The Effects of Wealth and Stake Size on Litigants and Attorneys*

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Abstract

We develop two models of litigation in which the probability of winning for a litigant depends on her attorney's capacity and effort relative to those of her opponent's attorney. In the models, money can buy attorneys' capacity as professional human resources; the plaintiff's attorney works either under a contingent fee or under an hourly fee, but the defendant's attorney works under an hourly fee. We find: (i) the wealth effect on the litigants' expected payoffs are very small; (ii) the marginal effect of increasing stake (or judgment) size over the plaintiff's incentives to exert effort is higher under the contingent fee than under the hourly fee; (iii) thus, if the stake size is big enough, the contingent-fee scheme brings the plaintiff a more expected payoff than the hourly-fee scheme. These findings are applied to the tobacco litigation in the United States.

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1. Introduction

Attorneys are a shining example of professional human resources. This paper analyzes litigants' choice of attorneys and attorneys' work incentives under different types of attorney-litigant fee agreements when stake (also called recovery for damages in tort) is varied in size. Attorneys are differentiated by their professional capacity (or ability).

In order to prevail in a civil case, it is important for a litigant to hire a high-capacity attorney. This is especially true in the adversarial system of litigation in the United States.\(^1\) We argue that the bigger the stake size of the case, the greater the capacity of a plaintiff's attorney under a contingent-fee arrangement. Though the plaintiff is poor, expectations of such damages could attract able attorneys to her side. (Throughout the paper, we use "she" to refer to a litigant, and "he" to refer to an attorney.) This means that the advantage of high-capacity attorneys is not necessarily with a wealthy defendant if stake size is big enough.

To investigate the effects of litigants' wealth and stake (or judgment) size on litigation outcomes, we develop two contest models in which the probability of winning for a litigant depends on her attorneys' relative capacity and effort levels relative to those of her opponent's attorney.\(^2\) In the models, a litigant with more wealth has better access to the pool of high-capacity attorneys than her opponent with less wealth, given the stake size.\(^3\) Similarly, given the wealth level, the greater the stake size, the higher the capacity of attorneys available for the litigants. We use logit-form probability-of-winning functions; thus, a litigant with a better attorney and higher effort is not guaranteed victory, but rather has a greater likelihood of victory.

We first consider a model—called the contingent-fee model—in which the plaintiff retains her attorney on a contingent-fee basis and the defendant does on an hourly-fee basis.\(^4\) For simplicity, we assume complete information and risk neutrality for litigants and attorneys. To be more precise, we set up the following two-stage game. In the first stage, each litigant hires her attorney and writes a contract with him, and then the litigants
simultaneously announce their attorneys' capacity and their contracts. In the second stage, the attorneys exert their effort simultaneously and independently to win the case. The plaintiff's attorney under the contingent fee chooses his own effort level, while the defendant with the hourly fee calculates the effort level and has her attorney implement it. Unlike the plaintiff, therefore, the defendant may have to incur some monitoring costs. At the end of the second stage, the winner is determined, and each litigant pays compensation to her attorney according to the contracts written in the first stage.

We next consider another model – called the hourly-fee model – in which the plaintiff as well as the defendant adopts the hourly fee. This game runs as follows. In the first stage, each litigant hires her attorney and writes a contract with him. The contract specifies the attorney's hourly-fee rate. Then, the litigants simultaneously announce their attorneys' capacity and their contracts. In the second stage, litigants 1 and 2 choose simultaneously the effort levels which attorneys 1 and 2 will expend, respectively, and then the attorneys expend their effort. At the end of the second stage, the winner is determined, and each litigant pays compensation to her attorney according to the contracts written in the first stage.

We first show that, in the two models, litigants hire the best of the available attorneys they can afford. We then compare the outcomes of the hourly-fee model with those of the contingent-fee model. Both models find that wealth effects on the litigants' expected payoffs are small but positive. This finding seems to be counterintuitive because a wealthier litigant can hire a better attorney so that she can increase her probability of winning and expected payoff. We can explain this, using her strategic and payoff-maximizing behavior. It is true that the wealthier the litigant, the greater her probability of winning with the better attorney. But hiring the better attorney increases her litigation costs because of a higher hourly-fee rate which is increasing in his capacity. Moreover, it could make her opponent aggressive, which in turn lowers her expected payoff. Recognizing such costs and strategic interactions, when the wealthy litigant hires a high-
capacity attorney, she makes him less aggressive by asking him to work less. We thus find that the wealth effects on the litigants' expected payoffs are not so great.\(^5\)

Next, we vary stake size. Assuming that an increase in the stake size enhances a litigant's financial ability to hire a better attorney, we show that as the stake size increases, a contingent-fee scheme makes an attorney exert more effort than an hourly-fee scheme. This is because, by choosing the contingent fee, a litigant motivates her attorney more strongly to win her case. Thus, if an attorney's initial effort level under the contingent fee is lower than that under the hourly fee, then a reversal of the effort levels occurs as the stake size increases. This provides a theoretical foundation for Kritzer (1990) who conjectures such a reversal empirically, using hypothetical cases.

As we adopt logit-form probability-of-winning functions, the reversal of the effort levels leads to a reversal of a litigant's expected payoffs. Specifically, if a litigant's initial payoff with the contingent fee is less than that with the hourly fee, then a reversal of the payoffs occurs when the stake size increases. This throws light on the tobacco litigation in the United States (see Sloan, Trogdon and Mathews, 2005). Since private attorneys earned a huge amount of money in the litigation, the state governments — though able to afford salaried attorneys for the litigation — were blamed for hiring them with the contingent fee. The reversal of the payoffs in our analysis implies, however, that the governments' choice of the contingent fee should not be blamed if the public wanted the governments to maximize expected payoffs. The reversal of the effort levels also implies that if stake size is big enough, the plaintiff's winning probability with the contingent fee could be greater than the defendant's winning probability with the hourly fee.

