

# **Trial *and* Settlement: A Study of High-Low Agreements**

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## **Abstract**

This paper presents the first systematic theoretical and empirical study of high-low agreements in civil litigation. A high-low agreement is a private contract signed by litigants before the conclusion of a trial that constrains the future damages payment to lie between a minimum and a maximum bound. Whereas the existing literature describes litigation as a choice between trial and settlement, high-low agreements—a relatively new phenomenon in civil litigation—introduce partial or incomplete settlements. In the theoretical model, trial is both costly and risky. When litigants have divergent subjective beliefs and are mutually optimistic about their trial prospects, cases may fail to settle. In these cases, high-low agreements can be in the litigants' mutual interest for either of two reasons. First, high-low agreements limit the risk of outlier damages awards while still allowing for an optimal degree of speculation. Second, high-lows limit mutually assured destruction when trial expenditures are endogenous and offsetting. Using a unique data set of insurance claims from a large national insurer, we empirically examine the factors that influence whether a high-low agreement occurs and the features of the agreement. Our empirical findings are consistent with the theoretical model.

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## 1. Introduction

In the summer of 2004, a semi-trailer truck cruising at 65 miles per hour on U.S. Highway 60 rear-ended a Ford pickup truck that was stopped in a line of traffic. The pickup truck was in flames as witnesses pulled the driver, Delbert Sanders, from the wreckage. The driver of the semi, who had been searching for his dropped cell phone at the time of the accident, was unharmed. Although the semi driver and his insurer admitted liability for the accident, the parties disagreed over the severity of Sander's alleged back injury. Settlement negotiations before trial reached an impasse—the defendants' offer of \$500,000 to Sanders was far below the \$1,300,000 that he demanded. Both sides were caught by surprise when the jury returned with a \$5.25 million verdict. Sanders did not walk away with \$5.25 million, however. Instead, the defendants paid only \$1.5 million under the terms of a so-called "high-low agreement" signed by the parties before the verdict was rendered.<sup>1</sup>

A high-low agreement is a contract "in which a defendant agrees to pay the plaintiff a minimum recovery in return for the plaintiff's agreement to accept a maximum amount regardless of the outcome of trial."<sup>2</sup> High-low agreements allow both sides to hedge their bets and possibly reduce their costs of litigation, and, perhaps as a result, these agreements have become increasingly popular over the last 30 years.<sup>3</sup> Although some lawyers and judges have expressed reservations about their use,<sup>4</sup> high-low agreements have found significant support among legal practitioners. In the words of Judge Bowes of the Superior Court of

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<sup>1</sup> Their agreement specified a low of \$300,000 and a high of \$1.5 million. See Emerick (2007).

<sup>2</sup> *Black's Law Dictionary*, 8<sup>th</sup> ed. (2004). A rare form of high-low agreement involves giving the factfinder a choice between two awards. Obviously, with this form of high-low agreement, the factfinder is aware of the settlement contract. In many cases, however, factfinders do not know of the agreements.

<sup>3</sup> McDonough (2005). In Cook County, Illinois, Judge Richard Elrod estimates that high-low agreements are discussed in 20 to 30 percent of the claims on his docket, and that 10 percent of the claims are ultimately resolved by high-low agreements. The exact origins of high-low agreements are unknown. A mid-1970s article by a sitting justice of the New York Supreme Court described the concept, its advantages, and some of the conditions under which parties might enter into a high-low agreement (Finz, 1976). These agreements, the justice argued, reduce the parties' risk while allowing the parties to avoid appeal delay.

<sup>4</sup> For example, according to one plaintiffs attorney, a high-low agreement "reduces the whole concept of a judicial proceeding to a wager..." and "make(s) a mockery of the system" (Riner, 1989). While largely enforceable in courts of law, high-low agreements have received greater scrutiny in situations involving multiple defendants and minors. See Hoenig (2006) and Faley & Alonso (1998). See also McDonough (2005).

Pennsylvania, “court, counsel, and litigants favor them; they assure plaintiffs of minimally-acceptable recoveries while protecting defendants against exorbitant verdicts.”<sup>5</sup>

This paper presents the first systematic study of high-low agreements in civil litigation.<sup>6</sup> We begin with a theoretical model in which litigants have the option to sign contracts prior to a risky and costly trial. The litigants are assumed to have possibly different subjective beliefs about the trial outcome, and they may or may not be risk averse. Naturally, we find that when the costs of litigation are not too large and the litigants are sufficiently mutually optimistic, litigants will fail to agree on an out-of-court settlement. But utility-maximizing litigants will not necessarily pursue a “naked” trial. A high-low agreement, in which the litigants place both a ceiling and a floor on the award that the plaintiff may receive, can emerge as the optimal contract under two sets of conditions. First, when at least one litigant is sufficiently risk averse and the risk at trial is large relative to the anticipated litigation costs, a high-low agreement reduces the disutility the litigants suffer from risk while still allowing them to speculate optimally on the trial outcome. Second, even if both parties are risk neutral, a high-low agreement can allow litigants to avoid overspending on litigation. Effectively, the parties can collude to adjust the stakes of the trial to avoid the “mutually assured destruction” that can occur when expenditures by plaintiffs and defendants are offsetting in their effects on the expected trial outcome.

We then explore the use of high-low agreements using a new data set from a large, national insurer. The insurer employs many lawyers, both in-house and by contract, and operates in nearly every state. The data set contains all claims that were open at any point between January 1, 2004, and March 31, 2009. Crucially, the insurance company granted us access to its detailed litigation notes, which has allowed us to identify those cases where high-low agreements were discussed, negotiated, and reached. The vast majority of claims were

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<sup>5</sup> *Thompson v. T.J. Whipple Const. Co.*, --- A.2d ----, 2009 WL 807467 (Pa.Super.), 2009 PA Super 57.

<sup>6</sup> The first known academic mention of high-low agreements was in 1968. See Coulson (1968). There is no detailed treatment of high-low agreements in either the legal or economics literatures, although there are articles that briefly discuss them. See, e.g., Gross & Syverud (1996, pp. 61-62).

resolved administratively by claims adjusters without any legal action. Close to 2,600 claims resulted in lawsuits that ended in trial or arbitration. More than 5 percent of these litigated claims involved high-low discussions, and almost 4 percent had high-low agreements in place at the time of resolution by verdict or decision. Moreover, hundreds of claims that ultimately fully settled before adjudication also involved high-low discussions and agreements.

We demonstrate that the behavior of the litigants in our data set is consistent with the predictions of the risk-reduction theory. Specifically, we find that those claims that are expected to be low cost and highly volatile are more likely, relative to baseline probabilities, to involve high-low discussions and/or result in a high-low agreement at some point during the litigation. Although we are not (yet) able to rigorously test the cost theory's predictions with our data, our preliminary results suggest that cost reduction may be playing a less important role than risk reduction. Importantly, we do not claim that lawyers consciously (or unconsciously) seek high-lows for the reasons we identify—only that the patterns in the data are *consistent* with their doing so.

Our paper contributes to the large theoretical and empirical literature on the resolution of litigation.<sup>7</sup> The vast majority of civil cases in the United States settle out of court. Among cases that are filed in state courts, fewer than 4 percent actually go to trial. In the federal courts, the figure is approximately 2 percent.<sup>8</sup> Choosing to sign a contract agreeing to “opt out” of formal litigation makes economic sense: the pursuit of litigation is expensive, time-consuming, and risky. Given the obvious advantages of settlement, much of the existing economics scholarship on litigation has focused on the specific factors that motivate most parties to settle and some parties to proceed to trial despite the benefits to avoiding the cost and uncertainties of adjudication.

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<sup>7</sup> Surveys of the settlement literature include Spier (2007), Daughety (2000), Cooter & Rubinfeld (1989), and Hay & Spier (1998).

<sup>8</sup> See Ostrom, Kauder, & La Fountain (2001, p. 29) and Judicial Business of the United States Courts (2001, p. 154 table C-4).

Starting with the work of Landes (1971), Posner (1973), and Gould (1973), commentators have suggested that settlement negotiations may fail when litigants have different subjective beliefs about the likely outcome at trial.<sup>9</sup> Others have argued that cases fail to settle because litigants are asymmetrically informed about particular parameters of the litigation. The plaintiff, for example, may have first-hand knowledge of the level of damages she has suffered while the defendant may have first-hand knowledge about his degree of involvement in (or liability for) the accident.<sup>10</sup> Early models of bargaining with private information include P'ng (1983) and Bebchuk (1984), in which the uninformed litigant makes a take-it-or-leave-it offer to the uninformed party before a costly trial,<sup>11</sup> and Reinganum & Wilde (1986), who assume that the informed litigant can make the take-it-or-leave-it offer.<sup>12</sup> In this literature, settlement is typically modeled as a simple transfer payment from the defendant to the plaintiff in exchange for a commitment by the plaintiff not to pursue the case further.<sup>13</sup> By contrast, we allow the parties to commit to future transfer payments that are

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<sup>9</sup> Scholars have employed this so-called “mutual optimism” framework to explore the selection of cases for trial (Priest & Klein, 1984), fee-shifting (Shavell, 1982), conflicts between lawyers and clients (Miller, 1987), and bifurcation of trials (Landes, 1993). It has also served as a foundation for empirical work on settlement (see Waldfogel, 1998). Experimental and anecdotal evidence indicates that litigants and their lawyers tend to exhibit self-serving biases (Loewenstein et al., 1993). As a group, plaintiffs may overestimate expected judgments at trial while defendants may underestimate them. Indeed, these self-serving biases may serve as an advantage in bargaining and can arise in evolutionary settings (Bar-Gil, 2006). See Yildiz (2003, 2004) for recent theoretical work on learning and delay without common priors.

<sup>10</sup> Litigants may know better the credibility of their own witnesses and the quality of their lawyers.

<sup>11</sup> Nalebuff (1987) extends Bebchuk’s analysis to allow the plaintiff to drop the case before trial. Spier (1992) presents a dynamic version of Bebchuk (1984) and establishes that there is a strong deadline effect. Farmer & Pecorino (1994) consider a model where the litigants are risk averse and privately informed about their own degrees of risk aversion, and show that settlement offers are accepted by the more risk averse litigants (since their costs of litigation are effectively higher). See also Heyes et. al. (2004).

<sup>12</sup> There are additional reasons for settlement failures. Parties may have long run interests in affecting the outcome of current litigation; the item in dispute may be indivisible (e.g., a child); and bargaining externalities may render settlement infeasible. See Spier (2007) and Daughety & Reinganum (2005).

<sup>13</sup> A notable exception, albeit an abstract one, is a literature that applies mechanism-design techniques of Myerson (1979) and Myerson & Satterthwaite (1983) to the problem of settlement and litigation. In this literature, privately-informed litigants announce their “types” and the mechanism maps their announcements into settlements (both the level and the probability) and transfer payments at trial (Spier, 1994). See also Neeman & Klement (2005). Linking the transfers to the awards at trial can encourage truth-telling, relaxing incentive compatibility constraints and achieving higher levels of social efficiency. Also related is the applied literature on Rule 68 of the Federal Rules of Civil Procedure that shifts legal fees based on settlement offers rejected before trial. See Miller (1986), Spier (1994), and Farmer & Pecorino (2000).

conditional on the outcome at trial. We show that high-low agreements can serve the litigants' joint interests by limiting the parties' risk exposure at trial—thereby reducing the risk premiums they bear—or by reducing their incentive to spend on litigation while still allowing them to benefit from their mutual optimism through speculation.<sup>14</sup>

Empirical work on settlement has explored Priest and Klein's (1984) selection hypothesis that, conditioned on a case proceeding to trial, the two parties should be equally likely to prevail. Waldfogel (1995), Kessler et al. (1996), Eisenberg & Farber (1997), and Siegelman & Waldfogel (1999), among others, have shown empirically that divergence from 50 percent can depend on a number of factors including case characteristics. In our data, the insurer prevails in a majority of the claims that proceed to trial. Others have studied the empirical drivers of the decisions whether and when to settle out of court, such as the damages at stake, the parties' appetite for risk, and the reputation effects of both the parties and their lawyers.<sup>15</sup> See, for example, Danzon & Lillard (1983), Farber & White (1991), Kessler (1996), Fournier & Zuehlke (1996), Fenn & Rickman (1999), Viscusi (1988) and the survey by Kessler & Rubinfeld (2004).<sup>16</sup> Our data allow us to extend this literature by examining the incidence of high-low agreements in litigation and the characteristics of the disputes associated with them.

The rest of the paper is organized as follows: Part 2 presents a settlement model that allows the litigants to modify future trial outcomes by private contract. We show that, under reasonable conditions, high-low agreements can be optimal from the perspective of both parties, giving them higher payoffs than could be achieved by settling out of court for a fixed

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<sup>14</sup> Our cost model is related to the economics literature on rent-seeking contests and all-pay auctions. See, for example, the early work of Tullock (1980) and Dixit (1987) and the more recent work of Siegel (2009).

<sup>15</sup> While the early literature (see, e.g., Viscusi, 1991; Galanter & Cahill, 1994) found settlement rates of 99 percent, recent scholarship, cautioning against interpreting all non-trials as settlement, concludes that the settlement rate is closer to two-thirds (Eisenberg & Lanvers, 2008; Clermont & Schwab, 2008; Hadfield, 2004).

<sup>16</sup> See also Sieg (2000) and Watanabe (2005) for important structural econometric models of the settlement process. Other branches of the literature explore the effects of tort reforms. Yoon (2001) explores the effect of an Alabama cap on jury awards. Snyder & Hughes (1990) and Hughes & Snyder (1995) study the effect of a temporary implementation of a "loser pays" rule for the allocation of legal fees in Florida.

amount. We then characterize the conditions under which parties would enter into a high-low agreement and identify likely features of those agreements. In Part 3, we describe our insurance data, and in Part 4 we outline our empirical approach and use the data to examine whether, in a large number of insurance disputes, the high-low discussion and agreement patterns we observe are consistent with our model's predictions. Part 5 concludes.

## 2. The Model

Two litigants, a plaintiff and a defendant, engage in settlement negotiations prior to a risky trial. If they fail to settle, they proceed to trial, where the court will award either high damages,  $x_H$ , or low damages,  $x_L$ , where  $x_H > x_L$ . The plaintiff and defendant assess the probability that the court will award high damages before they negotiate. The plaintiff believes that this probability is  $\pi_p \in [0, 1]$  while the defendant believes it is  $\pi_d \in [0, 1]$ . Note that these beliefs are subjective and may diverge from one another. The plaintiff's and defendant's preferences are represented by expected utility functions  $u_p(x)$  and  $u_d(x)$ , and their fixed litigation costs are  $c_p$  and  $c_d$ , respectively. These damages, beliefs, preferences, and costs are all common knowledge.

