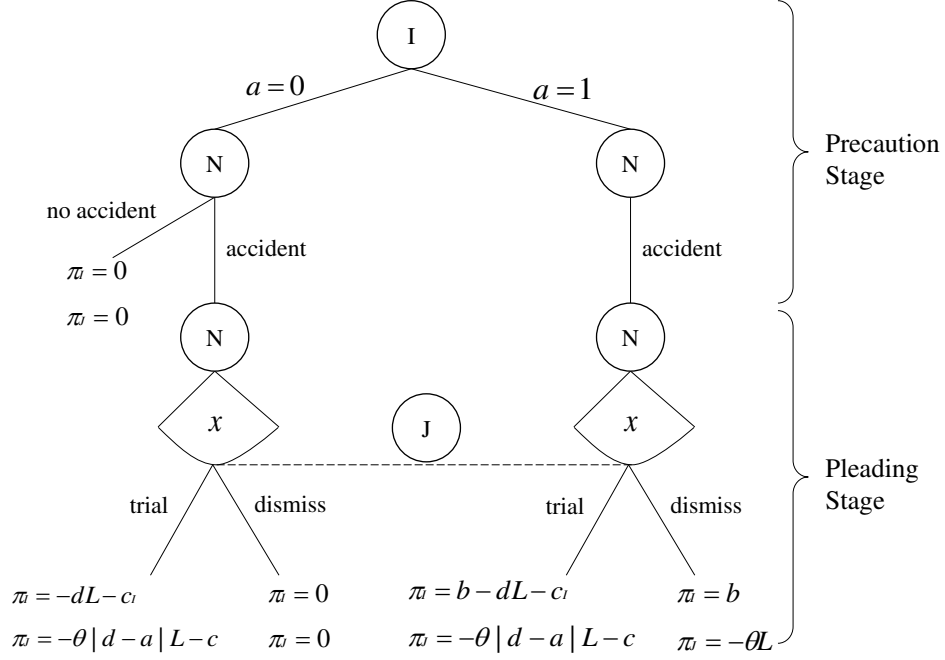


Figure 1: Game Tree for Game-T

a trial ensues, and the injurer and the judge obtain the following payoffs:

$$\begin{aligned}\pi_I &= ba - dL - c_I \\ \pi_J &= -\theta\delta - c = -\theta|d - a|L - c\end{aligned}\tag{2}$$

where c_I is the injurer's expenses at trial such as attorney fees. As litigation costs at trial are inclusive of the injurer's expenses, it seems reasonable to assume $c \geq c_I$. The expression for π_I is straightforward: the injurer obtains b under $a = 1$, is required to make compensations L under $d = 1$, and incurs litigation costs c_I . To understand the expression for π_J , observe that there are four possibilities at trial: $(d, a) \in \{(0, 0), (0, 1), (1, 0), (1, 1)\}$. Under the first and fourth possibilities, $(d, a) \in \{(0, 0), (1, 1)\}$, there are no error costs because

$$\delta = |aL - t| = \begin{cases} |0 \cdot L - 0| = 0 \\ |1 \cdot L - L| = 0 \end{cases}$$

In contrast, under the second and third possibilities, $(d, a) \in \{(0, 1), (1, 0)\}$, there are positive error costs because

$$\delta = |aL - t| = \begin{cases} |1 \cdot L - 0| = L \\ |0 \cdot L - L| = L \end{cases}$$

which explains the expression for π_J .

In Game-T, the judge has discretion to dismiss the case by comparing its litigation costs and error costs. If the judge sends the case to trial, payoffs are realized as in (2). If the judge dismisses the case, there are only error costs from the case and the payoffs are realized as follows:

$$\begin{aligned}\pi_I &= ab \\ \pi_J &= -\theta\delta = -\theta aL.\end{aligned}$$

In this situation, no litigation costs are incurred because a costly trial is avoided. Thus, the injurer's payoff is either b under $a = 1$ or 0 under $a = 0$. As the injurer is required to make no compensation due to the dismissal, the error costs are given by

$$\delta = |aL - t| = aL$$

which explains the expression for π_J .

Note that it is possible that the judge never sends a case to trial in Game-T if θ is close to 0 because litigation costs become the dominant factor in the judge's decision regardless of error costs. Then, there is no trial, and therefore litigation costs drop to 0 and the injurer is not deterred at all in Game-T. To rule out this extreme possibility and focus on more realistic situations, I assume that if the judge believes that the injurer was negligent ($a = 1$) for sure, the error costs from dismissal are higher than the total cost from trial, inducing the judge to send such a case to trial. In other words, θ cannot be too small:

Assumption 3. $\frac{c}{(1-e)L} < \theta$

One of the main purposes of this paper is to compare the levels of deterrence between the *Conley* and *Twigbal* regimes. For this purpose, it is convenient to have an “interior” level of deterrence under the *Conley* regime because this will help clarify the effect *Twigbal* has on deterrence.¹⁰ The following assumption on \bar{b} will be used to this end, which guarantees that the maximum benefit is sufficiently high so that some injurers are never deterred:

Assumption 4. $(1 - (1 + q)e)L + (1 - q)c_I < \bar{b}$

Assumptions 1-4 are maintained throughout the paper without further mention. In the next section, I analyze the model and compare the equilibrium outcomes from Game-C and Game-T. As the model is a dynamic game of incomplete information, the appropriate solution concept is the perfect Bayesian equilibrium, which is simply referred to as equilibrium throughout this paper.