Before proceeding, we should note the relationship between this paper and the litigation literature on the advantage of the "haves" (the rich in our context). In his seminal work, Galanter (1974) proposes that the haves achieve more favorable outcomes in litigation. The haves in his paper, e.g. insurance companies, are financially and organizationally stronger parties, compared to the have-nots. The haves are repeat litigants
in litigation, whereas the have-nots are one-shotters. Due to such merits, the haves tend to prevail in litigation, which is empirically supported by a number of scholars (see, e.g. Wheeler, Cartwright, Kagan and Friedman, 1987; Songer, Sheehan and Haire, 1999). We prove that, in accordance with Galanter's proposition, a wealthy litigant can maintain the advantage in terms of expected payoffs. Our numerical examples show, however, that the advantage is not so great. We conjecture that if our model could consider the issue of repeat litigants, the level of the advantage would become greater.

The paper proceeds as follows. Section 2 develops the contingent-fee model in which the plaintiff's attorney works under a contingent fee and the defendant's attorney works under an hourly fee. In Section 3, we consider the hourly-fee model in which both attorneys work under the hourly fee. Varying stake size, Section 4 compares the outcomes from the two models. Section 5 offers our concluding remarks.

2. The contingent-fee model

Consider a tort litigation in which a plaintiff seeks compensation for damages from a defendant. If the plaintiff wins the lawsuit, she receives a judgment $V$ from the defendant. On the other hand, if the plaintiff loses it—it is, if the defendant wins it—she receives nothing from the defendant. The litigants bear their own litigation costs, regardless of the outcome of the lawsuit. We model this litigation as a contest in which the two litigants compete to win a prize (or stake) of $V$.

The litigants each hire an attorney who exerts effort on her behalf. Let us call the plaintiff litigant 1, and the defendant litigant 2. The attorney hired by litigant 1 is called attorney 1, and the attorney hired by litigant 2 is called attorney 2. Reflecting typical compensation structures for tort cases in the United States, we assume in this section that attorney 1 is hired on a contingent-fee basis—so comes the title of the section—but attorney 2 is hired on an hourly-fee basis. More specifically, attorney 1 is paid a fee that is set as a fixed percentage of $V$ if litigant 1 wins the lawsuit, and nothing if she loses it.
On the other hand, attorney 2 is paid a fee which depends on his capacity and effort level, regardless of the outcome of the lawsuit.

Let \( x_i \) represent the effort level expended by attorney \( i, i = 1, 2 \). Effort levels are nonnegative and are measured in temporal units. Let \( p_i \) be the probability that attorney \( i \) (or litigant \( i \)) wins. Then we have \( p_2 = 1 - p_1 \). The litigation success function for attorney 1 is given by

\[
p_1 = \frac{\sigma_1 x_1}{\sigma_1 x_1 + \sigma_2 x_2} \quad \text{for } x_1 + x_2 > 0 \quad (1)
\]

\[
1/2 \quad \text{for } x_1 + x_2 = 0,
\]

where \( \sigma_i \) indicates attorney \( i \)'s capacity for the litigation. Function (1) implies two things. First, the litigants have the same degree of fault regarding the case: if \( x_1 = x_2 \) and \( \sigma_1 = \sigma_2 \), then attorney 1's probability of winning equals one half. Second, \( \sigma_i > \sigma_j \) implies that attorney \( i \) has more capacity than attorney \( j \): if \( x_1 = x_2 \), then attorney \( i \)'s probability of winning is greater than one half. (Throughout the paper, when we use \( i \) and \( j \) at the same time, we mean that \( i \neq j, i, j = 1, 2 \).) The attorneys' litigation success functions have the property that, given attorney \( j \)'s positive effort level, attorney \( i \)'s probability of winning is increasing in his effort level at a decreasing rate. They have also the property that, given his positive effort level, attorney \( i \)'s probability of winning is decreasing in attorney \( j \)'s effort level at a decreasing rate.

For each capacity level, there exist at least two attorneys of the capacity. The litigants know which attorney has what capacity. Litigant \( i \) hires an attorney whose capacity lies in the real interval \([1, \sigma_i]\), where \( \sigma_i > 1 \): in terms of the symbols, \( \sigma_i \in [1, \sigma_i] \).

As mentioned in Footnote 8, a plaintiff (litigant 1) is often an individual, while a defendant (litigant 2) is usually a firm that has a deep pocket. Based on this fact, we assume that \( \bar{\sigma}_1 \leq \bar{\sigma}_2 \). For concise exposition, we let \( \bar{\sigma}_1 = \bar{\sigma} \) and \( \bar{\sigma}_2 = \alpha \bar{\sigma} \), where \( \alpha \geq 1 \). We assume that the value of \( \bar{\sigma}_i \) is determined by both the value of \( V \) and litigant \( i \)'s wealth level. Note that given \( i \)'s wealth, an increase in \( V \) raises her expected payoff, which in turn enhances
her financial ability to hire better attorneys under the hourly fee scheme. Similarly, under
the contingent fee, an increase in $V$ entices better attorneys to work for litigant 1.