The contracts signed by the litigants before trial may take one of two forms. An *ordinary settlement contract* is a simple transfer payment,  $s$ , from the defendant to the plaintiff. By agreeing to this contract, the litigants can completely avoid both the risk and the direct costs of trial.<sup>17</sup> Alternatively, the litigants may agree to proceed to trial with an *award modification contract* that specifies two payments,  $s_H$  and  $s_L$ . Under this arrangement, the litigants still bear the litigation costs  $c_p$  and  $c_d$  but can define the bounds of the judicial award

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<sup>17</sup> Note that if the parties had the same subjective assessments of the probability that the plaintiff would win,  $\pi_p = \pi_d = \pi$ , then the litigants would be jointly better off settling out of court for the expected damages,  $s = \pi x_H + (1 - \pi)x_L$ . If the parties are both sufficiently optimistic about their own cases, so  $\pi_p$  is significantly higher than  $\pi_d$ , then there may be no ordinary settlement contract,  $s$ , that makes both the plaintiff and defendant better off.

in accordance with their divergent beliefs about trial outcome.<sup>18</sup> Specifically, when the court awards damages above the high bound under these terms, the defendant pays  $s_H$  to the plaintiff instead of  $x_H$ . Similarly, when the court awards damages below the low bound, the defendant pays  $s_L$  to the plaintiff instead of  $x_L$ . In order to focus attention on “realistic” award modification contracts, we impose the following restriction on the contract space:

Assumption 1:  $x_L \leq s_L \leq s_H \leq x_H$ .

This assumption allows for many of the contracts we observe in practice. It permits *ordinary settlement agreements* where  $s_L = s_H$ , for example. It also allows for *high-low agreements* in which the defendant agrees to a higher award in the low state,  $s_L > x_L$ , if the plaintiff agrees to a lower award in the high state,  $s_H < x_H$ . Finally, it is consistent with the parties arriving at *no agreement at all*, where  $s_L = x_L$  and  $s_H = x_H$ .

This assumption rules out contracts in which  $s_L > s_H$ , however. This comports with what we observe in actual litigation, where opposing litigants are sincere in their efforts to prevail at trial. Allowing  $s_L > s_H$  would encourage the litigants to sabotage their own cases: i.e., if the plaintiff were to receive more when the court found that his damages were in fact low, the plaintiff would withhold evidence and take other actions to hurt his own case. Assumption 1 also rules out contracts where the parties agree to *amplify* the risk at trial: i.e., making the high outcome,  $s_H$ , even higher than the actual damages,  $x_H$ , and the low outcome even lower than the actual damages,  $s_L < x_L$ .<sup>19</sup>

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<sup>18</sup> Importantly, we assume here that costs of litigation do not depend on whether there is an award modification contract in place.

<sup>19</sup> It might seem odd that risk-averse parties would ever write such a contract, but it might be jointly desirable when the plaintiff is *much* more optimistic than the defendant. Imagine an extreme case ( $\pi_p = 1$ ,  $\pi_d = 0$ ) in which each party believes with certainty that he will prevail. Suppose that the parties write a contract with  $s_L = 0 < x_L$  and  $s_H = 2x_H > x_H$ . The defendant is better off (because he pays zero in expectation!), and the plaintiff is better off because he gets twice as much as he would in the best-case scenario

The next two subsections describe scenarios where the litigants may forego ordinary settlement agreements in favor of high-low agreements. In the first scenario, the two litigants are risk averse. High-low agreements allow litigants with divergent beliefs to speculate optimally on the outcome at trial while at the same time reducing the risk to which each is exposed. In the second scenario, the litigants are risk neutral but litigation costs are endogenously determined. Trial is modeled as a simple rent-seeking contest where higher expenditures improve a litigant's odds of winning. By reducing the spread between the best- and worst-case scenarios, the high-low contract commits the two parties to expend fewer resources during adjudication. We derive comparative statics results for both scenarios.

## 2.1 Risk Reduction

Suppose that the plaintiff and the defendant have CARA (constant absolute risk aversion) expected utility functions  $u_p(x) = -\exp(-a_p x)$  and  $u_d(x) = -\exp(-a_d x)$ , where  $a_p$  and  $a_d$  are the coefficients of absolute risk aversion. The CARA specification is convenient because it will allow us to characterize closed-form solutions with relatively straightforward comparative statics results.<sup>20</sup> Ignoring the constraint imposed by Assumption 1, a Pareto optimal award-modification contract would satisfy:

$$\frac{(\pi_p)u'_p(s_H - c_p)}{(1 - \pi_p)u'_p(s_L - c_p)} = \frac{(\pi_d)u'_d(-s_H - c_d)}{(1 - \pi_d)u'_d(-s_L - c_d)}. \quad (1)$$

This equation defines a locus of points,  $(s_H, s_L)$ , where the plaintiff's and defendant's indifference curves are tangent.<sup>21</sup> Notice also that if  $\pi_p = \pi_d$  then the locus of tangency

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absent a contract. Note that with these extreme beliefs and absent liquidity constraints, the plaintiff and defendant would agree to  $s_L = -\infty$  and  $s_H = \infty$ .

<sup>20</sup> This utility function is very commonly used in finance and macroeconomics, and has the property that there are no income or wealth effects. Litigation costs will drop out of the calculation of the optimal award-modification contract.

<sup>21</sup> This may be derived by having the plaintiff choose  $s_H$  and  $s_L$  to maximize his expected utility,  $\pi_p u_p(s_H - c_p) + (1 - \pi_p)u_p(s_L - c_p)$ , subject to the individual rationality constraint that:  $\pi_d u_d(-s_H - c_d) + (1 - \pi_d)u_d(-s_L - c_d) \geq \pi_d u_d(-x_H - c_d) + (1 - \pi_d)u_d(-x_L - c_d)$ . Alternatively,

points is on the forty-five degree line, where  $s_H = s_L$ . This is not surprising. When the plaintiff and defendant have the same beliefs, they have the private incentive to fully insure each other against the risk at trial. The next Lemma characterizes the jointly optimal contract modification contracts (the proof of the result is in Appendix A).

Lemma 1: With CARA expected utility, the set of unconstrained Pareto-optimal award modification contracts satisfy

$$s_L = s_H - \frac{\theta}{a_p + a_d}, \quad (2)$$

where  $\theta$  is a constant that reflects the relative subjective beliefs of the litigants,

$$\theta = \ln \left[ \frac{(1/\pi_d) - 1}{(1/\pi_p) - 1} \right]. \quad (3)$$

This result may be understood intuitively. When the plaintiff and defendant are more risk averse, so  $a_p + a_d$  is larger, then  $s_L$  and  $s_H$  will be closer together, reflecting the greater need for insurance by the parties. When  $\pi_p = \pi_d$ , then  $\theta = \ln(1) = 0$  and so  $s_L = s_H$ . That is, when the litigants have the same beliefs about the probability of the plaintiff winning at trial, both parties would agree to insure each other fully against the risk of trial. When  $\pi_p > \pi_d$ , so the litigants are “mutually optimistic,” then Lemma 1 tells us that  $\theta > 0$  and  $s_L < s_H$ . In other words, the contract has the plaintiff receiving more when court determines that the damages are high than when the damages are low.

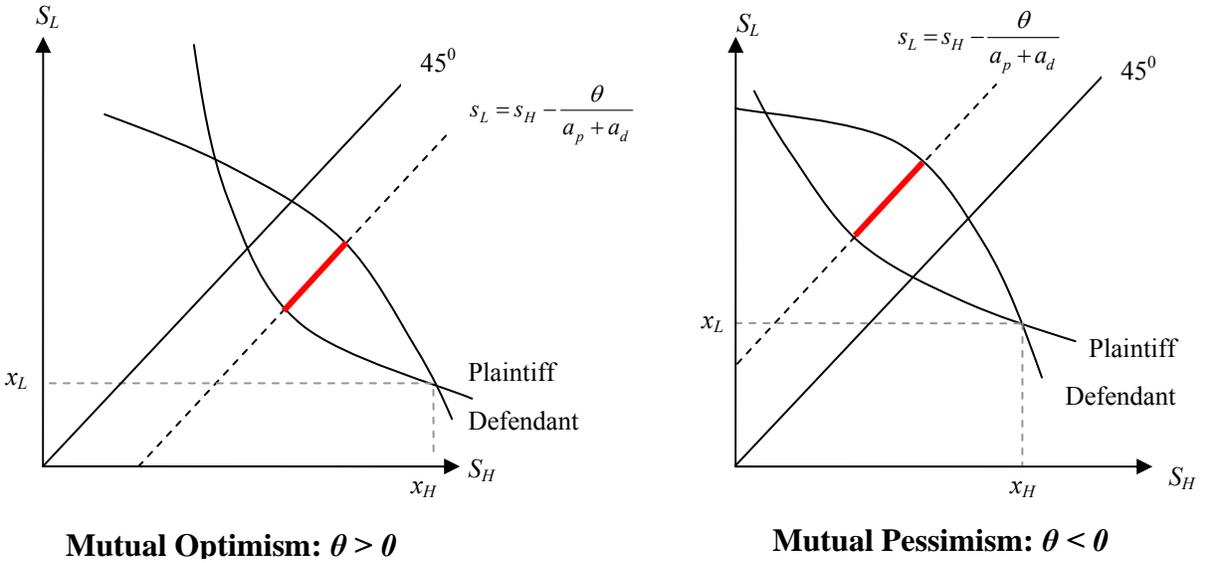
The left-hand side of Figure 1 shows this result graphically. The solid line segment below and to the right of the forty-five degree line represents the set of award modification contracts that Pareto dominate the status quo outcome  $(x_H, x_L)$ . Note that this segment corresponds to a locus of high-low agreements where  $x_L < s_L < s_H < x_H$ . When  $\theta$  is very

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the defendant could choose the contract to maximize his expected utility subject to individual rationality for the plaintiff. If the plaintiff has relatively more bargaining power then the transfers  $s_H$  and  $s_L$  will tend to be higher, and if the defendant has more bargaining power then the transfers will tend to be lower.

large, however, then the unconstrained Pareto optimal contract the parties would write would have  $s_L < x_L < x_H < s_H$ .

**FIGURE 1**



When the plaintiff and defendant are “mutually pessimistic,”  $\pi_p < \pi_d$ , then it is easy to verify that  $\theta < 0$  and  $s_L > s_H$ . This is shown on the right-hand side of Figure 1. Under these conditions, the parties would want to ensure a higher transfer when the court finds that damages were in fact low and a lower transfer payment when the court finds that the actual damages were high.<sup>22</sup> Again, this would violate Assumption 1 and, in practice, could lead the litigants to sabotage their own cases (and so would not be written in equilibrium). In these situations, therefore, the constrained jointly optimal contract would have  $s_L = s_H$ . Parties would prefer simply to settle.

<sup>22</sup> Imagine the extreme case in which  $\pi_p = 0$  and  $\pi_d = 1$ . The plaintiff is very happy to give up money in the high damage state in order to receive a higher payoff in the low damage state. The reverse is true for the defendant. Therefore the plaintiff and defendant would blissfully agree to  $s_L = \infty$  and  $s_H = -\infty$ .

The next proposition characterizes the litigants' jointly optimal decision to settle out of court or proceed to trial, either with a high-low contract (that specifies how any damages award would be modified) in place, or without any contract.

**Proposition 1:** Suppose that the litigants are risk averse with CARA utility functions. Under Assumption 1,

- i. If  $\theta \leq 0$  (so the plaintiff is no more optimistic than the defendant) then the parties settle out of court for a fixed amount.
- ii. If  $\theta \in (0, (a_p + a_d)(x_H - x_L)]$  (so the plaintiff is somewhat more optimistic than the defendant) then the litigants proceed to trial with a *high-low contract* specifying  $s_L = s_H - \theta / (a_p + a_d)$  when  $c_p + c_d \leq \psi(\pi_p, \pi_d, a_p, a_d)$  where:

$$\psi(\pi_p, \pi_d, a_p, a_d) = \ln \left\{ \pi_d^{-1/a_d} \pi_p^{-1/a_p} \left[ 1 + \left( \frac{1}{\pi_d} - 1 \right)^{\frac{a_p}{a_p + a_d}} \left( \frac{1}{\pi_p} - 1 \right)^{\frac{a_d}{a_p + a_d}} \right]^{\frac{1}{a_d + a_p}} \right\} > 0, \quad (4)$$

and settle out of court for a fixed amount otherwise.

- iii. If  $\theta > (a_p + a_d)(x_H - x_L)$  (so the plaintiff is much more optimistic than the defendant) then the litigants proceed to trial without any *modification of the court's award* when  $c_p + c_d \leq \varphi(x_H, x_L, \pi_p, \pi_d, a_p, a_d)$  where:

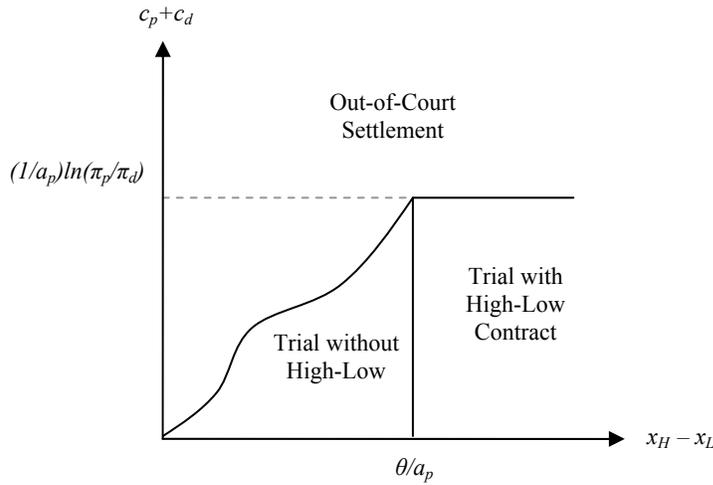
$$\varphi(\bullet) = -(1/a_p) \ln(1 - \pi_p + \pi_p e^{-a_p(x_H - x_L)}) - (1/a_d) \ln(1 - \pi_d + \pi_d e^{a_d(x_H - x_L)}) > 0, \quad (5)$$

and settle out of court for a fixed amount otherwise.

When the litigants are mutually pessimistic, so  $\theta \leq 0$ , then they will optimally choose to settle out of court for a fixed amount. Since Assumption 1 prevents litigants from “shorting their own stock” so to speak, there is no joint advantage to them from going to trial. When the plaintiff is somewhat more optimistic than the defendant,  $\theta \in (0, (a_p + a_d)(x_H - x_L))$ , so

long as fixed litigation costs are not too large, the parties will proceed to trial with a high-low agreement in place. If the plaintiff is much more optimistic than the defendant, then the litigants will embrace the risk of the trial and speculate, so long as the litigation costs are not too high. The results of the proposition are shown in Figure 2 for the special case of  $\theta > 0$  and defendant risk neutrality.<sup>23</sup>

**FIGURE 2**



Proposition 2: When  $x_H - x_L$  rises, the volume of high-low agreements will increase, but the volume of cases that proceed to trial without high-low agreements may either rise or fall. When  $c_p + c_d$  rises, the settlement rate rises and the litigation rate falls. The volume of trials with high-low agreements will fall, as will the volume of trials without high-low agreements.