¹⁰Otherwise, the deterrence could be maximal or minimal under both regimes, which renders the comparison ambiguous.

3 Equilibrium Analysis

3.1 Conley Regime

In Game-C, the judge is constrained to send every case to trial in her information set. Anticipating the judge's decision, the injurer knows that the non-negligent act will generate the expected payoff of

$$E\pi_I = -q(eL + c_I)$$

because an accident still occurs with probability q , in which case he will be brought all the way to trial with expected compensation eL and litigation costs c_I . Note that due to court errors, even the non-negligent injurer expects to fully compensate the victim with a positive probability. Similarly, the negligent act will provide the injurer with the expected payoff of

$$E\pi_I = b - (1 - e)L - c_I.$$

Although he obtains a private benefit b , he expects an accident, and consequently a trial, to occur for sure with expected compensation $(1 - e)L$ and litigation costs c_I . Because of court errors, the negligent injurer is held liable only with probability $1 - e$, with lower expected liability if the jury makes mistakes more frequently at trial. Thus, the injurer chooses $a = 1$ if and only if

$$D_C \equiv (1 - (1 + q)e)L + (1 - q)c_I < b \tag{3}$$

where D_C represents the level of deterrence in Game-C. Because I have $D_C > 0$, “low type” injurers with $b \in [0, D_C]$ are induced to choose the non-negligent act, and therefore the fraction of non-negligent injurers is positive: $F(D_C) > 0$. In addition, according to Assumption 4, the injurer with the maximum benefit ($b = \bar{b}$) will choose $a = 1$. Thus, by continuity, “high type” injurers with $b \in (D_C, \bar{b}]$ are not deterred, inducing $F(D_C) < 1$. Together, these observations show that the level of deterrence in Game-C is in the interior: $D_C \in (0, \bar{b})$ and $F(D_C) \in (0, 1)$.

Note that a higher level of deterrence is socially desirable under the *Conley* regime. To see this, observe that the social cost of the negligent act is $L + c$ because it incurs an accident for sure, with an accident cost L and consequent litigation costs c . Also observe that the social cost of the non-negligent act is $q(L + c)$ because an accident occurs only with probability q . Thus, the net social gain from the non-negligent act is $(1 - q)(L + c)$, and therefore a higher level of deterrence is preferred for society. ¹¹

¹¹This is a typical feature in models analyzed in the law and economics literature. For example, see [De-mougin and Fluet \(2006, 2008\)](#). Recently, [Kaplow \(2011\)](#) criticizes these modeling approaches, and introduces chilling effects in addition to deterrence effects.

From (3), it is straightforward to verify the effect of changes in litigation environment on deterrence as follows:

$$\frac{\partial D_C}{\partial e} < 0, \quad \frac{\partial D_C}{\partial L} > 0, \quad \frac{\partial D_C}{\partial c_I} > 0, \quad \frac{\partial D_C}{\partial q} < 0. \quad (4)$$

The signs of these derivatives are intuitive. First, as expected, higher court errors reduce deterrence: the possibilities that negligent injurers can avoid liability and non-negligent injurers can be held liable reduce the net benefit of choosing the non-negligent act. Thus, under the *Conley* regime, it is expected that court errors are inversely related to deterrence.¹² Second, a higher level of accident loss has a larger effect on negligent injurers because they have a higher chance of paying the compensation. Thus, the level of deterrence increases as the amount of accident loss increases. A similar reasoning applies to the effect of a higher level of litigation costs. Finally, if the non-negligent act is more likely to generate an accident, the level of deterrence decreases because it reduces the net benefit of the non-negligent act.

The other two important litigation outcomes, expected litigation costs (denoted by ELC_C) and expected error costs (denoted by EEC_C), can be readily calculated as follows:¹³

$$ELC_C = P(\text{trial})c \quad (5)$$

$$EEC_C = P(\text{trial})eL \quad (6)$$

where $P(\text{trial}) = F(D_C)q + 1 - F(D_C)$ is the probability that a trial occurs. Litigation costs are only expensed at trial, which generates the expression (5). To understand (6), first note that if a case proceeds to trial, it is expected to generate error costs of eL . If a trial does not occur, it turns out that there are no error costs because a trial does not occur only when the injurer is non-negligent.

Using the results from (4), we can see how these litigation outcomes respond to the changes in the litigation environment:

$$\begin{aligned} \frac{dELC_C}{de} &> 0, & \frac{dELC_C}{dL} &< 0, & \frac{dELC_C}{dc_I} &\geq 0, & \frac{dELC_C}{dq} &> 0, \\ \frac{dEEC_C}{de} &> 0, & \frac{dEEC_C}{dL} &\geq 0, & \frac{dEEC_C}{dc_I} &< 0, & \frac{dEEC_C}{dq} &> 0 \end{aligned} \quad (7)$$

where total derivatives are calculated to capture the indirect effect of parameter changes through deterrence. First, higher court errors unambiguously increase both ELC_C and EEC_C by reducing deterrence and increasing $P(\text{trial})$. In particular, the direct and indirect effects

¹²This is a standard result in the model of law enforcement. For example, see [Kaplow and Shavell \(1994\)](#).