If attorney 1 wins the lawsuit, his contingent fee is $\beta_1 V$, where $0 < \beta_1 < 1$. The
parameter $\beta_1$ is determined by the contract between litigant 1 and attorney 1. Attorney 2's
hourly-fee rate is assumed to equal his capacity, $\sigma_2$. Litigant 1 does not monitor attorney
1's effort level. This is because the fee is paid only if she wins the case. But litigant 2 may
have to incur some monitoring costs in order to deal with attorney 2's possible moral
hazard. We assume that, if litigant 2 asks attorney 2 to expend an effort level of $x_2$, then
she must expend a monitoring cost of $\delta x_2$, where $\delta > 0$. We assume that $\delta$ is exogenously
given and publicly known. Note that, if litigant 2 asks attorney 2 to expend more effort,
then she must incur more monitoring costs. Thus, if litigant 2 asks attorney 2 to expend an
effort level of $x_2$, then she must expend a total amount of $(\sigma_2 + \delta)x_2$.

We assume that the litigants and attorneys are risk-neutral, and try to maximize
their expected payoffs. Let $\pi_i$ represent the expected payoff for attorney $i$, and $\Pi_i$ the
expected payoff for litigant $i$. Then the payoff function for attorney 1 is

$$\pi_1 = p_1 \beta_1 V - x_1.$$  

We allow a rent for each attorney by assuming that he incurs a real cost of 1 per unit of his
effort; thus, the higher attorney $i$'s capacity, the more his rent. The payoff function for
attorney 2 of capacity $\sigma_2$ is $\pi_2 = (\sigma_2 - 1)x_2 \geq 0$. The payoff function for litigant 1 is

$$\Pi_1 = p_1 (1 - \beta_1) V,$$  

and that for litigant 2 is

$$\Pi_2 = (1 - p_1) V - (\sigma_2 + \delta)x_2.$$  

We formally consider the following two-stage game. In the first stage, each litigant
hires her attorney – that is, litigant $i$ chooses $\sigma_i$. Litigant 1 writes a contract with attorney
1, which specifies the contingent-fee parameter $\beta_1$. Litigant 2 writes a contract with attorney 2, which specifies attorney 2's hourly-fee rate. Then, the litigants simultaneously announce their attorneys' capacity and their contracts – that is, litigant 1 announces publicly the value of $\sigma_1$ and the value of $\beta_1$, and litigant 2 announces publicly the value of $\sigma_2$. In the second stage, attorney 1 and litigant 2 choose simultaneously the effort levels which attorneys 1 and 2 will expend, respectively, and then the attorneys expend their effort. Note that, since attorney 2 is hired on an hourly-fee basis, it is litigant 2 who chooses attorney 2's effort level. At the end of the second stage, the winner is determined, and each litigant pays compensation to her attorney according to the contracts written in the first stage.

Finally, we assume that all of the above is common knowledge among the litigants and attorneys. We employ a subgame-perfect equilibrium as the solution concept.

2.1. The second stage of the game

To solve for a subgame-perfect equilibrium of the two-stage game, we work backwards. We begin by considering the second stage. In the second stage, values of $\sigma_1$, $\sigma_2$ and $\beta_1$ are publicly known. Attorney 1 seeks to maximize his payoff (2) over his effort level, taking attorney 2's effort level as given. Litigant 2 seeks to maximize her payoff (4) over attorney 2's effort level, taking attorney 1's effort level as given. Each maximization problem yields a reaction function. Using the two reaction functions, then, we obtain a unique Nash equilibrium in the second stage of the game. We denote it by $(x_1(\beta_1, \sigma_1, \sigma_2), x_2(\beta_1, \sigma_1, \sigma_2))$.

**Lemma 1.** The Nash equilibrium in the second stage of the game is

\[
x_1(\beta_1, \sigma_1, \sigma_2) = \frac{\beta_1^2 (\sigma_2 + \delta) \sigma_1 \sigma_2 V}{\{\beta_1 (\sigma_2 + \delta) \sigma_1 + \sigma_2\}^2}
\]

and

\[
x_2(\beta_1, \sigma_1, \sigma_2) = \frac{\beta_1 \sigma_1 \sigma_2 V}{\{\beta_1 (\sigma_2 + \delta) \sigma_1 + \sigma_2\}^2}.
\]
Let $p_1(\beta_1, \sigma_1, \sigma_2)$ be the probability that attorney 1 wins at the Nash equilibrium of the second stage. From expression (1) and Lemma 1, we obtain

$$p_1(\beta_1, \sigma_1, \sigma_2) = \beta_1(\sigma_2 + \delta)\sigma_1 / \{\beta_1(\sigma_2 + \delta)\sigma_1 + \sigma_2\}. \quad (5)$$

Using expressions (3) and (5), we obtain the expected payoff of litigant 1 at the Nash equilibrium of the second stage:

$$\Pi_1(\beta_1, \sigma_1, \sigma_2) = \beta_1(1 - \beta_1)(\sigma_2 + \delta)\sigma_1 V / \{\beta_1(\sigma_2 + \delta)\sigma_1 + \sigma_2\}. \quad (6)$$

Similarly, using expressions (4) and (5), we obtain the expected payoff of litigant 2 at the Nash equilibrium of the second stage:

$$\Pi_2(\beta_1, \sigma_1, \sigma_2) = \sigma_2^2 V / \{\beta_1(\sigma_2 + \delta)\sigma_1 + \sigma_2\}^2. \quad (7)$$

2.2. The first stage of the game

Consider the first stage in which each litigant hires her attorney and writes a contract with him. Specifically, in the first stage, litigant 1 chooses the value of $\sigma_1$ and the value of $\beta_1$, and litigant 2 chooses the value of $\sigma_2$.