As  $x_H - x_L$  increases, trials become more risky for both of the litigants. Importantly, this rise in riskiness increases the private desirability of an optimal high-low contract (as defined in Lemma 1) relative to proceeding to trial without award-modification. Formally, as  $x_H - x_L$  increases, more lawsuits fall into case (ii) than into case (iii) in Proposition 1.

Because the decision of the litigants to settle out of court does not depend on  $x_H - x_L$  in case

<sup>23</sup> The intercepts in the figure are calculated by taking the limit as  $a_d$  approaches zero in Proposition 1.

(ii),<sup>24</sup> we know that the incidence of high-low contracts will rise. While fewer lawsuits fall into case (iii) as  $x_H - x_L$  increases, that fact does not necessarily imply that fewer cases will go to trials without award-modification agreements. Because the right-hand side of equation (5) is increasing in  $x_H - x_L$ , in case (iii), we may have fewer cases settling out of court and more cases going to trial.

## 2.2 Cost Reduction

We now explore a second reason that litigants may choose to modify the outcome of a trial by signing a high-low agreement: to lower their future costs of litigation. In contrast to the last section where risk-averse litigants sought to speculate optimally by modifying the range of trial outcomes, here we model litigation as a rent-seeking contest where the litigation expenditures of the two sides determine, at least in part, the outcome at trial.

Specifically, in this model, we redefine the probability that the court will award high damages following a trial as  $\pi + \beta(e_p^{1/2} - e_d^{1/2})$  and the probability it will award low damages as  $1 - \pi - \beta(e_p^{1/2} - e_d^{1/2})$ , where  $\pi$  is exogenously given and  $e_p$  and  $e_d$  are positive and represent the variable litigation expenditures of the plaintiff and defendant, respectively. Note that the probability of the high award is increasing in the plaintiff's litigation efforts and falling in the defendant's efforts. The parameter  $\beta$  reflects the sensitivity of the court's decision to the investing party's trial expenditures. When  $\beta$  is larger, the marginal benefit of litigation spending is also larger. The fixed litigation expenditures of the plaintiff and defendant remain  $c_p$  and  $c_d$ , so the total litigation costs of the plaintiff and defendant are, respectively,  $e_p + c_p$  and  $e_d + c_d$ .

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<sup>24</sup> Since  $\psi(\pi_p, \pi_d, a_p, a_d)$  is independent of  $x_H$  and  $x_L$ .

Given an award modification contract  $s_H$  and  $s_L$ , and his beliefs  $\pi_p$ , the plaintiff chooses  $e_p$  to maximize his expected payoff from trial:

$$[\pi_p + \beta(e_p^{1/2} - e_d^{1/2})]s_H + [1 - \pi_p - \beta(e_p^{1/2} - e_d^{1/2})]s_L - e_p - c_p. \quad (6)$$

Similarly, the defendant chooses  $e_d$  to minimize his future payments:

$$[\pi_d + \beta(e_p^{1/2} - e_d^{1/2})]s_H + [1 - \pi_d - \beta(e_p^{1/2} - e_d^{1/2})]s_L + e_d + c_d. \quad (7)$$

It is easy to show that the equilibrium levels of litigation spending are

$$e_p = e_d = \frac{\beta^2 (s_H - s_L)^2}{4} \quad (8)$$

if  $s_H > s_L$ . In this case, the variable litigation costs are monotonically increasing in the high-low spread,  $s_H - s_L$ , and in the sensitivity of the trial outcome to the variable litigation expenditures,  $\beta$ . They are also independent of the litigants' beliefs about the probability of the high award,  $\pi$ . If  $s_H < s_L$ , on the other hand, then  $e_p = e_d = 0$ .

When  $s_H > s_L$ , the joint payoff of the plaintiff and defendant from going to trial is:

$$(\pi_p - \pi_d)(s_H - s_L) - (\beta^2/2)(s_H - s_L)^2 - c_p - c_d. \quad (9)$$

Differentiating this expression with respect to  $s_H - s_L$  gives the following result.<sup>25</sup>

**Lemma 2:** Suppose that the litigants are risk neutral and litigation costs are endogenous.

When  $\pi_p > \pi_d$ , the set of unconstrained Pareto-optimal award modification contracts satisfy

$$s_L = s_H - (\pi_p - \pi_d) / \beta^2. \quad (10)$$

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<sup>25</sup> The first order condition is  $(\pi_p - \pi_d) - \beta^2(s_H - s_L) = 0$ .

<sup>26</sup> When  $\pi_p < \pi_d$  then  $s_L = s_H$ . More precisely, when  $\pi_p < \pi_d$ , the unconstrained optimum is in fact degenerate, and risk neutral litigants will speculate with infinite transfers. Assumption 1 binds in this case.

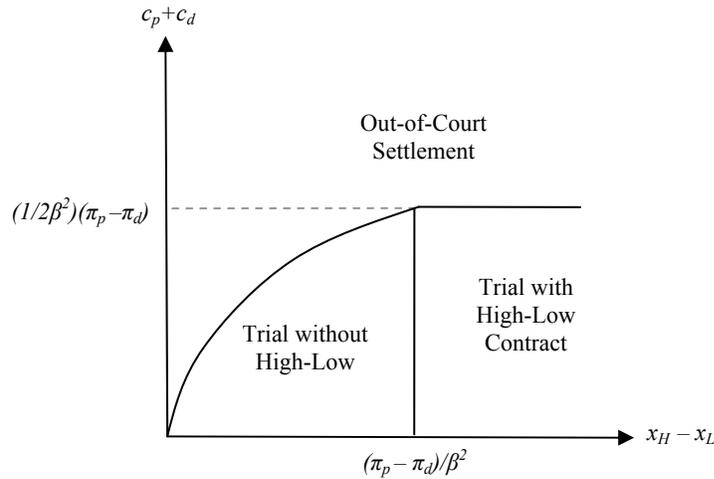
This makes intuitive sense. When  $\pi_p > \pi_d$ , the plaintiff and defendant are mutually optimistic. They jointly benefit from the speculation value of trial, but they also want to avoid the wasteful rent seeking. The award modification contract in Lemma 2 trades off these two objectives. Note that the spread between the high and low awards,  $s_H - s_L$ , is smaller when  $\beta$  is larger, meaning that when the probabilities are more sensitive to expenditures, litigants have an even greater incentive to constrain their variable litigation costs through a tighter high-low spread.

Proposition 3: Suppose that the litigants are risk neutral and litigation costs are endogenous.

- i. If  $\pi_p - \pi_d \leq 0$  (so the plaintiff is no more optimistic than the defendant) then the parties settle out of court for a fixed amount.
- ii. If  $\pi_p - \pi_d \in (0, \beta^2(x_H - x_L)]$  (so the plaintiff is somewhat more optimistic than the defendant) then the litigants proceed to trial with a *high-low contract* specifying  $s_L = s_H - (\pi_p - \pi_d) / \beta^2$  when  $c_p + c_d \leq \frac{(\pi_p - \pi_d)}{2\beta^2}$  and settle out of court for a fixed amount otherwise.
- iii. If  $\pi_p - \pi_d > \beta^2(x_H - x_L)$  (so the plaintiff is much more optimistic than the defendant) then the litigants proceed to trial without any *modification of the court's award* when  $c_p + c_d \leq (\pi_p - \pi_d)(x_H - x_L) - (\beta^2/2)(x_H - x_L)^2$  and settle out of court for a fixed amount otherwise.

The predictions of this model are shown in the following figure:

**FIGURE 3**



### 3. Data Description

The empirical study of high-low agreements poses several challenges. First, many of the parameters of interest—most notably the parties’ appetite for risk and their beliefs about prevailing at trial—are difficult to observe. Second, parties are either small (making collection of uniform data difficult or impossible) or, if large, highly protective of their litigation-related information.<sup>27</sup> Finally, even where a public entity eliminates some of these problems (e.g., a court system that collects data on outcomes), much of settlement behavior occurs—and even the agreements remain—behind closed doors, rarely disclosed to anyone. Therefore, it is unsurprising that little is known about high-low settlement behavior.

The source of our data is a large national auto and general liability insurer,<sup>28</sup> which allows us to overcome many of these hurdles. First, the insurer is a repeat litigant. We are able to observe a large, complete sample of disputed claims from the occurrence of the underlying event until the final resolution of the dispute (including all arbitrations and pre-suit settlements). Second, the insurer records detailed information not only about the underlying

<sup>27</sup> Many litigants are what Galanter (1974) describes as “one-shotters”; tracking down each of these litigants is a Herculean task. Some litigants are “repeat players” (Galanter, 1974), but are reluctant or opposed to making public their litigation outcomes.

<sup>28</sup> As a condition of allowing us to use its data, the insurer required anonymity.

dispute and the opposing party, but about the litigation and, in particular, any high-low negotiations that have transpired or agreements that have been concluded.<sup>29</sup>

Our data set comprises two parts. The first part is individual claim-level data that the insurer routinely collects in auto and general liability disputes involving their policyholders. In these claims, the plaintiff (claimant) alleges that the policyholder has caused her harm in a manner covered by the policyholder's insurance policy. As a result, the insurer is effectively the primary defendant in these disputes: the plaintiff seeks to recover first from the insurer, turning only to the insured in those cases where damages exceed policy limits. As a practical matter, the insurer is typically the only defendant either because the plaintiff seeks damages that fall within the policyholder's policy limit or because the plaintiff finds it unprofitable to pursue the insured individually for any excess.

We examine all closed claims between January 1, 2004, and March 31, 2009. Table 1 shows summary statistics for claims in dispute (n=48,349) broken down by whether or not a high-low agreement was in place at a claim's resolution.<sup>30</sup> Column 3 (relative to columns 1 and 2) makes clear that claims litigated under high-low agreements are qualitatively different. For instance, claims resolved through arbitration or trial *with a high-low agreement* take more than 10 months longer on average to conclude, result in an average payout that is two and a half times larger, generate lower litigation costs overall (despite the larger payout), and typically have significantly *lower* policy limits than litigated claims where no high-low is in place.<sup>31</sup> High-low litigated claims are also less likely to involve a fatality, are more common

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<sup>29</sup> Much of these data are not otherwise observable—high-low agreements are typically private and parties do not report them (at least consistently) to courts. If a high-low agreement is disclosed to a judge or arbitrator, it is primarily to ensure its enforceability should one party seek to challenge the contract after the trial. To our knowledge, disclosure is not a codified requirement in any jurisdiction.

<sup>30</sup> Table A1 summarizes some of the claim-specific information we have for all litigated claims (n=2,638), for all claims in which a high-low discussion occurred (n=937), and for all claims involving a high-low agreement (n=248). These are partially overlapping groups. Appendix B contains additional details about the contents and construction of the data set and the individual variables we use in the empirical analysis below.

<sup>31</sup> One lawyer who represented the insurer as outside counsel explained that high-low discussions are influenced in large part by the alleged harm relative to the policy limit. The insurer—and the lawyer—are wary of a judgment that exceeds the policy limit, which would then place the policyholder at risk for any excess

in the northeast (and less common in the south and west), are more likely to involve an auto policy than a general liability policy, and are more likely to involve individual plaintiffs.

Litigated claims that eventually involve a high-low agreement also appear to start with a lower initial reserve on average. The *reserve* or *incurred loss* is a claim-specific fund the insurer sets aside to cover its obligations under the insurance contract when a claimant files a claim. All insurers, pursuant to state insurance regulations, are required by law to hold minimum reserves per claim to ensure that they have sufficient funds to resolve disputes.<sup>32</sup> In theory, by setting the reserve, the insurer is balancing legal and economic factors: having enough reserves to pay out claims, but not overly restricting funds could otherwise be used for more profitable purposes (e.g., investment). In practice, claims handlers are directed to “conservatively” determine a claim’s expected value, and handlers are evaluated in part by the accuracy of their determinations. Over the course of a dispute, the insurer adjusts the reserve to account for new information about the underlying claim or the litigation.

The second part of our data comes from extensive narrative records the insurer maintains (entered both by claim evaluators and lawyers) on how each litigated claim is handled during the litigation period.<sup>33</sup> Using a text-mining algorithm, we were able to identify those claims that involved some consideration of a high-low arrangement, at least on the insurer’s side, including high-low agreements and discussions.<sup>34</sup> For each of these high-low relevant claims, we recorded the context in which the high-low discussion arose, whether the parties reached an agreement, the number of back and forth proposals, the relevant dates,

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judgment. When this happens, and a settlement below the policy limit had been possible at some point in the litigation, the insurer potentially faces liability for exercising bad faith in refusing to settle the claim. *See State Farm Auto Ins. v. Campbell*, 538 U.S. 408 (2003). As a practical matter, then, an insurer will typically pay any excess judgment when it refuses to accept a settlement demand that is within the policy limit.

<sup>32</sup> “All states impose reserve requirements on insurers to provide protection to policyholders, assuring that assets will be available to pay claims.” (McGuire, 1996 p. 38).

<sup>33</sup> Unfortunately, the insurer does not maintain electronic records of any of its settlement agreements or “partial settlement” arrangements, including whether there was a written or oral high-low agreement in place.

<sup>34</sup> See Appendix B for a description of the search algorithm, the information we collected, the coding process we employed, and the procedures we used to ensure accuracy.

and the proximity of the discussion to trial or arbitration, if apparent. In the event of an agreement, we recorded the high and low bounds.

The parties reached a high-low agreement in our data in 248 claims, and many hundreds of serious negotiations occurred between the insurer and the claimant over possible high-low agreements. We report summary statistics for 241 claims with high-low *agreements* in Table 2.<sup>35</sup> The average high of the agreement is approximately \$158,000, while the average low is approximately \$44,000. Parties typically reached a high-low agreement in the latter stages of the claim (around the 80<sup>th</sup> percentile of the total duration of the claim). The parties usually concluded a high-low agreement in anticipation of trial or arbitration, but in significantly more than half of these claims, the parties eventually fully settled the case prior to formal adjudication. In addition, conditioned on going to trial, the insurer won more than half of the trials and arbitrations, either through a directed verdict or a defense verdict after a full adjudication, when a high-low arrangement was in place.

Although our data do not include information on jury, judge, or arbitrator awards, we do know what the insurance company ultimately paid out to the plaintiff. In the case of a trial or arbitration award in the shadow of a high-low agreement, we can assume that the “loss paid” to the claimant is roughly, if not exactly, the tribunal’s award. Most outcomes—69 percent—fell between the upper and lower bounds (exclusive of those bounds) of the high-low agreement. Subsequent to a high-low agreement, all payouts will (or should) fall between the high and the low (inclusive), and because we do not observe actual awards, we do not know how often the high or low is the *exact* amount awarded. Still, we know that in 17 percent of the claims, the insurer payout was at the low of the high-low agreement, while the insurer paid the high in slightly less than 14 percent of the claims.<sup>36</sup>

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<sup>35</sup> For six of the high-low agreements we identified, we were unable to establish the exact terms (high and/or low) of the agreement. In addition, one of the high-low agreements had miscoded dates. Where this information is required in our analysis, we omitted these seven claims. All but 101 of these claims were settled out of court or were successfully mediated.