¹³Legal scholars have long considered these two litigation outcomes as the two most important ones. Posner argues that accuracy and cost are the two most important criteria in comparing legal systems ([Posner, 1999](#), p.1542). [Kaplow \(1994\)](#) also notes that “[one] might go so far as to say that a large portion of the rules of civil, criminal, and administrative procedure and rules of evidence involve an effort to strike a balance between accuracy and legal costs.”

of higher e coincide in increasing EEC_C : as the jury makes more mistakes in assigning the liability, it directly raises the error costs from trial; in addition, higher court errors reduce deterrence, thereby increasing $P(\text{trial})$ and consequently the error costs. Thus, this result, together with the effect of court errors on deterrence, shows that court errors are detrimental in three important measures of legal outcomes. In contrast, it will be shown later that this intuitive result under *Conley* may not hold under *Twiqbal*.

Second, a higher level of accident loss reduces ELC_C by reducing $P(\text{trial})$ through higher deterrence, but its effect on EEC_C is ambiguous because higher L also directly raises EEC_C . The effect of higher litigation costs can be similarly understood. It is interesting to observe that a higher value of c_I could reduce the *expected* litigation costs. This seemingly counter-intuitive result arises in my model because the change in litigation costs could influence an individual's behavior; if this effect on behavior is sufficiently strong, the increase in litigation costs could benefit society by reducing the expected amount of litigation expenses. Finally, if the non-negligent act generates an accident more often, it is detrimental in terms of both ELC_C and EEC_C by raising $P(\text{trial})$ through lower deterrence.

3.2 *Twiqbal* Regime

To find the equilibrium of Game-T, I first consider the judge's behavior in Pleading Stage. When this stage of the game is reached, the judge knows that an accident occurred and observes the strength of the claim against the injurer. With this information and her belief about the level of deterrence,¹⁴ the judge dismisses a case if and only if the expected error costs from dismissing the case are less than the total cost from trial:

$$E[\theta\delta|x, \text{accident}] \leq c + \theta eL. \tag{8}$$

If the judge dismisses the case, she expects to incur error costs given on the left-hand side of (8), which is the expectation of $\theta\delta$ conditional on the judge's information. If the case proceeds to trial, litigation costs, c , will be incurred and the jury decision is expected to generate error costs of eL , which are given on the right-hand side of (8). The following lemma demonstrates that the judge uses a cutoff strategy, where the cutoff depends on the litigation environment.¹⁵

Lemma 1. *Given the judge's belief about the level of deterrence, there exists a unique cutoff \bar{x} such that the judge dismisses a case if and only if $x \leq \bar{x}$ where $|\bar{x}| < \infty$. Moreover, \bar{x} is strictly increasing in e , c , and q , and strictly decreasing in θ and L .*

¹⁴As the judge cannot observe the injurer's action directly, she must form a belief about the level of deterrence. This belief must be eventually consistent with the injurer's strategy in equilibrium, which is shown in Proposition 1.

¹⁵In the following analysis, I assume that the judge's belief about the level of deterrence is non-degenerate, i.e., the judge believes that deterrence is in the interior. This is because degenerate beliefs held by the judge cannot constitute an equilibrium. See Appendix 5.1 for details.

Proof. See the Appendix. □

If the strength of the claim is weak, the judge believes that the injurer was non-negligent with a high probability. This belief in turn reduces the expected error costs from dismissal because dismissing a case is equivalent to imposing no liability on the injurer. As the case strength becomes stronger, it is more likely that the injurer acted negligently, increasing the expected error costs from dismissal and thereby inducing the judge to send the case to trial. This argument shows that one can find a cutoff \bar{x} such that the judge dismisses a case if and only if the strength of the case is less than the cutoff value.

Lemma 1 also demonstrates how the judge's cutoff decision-rule responds to the changes in the litigation environment. Intuitively, the rise in e , c , or q induces the judge to dismiss stronger cases because it raises the cost of using a trial. If court errors or litigation costs increase, they directly reduce the value of using a trial. If q increases, the non-negligent act generates an accident with a higher probability than before, and therefore the portion of non-negligent injurers in the pool of injurers brought to the court increases, thereby reducing the value of using a trial. The opposite effects arise when θ or L increases, which induces the judge to care more about error costs, thereby inducing the judge to send weaker cases to trial.

Using backward induction, in Precaution Stage, anticipating the judge's behavior, the injurer believes that his expected payoffs are given by

$$\begin{aligned} a = 0 &\Rightarrow E\pi_I = -q \underbrace{(1 - G(\bar{x}|0))}_{(*)} (c_I + eL) \\ a = 1 &\Rightarrow E\pi_I = b - \underbrace{(1 - G(\bar{x}|1))}_{(**)} (c_I + (1 - e)L) \end{aligned}$$

where (*) and (**) are the probabilities that a trial ensues under each act. For instance, (*) is the probability that the strength of the case filed against the non-negligent injurer exceeds the threshold \bar{x} . As the judge sends such a case to trial, the injurer anticipates that a trial occurs with probability (*) when brought to the court under $a = 0$. The other part, (**), can be similarly understood. Thus, the injurer chooses $a = 1$ if and only if

$$D_T \equiv (1 - G(\bar{x}|1))(c_I + (1 - e)L) - q(1 - G(\bar{x}|0))(c_I + eL) < b$$

where D_T represents the level of deterrence in Game-T. In equilibrium, the judge's belief must be consistent with the injurer's strategy, which is dealt with in the following proposition.