First consider litigant 1. Taking a value of $\sigma_2$ as given, litigant 1 seeks to maximize her expected payoff (6) over $\sigma_1$ and $\beta_1$. From the first-order condition for maximizing (6) over $\beta_1$, we obtain the following reaction function:

$$\beta_1(\sigma_1, \sigma_2) = \{\sigma_2^2 + (\sigma_2 + \delta)\sigma_1\sigma_2 \}^{1/2} - \sigma_2 \} / \{(\sigma_2 + \delta)\sigma_1\}. \quad (8)$$

Substituting (8) into (6), we obtain:

$$\Pi_1(\sigma_1, \sigma_2) = [(\sigma_2 + \delta)\sigma_1 + 2\sigma_2 - 2\{\sigma_2^2 + (\sigma_2 + \delta)\sigma_1\sigma_2 \}^{1/2}] V / (\sigma_2 + \delta)\sigma_1.$$

Partially differentiating $\Pi_1(\sigma_1, \sigma_2)$ with respect to $\sigma_1$, we obtain $\partial \Pi_1(\sigma_1, \sigma_2) / \partial \sigma_1 > 0$.

Next, consider litigant 2. Litigant 2 chooses $\sigma_2$ without observing $\sigma_1$ and $\beta_1$. Thus litigant 2 seeks to maximize her expected payoff (7) over $\sigma_2$, given a value of $\sigma_1$ and a
value of $\beta_1$. Partially differentiating $\Pi_2(\beta_1, \sigma_1, \sigma_2)$ in (7) with respect to $\sigma_2$, we obtain
\[ \frac{\partial \Pi_2(\beta_1, \sigma_1, \sigma_2)}{\partial \sigma_2} > 0. \]

Lemma 2 summarizes each litigant's choice of her attorney's capacity in equilibrium.

**Lemma 2.** Litigant $i$'s expected payoff is monotonically increasing in $\sigma_i$: in terms of the symbols, we have $\frac{\partial \Pi_1(\sigma_1, \sigma_2)}{\partial \sigma_1} > 0$ and $\frac{\partial \Pi_2(\beta_1, \sigma_1, \sigma_2)}{\partial \sigma_2} > 0$. Therefore, in equilibrium, litigant 1 chooses an attorney of capacity $\bar{\sigma}$, and litigant 2 chooses an attorney of capacity $\alpha\bar{\sigma}$: in terms of the symbols, $\sigma_1^* = \bar{\sigma}$ and $\sigma_2^* = \alpha\bar{\sigma}$.

The first part of Lemma 2 says that, given the capacity of the opponent's attorney, each litigant's expected payoff increases as she hires an attorney of higher capacity. Our explanation is rather straightforward. Consider first litigant 1. Her payoff function can be written as $\Pi_1(\sigma_1, \sigma_2) = p_1(\sigma_1, \sigma_2)\{1 - \beta_1(\sigma_1, \sigma_2)\}V$, which comes from expression (3). By hiring an abler attorney, she can lower the contingent-fee fraction and increase her probability of winning, which certainly increases her expected payoff. Next, from expression (4), litigant 2's payoff function is $\Pi_2(\beta_1, \sigma_1, \sigma_2) = \{1 - p_1(\beta_1, \sigma_1, \sigma_2)\}V - (\sigma_2 + \delta)x_2(\beta_1, \sigma_1, \sigma_2)$. Hiring an abler attorney increases litigant 2's probability of winning and thus her gross expected payoff, $\{1 - p_1(\beta_1, \sigma_1, \sigma_2)\}V$. On the other hand, hiring an abler attorney either increases or decreases her costs, $(\sigma_2 + \delta)x_2(\beta_1, \sigma_1, \sigma_2)$. But the former positive effect on her expected payoff dominates the latter negative effect, if any. Therefore, litigant 2's expected payoff increases as she hires an abler attorney. Lemma 2 implies that, in order to maximize her expected payoff, each litigant has to hire the best of the available attorneys she can afford.

Utilizing Lemma 2 and expression (8), then, we obtain the equilibrium contingent-fee parameter:
\[ \beta_1^* = \left[ \{\alpha^2\bar{\sigma}^2 + \alpha(\alpha\bar{\sigma} + \delta)\bar{\sigma}^2\}^{1/2} - \alpha\bar{\sigma}\right]/\{(\alpha\bar{\sigma} + \delta)\bar{\sigma}\}. \] (9)
Now, using Lemmas 1 and 2, and expressions (6), (7), and (9), we obtain Lemma 3. It reports the attorneys’ effort levels and the litigants’ expected payoffs which are specified in the subgame-perfect equilibrium of the two-stage game.

**Lemma 3.** In the subgame-perfect equilibrium, the effort levels of attorneys 1 and 2 are

\[ x_1^* = \left[ \{\alpha(\alpha + \alpha \sigma + \delta)\}^{1/2} - \alpha \right]^2 V / \{\alpha \sigma + \delta\}(\alpha + \alpha \sigma + \delta) \] and

\[ x_2^* = \left[ \{\alpha(\alpha + \alpha \sigma + \delta)\}^{1/2} - \alpha \right] V / \{\alpha \sigma + \delta\}(\alpha + \alpha \sigma + \delta), \]

and the expected payoffs of litigants 1 and 2 are

\[ \Pi_1^* = \left\{\alpha + \alpha \sigma + \delta\right\}^{1/2} - \alpha \}^2 V / (\alpha \sigma + \delta) and \Pi_2^* = \alpha V / (\alpha + \alpha \sigma + \delta). \]

3. The hourly-fee model

We assume in this section that both attorney 1 and attorney 2 are hired on an hourly-fee basis. That is, each attorney is paid a fee which depends on his capacity and effort level, regardless of the outcome of the lawsuit. In this hourly-fee model, we look at the following two-stage game. In the first stage, each litigant hires her attorney – that is, litigant \(i\) chooses \(\sigma_i\) – and writes a contract with him. The contract specifies the attorney’s hourly-fee rate. Then, the litigants simultaneously announce their attorneys’ capacity and their contracts – that is, litigant 1 announces publicly the value of \(\sigma_1\), and litigant 2 announces publicly the value of \(\sigma_2\). In the second stage, litigants 1 and 2 choose simultaneously the effort levels which attorneys 1 and 2 will expend, respectively, and then the attorneys expend their effort. At the end of the second stage, the winner is determined, and each litigant pays compensation to her attorney according to the contracts written in the first stage.