<sup>36</sup> If these figures are representative, and the distribution of possible damages awards had symmetric tails, this pattern would indicate that the insurer was behaving irrationally, paying more than necessary on

Parties discussed high-low agreements in 937 claims, and the insurer raised the idea *internally* at least once in more than 300 additional disputed claims, although we found no evidence in those cases that any discussion with the plaintiff occurred. We report summary statistics for those claims with the high-low *discussions* in Table 3. While there are differences across these three groups of claims—in which a high-low agreement was only raised as a possibility by one party, only seriously discussed by both parties, and executed as a formal contract—simple unconditional averages do not reveal any particular patterns. This fact may hint that while claims that are candidates for high-low agreements are noticeably different from the typical litigated claim, the line that separates the consideration of a high-low agreement from the signing of one may be somewhat arbitrary, perhaps turning on attorney personalities or other chance circumstances.

#### **4. Empirical Strategy and Results**

In this part of the paper, we use our detailed litigation and settlement data to examine some of our model’s predictions. We begin by studying the risk-reduction hypothesis for high-lows. Our work here is preliminary, but we nevertheless detect patterns in our data that are consistent with our model. With respect to the cost-reduction hypothesis, we find little in the data that points in the direction either for or against cost reduction as explaining the use of high-lows, although there are reasons to believe that relying on litigation data from a large insurance company to study the cost-reduction hypothesis might not be particularly fruitful. We address each hypothesis in turn.

##### 4.1 Risk Reduction

Because we do not empirically observe litigants’ beliefs about likely damages awards, and we cannot directly measure their levels of risk aversion, we are unable to test the validity

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average by engaging in high-low agreements. But the tails are not symmetric (awards are bounded below by zero), and so it is unclear whether the insurer does better or worse on average in terms of actual damages paid (i.e., not considering gains from avoiding risk).

of our risk-reduction model directly. Instead, our empirical strategy relies on basic comparative statics derived from the risk-reduction analysis. Specifically, we combine two of the model’s predictions about litigant behavior under varying exogenous conditions to identify a particular pattern in the data that we are likely to observe if the model’s risk reduction theory can help to explain the behavior of litigating parties.<sup>37</sup>

First, when *expected* legal expenses are high (on one or both sides of the litigation), and those costs are fixed as described in the risk-reduction discussion in section 2.1, we should see more settlement and fewer trials, including fewer high-low agreements, all else equal.<sup>38</sup> Second, when case outcomes are less predictable (variance in the award/payout amount is high because the distribution has a larger spread—e.g.,  $x_H - x_L$  is large), we should see an increase in the likelihood of full settlement, an increase in the likelihood of a high-low agreement, and a reduction in the likelihood of trial, all else equal.<sup>39</sup>

By combining these two predictions, we can identify and rank four types of cases in terms of how “likely” they are to involve high-low discussions or agreements,<sup>40</sup> from most-likely to least likely:<sup>41</sup>

- (1) Low Expected Cost, High Expected Variance (LC-HV)
- (2a) Low Expected Cost, Low Expected Variance (LC-LV)
- (2b) High Expected Cost, High Expected Variance (HC-HV)
- (3) High Expected Cost, Low Expected Variance (HC-LV)

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<sup>37</sup> Importantly, demonstrating a causal relationship—specifically, that parties use high-low agreements to reduce risk-associated losses—requires more than a pattern in the data that is consistent with the model. We also have to rule out any and all *alternative explanations* for that pattern. Although we are not aware of any obvious alternative explanations for what we find, our empirical claim is solely descriptive at this point.

<sup>38</sup> As the cost-reduction theory shows, entering into a high-low agreement might *lead* to lower costs if, by limiting upside and downside opportunities, parties prefer to spend less on litigation. But parties to a high-low agreement on a claim that goes to trial will still spend more than they would have had they fully settled.

<sup>39</sup> In a more general model, we are likely to see an attempt to reduce risk generally when the damages become more variable, through either settlement or the use of high-low agreements.

<sup>40</sup> We separately study cases in which high-low agreements were proposed and discussed and cases in which high-low agreements were actually concluded. Our assumption is that cases in which the parties “discussed” entering into a high-low share some of the same characteristics as those in which the parties agree to a high-low.

<sup>41</sup> The rank ordering of (2a) and (2b) is theoretically ambiguous.

Below, we empirically verify this pattern using a simple multinomial choice model, where we evaluate the likelihood that parties will settle, fully litigate (through trial or arbitration), or enter into a high-low discussion or an agreement.

The intuition behind the empirical model is that the parties' willingness to enter into a high-low agreement depends on their beliefs about the case before them (both about possible damages and the relative degree of fault), which in turn depend on the formal adjudication of similarly situated cases and the known outcomes from the trial, arbitration, or settlement of other claims. While both parties may be optimistic in their assessment of the case ( $\pi_p > \pi_d$ ), their beliefs will be shaped by their knowledge of how disputes involving similar claims (e.g., type of injury, type of claim, etc.) have fared in the past.<sup>42</sup> Our approach therefore assumes that the parties know the details of their cases and form beliefs based on that information about the likely consequences (in particular, litigation costs and outcome variability) of going to trial or submitting to arbitration. We use the outcomes in cases with similar characteristics as proxies for these beliefs.

We believe these assumptions are reasonable, given that the parties are typically represented by legal counsel with experience in litigating insurance cases. But, ultimately, this assumption is empirical in nature. Fortunately, we can, at least in part, test whether litigants are behaving in a way that is consistent with their being rational and informed about their own case and the outcomes of similar cases. As a practical matter, the insurer may be better informed than the plaintiff given that, institutionally, the insurer and its lawyers are likely to have participated in the resolution of more claims and are therefore more experienced than most if not all plaintiffs' lawyers in the specifics of insurance litigation. Any such differences, however, do not upset our predictions about the role of outcome variance and litigation expenses in settlement behavior.

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<sup>42</sup> Obviously, the attractiveness of a high-low agreement turns on the belief that the other party is committed to formal adjudication (either trial or arbitration). While parties are certainly free to enter into a high-low agreement at any point after a claim is made, it is unlikely that such discussions take place early in the litigation process, certainly not before a law suit has been filed, which is why we focus in much of our analysis only on those claims that were actively litigated.

In the empirical work, we are forced to model the probability of a high-low agreement using only information available to the insurer because we do not observe any private information that individual plaintiffs (or even groups of plaintiffs) possess. This is a limitation, but we do not believe it is a serious one. First, payout amounts are close to zero sum, meaning that a highly variable claim for a defendant is also highly variable for the plaintiff. Second, we assume that litigation plaintiff and defense costs are highly correlated because they are likely to be complementary (Danzon, 1985), as our cost-reduction theory suggests. Certainly there will be periods of divergence, especially over short periods of time. The *timing* of litigation expenses is likely to differ significantly between the insurer (which has large fixed costs in the form of a career legal staff) and an individual represented by a solo practitioner plaintiff's attorney because of the very different organizational approaches these litigants take to defending their interests in court. Still, this assumption is likely to be true on average for *total* legal costs per claim, allowing us to use  $c_d$  as a rough proxy for  $c_p$ .

Before discussing the specifics of the empirical model, we describe how we develop the key inputs to that analysis: the outcome variable (trial, settlement, high-low agreement), our measurement of expected litigation costs, and our measurement of perceived variability of the likely payout, conditional on going to trial or arbitration. The incredible detail provided by the insurance data allows us to pursue a number of different approaches, only some of which we discuss in this draft. Furthermore, although our results, as we report below, are consistent with our model's predictions, there are weaknesses to our approach we have yet to resolve. We discuss these briefly as well, and highlight some of our future directions.

First, we require a measure of *expected* litigation costs. As noted above, for each claim we have multiple measures of litigation costs (fees paid to outside counsel, internal transfers to the insurer's legal department, etc.). However, litigation costs of a claim are obviously jointly determined along with the outcome of that claim's litigation.<sup>43</sup> So, we employ the

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<sup>43</sup> For example, assume that claims that settle tend to settle very early. In that case, low litigation costs will be correlated with settlement, and a regression of outcomes on litigation costs will incorrectly indicate that lawyers take really expensive cases to trial, but choose to settle inexpensive cases.

following approach to generate a less biased measure: We take all cases that were litigated to formal adjudication (i.e., a trial or arbitration), and, for every claim  $c$ , we regress the litigation costs of *all* claims on a set of their exogenous characteristics, including fixed details about the plaintiff, the injury or damage sustained, the insurance policy, the location of the suit and of the accident, etc.<sup>44</sup> We take the  $\hat{\beta}$ ’s produced, and use the values of the exogenous variables for each  $c$  to generate a “predicted cost” of that claim were it to go all the way to trial or arbitration. Because a lawyer is choosing whether to deviate from a trial to a settlement, this strikes us as an appropriate measure.

A drawback of building our expected litigation costs measure from this set of “litigated claims” is that it creates a sample selection problem in our analysis—by assumption, cases that go all the way to trial or arbitration are likely to be less costly, all else equal, than those that settle. Fortunately, as we discuss in more detail below, our empirical strategy relies only on the ordinal rank of cases in terms of their litigation expense. Assuming that exogenous characteristics that make fully litigated cases more expensive also make settled cases more expensive in roughly the same pattern, this selection concern should not pose a problem. Nevertheless, we also conducted the same approach using all claims “in dispute,” whether they settle or not. Both measures produce similar results.

One way to solve this problem directly is to identify some exogenous cost shock or shifter—some characteristic that makes certain claims more or less expensive to litigate, regardless of the stage at which the claims are resolved. We explored a number of candidate instruments, including federal civil and criminal case loads and durations, state civil and criminal per-capita case loads, state-specific cost averages, and an indicator for whether the

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<sup>44</sup> More specifically, we include different subsets of the following: state of litigation fixed effects, a pre-suit estimation of liability by the insurer, fixed effects for the year in which the loss was reported, dummies for the number of individuals injured in the “loss event,” a detailed set of indicators for the type of injury and/or loss, a fatality indicator, whether the claim was in the automobile or general liability line of business, fixed effects for the state and region of the accident, the policy limit, the population density where the insured lived and where the claimant lived, the early estimates (in months 2, 3, and 4) by the insurance company of its “incurred losses” or reserve amount on the claim, other demographic information about the area where the insured lives, the type of plaintiff (individual or company), and the year in which the lawsuit was filed.

case was being litigated in a state other than where the accident took place. In these initial attempts, at least without excluding relevant regressors, our first-stage results were too weak to pursue an IV strategy. Put differently, most of the variation in predicted litigation expenses appears to be due to claimant-, insured-, or claim-specific variation and not to group-specific, plausibly exogenous cost shocks or shifters. In future drafts, we will explore additional instruments and alternative approaches to identification.

In addition to expected litigation costs, we require some measure of *expected* outcome volatility. A lawyer who is trying to decide whether to settle a case out of court or to push for a high-low agreement must first determine whether the claim is sufficiently “risky” to justify the necessary concessions to the plaintiff. Claims can be unpredictable in at least two ways. First, new information may arrive at any time during the life of the litigation—information that dramatically alters the stakes and likely outcome of any trial or arbitration. Presumably, certain types of claims are more likely than others to evolve in *predictably unpredictable* ways. Second, certain claims may be very predictable throughout the litigation process with no surprises along the way, but may face factfinders (juries, judges, or arbitrators) who nonetheless produce predictably very unpredictable verdicts. As with expected litigation costs, we assume that lawyers are able to identify both types of unpredictability by examining the features of a claim at some early point in the litigation.

We have devised two ways to identify and measure expected claim volatility, only one of which we employ in this draft. First, as noted in our discussion of the data in Part 3, the insurer is required by law in every state to establish a “reserve amount” or “incurred loss,”<sup>45</sup> an estimate of the likely value of a claim once the claim has been filed. These reserves are entirely internal and used for recordkeeping and regulatory compliance, meaning there is no obvious reason for the insurer or its employees to manipulate the reserve amount for strategic reasons related to the litigation or otherwise (and our conversations with officers of the insurer revealed that claim handlers are evaluated in part on their ability to “predict

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<sup>45</sup> See McGuire (1996 p. 38).

correctly”). The reserve is supposed to capture the current, but conservative, “best guess” of the value of the claim from the insurer’s perspective,<sup>46</sup> a measure that can change repeatedly throughout the life of any litigation. The insurer generously provided us with the reserve amount by month for every claim in our sample.

We use this information to deal with the first type of volatile claims described above—those claims that are predictably unpredictable *during litigation* because new information or resources materialize. For these claims, the reserve amount (the expected incurred loss) will change regularly, as often as newly relevant information comes to light. Therefore, a straightforward estimate of volatility is the variance of the reserve amount over the course of the claim’s life, conditional on the length of the claim’s life. We rely on this approach in the work below, but many other related measures of volatility are possible using the reserve information, including the total number of changes to the reserve amount, the difference between the first reserve amount and the last reserve amount, and so on. Unfortunately, however, all of these methods only capture volatility due to a claim’s predictable unpredictability while the litigation is ongoing.

A second method would make use of the fact that the reserve amount is considered a conservative guess—closer to 55% or 60% of the expected loss rather than the mean of the damages probability distribution. Similar to the mean regression method described above for litigation costs, a quantile regression framework can be employed where exogenous features about the claim are used to predict the 50<sup>th</sup> and the 90<sup>th</sup> percentile of reserve amount in, say, the fifth month of the claim’s life. The ratio of the 90<sup>th</sup> to the 50<sup>th</sup> percentile can then be used as a measure of volatility because it will provide a measure of the spread of the reserve amount distribution at a fixed point in time.<sup>47</sup>

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<sup>46</sup> In phone conversations with insurer officers, we inquired whether there was a more precise meaning to the “best guess” description. The answer was, in essence, that the reserve is the expected value of the claim, viewed conservatively. Therefore, we assume the reserve amount lies somewhere between the 50<sup>th</sup> and 60<sup>th</sup> percentile of the estimated distribution of likely damages, from the insurance company’s perspective.

<sup>47</sup> This can be shown analytically (forthcoming). Note that if the reserve amount is actually the median, instead of the 55<sup>th</sup> percentile, this approach not appropriate because the inference drawn about the shape of the

Types of claims that have a single reserve amount throughout the litigation but which are nevertheless very unpredictable once they go to a factfinder should have a greater spread of fifth month reserves, all else equal. In essence, the conservative tweak introduced by the insurer can be used to identify, at least under some conditions, the second category of unpredictable claims. We plan to pursue this course in the next draft. Alternatively, the same approach can be used to predict the spread in the final “loss paid” amount, although this method suffers from some of the same sample selection drawbacks of our expected litigation measure described above.<sup>48</sup>

For lawyers evaluating these claims, the cost of the “going all the way” or “going the rest of the way” and the expected volatility of the claim are sensible inputs to the decision of whether to settle a claim, or continue forward to a trial, without or without a high-low agreement. Figure 4 depicts the basic dynamics of this decision process. At the outset, the baseline is that the dispute will be resolved through a trial where parties will be bound by the verdict of the factfinder. Only by settling or entering into a high-low agreement, at some stage, can the parties reduce the volatility of the outcome, and in our risk-reducing model, only by fully settling can the litigants save the costs of going to trial. If new information were to arrive post-settlement or after a high-low agreement had been concluded, the parties could always agree to renegotiate. This does not happen in practice with settlement, although it is theoretically possible. It is also possible, although we see no evidence of it, for parties to unwind a high-low agreement and go to trial unfettered by a contract.