Proposition 1. *There exists an equilibrium (D_T^*, \bar{x}^*) in Game-T such that (i) the injurer chooses $a = 1$ if and only if $D_T^* < b$ and (ii) the judge dismisses a case if and only if $x \leq \bar{x}^*$,*

where $|\bar{x}^*| < \infty$ and

$$D_T^* = (1 - G(\bar{x}^*|1))(c_I + (1 - e)L) - q(1 - G(\bar{x}^*|0))(c_I + eL) \in (0, \bar{b}).$$

Proof. See the Appendix. □

As under *Conley*, a higher level of deterrence is also preferred under *Twigbal*. To see this, observe that the negligent act generates the social cost of $L + (1 - G(\bar{x}^*|1))c$ because it incurs the accident loss L for sure, sometimes followed by a trial with the litigation cost c . Similarly, the social cost under the non-negligent act is $q(L + (1 - G(\bar{x}^*|0))c)$, which can be easily shown to be smaller than the social cost under the negligent act. Thus, the net social gain from the non-negligent act is positive, and therefore a higher level of deterrence is beneficial for society.

While the effect of changes in the litigation environment on deterrence is unambiguous in Game-C as shown in (4), this is not true in case of Game-T because the effect crucially depends on the shape of the distribution $G(x|a)$. To see this point clearly, taking the partial derivative of D_T^* with respect to e , I obtain

$$\begin{aligned} \frac{\partial D_T^*}{\partial e} &= \underbrace{(qg(\bar{x}^*|0)(c_I + eL) - g(\bar{x}^*|1)(c_I + (1 - e)L))}_{(a)} \cdot \frac{\partial \bar{x}^*}{\partial e} \\ &\quad - \underbrace{(1 - G(\bar{x}^*|1) + q(1 - G(\bar{x}^*|0)))}_{(c)} \cdot L \end{aligned}$$

where the first line captures the indirect effect of higher court errors through a higher cutoff, and the second line exhibits its direct effect. As can be easily seen, the direct effect reduces the net benefit of the non-negligent act because negligent injurers expect to pay less and non-negligent injurers expect to pay more due to higher court errors. Thus, deterrence falls due to the direct effect. In contrast, the indirect effect is ambiguous and it depends on the number of marginal injurers who can avoid trial under each act. On the one hand, $g(\bar{x}^*|0)$ from (a) indicates the number of marginal non-negligent injurers who can avoid trial due to the higher cutoff. Thus, if this value is large, it raises the benefit of the non-negligent act, thereby raising deterrence. On the other hand, $g(\bar{x}^*|1)$ from (b) indicates the number of marginal negligent injurers who can avoid trial due to the higher cutoff. Consequently, if this value is large, it raises the benefit of the negligent act, thereby reducing deterrence. Therefore, the indirect effect on deterrence is ambiguous and depends on the relative strength of these two forces, which renders the sign of the total effect undetermined.¹⁶

¹⁶This finding leads us to the important empirical question of estimating the number of individuals whose decisions could be affected by the changes in litigation environment. A similar observation is made by [Kaplow \(2013\)](#): "... there is the further empirical question ... of how many individuals with the opportunity to commit a harmful act have a private benefit in the range of 50 to 60" (p. 1197).

The equilibrium expected litigation and error costs are, respectively, given by

$$ELC_T = P(\text{trial})c \quad (9)$$

$$EEC_T = P(\text{trial})eL + (1 - F(D_T^*))G(\bar{x}^*|1)L \quad (10)$$

where $P(\text{trial}) = F(D_T^*)q(1 - G(\bar{x}^*|0)) + (1 - F(D_T^*))(1 - G(\bar{x}^*|1))$. The expression (9) is straightforward because litigation costs are expensed only at trial. As for (10), if a case proceeds to trial, it is expected to generate error costs of eL . In addition, a portion of dismissed cases involves negligent injurers who avoid a costly trial with the help of weak claims against them. These cases inflict error costs L , which is captured by the second term in (10).

Observe that the effect of changes in litigation environment on these litigation outcomes is also ambiguous because the indirect effect through deterrence is itself ambiguous as discussed above. As ELC_T and EEC_T crucially depend on the level of deterrence, it is important to assess the ways in which the injurer responds to the changes in litigation environment. Despite its importance, however, according to [Klerman \(2015\)](#), empirical research has mainly focused on direct costs such as litigation costs although there has been extensive research on the motion to dismiss. My results suggest that to accurately assess the effects of policy changes under *Twiqbal*, we need more research on the ruling's effects on deterrence, and the mechanism behind the ways in which deterrence may influence important litigation outcomes.

3.3 Effects of *Twiqbal* on Litigation Outcomes

In this subsection, I compare the equilibrium outcomes across the two legal regimes, and discuss the ways in which the Supreme Court's decision may influence litigation outcomes. In particular, I study the decision's effect on three important variables: deterrence, expected litigation costs, and expected error costs.