Let \(\hat{\Pi}_i\) represent the expected payoff for litigant \(i\). Then, the payoff function for litigant 1 is

\[ \hat{\Pi}_1 = p_1 V - (\sigma_1 + \delta)x_1, \]
and that for litigant 2 is
\[ \hat{\Pi}_2 = (1 - p_1)V - (\sigma_2 + \delta)x_2, \]

where \( p_1 \) is defined by expression (1).

To solve for a subgame-perfect equilibrium of the two-stage game, we need to work backwards. Since the analysis of this game is similar to that of the contingent-fee model in Section 2, we report the results without explaining the analysis in detail.

**Lemma 4.** The Nash equilibrium in the second stage of the game is
\[ \hat{x}_1(\sigma_1, \sigma_2) = (\sigma_2 + \delta)\sigma_1 \sigma_2 V / \{2\sigma_1 \sigma_2 + \delta(\sigma_1 + \sigma_2)\}^2 \text{ and } \]
\[ \hat{x}_2(\sigma_1, \sigma_2) = (\sigma_1 + \delta)\sigma_1 \sigma_2 V / \{2\sigma_1 \sigma_2 + \delta(\sigma_1 + \sigma_2)\}^2. \]

As in Lemma 2, \( \hat{\Pi}_i(\sigma_1, \sigma_2) \) is monotonically increasing in \( \sigma_i \): in terms of the symbols, we have \( \partial \hat{\Pi}_1(\sigma_1, \sigma_2) / \partial \sigma_1 > 0 \) and \( \partial \hat{\Pi}_2(\sigma_1, \sigma_2) / \partial \sigma_2 > 0 \). Thus, litigant 1 chooses an attorney of capacity \( \sigma_1 = \bar{\sigma} \) and litigant 2 chooses an attorney of capacity \( \sigma_2 = \bar{\sigma} \) in equilibrium: in terms of the symbols, we have \( \hat{\sigma}_1^* = \bar{\sigma}_1 = \bar{\sigma} \) and \( \hat{\sigma}_2^* = \bar{\sigma}_2 = \alpha \bar{\sigma} \). Using this and Lemma 4, we obtain Lemma 5.

**Lemma 5.** In the subgame-perfect equilibrium, the effort levels of attorneys 1 and 2 are
\[ \hat{x}_1^* = \alpha(\alpha \bar{\sigma} + \delta)V / \{2\alpha \bar{\sigma} + (\alpha + \delta)\}^2 \text{ and } \hat{x}_2^* = \alpha(\bar{\sigma} + \delta)V / \{2\alpha \bar{\sigma} + (\alpha + \delta)\}^2, \]
and the expected payoffs of litigants 1 and 2 are
\[ \hat{\Pi}_1^* = [(\alpha \bar{\sigma} + \delta) / \{2\alpha \bar{\sigma} + (1 + \alpha)\delta\}]^2 V \]
and
\[ \hat{\Pi}_2^* = [\alpha(\bar{\sigma} + \delta) / \{2\alpha \bar{\sigma} + (1 + \alpha)\delta\}]^2 V. \]

**4. The effects of wealth and stake size**

We now investigate how an increase in \( \alpha \) (the wealth parameter) affects the litigants' equilibrium payoffs in the contingent-fee and the hourly-fee model. In doing so,
we begin with a situation in which the value of $\sigma$ depends solely on the size of $V$ (stake).\footnote{13} And then we change the size of $\alpha$ in order to check the wealth effects.

**Proposition 1.** Fix the level of $\sigma$ and $\delta$. Then, $\Pi^*_1(\alpha)$ and $\Pi^*_1(\alpha)$ are monotonically decreasing in $\alpha$, and $\Pi^*_2(\alpha)$ and $\Pi^*_2(\alpha)$ are monotonically increasing in $\alpha$. The rate of decrease and increase is very small, compared with the increasing rate of $\alpha$. This means that the wealth effects on the litigants' equilibrium payoffs are very small.

Proposition 1 is illustrated in Figures 1 and 2. (Throughout the paper, most decimal fractions are rounded off to two decimals, but some decimal fractions to four decimals if necessary.) The figures show how an increase in $\alpha$ affects $\Pi^*_1(\alpha)$ and $\Pi^*_1(\alpha)$ when $\sigma = 2$ and $\delta = 0.1$.\footnote{14} Specifically, as the value of $\alpha$ increases five times, the litigants' expected payoffs show only a small change of 0.01$V$. It is easy and intuitive to see that $\partial \Pi^*_1(\alpha)/\partial \alpha < 0$ and $\partial \Pi^*_1(\alpha)/\partial \alpha < 0$, and $\partial \Pi^*_2(\alpha)/\partial \alpha > 0$ and $\partial \Pi^*_2(\alpha)/\partial \alpha > 0$. But the reason why the rate of decrease and increase is so small needs an explanation. Our explanation is based on the litigants' strategic and payoff-maximizing behavior.