The fact that high-low agreements are often a first step toward full settlement (solid line in figure) raises a question about how to categorize the outcomes for our empirical work. Is a

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probability distribution turns on the *difference* between the reserve amount and the median relative to the same difference of other claims.

<sup>48</sup> We also built a number of candidate volatility instruments, but they suffered from the same problem that our instruments for litigation costs did. As candidates, we considered different measures of tort reform designed to limit “excessive verdicts,” including various types of damages caps and joint-and-several liability reform. We are currently seeking costs and attorneys fees shifting measures because a law that has the effect of shifting attorneys fees will essentially *increase* the variance.

high-low agreement that turns into a settlement a high-low agreement or a settlement? We consider both possibilities for a few reasons. First, even if a high-low winds up as a settlement, we are interested in the conditions that cause the litigants to enter into that agreement at *any* stage of the litigation, even temporarily.<sup>49</sup> Still, a temporary high-low may occur because of an artificial time constraint (at a settlement conference, for example) makes it impossible to negotiate a full settlement at a single sitting. A high-low agreement may be faster and easier to obtain, and while providing at least some insurance until the full settlement terms are determined. As we show below, the ultimately categorization of our high-low variable, whether we look at the first choice or the final stage, or whether we consider high-low discussions or only actual agreements, does affect the substance of empirical conclusions. The pattern we find is stable across these choices.

Our empirical strategy attempts to identify factors which explain one of three possible outcomes—1) trial; 2) high-low agreement; and 3) settlement. Because these categories are unordered, we adopt a multinomial logit (MNL) model, which estimates the probability of a particular outcome relative to a baseline category.<sup>50</sup>

The MNL model postulates:

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<sup>49</sup> There is a deeper question here: does a high-low that later evolves into a full settlement occur because of new information (consistent with a rational agent's behavior) or because of some behavioral tendency on the part of the litigants?

<sup>50</sup> This modeling decision, although appropriate, generated a host of thorny technical issues when we attempted to employ IV methods to remove selection effects. Estimating a MNL model with endogenous regressors is non-trivial. We employed the control function approach described in Terza, Basu, & Rathouz (2008), although this approach is not fully satisfactory. See Imbens & Wooldridge (2007), at [http://www.nber.org/WNE/lect\\_6\\_controlfuncs.pdf](http://www.nber.org/WNE/lect_6_controlfuncs.pdf) ("Allowing endogenous explanatory variables (EEVs) in multinomial response models is notoriously difficult, even for continuous endogenous variables. There are two basic reasons. First, multinomial probit (MNP), which mixes well [with] a reduced form normality assumption for  $D(y_2|z)$ , is still computationally difficult for even a moderate number of choices. Apparently, no one has undertaken a systematic treatment of MNP with EEVs, including how to obtain partial effects. The multinomial logit (MNL), and its extensions, such as nested logit, is much simpler computationally with lots of alternatives. Unfortunately, the normal distribution does not mix well with the extreme value distribution, and so, if we begin with a structural MNL model (or conditional logit), the estimating equations obtained from a CF approach are difficult to obtain, and MLE is very difficult, too, even if we assume a normal distribution in the reduced form(s).")

$$p(y_i = j) = \frac{\exp(x'_{ij}\beta_j)}{\sum_k \exp(x'_{ik}\beta_k)}, \quad (10)$$

Where  $x_{ij}$  denotes claim  $i$ 's characteristics, which are associated with each of the  $J$  alternatives and  $\beta$  is a  $K \times I$  vector of estimated coefficients.

Because going to trial without a high-low is in some sense the default, we selected it as the baseline category. Using our calculations of expected litigation costs and expected volatility, we generate two dummy variables. For the disputed claims under study, we calculate the *median* expected litigation cost and the *median* expected volatility level. We then categorize claims by whether they are “above the median” or “below the median” in each category.<sup>51</sup> By interacting these two dummy variables, we produce four categories of claims as described above. For our data to be consistent with the predictions made by the risk-reduction model, claims that have below-median costs *and* above-median variance in outcomes are going to be significantly more likely, relative to other claims, to resolve through a high-low agreement or involve a high-low discussion.

This specification is a fairly parsimonious way to examine the risk-reduction theory, but it is also intuitive and generates results that are straightforward in their interpretation. In unreported work, we have refined our estimating approach to include variables that are continuous measures of expected volatility and expected litigation costs and have found results that are similar in substance to the ones we report below.

The results of our empirical work on our risk-reduction model are reported in Tables 4 through 7. The four tables differ in the following two ways. First, Tables 4 and 6 use only cases litigated through to trial to calculate the expected litigation costs, whereas Tables 5 and 7 use all claims in dispute, regardless of their final disposition, to make these calculations. Second, Tables 4 and 5 categorize a claim as being a high-low claim if a high-low

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<sup>51</sup> Our framework makes use of generated regressors and, as a consequence, the standard errors reported in Tables (5)-(8) are biased (Murphy & Topel, 1985). We will remedy this issue in the next draft, but we do not expect the adjustment to alter the content of the results in a serious way.

arrangement was discussed at some point in the litigation. Tables 6 and 7 use a more exacting measure—high-low cases in those tables involve only those claims where there was an actual high-low agreement and that agreement was not renegotiated.

Columns (1)-(4) of each table present results where the high-low group is defined to include those claims in which a high-low discussion/agreement occurred and the claim ended in a trial or arbitration (i.e., it was not subsequently settled).<sup>52</sup> Columns (5)-(8) of the tables present an alternative approach where a high-low discussion/agreement label is applied to every claim in which a high-low discussion/agreement took place, even if the claim subsequently settled. We refer to this as the “first choice” approach. Although the results from these different approaches vary somewhat, the basic result is similar—high-low discussions and agreements are more likely, relative to settlement and trial, when expected costs are low and expected volatility is high.

Table 4 illustrates this finding. The key coefficients of interest are those on LC\_HV under both the high-low discussion category and the settlement category. The high-low coefficient (reported as relative risk ratios) on LC\_HV is significantly different from one, and is also significantly different from the LC\_HV coefficient on settlement. To interpret, these numbers, if we look at column (4), show that a claim that has below-median costs and above-median volatility claim has odds of a high-low discussion that are over eight times higher than a claim that has above-median costs and below-median variance (the excluded category).<sup>53</sup> The coefficient on HC\_HV comes close to the coefficient on LC\_HV, suggesting that expected volatility, as opposed to high expected litigation costs, may play a more important role in a lawyer’s decision to enter into a high-low agreement. Note that the coefficient on LC\_HV under settlement is also significantly different from one, suggestion that highly

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<sup>52</sup> As explained in the tables more fully, the differences between columns (1), (2), (3), and (4) are the variables used to calculate expected litigation costs.

<sup>53</sup> Although I report relative risk ratios (odds ratios) in Tables (5)-(8), I have also calculated the average partial effects (which can differ significantly) using the estimates from equation (10). These results are similar in direction and magnitude to what is presented in the tables.

volatile claims are also more likely to lead to settlement, relative to trial, which lines up with our model's intuition on how risk and costs ought to affect settlement decisions.

When we turn to studying just high-low agreements in Table 6, the results are even stronger. Claims with below-median costs and above-median volatility are relatively much more likely to wind up with a high-low agreement than other sorts of claims. As in Table 4 (and the other tables), the pattern suggests that volatility avoidance is playing a larger role than expected low costs in driving entry into high-low agreements. Cases with below-median costs and above-median volatility are more than 8 times as likely to wind up in a high-low agreement as a below-median cost, below-median volatility claim. In future work, we plan to refine our specification and offer a number of additional robustness checks.

#### 4.2 Cost Reduction

Using our data to test the cost-reduction theory of high-low agreements is less straightforward than testing the risk-reduction theory and has, to this point, been less fruitful. In the future, we hope to devise or identify an exogenous proxy for  $\beta$ , but so far we have only succeeded in testing a possible, but not necessary, implication of the cost-reduction model. With respect to this particular implication, at least in this very preliminary work, we find no evidence that litigants behave in the way our analysis indicates they might.

If two litigants employ a high-low agreement to reduce excessive litigation expenditures by dampening overly powerful investment incentives, one possible (and potentially observable) consequence is a post-high-low decline (or a relatively slower increase relative to non-high-low claims) in litigation expenditures by both parties. The absence of such a pattern in no way requires a rejection of the cost-reduction theory, however. Litigants may be able to foresee those claims in which a high-low will make sense, and reduce

spending *in advance* of any actual agreement.<sup>54</sup> Alternatively, many litigation costs may be fixed or sunk in the short term, especially at a large national insurer that has a fulltime legal staff. Unfortunately, although the insurer agreed to provide us with month-by-month accounts of litigation expenses, both for in-house and external counsel, for virtually every claim in our data set, we cannot observe plaintiff behavior.

We employed a straightforward empirical strategy making use of random-effects panel methods. We began with a simple differences strategy, checking to see whether, relative to all other claims, monthly expenditures for claims with high-low agreements in place were lower than the claims not involving high-low agreements. We found no statistical difference between spending in high-low and non-high-low cases. Next, we tried to control for unobservables, despite our inclusion of a large number of covariates, by comparing the spending patterns in high-low cases to those in cases where a high-low case was seriously negotiated. Again, our preliminary work shows no significant differences between high-low and non-high-low claims over time or across groups in monthly litigation expenses.

## **5. Conclusion**

This paper presented the first systematic study of high-low agreements, a contractual device that has grown increasingly popular in civil litigation in the United States over the last several decades. We began by presenting a formal model of risk-averse litigants in which these agreements arise endogenously. When the litigants are mutually optimistic about their prospects at trial and out-of-court settlement is elusive, high-low agreements provide a value-enhancing opportunity. They eliminate the risk of a “strike out” or a “home run,” while still maintaining scope for disagreement. We also explored the cost-reduction value of high-low agreements in a model of mutually assured destruction. Using a proprietary data set from one

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<sup>54</sup> Indeed, one could imagine a pre-agreement form of tacit collusion where behavior on both sides mimicked behavior under a high-low agreement. In such a setting, there would be no sharp change in behavior at the time the parties entered into the anticipated contract.

of the country's largest insurers, we found that high-low agreements are not uncommon, at least in some areas of litigation. Moreover, although we made little empirical headway in evaluating our cost-reduction theory of high-lows, we offered evidence that high-lows tend to be used in the circumstances identified by our risk-reduction theory: when the litigation environment is sufficiently uncertain (signifying scope for disagreement) and the costs of litigation are not too large.

We hope that our analysis will broaden the scope of discussion about litigation and settlement. The literature on litigation and settlement has tended to view dispute resolution in a dichotomous light where on one end of the spectrum cases are settled or dropped, and on the other end cases go to full-blown trial. In practice, however, dispute resolution may be better viewed as a continuum. For example, presumably to reduce costs on both sides, parties often agree to arbitrate their dispute, which amounts to an agreement to ignore certain procedural requirements of formal trial and to rely on arbitrators to resolve the dispute quickly. For similar reasons, parties often agree to waive their jury trial rights, stipulate to certain facts or points of law, etc., while still asking a judge or jury to determine many key questions of fact and law. These practices show that settlement in litigation is actually a much broader category of agreements than simply "settlement without adjudication." While the "cost-reducing" benefits of arbitration are well-recognized, most commentators have overlooked the "risk-reducing" benefits of mechanisms such as high-low agreements.

There remains additional theoretical and empirical work to be done in this area. Our paper looked at a model of high-low agreements where the litigants have different subjective prior beliefs. From a theoretical perspective, it might be interesting to explore their use in models with asymmetric information. There are also a number of unexplored public policy issues and concerns. First, because these private agreements mitigate the risk of trial for the litigants, they decrease the attractiveness of a full settlement. For this reason, their use should increase the demand for (high-low constrained) trials. This potentially imposes external costs and benefits. First, as the demand for litigation increases, this could lead to higher overall

litigation costs since the court system—including the buildings, the court employers, and the juries—are all heavily subsidized. Second, because there is currently no requirement in most jurisdictions to disclose the existence of a high-low agreement to the court, there may be a misallocation of scarce court resources at trial.<sup>55</sup> These topics, and others, remain fruitful areas for further research.

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<sup>55</sup> Note that this is a distinct feature of high-low agreements, as opposed to other forms of partial settlement where it is court involvement is necessary (for example, stipulating to a particular fact). Even though not compelled by law, some litigants find it strategically wise to inform judges of the existence of a high-low agreement, in part because having the judge sign off on the agreement in open court may increase the chances it will be enforced at some later point, should one party seek to breach. In arbitration, because of the informality of the proceeding, arbitrators are even more likely to know about the existence of a partial settlement arrangement. Additional distortions in the use of public funds may arise for jurisdictional reasons. For example, imagine a lawsuit alleging \$100,000 in damages, above the \$75,000 amount in controversy requirement required to make use of the federal courts on diversity jurisdiction. Using a high-low agreement, the parties might agree to limit possible damages to a range of \$40,000 to \$60,000. In effect, then, the amount in controversy is only \$20,000 and yet an undisclosed agreement allows the use of the federal courts. One can go further and imagine an out of court *full* settlement (i.e., agreeing to a \$50,000 payment regardless of the outcome at trial) between two parties who then seek to use a jury to determine “who was right, after all.” We usually assume that the costs of litigation will keep the number of such cases to a minimum, where substantial sums are still at issue, there is no reason to think that such arrangements will not be fairly common.

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## Appendix A: Proof of Lemma 1 and Proposition 1

Proof of Lemma 1: Using equation (1), the award modification contract would satisfy:

$$\frac{\pi_p a_p e^{-a_p(s_H - c_p)}}{(1 - \pi_p) a_p e^{-a_p(s_L - c_p)}} = \frac{\pi_d a_d e^{-a_d(-s_H - c_d)}}{(1 - \pi_d) a_d e^{-a_d(-s_L - c_d)}}.$$

The litigation costs drop out, giving

$$\frac{\pi_p e^{-a_p s_H}}{(1 - \pi_p) e^{-a_p s_L}} = \frac{\pi_d e^{a_d s_H}}{(1 - \pi_d) e^{a_d s_L}}.$$

Rearranging this expression,

$$\left[ \frac{(1/\pi_d) - 1}{(1/\pi_p) - 1} \right] = e^{(a_p + a_d)(s_H - s_L)}.$$

Taking the natural logarithm of both sides, and using the definition of  $\theta$  from Lemma 1, this becomes  $\theta = (a_p + a_d)(s_H - s_L)$ . Rearranging terms gives the result. ■

Proof of Proposition 1: We will first prove the following claim.

*Claim:* Under Assumption 1, Pareto-optimal award-modification agreements have the following characteristics.