Deterrence

First, I study how the judge's enhanced gate-keeping power may influence the level of deterrence. In particular, I find the conditions under which *Twiqbal* may or may not induce a higher level of deterrence. To this end, subtracting D_C from D_T^* , I obtain

$$\begin{aligned} D_T^* - D_C &= (1 - G(\bar{x}^*|1))(c_I + (1 - e)L) - q(1 - G(\bar{x}^*|0))(c_I + eL) \\ &\quad - (1 - (1 + q)e)L - (1 - q)c_I \\ &= \underbrace{-G(\bar{x}^*|1)(c_I + (1 - e)L)}_{(A)} + \underbrace{qG(\bar{x}^*|0)(c_I + eL)}_{(B)} \end{aligned}$$

where (A) indicates the detrimental effect of *Twiqbal* on deterrence and (B) the beneficial effect. As the judge dismisses weak cases using her gate-keeping power, injurers who had to face costly trials under *Conley* can now avoid them if the claims against them are weak. This possibility reduces the costs of both negligent and non-negligent acts, which are captured by (A) and (B). Therefore, deterrence increases under *Twiqbal* if and only if the following condition holds:

$$\frac{G(\bar{x}^*|1)}{G(\bar{x}^*|0)} < \frac{q(c_I + eL)}{c_I + (1 - e)L} \quad (11)$$

where the right-hand side is less than 1.

Proposition 2. *If the dismissal ratio is sufficiently small, deterrence increases after *Twiqbal*.*

The left-hand side of (11) is the ratio between the dismissal rates of each type of injurers, which is strictly less than 1 due to Assumption 1. The condition (11) imposes a constraint on this ratio for *Twiqbal* to generate a higher level of deterrence, requiring this dismissal ratio to be sufficiently small. If the case strength has a strong correlation with the injurer’s act, the dismissal ratio is likely to be small, satisfying the constraint above. Thus, in contrast to [Campos et al. \(2015\)](#), my model suggests a possibility that the Supreme Court’s decisions raise deterrence.

Presumably, the degree of correlation between the case strength and the injurer’s primary act could vary across different types of torts. In case of financial lawsuits, the correlation could be relatively high because of the wide availability of transaction data and the active monitoring activities of market participants. In contrast, the correlation could be relatively low in civil rights cases, because the plaintiff often lacks direct evidence of the defendant’s motives at the outset of litigation;¹⁷ moreover, courts often hold that police officers may use race and other characteristics in determining the likelihood that a person has engaged in a crime, as long as this use is reasonably related to law enforcement and is not a pretext for racial harassment.¹⁸ Thus, if this were the case, one could argue that (11) is more likely to hold in financial lawsuits, with an implication that *Twiqbal* could reduce financial frauds (i.e., more deterrence in financial cases) but raise the instances of discriminatory activities (i.e., less deterrence in civil rights cases).

These different changes in deterrence could explain to a certain extent the mixed picture described by empirical research about *Twiqbal*’s effect on litigation outcomes. If the level of deterrence increases in financial cases as suggested above, the average case filed at trial courts becomes weaker as the proportion of non-negligent injurers in the population increases,

¹⁷[Kilaru \(2010\)](#) argues that “civil rights plaintiffs ... cannot state a claim because they do not have access to documents or witnesses they believe exist; and they cannot get access to those documents or witnesses without stating a claim.”

¹⁸For instance, see [Thompson \(1999\)](#) for an analysis of this issue. See also [Persico \(2002\)](#) for the concept of statistical discrimination in law enforcement.

which results in the judge granting motions to dismiss more often.¹⁹ Following a similar logic, one obtains the opposite result in civil rights cases, resulting in different rates of motions to dismiss granted by federal judges, which could contribute to mixed empirical findings.

In addition, as the direction of effect could be different across different types of torts, one needs to interpret empirical findings with caution. In particular, the ruling's positive effect on deterrence in a certain type of tort could provide poor guidance to researchers about the direction of effect in other types of torts. This could potentially pose a challenge to empirical research in estimating the ruling's effect on deterrence.

Expected Litigation Costs

The expected litigation costs from (5) and (9) are reproduced here:

$$\begin{aligned} \text{Game-C : } & (F(D_C)q + 1 - F(D_C))c \\ \text{Game-T : } & (F(D_T^*)q(1 - G(\bar{x}^*|0)) + (1 - F(D_T^*))(1 - G(\bar{x}^*|1)))c. \end{aligned}$$

If (11) holds, it is straightforward to show that the following inequalities hold:

$$\begin{aligned} & (F(D_C)q + 1 - F(D_C))c \\ & > \underbrace{(F(D_C)q)}_{(a)} \underbrace{(1 - G(\bar{x}^*|0))}_{(b)} + \underbrace{(1 - F(D_C))}_{(c)} \underbrace{(1 - G(\bar{x}^*|1))}_{(d)}c \\ & > \underbrace{(F(D_T^*)q)}_{(a')} \underbrace{(1 - G(\bar{x}^*|0))}_{(b)} + \underbrace{(1 - F(D_T^*))}_{(c')} \underbrace{(1 - G(\bar{x}^*|1))}_{(d)}c \end{aligned}$$

The first inequality is true because of multiplication of fractions (b) and (d). To see why the second inequality is true, observe that (b) < (d) because $G(\bar{x}^*|0) > G(\bar{x}^*|1)$, which follows from Assumption 1. Then, assuming (11), the second inequality is true because the average is taken with a larger weight on (b) than on (d), i.e., (a) < (a') and (c) > (c'). Thus, if the level of deterrence rises under *Twiqbal*, it operates to reduce the expected litigation costs by reducing the number of cases proceeding to trial.