Expression (1) implies that an increase in $\alpha$ enhances litigant 2's probability of winning and thus her gross expected payoff, $(1 - p_1)V$ in (4). At the same time, however, it also raises her costs because the hourly-fee rate is equal to her attorney's capacity and is increasing in $\alpha$ (see (4) and Lemma 2). Moreover, it could make attorney 1 in the contingent-fee model or litigant 1 in the hourly-fee model aggressive, which in turn may lower litigant 2's expected payoff. Realizing such costs and strategic interactions, in equilibrium, litigant 2 with a high $\alpha$ makes attorney 2 less aggressive by asking him to work less. In the meantime, a decrease in attorney 1's effort level is small. Let's take some numerical examples. When $\sigma = 2$ and $\delta = 0.1$, for instance, $\hat{x}_2^* = 0.0807V$ with $\alpha = 1$ and $\hat{x}_2^* = 0.0167V$ with $\alpha = 5$. That is, as the value of $\alpha$ increases five times, attorney 2's equilibrium effort level decreases by about 80%. But there is only a small decrease in
How does litigant 1’s choice of a fee arrangement change the wealth effect on herself? In terms of absolute values, her choice produces little difference. When $\sigma = 2$ and $\delta = 0.1$, for instance, $\Pi_1^*(\alpha = 1) - \Pi_1^*(\alpha = 5) = 0.0061V$ and $\hat{\Pi}_1^*(\alpha = 1) - \hat{\Pi}_1^*(\alpha = 5) = 0.0097V$. The two numerical values show, however, the wealth effects in the contingent-fee model are relatively greater than those in the hourly-fee model. This can be explained as follows. When $\alpha$ increases, by adopting the contingent fee, litigant 1 can drive attorney 1 more strongly to win the lawsuit so that she can reduce the gap in the payoffs.

Until now, we have assumed that the amount at stake, $V$, is fixed. We now vary the value of $V$. It is very likely that $\bar{\sigma}$ and $\alpha V$ rise in proportion to the size of $V$. This is because an increase in $V$ raises the litigants' expected payoffs, which in turn enhances their financial ability to hire better attorneys under the hourly fee. Under the contingent fee, an increase in $V$ entices better attorneys to work for litigant 1. For the sake of analytical simplicity, we assume a linear relationship between $V$ and $\bar{\sigma}$: to be specific, $\bar{\sigma} = sV$, where $s$ is a positive constant. We also assume that $\alpha$ is independent of $V$. Substituting $\bar{\sigma}/s$ for $V$ in Lemmas 3 and 5, we obtain Proposition 2.

**Proposition 2.** Fix the level of $\alpha$, $\delta$ and $s$. Then, the marginal effect of increasing $V$ over attorney 1’s effort is higher under the contingent fee than it is under the hourly fee. The marginal effect of attorney 1’s is also higher than that of attorney 2’s. Thus, if the initial effort level of attorney 1 under the contingent fee is lower than that of himself under the hourly fee or that of attorney 2, then a reversal of the effort levels occurs as $V$ increases.
Proposition 2 is illustrated in Figures 3 and 4. In Figure 3, $\alpha = 2$ and $\delta = 0.1$, and in Figure 4, $\alpha = 1$ and $\delta = 0.1$. The figures show how an increase in $V$ changes the attorneys' equilibrium effort levels in units commensurate with $V$. First, in the hourly-fee model, given $\alpha$ and $\delta$, we have $\partial x_i^*/\partial \sigma > 0$: as in Katz (1988), it is intuitive that given $s$, an increase in $\sigma$ (via an increase in $V$) leads both attorneys to increase their effort levels.

Second, in the contingent-fee model, given $\alpha$ and $\delta$, we have $\partial x_1^*/\partial \sigma > 0$, which is also intuitive. But it is somewhat counterintuitive that the sign of $\partial x_2^*/\partial \sigma$ is indeterminate. As shown in Figure 3, for instance, $x_2^*$ is initially increasing in $V$ but very slowly compared with the increase in $x_1^*$; it reaches its maximum $0.12V$ at $3.13V$; then it is very slowly decreasing in $V$. Why does this happen? Recall that, in the contingent-fee model, litigant 1 adopts incentive delegation with the contingent fee, whereas litigant 2 instructive delegation with the hourly fee. Given attorney 1's effort level, if litigant 2 has attorney 2 with a higher $\sigma$ put more effort, her winning probability goes up and so does her gross expected payoff. At the same time, however, it raises her expenses of hourly fees which are increasing in $\sigma$ and in $x_2^*$. Moreover, the increase in $x_2^*$ may make attorney 1 under the contingent fee more aggressive. Considering such cost effects and strategic interactions, litigant 2 determines attorney 2's effort level in order to maximize her expected payoff. This results in $x_2^*$ in Figure 3.

Figure 3 shows a reversal of the effort levels caused by a different increasing rate of effort of the two attorneys when $V$ increases. Figure 4 also shows a similar reversal of attorney 1's effort levels caused by the different fee schemes. To see such a reversal empirically, Kritzer (1990, pp. 118-120) takes hypothetical cases and systematically varies the level of stakes. Figure 8-1 in Kritzer (1990) shows that the reversal occurs at about $40,000, though he does not distinguish between the contingent-fee and the hourly-fee model. We conjecture, however, that Figure 4 fits his idea better than Figure 3 does. This is because Figure 4 deals with a difference in the same attorney's effort levels when the fee scheme is changed and when there is no wealth effect. If this is the case, $1.67V$ in Figure 4
corresponds to about $40,000 in Kritzer (1990). On the other hand, Figure 3 deals with a
difference in the effort levels of the two different attorneys under the different fee schemes.
We thus conclude that Proposition 2 with Figure 4 may provide a theoretical foundation
for the reversal of the effort levels in Kritzer (1990). Our explanation for the rationale
utilizes the fact that when \( V \) increases, the contingent fee makes attorney 1 more
aggressive than the hourly fee does.

Next, we investigate how an increase in \( V \) affects the litigants' equilibrium payoffs
in each model. Together with the probability-of-winning function (1), Proposition 2 leads
to Corollary 1.