- i. If  $\theta \leq 0$  (so the plaintiff is no more optimistic than the defendant) then the parties agree to a *full-insurance contract* with  $s_L = s_H$ .
- ii. If  $\theta \in (0, (a_p + a_d)(x_H - x_L)]$  then the litigants agree to a *high-low contract* with  $s_L = s_H - \theta / (a_p + a_d)$ .
- iii. If  $\theta > (a_p + a_d)(x_H - x_L)$  then the parties agree *not to modify the court's award* and remain with the status quo,  $s_L = x_L$  and  $s_H = x_H$ .

The proof of this is straightforward and will only be sketched here. When  $\theta \leq 0$  then the litigants are mutually pessimistic. If the contracts were unrestricted, they would agree to  $s_L > s_H$ . Under Assumption 1, the constraint that  $s_L \leq s_H$  is binding so the parties agree to  $s_L = s_H$ . When  $\theta > (a_p + a_d)(x_H - x_L)$ , then equation 2 would imply that

$s_H - s_L > x_H - x_L$ . This speculation violates Assumption 1. Again, the constraint binds and so  $s_L = x_L$  and  $s_H = x_H$ . □

Consider case (i) where  $\theta \leq 0$ . The litigants would clearly prefer setting out of court in this case, since they would avoid the litigation costs. Next consider case (ii) where  $\theta \in (0, (a_p + a_d)(x_H - x_L)]$ . Suppose there is an ordinary settlement contract,  $s$ , that is better for both litigants than their preferred *high-low contract* with  $s_L = s_H - \theta / (a_p + a_d)$ . For the plaintiff, it must be the case that:

$$-\exp[-a_p s] > -\pi_p \exp[-a_p (s_H - c_p)] - (1 - \pi_p) \exp[-a_p (s_L - c_p)] \quad (\text{A1})$$

Substituting for  $s_L$  from equation (2) in the text and rearranging terms gives a lower bound for  $s$ ,

$$s > s_H - c_p - \frac{1}{a_p} \ln \left[ \pi_p + (1 - \pi_p) \left[ \frac{(1/\pi_d) - 1}{(1/\pi_p) - 1} \right]^{\frac{a_p}{a_p + a_d}} \right]. \quad (\text{A2})$$

For the defendant, we must have

$$-\exp[a_d s] > -\pi_d \exp[-a_d (-s_H - c_d)] - (1 - \pi_d) \exp[-a_d (-s_L - c_d)]. \quad (\text{A3})$$

Again, substituting for  $s_L$  from equation (2) and rearranging terms gives us an upper bound,

$$s < s_H + c_d + \frac{1}{a_d} \ln \left[ \pi_d + (1 - \pi_d) \left[ \frac{(1/\pi_d) - 1}{(1/\pi_p) - 1} \right]^{\frac{-a_d}{a_p + a_d}} \right]. \quad (\text{A4})$$

Putting these expressions together, we see that the litigants will sign an ordinary settlement contract with the sum of their litigation costs high as characterized in equation (4) in the text. To show that  $\psi(\pi_p, \pi_d, a_p, a_d) > 0$  is positive, it is sufficient to show that

$$\pi_d^{-1/a_d} \pi_p^{-1/a_p} \left[ 1 + \left( \frac{1}{\pi_d} - 1 \right)^{\frac{a_p}{a_p + a_d}} \left( \frac{1}{\pi_p} - 1 \right)^{\frac{a_d}{a_p + a_d}} \right]^{\left( \frac{1}{a_d} + \frac{1}{a_p} \right)} > 1.$$

Rearranging terms, this becomes

$$1 + \left( \frac{1}{\pi_d} - 1 \right)^{\frac{a_p}{a_p + a_d}} \left( \frac{1}{\pi_p} - 1 \right)^{\frac{a_d}{a_p + a_d}} < \left[ \pi_d^{-1/a_d} \pi_p^{-1/a_p} \right]^{\frac{a_p a_d}{a_p + a_d}} = \pi_d^{-a_p/(a_p + a_d)} \pi_p^{-a_d/(a_p + a_d)},$$

or, equivalently,

$$\pi_d^{a_p/(a_p + a_d)} \pi_p^{a_d/(a_p + a_d)} + (1 - \pi_d)^{a_p/(a_p + a_d)} (1 - \pi_p)^{a_d/(a_p + a_d)} < 1.$$

When  $\pi_p = \pi_d$ , it is easy to show that the left-hand side is equal to one. So if we verify that the left-hand side is decreasing in  $\pi_p$ , then we are done. Differentiating with respect to  $\pi_p$ ,

$$\left( \frac{a_d}{a_p + a_d} \right) \pi_d^{a_p/(a_p + a_d)} \pi_p^{-a_p/(a_p + a_d)} - \left( \frac{a_d}{a_p + a_d} \right) (1 - \pi_d)^{a_p/(a_p + a_d)} (1 - \pi_p)^{-a_p/(a_p + a_d)}.$$

This has the same sign as

$$\left( \frac{\pi_d}{\pi_p} \right)^{a_p/(a_p + a_d)} - \left( \frac{1 - \pi_d}{1 - \pi_p} \right)^{a_p/(a_p + a_d)},$$

and it is easy to show that this is negative when  $\pi_p < \pi_d$ .

Now suppose that  $\theta > (a_p + a_d)(x_H - x_L)$ . According to our earlier claim, the parties are sufficiently optimistic about their own prospects at trial that they do not modify the court award. Suppose there is an ordinary settlement contract,  $s$ , that is better for both litigants. For the plaintiff, it must be the case that:

$$-\exp[-a_p s] > -\pi_p \exp[-a_p(x_H - c_p)] - (1 - \pi_p) \exp[-a_p(x_L - c_p)] \quad (\text{A5})$$

Rearranging terms, this becomes:

$$s > -c_p - (1/a_p) \ln(\pi_p e^{-a_p x_H} + (1 - \pi_p) e^{-a_p x_L}) \quad (\text{A6})$$

Similarly for the defendant, settling must be better than going to trial, so

$$-\exp[a_d s] > -\pi_d \exp[a_d(x_H + c_d)] - (1 - \pi_d) \exp[a_d(x_L + c_d)] \quad (\text{A7})$$

Rearranging terms, this becomes:

$$s < c_d + (1/a_d) \ln(\pi_d e^{a_d x_H} + (1 - \pi_d) e^{a_d x_L}) \quad (\text{A8})$$

Combining and rearranging terms, we have

$$c_p + c_d > -(1/a_p) \ln(1 - \pi_p + \pi_p e^{-a_p(x_H - x_L)}) - (1/a_d) \ln(1 - \pi_d + \pi_d e^{a_d(x_H - x_L)})$$

Renaming the right hand side  $\varphi(x_H, x_L, \pi_p, \pi_d, a_p, a_d)$ , we have equation (5) from the proposition. Now we will show that  $\varphi(x_H, x_L, \pi_p, \pi_d, a_p, a_d) > 0$ . First, if  $x_H - x_L = 0$  then it is clear that  $\varphi(\bullet) = 0$ . We can prove that  $\varphi(\bullet)$  is increasing in  $x_H - x_L$ . Differentiating expression (5) with respect to  $x_H - x_L$  gives us

$$\frac{\pi_p e^{-a_p(x_H - x_L)}}{1 - \pi_p + \pi_p e^{-a_p(x_H - x_L)}} - \frac{\pi_d e^{-a_d(x_H - x_L)}}{1 - \pi_d + \pi_d e^{-a_d(x_H - x_L)}}.$$

This is positive when

$$\frac{\pi_p e^{-a_p(x_H - x_L)}}{1 - \pi_p + \pi_p e^{-a_p(x_H - x_L)}} > \frac{\pi_d e^{-a_d(x_H - x_L)}}{1 - \pi_d + \pi_d e^{-a_d(x_H - x_L)}},$$

Cross multiplying and rearranging terms, we find that this is true when

$$\frac{(1 - \pi_d)/\pi_d}{(1 - \pi_p)/\pi_p} > e^{(a_p + a_d)(x_H - x_L)},$$

which is true because we are in case (iii) where  $\theta > (a_p + a_d)(x_H - x_L)$ .

## Appendix B: Additional Data Description

The insurer provided us with detailed data for all claims that were either closed or open at any point between January 1, 2004, and March 31, 2009. The raw claim data included approximately 570,000 total claims. Because we do not know how open claims eventually resolve, we do not use them in our analysis. By also removing claims that were missing extensive information or were outliers in subject matter, geography, or timing, we constructed a “clean” data set of approximately 385,000 claims.

The clean data set consists of two types of claims: claims resolved administratively through a claim handler and “disputed” claims. For our purposes, we define a claim as being “in dispute” if either (1) positive litigation costs are recorded by the insurer’s in-house legal counsel or an outside firm, or (2) a suit date is recorded (which occurs when the insurer receives notice that the plaintiff has filed a complaint, at which point the insurer refers to the claim as being “in suit”). A little more than 12 percent or about 48,500 of the claims were “in dispute” using our definition. Approximately 5 percent of the disputed claims, or about 2,600 claims, were “litigated” (resolved by trial or arbitration). Most non-administrative claims involve *both* a suit date and positive litigation costs, but a small fraction involves only one or the other. In Table A2, we provide summary statistics for the data, and we include alternative “broad” and “narrow” measures of the “disputed” claims category by using the union and intersection of conditions (1) and (2), respectively.

When a claimant notifies the insurer of a claim against one of its policies, the insurer first internally assesses the claim to determine to what extent, if any, the policyholder is responsible for the alleged harm. Based on this determination, the insurer attempts to resolve the claim through one of its claims agents. Most claims are resolved in this way, essentially administratively. If the claims agent is unable to resolve the claim through negotiation, and the claimant subsequently files suit, the insurer continues in its efforts to settle the claim but either assigns its own in-house legal staff or outside legal counsel to manage the claim. Consistent with most litigation, suits against the insurer typically end in settlement, with a small percentage proceeding to trial or arbitration.

For each claim, the insurer records the date of the alleged harm, the date the insurer received notice of the claim, and the close date (i.e., when the claim is resolved, regardless of its disposition). With these dates, it is possible to calculate the duration of each claim. In addition, the insurer gathers detailed information about the alleged harm and its likely “litigation” value. Of particular interest, the insurance company makes an initial assessment of the harm and the extent of its perceived liability, but also subsequently records a second post-evaluation, pre-litigation evaluation of the likely value of the claim. It also records the state (and sometimes city) in which the accident or harm occurred and maintains demographic information about the area in which the insured and claimant (plaintiff) live or lived. For all claims, the insurer also collects the amount ultimately paid out, if anything, to the claimant, as well as any legal fees or other legal expenses incurred. Each record also contains the policy limit for the policyholder (which affects how the insurer handles the claim), information about how long the insured had the policy, and when it became effective.

For approximately 80% of the claims, the insurer recorded whether the plaintiff was an individual or a business. The company also records extremely detailed information about the type of harm allegedly suffered by the plaintiff. Possible harms include property/economic

damage, personal injury or death, or, in many instances, both. Property/economic damage and personal injury raise different concerns for the insurer. With property/economic damage, the magnitude of harm is typically quantifiable using market measures, leaving liability as the central issue. By contrast, claims involving personal injury require the insurer to determine both the magnitude of the harm as well as the extent of liability, so the insurer catalogs the part of the body allegedly harmed (e.g., head, neck, spine) as well as the nature of the injury (e.g., contusion, sprain, fracture). If there are multiple injuries, the insurer records them, as well as whether other people were injured during the “loss event” and other indicators of injury (the use of an ambulance, for example).

As the summary statistics in Table A2 suggest, “in dispute” claims are different from administratively handled claims. The fatality rate is more than four times higher in disputed claims than in administrative claims. In addition, a disputed claim takes on average four times longer to resolve and involves payouts eight times greater than an administrative claim. The insurer tracks how the claim resolved, whether by settlement, arbitration, or trial. Table A3 reports the same summary statistics as Table A2, broken down by whether the claim involved a high-low discussion (irrespective of whether the parties reached a high-low agreement or how the claim ultimately resolved), resolved through settlement without a high-low discussion, or resolved by trial or arbitration without a high-low discussion. Consistent with the existing literature on settlement rates (Galanter, 1994), the vast majority of claims (95 percent) resolve without formal adjudication.

The insurer does not store any of its settlement agreements (including even whether there was a written or oral high-low agreement in place) in its standard, uniformly coded and collected electronic records. However, the insurer does keep extensive electronic narrative records on how the claim is handled while it is in dispute. Claim handlers, lawyers, and anyone else involved with a claim enter their notes as claims evolves, although the notes are not entirely complete and can be difficult to decipher.

To extract information about high-low agreements from these notes (which run at least many dozens of pages per “in dispute” claim when aggregated), we worked with the insurer to design an algorithm that extracted chunks of text surrounding references to a “high-low” agreement. The algorithm was designed to identify the many ways different people might have referred to high-low agreements in the notes: e.g., “hi-lo,” “high/low,” and “hi/low.”

A single claim often gave rise to several notes, depending on the frequency of high-low references. All notes included the following:

- Event ID: the underlying event giving rise to one or more claims;
- Claim ID: the specific claim corresponding to a given event;
- Note ID: individual identifier for the specific note;
- Note Type: the category of note, e.g., negotiation, legal, medical, etc.;
- Note Date: the date corresponding to the note;
- Note Count: the total number of notes attached to the claim.

The algorithm also recorded how many times the variation of the term appeared in the claim notes. For privacy reasons, notes were redacted to exclude names, addresses, social security numbers, and other sensitive information.

We read through a large sample of complete case notes and algorithm-extracted chunks of text to better understand the scope of the notes and to design a coding regimen. Research assistants completed the coding and double checking of the data. For each of these “high-low” relevant claims, we read the available narrative information, and recorded the context in which the high-low agreement arose, whether the parties reached an actual agreement, as well as other potentially useful information, such as the number of back and forth proposals, relevant dates, and the proximity of the discussion to trial or arbitration, if apparent.

When the redactions inhibited our ability to understand the notes, we requested additional information from the insurer. Officials at the insurer either helped us to determine the substance of the notes or forwarded hand-redacted notes. These notes were then recombined with the existing notes for those claims. The same procedure was used for both auto (AL) and general liability (GL) claims. The high-low data was structured such that each row in a spreadsheet contained a new note and all of the information we had about that note. The data were sorted by Event ID to determine whether there were multiple claims for an event, then sorted by claim ID to group each claim together, then sorted by date so that the notes were in chronological order within each claim. We ultimately coded a total of almost 300,000 text entries (many for each claim).

From the claim notes identified and redacted by the text-mining algorithm, we collected the following information on high-low discussions and agreements.