Proposition 3. *If the dismissal ratio is sufficiently small, expected litigation costs decrease after Twiqbal.*

Although the avoidance of high litigation costs is the reasoning behind the Supreme Court's decision, the judge's enhanced role in screening cases itself cannot guarantee this result because

¹⁹A Federal Judicial Center study found that motions to dismiss were filed in a greater percentage of cases after the Supreme Court's decision (4.0% in 2005-2006 versus 6.2% in 2009-2010 according to Cecil et al. (2011a)), but its influence had been quite different across different types of torts. In particular, the increase was smallest in civil rights cases although *Ashcroft v. Iqbal* involved a dispute regarding discriminatory activities. Furthermore, although the overall percentage of motions to dismiss granted went up from 66% to 75%, the effect was statistically significant only for financial lawsuits.

the level of deterrence could fall under *Twiqbal* (i.e., when (11) is not satisfied), thereby raising the expected litigation costs. Thus, again, the study of the effect on deterrence is important for researchers to assess the ruling's effect on litigation costs.

Expected Error Costs

The expected error costs from (6) and (10) under each regime can be rearranged as follows:

$$\begin{aligned} \text{Game-C :} & \quad F(D_C) \underbrace{qeL}_{(a)} + (1 - F(D_C)) \underbrace{eL}_{(b)} \\ \text{Game-T :} & \quad F(D_T^*) \underbrace{q(1 - G(\bar{x}^*|0))eL}_{(a')} + (1 - F(D_T^*)) \underbrace{\{G(\bar{x}^*|1)L + (1 - G(\bar{x}^*|1))eL\}}_{(b')} \end{aligned}$$

Investigation of these expressions reveals that the total effect of *Twiqbal* on the expected error costs consists of two effects: the *dismissal effect* and the *deterrence effect*. First, I consider the dismissal effect, where I fix the level of deterrence across the two legal regimes (i.e., $D_C = D_T^*$) and investigate *Twiqbal*'s direct effect on error costs. On one hand, observe that the negligent act generates higher error costs than the non-negligent act under both regimes: $(a) < (b)$ and $(a') < (b')$. The reasons are that (i) a trial occurs less frequently under the non-negligent act, (ii) dismissing negligent injurers generates error costs while dismissing non-negligent injurers does not, and (iii) non-negligent injurers' cases are more likely to be dismissed.²⁰ On the other hand, *Twiqbal* reduces the error costs resulting from the non-negligent act but raises those resulting from the negligent act: $(a') < (a)$ and $(b) < (b')$. The first inequality holds because the dismissal of non-negligent injurers' cases incurs no error costs, and the second inequality holds because (i) the expected error costs from trial are the same across the two legal regimes (i.e., eL) and (ii) the dismissal of negligent injurers' cases after *Twiqbal* incurs higher error costs (i.e., L) than the trial does (i.e., eL). These two factors suggest that, when the level of deterrence across the two legal regimes is fixed, *Twiqbal*'s effect on error costs becomes ambiguous and depends on the dismissal rates of the two types of injurers. If the judge dismisses non-negligent injurers' cases sufficiently more often (i.e., $G(\bar{x}^*|0) \gg G(\bar{x}^*|1)$), I could obtain $(a') \ll (a)$ and $(b) \approx (b')$, thereby obtaining smaller expected error costs under *Twiqbal* and vice versa.

Second, I consider the deterrence effect, where I look at *Twiqbal*'s indirect effect on error costs via deterrence. If condition (11) is satisfied, the enhanced deterrence under *Twiqbal* operates to reduce expected error costs. This can be seen by observing that EEC_T is an average of (a') and (b') with a weight to (a') given by $F(D_T^*)$. Thus, if the level of deterrence becomes higher under *Twiqbal* (i.e., D_T^* and $F(D_T^*)$ become larger), EEC_T decreases because

²⁰In other words, (i) q is multiplied in (a) and (a') , (ii) $G(\bar{x}^*|1)L$ appears in (b') and $G(\bar{x}^*|0) \cdot 0$ in (a') , and $(1 - G(\bar{x}^*|0))$ in (a') is smaller than $(1 - G(\bar{x}^*|1))$ in (b') .

$(a') < (b')$. Therefore, the deterrence effect is unambiguous, and it always operates to reduce the expected error costs.

Although the total effect of *Twiqbal* is ambiguous, a useful sufficient-condition can be easily derived. As the deterrence effect operates to reduce expected error costs, if the dismissal effect has the same effect, expected error costs unambiguously decrease under *Twiqbal*. This can be done by fixing the levels of deterrence at D_C in EEC_C and EEC_T and deriving the following condition from the comparison between the two error costs:

$$\frac{G(\bar{x}^*|1)}{G(\bar{x}^*|0)} < \frac{F(D_C)qe}{(1 - F(D_C))(1 - e)} \quad (12)$$

which again imposes a constraint on the ratio between the dismissal rates under each act.