**Corollary 1.** Fix the level of \( \alpha, \delta \) and \( s \). Then, the marginal effect of increasing \( V \) over
litigant 1's expected payoff is greater under the contingent fee than it is under the hourly
fee. The marginal effect of litigant 1's is also greater than that of litigant 2's. Thus, if
litigant 1's initial payoff with the contingent fee is less than that of herself or that of
litigant 2's, then a reversal of the payoffs occurs as \( V \) increases.

Corollary 1 is illustrated in Figures 5 and 6. In Figure 5, \( \alpha = 2 \) and \( \delta = 0.1 \), which
corresponds to Figure 3, and in Figure 6, \( \alpha = 1 \) and \( \delta = 0.1 \), which corresponds to Figure
4. As \( V \) increases, the equilibrium effort ratio \( x_1^*/x_2^* \) or \( x_1^*/\hat{x}_1^* \) increases, shown in
Proposition 2. This means that litigant 1's probability of winning with the contingent fee
increases. And consequently, as \( V \) increases, the increasing rate of \( \Pi_1^* \) exceeds that of \( \Pi_2^* \)
or that of \( \hat{\Pi}_1^* \).

Corollary 1 implies that when the stake size is getting bigger, litigant 1's choice of
the contingent fee could become a better choice, compared with her choice of the hourly
fee. In Figure 6, for example, litigant 1's expected payoff with the contingent fee
exceeds her payoff with the hourly fee at 1.68\( V \). Our analysis has an important policy
implication for the recent tobacco litigation in the United States. The states as plaintiffs
filed lawsuits against tobacco companies seeking reimbursement for medical expenses paid by government insurance agencies attributed to tobacco-related illness. In November 1998, the four major tobacco companies (Philip Morris, R.J. Reynolds, Lorillard and Brown & Williamson) and the attorney general reached the Master Settlement Agreement, under which the companies agreed to pay 46 states about $206 billion over the next 25 years. In doing so, the states retained private attorneys under the contingent fee, though they were able to afford salaried attorneys for the litigation. As the contingent-fee attorneys earned $10 or 20 billion, criticism against the state governments has arisen. Corollary 1 with Figure 6 says, however, that the governments' choice of the contingent fee should not be criticized if the public wanted the governments to maximize the reimbursement. Corollary 1 with Figure 5 also says that if stake size is big enough as in the Simpson case, a plaintiff's winning probability in expression (1) with the contingent fee exceeds that of a defendant with the hourly fee.

5. Concluding remarks

We have modeled civil litigation as a contest with delegation: A litigant delegates his attorney to seek a prize. Attorneys' capacity as professional human resources does matter in the contest. In order to describe a tort case in the United States, we first have considered the contingent-fee model in which the plaintiff hires her attorney on a contingent-fee basis, but the defendant does on an hourly-fee basis. Then we have considered the hourly-fee model where both attorneys work under the hourly fee, which fits cases of divorce and contract disputes. We have assumed that the probability of winning for a litigant depends on two opposing attorneys' relative capacity and effort levels.

We have found that, in the two models, each litigant hires the best of the available attorneys she can afford; thus, the wealthier a litigant, the abler her attorney. Because of strategic interactions, however, the defendant's wealth contributes only a little to an
increase in her expected payoff. Moreover, as stake size increases, the plaintiff can take advantage of the contingent fee which motivates her attorney more strongly to win the case.

We have also found that, as the stake size increases, the contingent fee drives the plaintiff's attorney to put more effort than the hourly fee; thus, the contingent fee may give the plaintiff a more expected payoff than the hourly fee. This finding relieves the state governments of being blamed for hiring private attorneys on a contingent-fee basis in the tobacco litigation. To be specific, their choice of the contingent fee in such mass tort litigation would bring them more expected payoffs, compared with their choice of the hourly fee.

Some extensions of our model seem interesting: (i) considering the case in which litigants have different perceptions about the amount at stake; (ii) reflecting different degrees of fault for litigants in calculating a litigant's probability of winning; and (iii) allowing the defendant to choose between the contingent and the hourly fee. We leave these extensions for future research.
Footnotes

1. Critics of the adversarial system worry that a litigant's probability to prevail in a lawsuit may rely more upon the capacity of his or her attorney than on the facts of the case and thus, the rich can buy justice, as compared to the inquisitorial system where a presiding judge dominates the trial. See Parisi (2002) for the difference between the adversarial and the inquisitorial system.

2. A contest is defined as a situation in which contestants compete with one another by expending irreversible effort to win a prize (see Epstein, Mealem and Nitzan, 2011). A contest model is appropriate for a description of litigation since a plaintiff side and a defendant side expend irreversible litigation effort to prevail in their case. Moreover, a contest model allows us to investigate strategic interactions between the two sides. Because of such merits, contest models have long been considered to analyze legal disputes. Examples include Plott (1987), Farmer and Pecorino (1999), Hirshleifer and Osborne (2001), Baik and Kim (2007a, b), and Carbonara, Parisi and von Wangenheim (2015).

3. A novelty of this paper is an introduction of attorneys as delegates. See Baik and Kim (1997), Konrad, Peters and Wärneryd (2004), Katz (2006), and Baik and Kim (2007a, b) for delegation in contests.