- H/L Discussion Level (measures the extent of high-low discussion). A “0” indicates that a high-low was mentioned by the insurer but there was no discussion between the parties. A “1” indicates that it was mentioned by one party but the other party was not interested. A “2” indicates that a high-low was discussed and seriously considered by both sides, but that no high-low was ever reached. Any type of interest on the other party’s part (such as “let me check with my client”) received a “2” coding. A “3” indicates that a high-low agreement was made. “4” records unknown/unclear.
- Party Name (identifies the party initiating the high-low discussion). A “1” indicates that the insurer raised the possibility of a high-low, a “2” means the plaintiff raised it, a “3” indicates a co-defendant (such as another insurance company also involved in the litigation) raised it, and a “4” means that it was unclear from the notes which party raised the possibility. A “5” indicates that a judge raised the idea.
- Date H/L Raised (the date of the first recorded mention of a high-low).
- H/L Context (the stage of the claim at which the discussion of the high-low occurred). A “0” represents a very early planning/negotiation stage, “1” is for arbitration, “2” is for mediation, and “3” is for trial.
- Date H/L Reached (if applicable, the date when the parties agreed to a high-low)
- High (if applicable, the high of the agreement).
- Low (if applicable, the low of the agreement).
- Claim Resolution (how the claim was eventually resolved). A “1” is for arbitration, a “2” is for mediation, a “3” is for trial, a “4” is for settlement, a “5” is for a dismissal or dropped case, and a “6” is recorded when the notes did not provide sufficient information to determine the resolution.

In the rare event that claims involved multiple parties and multiple distinct high-low agreements, we recorded the information in multiple separate rows as if there were separate agreements. We then later determined the appropriate treatment based on the facts and procedural posture of the case.

We also collected whether a claim involved multiple high-low proposals and, if so, we recorded the terms of each offer or demand, up to three proposals. (In a few instances, the notes did not report the actual terms of the high-low proposal.) These proposals usually, but not necessarily, resulted in the parties reaching a high-low agreement. Finally, we kept track of any information indicating the motivation or thinking of the lawyers or other insurer personnel in engaging in a high-low negotiation or agreement, and also recorded any other information possibly relevant to analyzing the case.

As an internal check, many claims (several hundred) were coded redundantly to ensure accuracy. Subsequent spot-checking also revealed that coding was highly consistent. The research assistants also recorded the certainty of their coding. A claim coded as a “1” was evaluated by another research assistant or by one of us, a “2” indicated that the claim required additional attention, and a “3” meant the RA had high confidence in the coding.

**Table 1: Final Resolution of All Claims in Dispute**

	Claims in Dispute Resolved by Trial or Arbitration with No High-Low in Place	Claims in Dispute Resolved by Settlement with No High-Low Agreement in Place	Claims Resolved by Trial or Arbitration with a High- Low in Place
Total Number of Claims	2,537	43,649	101
Claims by Year (when closed)			
2004	301	4,941	11
2005	443	7,302	8
2006	541	8,704	18
2007	542	9,845	32
2008	586	11,225	29
2009	124	1,632	3
Type of Claim			
Auto Liability	905	23,922	80
General Liability	1,632	19,727	21
Accident Characteristic			
Region Where Claim Arose			
Northeast	40.20%	32.61%	63.37%
South	26.61%	29.98%	17.82%
Midwest	8.79%	11.83%	10.89%
West	23.81%	25.25%	6.93%
Pacific	0.55%	0.27%	0.99%
Claimant Characteristics			
Claimant Type			
Firm/Business	10.5%	6.7%	1.0%
Individual	86.2%	89.8%	90.1%
Unknown	3.4%	3.5%	8.9%
Part of Body			
Fatality	2.3%	2.5%	0.0%
Head	5.8%	6.8%	5.0%
Lower Extremities	13.0%	11.5%	12.9%
Multiple Injuries	3.3%	1.8%	0.0%
Neck	13.2%	14.8%	8.9%
Spinal	4.1%	6.5%	11.9%
Trunk	23.7%	29.8%	41.6%
Upper Extremities	7.9%	9.4%	13.9%
Personal Injury	4.9%	4.3%	1.0%
Unreported	21.8%	12.6%	5.0%
Average Claim Characteristic			
Duration of Claim (months)	28.03 (19.08)	26.28 (15.71)	39.04 (13.64)
Initial Reserve	\$7,114 (13,701)	\$7,352 (16,170)	\$4,469 (4,486)
Loss Paid	\$30,322 (125,825)	\$42,411 (110,808)	\$74,075 (108,891)
Total Litigation Costs	\$13,996 (34,873)	\$7,847 (20,699)	\$10,748 (10,749)
Policy Limit (per person)	\$996,787 (883,433)	\$795,862 (893,086)	\$409,885 (505,977)
Policy Limit (per event)	\$1,418,445 (2,429,681)	\$1,056,617 (1,246,849)	\$582,027 (618,504)

Notes: All figures are computed from machine data or litigation notes provided by the insurer. All financial figures are reported in 2008 dollars. The three categories are designed to capture the "final resolution" of all claims in dispute, including whether the claim resolved through arbitration or trial with a high-low agreement in place. Any high-low agreement is, by definition, no longer in force if the parties decide to renegotiate and fully settle. Standard deviations are reported in parentheses.

**Table 2: Details of High-Low Agreements**

	<b>High-Low Agreement Reached</b>
Total number High-Low Agreements (complete)	241
Average Duration from Report Date	
High-Low Agreement Reached (months)	31.96 (14.9)
Claim Closed (months)	39.59 (15.9)
High-Low Agreement Details	
Average High Amount	\$157,702 (219,654)
Average Low Amount	\$43,641 (107,455)
How High -Low Claims Resolved	
Arbitration	34.4%
Suit - Full Trial: Defendant Wins	5.4%
Suit - Full Trial: Plaintiff Wins	7.9%
Suit - Directed Verdict for Defendant	0.8%
Suit - Settled Before Trial	44.0%
Suit - Settled Before End of Trial	3.3%
Suit - Withdrawn	2.5%
Unknown	1.7%
Outcome When Claim Adjudicated Under High-Low Agreement	
Outcome Below the Low	17.3%
Outcome Between the High and Low	68.5%
Outcome Above the High	14.3%

Notes: All figures are computed from machine data or litigation notes provided by the insurer. All financial figures are reported in 2008 dollars. The data contain a total of 248 high-low agreements, but seven were eliminated from the calculations in Table 2 because 1) the high or low of the agreement could not be determined or 2) the timing of the agreement could not be determined. Standard deviations are in parentheses.

**Table 3: Intensity of High-Low Discussion**

	Level of High-Low Discussion		
	High-Low Raised by One Party	Parties Amenable to High-Low	High-Low Agreement Reached
Total Number of Claims	345	344	248
Claims by Year (when closed)			
2004	59	52	27
2005	66	56	29
2006	70	57	54
2007	59	79	68
2008	82	87	61
2009	9	13	9
Type of Claim			
Auto Liability	224	201	167
General Liability	121	143	81
Accident Characteristic			
Region Where Claim Arose			
Northeast	70.43%	65.12%	68.55%
South	12.75%	13.66%	16.13%
Midwest	5.80%	8.43%	6.05%
West	10.72%	12.50%	8.87%
Pacific	0.29%	0.29%	0.40%
Claimant Characteristics			
Claimant Type			
Firm/Business	1.5%	0.9%	2.4%
Individual	91.0%	93.9%	91.1%
Unknown	7.5%	5.2%	6.5%
Part of Body			
Fatality	1.7%	2.3%	0.4%
Head	8.1%	9.3%	7.7%
Lower Extremities	12.8%	14.8%	15.3%
Multiple Injuries	0.6%	2.0%	0.4%
Neck	9.6%	9.6%	8.9%
Spinal	8.1%	12.5%	11.7%
Trunk	44.6%	32.0%	38.3%
Upper Extremities	12.8%	12.8%	12.5%
Personal Injury	0.3%	1.5%	1.6%
Unreported	1.5%	3.2%	3.2%
Average Claim Characteristic			
Duration of Claim (months)	35.36 (20.77)	37.68 (17.69)	39.37 (15.77)
Initial Reserve	\$7,307 (14,351)	\$7,785 (12,475)	\$5,673 (8,841)
Loss Paid	\$78,472 (147,138)	\$112,377 (216,173)	\$83,005 (128,910)
Total Litigation Costs	\$13,420 (37,407)	\$16,123 (32,183)	\$12,585 (20,672)
Policy Limit (per person)	\$606,609 (618,820)	\$723,243 (907,452)	\$538,767 (613,084)
Policy Limit (per event)	\$860,351 (788,358)	\$951,524 (816,792)	\$790,515 (789,372)

Notes: All figures are computed from machine data or litigation notes provided by the insurer. All financial figures are reported in 2008 dollars. "High-Low Raised by One Party" indicates that either the insurer or the other party raised the possibility of a high-low agreement in a settlement discussion, but the other side was uninterested according to the litigation notes. "Parties Amenable to High-Low" indicates that the parties attempted to negotiate a high-low agreement at some point in the litigation. Standard deviations are reported in parentheses.

**Table 4: Multinomial Model: Likelihood of High-Low Discussion and Full-Settlement  
Relative to Trial or Arbitration  
(Litigation Costs Predicted Using Only Tried Cases)**

	Outcome Final States				First Choice States			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>High-Low Discussion</b>								
HC_HV	4.329** (1.52)	5.088** (1.96)	5.971** (2.06)	4.414** (1.32)	4.873** (0.72)	4.225** (0.60)	4.513** (0.58)	3.387** (0.38)
LC_HV	5.983** (2.07)	10.319** (3.92)	10.939** (3.85)	8.581** (2.66)	5.623** (0.83)	7.039** (1.02)	8.355** (1.14)	5.760** (0.72)
LC_LV	0.980 (0.41)	1.691 (0.74)	2.122+ (0.89)	1.206 (0.50)	1.477* (0.24)	1.558** (0.25)	1.992** (0.31)	0.978 (0.15)
<b>Settlement</b>								
HC_HV	1.108+ (0.07)	1.061 (0.06)	1.126* (0.06)	1.086 (0.06)	1.085 (0.07)	1.042 (0.06)	1.106+ (0.06)	1.067 (0.05)
LC_HV	1.034 (0.06)	1.296** (0.08)	1.466** (0.10)	1.399** (0.09)	1.008 (0.06)	1.262** (0.08)	1.424** (0.09)	1.365** (0.09)
LC_LV	0.835** (0.05)	0.947 (0.06)	1.093 (0.06)	0.971 (0.06)	0.830** (0.05)	0.943 (0.06)	1.087 (0.06)	0.971 (0.06)
<b>Calculating Expected Litigation Costs</b>								
Set #1 (see notes)	✓	✓	✓	✓	✓	✓	✓	✓
Set #2 (see notes)		✓	✓	✓		✓	✓	✓
Set #3 (see notes)			✓	✓			✓	✓
Set #4 (see notes)				✓				✓
<b>Num of Obs.</b>	46281	46281	46281	46281	46286	46286	46286	46286

Notes: Estimates are reported as relative risk ratios. The outcome variable in columns (1)-(4) are measured at the conclusion of the litigation: (1) high-low discussions (ending in trial or arbitration), (2) settlement, or (3) trial/arbitration (excluded category). In columns (5)-(8), the outcome variable is measured at the time of first choice into a settlement or a high-low discussion, if any: (1) high-low discussions, (2) settlement, or (3) trial/arbitration (excluded category). The independent variables are indicators for the interaction between a dummy for whether the claim had above median expected variance and a dummy for whether the claim had above median expected litigation costs. Therefore, HC\_HV is a one for those claims with high expected costs and high expected variance; LC\_HV is a one for those claims with low expected costs, but high expected variance; and LC\_LV is a one for those claims with low expected costs and low expected variance. Standard errors (in parentheses) are listed below estimates. Indications for significance levels: \*\* < 1%, \* < 5%, + < 10%. The method for calculating expected litigation costs is explained in the text. Here, we show estimates using four different estimates of expected litigation costs. Group #1 includes: state of litigation fixed effects, accident region fixed effects, fixed effects for the insurance company's estimate of percentage of liability, year effects for when accident was reported, fixed effects for the number of persons injured in the event, fixed effects for type of injury or damage, a fatality flag indicator, and an indicator for whether the line of business was automobile liability or general liability. Group #2 includes Group #1 variables plus state of accident fixed effects, the insurance policy claim limit, the population density of the insured's geographic area, and the insurance company's estimates of "incurred loss" in months 3, 4, and 5 after the filing of a claim. Group #3 includes variables from Groups #1 and #2 and a number of demographic variables about the area where the insured lives, the type of plaintiff (company or individual), and the population density of the plaintiff's geographic area. Group #4 includes all of the previous variables, plus an indicator for the year in which the suit was filed.

**Table 5: Multinomial Model: Likelihood of High-Low Discussion and Full-Settlement  
Relative to Trial or Arbitration  
(Litigation Costs Predicted Using All Litigated Cases)**

	Outcome Final States				First Choice States			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>High-Low Discussion</b>								
HC_HV	4.557** (1.78)	4.855** (2.01)	5.563** (2.03)	3.810** (1.16)	4.936** (0.75)	5.115** (0.78)	4.338** (0.56)	3.541** (0.40)
LC_HV	12.771** (4.82)	19.189** (7.68)	20.235** (7.36)	12.826** (3.92)	9.634** (1.46)	12.946** (2.01)	11.874** (1.65)	7.274** (0.93)
LC_LV	2.003 (0.87)	2.849* (1.29)	3.236** (1.38)	1.448 (0.61)	2.320** (0.38)	2.923** (0.49)	2.499** (0.39)	1.252 (0.20)
<b>Settlement</b>								
HC_HV	1.158* (0.07)	1.144* (0.06)	1.164** (0.06)	1.138** (0.06)	1.136* (0.06)	1.123* (0.06)	1.144** (0.06)	1.118* (0.06)
LC_HV	1.610** (0.10)	1.857** (0.12)	2.059** (0.15)	1.756** (0.13)	1.568** (0.10)	1.804** (0.12)	2.000** (0.14)	1.715** (0.12)
LC_LV	1.251** (0.07)	1.352** (0.08)	1.484** (0.09)	1.251** (0.08)	1.245** (0.07)	1.343** (0.08)	1.477** (0.09)	1.251** (0.08)
<b>Calculating Expected Litigation Costs</b>								
Set #1 (see notes)	✓	✓	✓	✓	✓	✓	✓	✓
Set #2 (see notes)		✓	✓	✓		✓	✓	✓
Set #3 (see notes)			✓	✓			✓	✓
Set #4 (see notes)				✓				✓
<b>Num of Obs.</b>	46281	46281	46281	46281	46286	46286	46286	46286

Notes: Estimates are reported as relative risk ratios. The outcome variable in columns (1)-(4) are measured at the conclusion of the litigation: (1) high-low discussions (ending in trial or arbitration), (2) settlement, or (3) trial/arbitration (excluded category). In columns (5)-(8), the outcome variable is measured at the time of first choice into a settlement or a high-low discussion, if any: (1) high-low discussions, (2) settlement, or (3) trial/arbitration (excluded category). The independent variables are indicators for the interaction between a dummy for whether the claim had above median expected variance and a dummy for whether the claim had above median expected litigation costs. Therefore, HC\_HV is a one for those claims with high expected costs and high expected variance; LC\_HV is a one for those claims with low expected costs, but high expected variance; and LC\_LV is a one for those claims with low expected costs and low expected variance. Standard errors (in parentheses) are listed below estimates. Indications for significance levels: \*\* < 1%, \* < 5%, + < 10%. The method for calculating expected litigation costs is explained in the text. Here, we show estimates using four different estimates of expected litigation costs. Group #1 includes: state of litigation fixed effects, accident region fixed effects, fixed effects for the insurance company's estimate of percentage of liability, year effects for when accident was reported, fixed effects for the number of persons injured in the event, fixed effects for type of injury or damage, a fatality flag indicator, and an indicator for whether the line of business was automobile liability or general liability. Group #2 includes Group #1 variables plus state of accident fixed effects, the insurance policy claim limit, the population density of the insured's geographic area, and the insurance company's estimates of "incurred loss" in months 3, 4, and 5 after the filing of a claim. Group #3 includes variables from Groups #1 and #2 and a number of demographic variables about the area where the insured lives, the type of plaintiff (company or individual), and the population density of the plaintiff's geographic area. Group #4 includes all of the previous variables, plus an indicator for the year in which the suit was filed.