Proposition 4. *If the dismissal ratio is sufficiently small, expected error costs decrease after Twiqbal.*

On one hand, observe that the condition above is not binding if $F(D_C) \approx 1$ because, in that case, the right-hand side is larger than 1 whereas the left-hand side is smaller than 1. Thus, if the level of deterrence is already high under *Conley*, the dismissal of non-negligent injurers (the (a') part) becomes the dominant factor in the dismissal effect and expected error costs decrease accordingly after *Twiqbal*. On the other hand, if the level of deterrence is very low under *Conley*, it imposes a stringent constraint on the dismissal ratio so that the judge needs to dismiss non-negligent injurers' cases sufficiently often in equilibrium under *Twiqbal*. Thus, if both (11) and (12) are satisfied, *Twiqbal* simultaneously raises deterrence and reduces expected litigation costs and expected error costs, thus contributing to higher social welfare.

4 Concluding Remarks

The Supreme Court's important decisions, known as *Twiqbal*, have triggered a plethora of research on their effects on litigation outcomes in the United States, mostly focusing on litigation costs. Thus, the effect of those decisions on the injurer's primary behavior has been largely neglected in literature, which could pose a problem because the effect on deterrence is crucial in understanding the ruling's effect on various litigation outcomes. To this end, within a stylized game-theoretic model, this paper investigates the ways in which the Court's ruling might influence the level of deterrence as well as other important litigation outcomes. I demonstrate that the ruling could bring about desirable changes in terms of deterrence, expected litigation costs, and expected error costs as long as the dismissal ratio is sufficiently small, which depends on the correlation structure between the injurer's primary behavior and the strength of the case filed at trial courts.

An interesting avenue for future research is to study the ruling's effect on the rate of

frivolous lawsuits.²¹ A frivolous lawsuit is a case in which an injurer is brought to the court without incurring harm. The number of frivolous lawsuits under each legal regime is

$$\begin{aligned} \text{Game-C :} & \quad F(D_C)(1 - q)s_C \\ \text{Game-T :} & \quad F(D_T^*)(1 - q)s_T \end{aligned}$$

where s_i for $i \in \{C, T\}$ is the probability that an injurer is brought to the court without incurring harm under each legal regime. Although I assume $s_i = 0$ in the basic model, it could be positive in a general setting. If the number of non-negligent injurers increases under *Twiqbal*, it, in turn, raises the base for potentially frivolous lawsuits. Thus, if s_i does not change across the two legal regimes, frivolous lawsuits will occur more frequently under *Twiqbal*, which is a result contrary to [Campos et al. \(2015\)](#).

In reality, s_i may differ across legal regimes. Suppose a victim must incur a certain amount of cost to bring an injurer to the court. Under *Twiqbal*, the judge could dismiss the case; therefore, the victim expects to waste the cost for nothing with a high probability. As the judge's gate-keeping power reduces the net value of bringing a frivolous lawsuit, the victim may bring such a suit less often, i.e., $s_C > s_T$. However, although we have $s_C > s_T$, it does not guarantee that we can reduce these wasteful lawsuits under *Twiqbal*, because the base for these suits may increase due to higher deterrence. Thus, whether the judge's gate-keeping power can eliminate frivolous lawsuits crucially depends on these countervailing forces.

This discussion suggests that to evaluate a legal change's effect on frivolous suits, it is important to assess its effect on deterrence. The Supreme Court reasoned that *Twiqbal* could eliminate such suits by having judges screen meritless claims; however, this reasoning could be partial. As the model suggests, if the judge's gate-keeping power raises the level of deterrence, it operates to raise frivolous suits by raising the base for such lawsuits. Future research is needed to shed more light on this complex interplay between deterrence and frivolous lawsuits.

5 Appendix

5.1 Degenerate Beliefs Case

Let μ denote the judge's belief about the fraction of non-negligent injurers in the population. In the following, I show that degenerate beliefs held by the judge (i.e., $\mu \in \{0, 1\}$) cannot constitute an equilibrium.

²¹Scholars have suggested various ways to fight frivolous lawsuits. [Kozel and Rosenberg \(2004\)](#) argue for mandating motions for summary judgment. [Rosenberg and Shavell \(2006\)](#) suggest an option to bar settlement as a solution to eliminate frivolous suits, but [Sichelman \(2008\)](#) argue that the option to bar settlement may reduce social welfare by inducing defendants to exercise the option in meritorious suits. [Stone and Miceli \(2013\)](#) study the ways in which the existence of frivolous suits affects the defendant's primary behavior.

Suppose $\mu = 0$, which implies that the judge believes that all injurers were negligent. Then, I have

$$\begin{aligned}
E[\theta\delta|x, \text{accident}] &= P(a = 1|x, \text{accident})\theta L \\
&= \frac{(1 - \mu)g(x|1)}{(1 - \mu)g(x|1) + \mu g(x|0)q} \times \theta L \\
&= \frac{g(x|1)}{g(x|1)} \times \theta L \\
&= \theta L \\
&> c + \theta eL
\end{aligned}$$

where the last inequality holds by Assumption 3. Therefore, in Pleading Stage, the judge sends all cases to trial for all $x \in \mathbb{R}$.