4. In the United States, most tort plaintiffs file suit under a contingent-fee arrangement. According to a survey in Kritzer (1990), 87 percent of individual plaintiffs in torts retain their lawyers on a contingent-fee scheme. On the other hand, most plaintiffs in divorce adopt an hourly-fee scheme. Defendants' attorneys both in torts and divorce are usually paid under an hourly fee (see Bebchuk and Guzman, 1996; Emons and Fluet, 2016). Many law and economics scholars study contingent fees. Examples include Danzon (1983), Dana and Spier (1993), Rubinfeld and Scotchmer (1993), Baik and Kim (2007a, b), and Zamir and Ritov (2010).
5. This finding hinges critically on the assumption that both litigants can afford to hire their own attorneys. If a litigant is too poor to hire an attorney with the hourly fee or if no attorney is interested in her case with the contingent fee, then she is obliged to give up the suit. In that case, the wealth effect is extremely great since her opponent wins the case by exerting almost zero effort.

6. This is called the American fee-shifting rule. In contrast, under the English (or British) rule, the loser bears the winner's litigation costs (see Plott, 1987; Carbonara, Parisi and von Wangenheim, 2015; and Fenn, Grembi and Rickman, 2017).

7. Usually, in tort cases, defendants are large insurance companies, whereas plaintiffs are individuals who may not have enough wealth to hire attorneys under the hourly fee. The insurance companies mostly use in-house attorneys on the hourly-fee basis or get contracts with large law firms on the hourly-fee basis. Garoupa and Gomez-Pomar (2008) argue that large law firms also seem to prefer the hourly fee over the contingent fee.

8. Katz (1987) reports that in the United States, legal fees of plaintiffs on average are about one fourth of the amount at stake. Interestingly, Baik and Kim (2007a, b) and our model with the logit-form probability-of-winning functions show that, in equilibrium, a litigant's legal fee is about one fourth of $V$. The logit-form probability-of-winning functions are widely used in the litigation contest literature. See, for example, Posner (1973), Plott (1987), Farmer and Pecorino (1999), Hirshleifer and Osborne (2001), Parisi (2002), and Carbonara, Parisi and von Wangenheim (2015).

9. Recall that attorney 2's hourly-fee rate is assumed to equal his capacity, $\sigma_2$.

10. Fershtman and Kalai (1997) distinguish between two types of delegation: incentive delegation and instructive delegation. According to their classification, litigant 1 adopts incentive delegation, while litigant 2 adopts instructive delegation.

11. In terms of the symbols, we have $\frac{\partial \beta_1(\sigma_1, \sigma_2)}{\partial \sigma_1} < 0$ and $\frac{\partial p_1(\sigma_1, \sigma_2)}{\partial \sigma_1} > 0$, where $p_1(\sigma_1, \sigma_2) = 1 - \sigma_2/(\sigma_2^2 + (\sigma_2 + \delta)\sigma_1\sigma_2)^{1/2}$. Note that we obtain $p_1(\sigma_1, \sigma_2)$ by substituting (8) into (5).
12. This compensation structure is widely used in the United States for civil cases such as divorce and contract disputes.

13. Put differently, we assume that under the contingent fee, litigant 1’s decision on the capacity of attorney 1 at the beginning point is not affected by her wealth but by the size of $V$.

14. The values of $\Pi_1^*$ and $\Pi_2^*$ are increasing and decreasing in $\overline{r}$, respectively. If $\overline{r} \geq 2.29$, the initial value of $\Pi_1^*$ at $V$ becomes to exceed that of $\Pi_2^*$ (refer Figure 1).

15. Throughout the paper, in numerical examples, we set $\delta = 0.1$. We may interpret $\delta$ as a possible overcharge rate. To be specific, attorney $i$ could overcharge his hourly-fee by an amount of $\delta x_i$, exploiting his informational advantage on $x_i$. Interestingly, Kritzer (1990, pp. 135-61) reports that, on average, hourly-fee attorneys spent 49.5 hours and contingent-fee attorneys 45.7 hours in civil litigation in the United States. If we interpret the difference in hours spent as the overcharge, then $\delta = (49.5 - 45.7)/45.7 = 0.08$, which is close to 0.1.

16. It is not clear whether $\alpha$ in reality is increasing or decreasing in $V$. We, thus, assume its independence here for simplicity.

17. In Proposition 2 and Corollary 1, and Figures 3, 4, 5 and 6, we use $V$ instead of $\overline{r}/s$, though we obtain the results by substituting $\overline{r}/s$ for $V$. This is possible because both the independent and dependent variables in Proposition 2 and Corollary 1 include $\overline{r}/s$ and thus, we re-substitute $V$ for $\overline{r}/s$.

18. A natural question is then, unlike litigant 1, why litigant 2 sticks to the hourly-fee scheme even when the contingent-fee scheme looks more lucrative. One possible explanation is that in a repeated game, the hourly-fee scheme could bring a litigant more payoffs than the contingent-fee scheme. Note that our model is a one-shot game. In the real world, a corporate defendant, e.g. an auto insurance company as a liability insurer, is involved in many similar litigations over time. Thus, the corporate defendant as a repeat
litigant can easily acquire the "know-how" of keeping attorneys under the hourly fee, whereas the individual plaintiff as an one-shotter may not.

19. The companies settled separately with the four remaining states (Florida, Minnesota, Mississippi, and Texas). See Sloan, Trogdon and Mathews (2005) who provide a succinct review of the wave of tobacco litigation.
References


Figure 1. The wealth effects on $\Pi_i^*$ in the contingent-fee model when $\sigma = 2$.

Figure 2. The wealth effects on $\hat{\Pi}_i^*$ in the hourly-fee model when $\sigma = 2$. 
Figure 3. A reversal of effort levels in the contingent-fee model when $\alpha = 2$.

Figure 4. A reversal of attorney 1's effort levels in the two models when $\alpha = 1$. 
Figure 5. The effects of stake size on \( \Pi_i^* \) in the contingent-fee model when \( \alpha = 2 \).

Figure 6. The effects of stake size on \( \Pi_1^* \) and \( \hat{\Pi}_1^* \) when \( \alpha = 1 \).