Anticipating this, in Precaution Stage, the injurer knows that his expected payoff is given by

$$\begin{aligned}
a = 0 &\Rightarrow E\pi_I = -q(eL + c_I) \\
a = 1 &\Rightarrow E\pi_I = b - (1 - e)L - c_I
\end{aligned}$$

Thus, the injurer chooses $a = 1$ if and only if

$$(1 - (1 + q)e)L + (1 - q)c_I < b \tag{13}$$

where the left-hand side of the inequality is greater than 0. Thus, those low-type injurers with $b \approx 0$ are deterred, which is not consistent with the judge's belief of $\mu = 0$. Therefore, $\mu = 0$ cannot constitute an equilibrium.

If $\mu = 1$, it can be similarly shown that it cannot constitute an equilibrium. This completes the proof.

5.2 Proof for Lemma 1

Let $\mu \equiv F(D_T) \in (0, 1)$ be the judge's belief about the portion of non-negligent injurers where D_T is the level of deterrence. Then, I have

$$\begin{aligned}
E[\theta\delta|x, \text{accident}] &= P(a = 1|x, \text{accident})\theta L \\
&= \frac{(1 - \mu)g(x|1)}{(1 - \mu)g(x|1) + \mu g(x|0)q} \times \theta L \\
&= \left[1 + \frac{\mu g(x|0)q}{(1 - \mu)g(x|1)} \right]^{-1} \times \theta L
\end{aligned}$$

$$\begin{aligned}
&= \underbrace{\left[1 + \frac{\mu q}{(1 - \mu)\phi(x)}\right]^{-1}}_{\equiv \psi(x)} \times \theta L \\
&= \psi(x)\theta L.
\end{aligned}$$

Thus, the judge dismisses the case if and only if

$$\psi(x)\theta L \leq c + \theta eL \iff \psi(x) \leq \underbrace{\frac{c + \theta eL}{\theta L}}_{\equiv K}$$

where $K < 1$ by Assumption 3. By Assumptions 1 and 2, $\psi(x)$ is strictly increasing in x and I have

$$\lim_{x \rightarrow -\infty} \psi(x) = 0 \quad \text{and} \quad \lim_{x \rightarrow \infty} \psi(x) = 1.$$

Thus, there exists a unique cutoff \bar{x} such that

$$\begin{aligned}
\psi(x) &< K \quad \forall x < \bar{x} \\
\psi(\bar{x}) &= K \\
\psi(x) &> K \quad \forall x > \bar{x}
\end{aligned}$$

which also shows that $|\bar{x}| < \infty$. Therefore, the judge dismisses the case if and only if $x \leq \bar{x}$.

To prove the second part, observe that K is strictly increasing in c and e , and strictly decreasing in θ and L . Because \bar{x} is determined from the equation $\psi(\bar{x}) = K$ and $\psi(x)$ is strictly increasing in x , it is straightforward to see that \bar{x} is strictly increasing in c and e , and strictly decreasing in θ and L . Finally, if q increases, the $\psi(x)$ function shifts down. Thus, with K fixed, the value of \bar{x} for $\psi(\bar{x}) = K$ increases. This completes the proof.

5.3 Proof for Proposition 1

To prove the existence, it is sufficient to show that there exists a solution \bar{x}^* to the following equation:

$$\frac{\theta L}{1 + \underbrace{\left(\frac{\mu^* q}{(1 - \mu^*)\phi(\bar{x}^*)}\right)}_{(A)}} = c + \theta eL \tag{14}$$

where

$$\mu^* = F[(1 - G(\bar{x}^*|1))(c_I + (1 - e)L) - q(1 - G(\bar{x}^*|0))(c_I + eL)].$$

As $\bar{x}^* \rightarrow -\infty$, I have

$$\mu^* \rightarrow F(c_I + (1 - e)L - q(c_I + eL))$$

which is a number strictly between 0 and 1. This is because

$$c_I + (1 - e)L - q(c_I + eL) = (1 - (1 + q)e)L + (1 - q)c_I < \bar{b}$$

due to Assumption 4, and

$$c_I + (1 - e)L - q(c_I + eL) = (1 - e)L - qeL + (1 - q)c_I > (1 - q)c_I > 0$$

due to $q \in (0, 1)$ and $e \in (0, 1/2)$. Thus, as $\bar{x}^* \rightarrow -\infty$, I have $(A) \rightarrow \infty$ because μ^* converges to a number strictly between 0 and 1 and $\phi(\bar{x}^*)$ converges to 0, and therefore the left-hand side of (14) converges to 0, which is smaller than the right hand side of (14). As $\bar{x}^* \rightarrow \infty$, I have $\mu^* \rightarrow F(0) = 0$. Thus, as $\bar{x}^* \rightarrow \infty$, I have $(A) \rightarrow 0$, and therefore the left-hand side of (14) converges to θL , which is larger than the right-hand side of (14) by Assumption 3. Thus, there exists a solution \bar{x}^* to (14) where $|\bar{x}^*| < \infty$. As it is routine to show $D_T^* \in (0, \bar{b})$, this completes the proof.

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