**Table 6: Multinomial Model: Likelihood of High-Low Agreement and Full-Settlement  
Relative to Trial or Arbitration  
(Litigation Costs Predicted Using Only Tried Cases)**

	Outcome Final States				First Choice States			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b><u>High-Low Agreement</u></b>								
HC_HV	2.997** (1.21)	3.916** (1.77)	3.733** (1.40)	2.514** (0.83)	5.851** (1.84)	6.039** (1.97)	6.183** (1.69)	4.757** (1.16)
LC_HV	5.348** (2.07)	9.538** (4.18)	9.000** (3.38)	7.347** (2.39)	9.862** (3.04)	14.703** (4.71)	13.760** (3.79)	11.939** (2.96)
LC_LV	1.051 (0.48)	1.974 (0.97)	1.844 (0.84)	0.905 (0.43)	1.402 (0.50)	1.922+ (0.70)	1.886+ (0.64)	1.200 (0.41)
<b><u>Settlement</u></b>								
HC_HV	1.073 (0.07)	1.035 (0.06)	1.091+ (0.06)	1.050 (0.05)	1.069 (0.07)	1.031 (0.06)	1.087 (0.06)	1.045 (0.05)
LC_HV	1.007 (0.06)	1.250** (0.08)	1.419** (0.09)	1.363** (0.09)	1.000 (0.06)	1.240** (0.08)	1.409** (0.09)	1.352** (0.09)
LC_LV	0.836** (0.05)	0.948 (0.06)	1.088 (0.06)	0.966 (0.06)	0.835** (0.05)	0.947 (0.06)	1.088 (0.06)	0.965 (0.06)
<b>Calculating Expected Litigation Costs</b>								
Set #1 (see notes)	✓	✓	✓	✓	✓	✓	✓	✓
Set #2 (see notes)		✓	✓	✓		✓	✓	✓
Set #3 (see notes)			✓	✓			✓	✓
Set #4 (see notes)				✓				✓
<b>Num of Obs.</b>	46281	46281	46281	46281	46281	46281	46281	46281

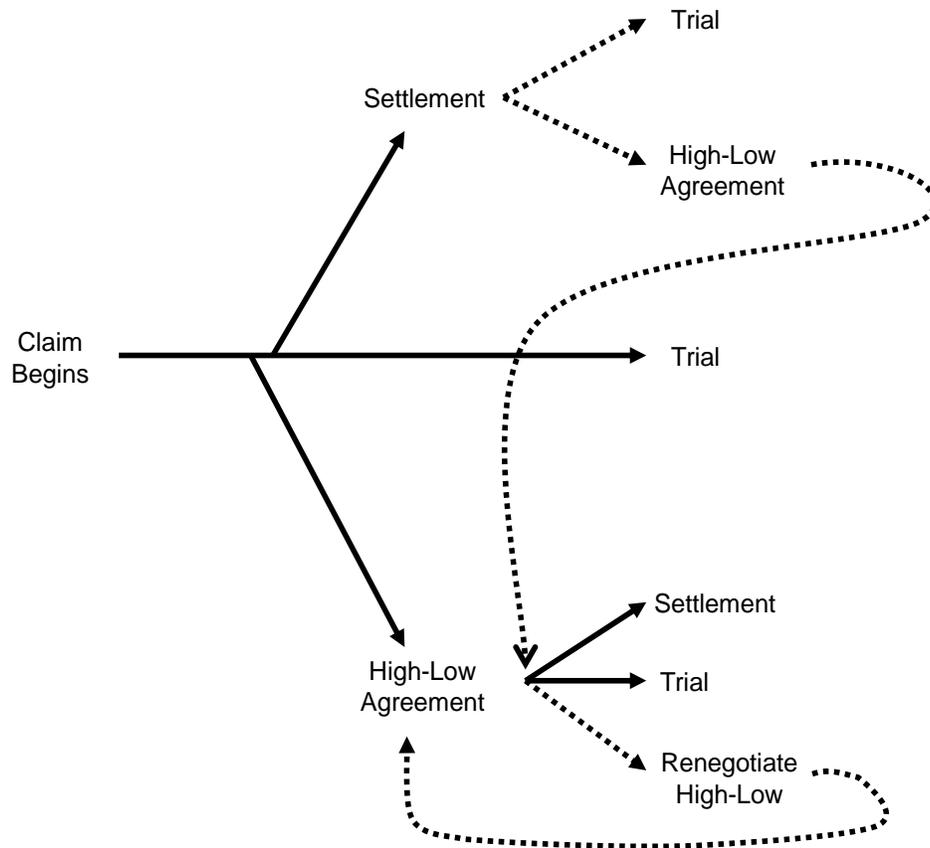
Notes: Estimates are reported as relative risk ratios. The outcome variable in columns (1)-(4) are measured at the conclusion of the litigation: (1) high-low agreement (ending in trial or arbitration), (2) settlement, or (3) trial/arbitration (excluded category). In columns (5)-(8), the outcome variable is measured at the time of first choice into a settlement or a high-low discussion, if any: (1) high-low discussions, (2) settlement, or (3) trial/arbitration (excluded category). The independent variables are indicators for the interaction between a dummy for whether the claim had above median expected variance and a dummy for whether the claim had above median expected litigation costs. Therefore, HC\_HV is a one for those claims with high expected costs and high expected variance; LC\_HV is a one for those claims with low expected costs, but high expected variance; and LC\_LV is a one for those claims with low expected costs and low expected variance. Standard errors (in parentheses) are listed below estimates. Indications for significance levels: \*\* < 1%, \* < 5%, + < 10%. The method for calculating expected litigation costs is explained in the text. Here, we show estimates using four different estimates of expected litigation costs. Group #1 includes: state of litigation fixed effects, accident region fixed effects, fixed effects for the insurance company's estimate of percentage of liability, year effects for when accident was reported, fixed effects for the number of persons injured in the event, fixed effects for type of injury or damage, a fatality flag indicator, and an indicator for whether the line of business was automobile liability or general liability. Group #2 includes Group #1 variables plus state of accident fixed effects, the insurance policy claim limit, the population density of the insured's geographic area, and the insurance company's estimates of "incurred loss" in months 3, 4, and 5 after the filing of a claim. Group #3 includes variables from Groups #1 and #2 and a number of demographic variables about the area where the insured lives, the type of plaintiff (company or individual), and the population density of the plaintiff's geographic area. Group #4 includes all of the previous variables, plus an indicator for the year in which the suit was filed.

**Table 7: Multinomial Model: Likelihood of High-Low Agreement and Full-Settlement  
Relative to Trial or Arbitration  
(Litigation Costs Predicted Using All Litigated Cases)**

	Outcome Final States				First Choice States			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b><u>High-Low Agreement</u></b>								
HC_HV	2.145+ (0.97)	2.618* (1.24)	3.282** (1.33)	2.178* (0.73)	5.226** (1.66)	4.900** (1.50)	5.802** (1.59)	4.505** (1.08)
LC_HV	11.239** (4.55)	16.265** (7.06)	16.716** (6.49)	10.238** (3.30)	15.937** (4.89)	18.307** (5.43)	20.095** (5.54)	14.385** (3.51)
LC_LV	1.854 (0.88)	2.728* (1.34)	2.895* (1.33)	1.085 (0.51)	1.997+ (0.71)	2.068* (0.73)	2.413** (0.82)	1.282 (0.44)
<b><u>Settlement</u></b>								
HC_HV	1.122* (0.06)	1.116* (0.06)	1.134* (0.06)	1.107* (0.05)	1.118* (0.06)	1.112+ (0.06)	1.129* (0.06)	1.103* (0.05)
LC_HV	1.561** (0.10)	1.776** (0.12)	1.962** (0.14)	1.678** (0.12)	1.549** (0.10)	1.763** (0.11)	1.947** (0.14)	1.665** (0.12)
LC_LV	1.247** (0.07)	1.347** (0.08)	1.475** (0.09)	1.243** (0.08)	1.247** (0.07)	1.347** (0.08)	1.475** (0.09)	1.243** (0.08)
<b>Calculating Expected Litigation Costs</b>								
Set #1 (see notes)	✓	✓	✓	✓	✓	✓	✓	✓
Set #2 (see notes)		✓	✓	✓		✓	✓	✓
Set #3 (see notes)			✓	✓			✓	✓
Set #4 (see notes)				✓				✓
<b>Num of Obs.</b>	46281	46281	46281	46281	46281	46281	46281	46281

Notes: Estimates are reported as relative risk ratios. The outcome variable in columns (1)-(4) are measured at the conclusion of the litigation: (1) high-low agreement (ending in trial or arbitration), (2) settlement, or (3) trial/arbitration (excluded category). In columns (5)-(8), the outcome variable is measured at the time of first choice into a settlement or a high-low discussion, if any: (1) high-low discussions, (2) settlement, or (3) trial/arbitration (excluded category). The independent variables are indicators for the interaction between a dummy for whether the claim had above median expected variance and a dummy for whether the claim had above median expected litigation costs. Therefore, HC\_HV is a one for those claims with high expected costs and high expected variance; LC\_HV is a one for those claims with low expected costs, but high expected variance; and LC\_LV is a one for those claims with low expected costs and low expected variance. Standard errors (in parentheses) are listed below estimates. Indications for significance levels: \*\* < 1%, \* < 5%, + < 10%. The method for calculating expected litigation costs is explained in the text. Here, we show estimates using four different estimates of expected litigation costs. Group #1 includes: state of litigation fixed effects, accident region fixed effects, fixed effects for the insurance company's estimate of percentage of liability, year effects for when accident was reported, fixed effects for the number of persons injured in the event, fixed effects for type of injury or damage, a fatality flag indicator, and an indicator for whether the line of business was automobile liability or general liability. Group #2 includes Group #1 variables plus state of accident fixed effects, the insurance policy claim limit, the population density of the insured's geographic area, and the insurance company's estimates of "incurred loss" in months 3, 4, and 5 after the filing of a claim. Group #3 includes variables from Groups #1 and #2 and a number of demographic variables about the area where the insured lives, the type of plaintiff (company or individual), and the population density of the plaintiff's geographic area. Group #4 includes all of the previous variables, plus an indicator for the year in which the suit was filed.

**Figure 4: Dynamics of Settlement and High-Low Agreements**



**Table A1: Litigated and High-Low Related Claims**

	Claims Resolved by Trial or Arbitration	Claims with High- Low Discussions	Claims with High- Low Agreements
Total Number of Claims	2,638	937	248
Claims by Year (when closed)			
2004	312	138	27
2005	451	151	29
2006	559	181	54
2007	574	206	68
2008	615	230	61
2009	127	31	9
Type of Claim			
Auto Liability	985	592	167
General Liability	1,653	345	81
Accident Characteristic			
Region Where Claim Arose			
Northeast	41.09%	67.98%	68.55%
South	26.27%	13.98%	16.13%
Midwest	8.87%	6.83%	6.05%
West	23.16%	10.89%	8.87%
Pacific	0.57%	0.32%	0.40%
Claimant Characteristics			
Claimant Type			
Firm/Business	10.1%	1.5%	2.4%
Individual	86.3%	92.1%	91.1%
Unknown	3.6%	6.4%	6.5%
Part of Body			
Fatality	2.2%	1.6%	0.4%
Head	5.8%	8.4%	7.7%
Lower Extremities	13.0%	14.2%	15.3%
Multiple Injuries	3.2%	1.1%	0.4%
Neck	13.0%	9.4%	8.9%
Spinal	4.4%	10.7%	11.7%
Trunk	24.3%	38.3%	38.3%
Upper Extremities	8.2%	12.7%	12.5%
Personal Injury	4.8%	1.1%	1.6%
Unreported	21.2%	2.6%	3.2%
Average Claim Characteristic			
Duration of Claim (months)	28.45 (19.02)	37.27 (18.48)	39.37 (15.77)
Initial Reserve	\$7,010 (13,469)	\$7,049 (12,413)	\$5,673 (8,841)
Loss Paid	\$31,997 (125,482)	\$92,119 (172,360)	\$83,005 (128,910)
Total Litigation Costs	\$13,872 (34,268)	\$14,191 (31,762)	\$12,585 (20,672)
Policy Limit (per person)	\$974,257 (879,168)	\$631,473 (739,790)	\$538,767 (613,084)
Policy Limit (per event)	\$1,388,664 (2,393,859)	\$876,832 (801,237)	\$790,515 (789,372)

Notes: All figures are computed from machine data or litigation notes provided by the insurer. All financial figures are reported in 2008 dollars. "Claims with High-Low Discussions" are claims in which the parties at least raised in settlement negotiations the possibility of a high-low agreement. "Claims with High-Low Agreements" is the subset of "Claims with High-Low Discussions" in which the parties reached an actual agreement. Because some high-low agreements subsequently resolved through settlement, "Claims Resolved through Trial or Arbitration" includes many, but not all, of the high-low discussions and agreements. Standard deviations are reported in parentheses.

**Table A2: Full Universe of Insurance Claims**

	All Claims	Admin. Claims	Claims in Dispute		Litigated Claims	High-Low Discussions
			Broad	Narrow		
Total Number of Claims	385,069	336,720	48,349	34,282	2,638	937
Claims by Year (when closed)						
2004	68,445	62,527	5,918	3,699	312	138
2005	79,699	71,481	8,218	5,730	451	151
2006	83,805	74,227	9,578	6,727	559	181
2007	87,446	76,742	10,704	7,684	574	206
2008	62,670	50,545	12,125	8,959	615	230
2009	3,004	1,198	1,806	1,483	127	31
Type of Claim						
Auto Liability	224,885	199,724	25,161	18,388	985	592
General Liability	160,184	136,996	23,188	15,894	1,653	345
Accident Characteristic						
Region Where Claim Arose						
Northeast	22.58%	21.13%	32.69%	35.82%	41.09%	67.98%
South	39.14%	40.49%	29.73%	27.56%	26.27%	13.98%
Midwest	12.62%	12.77%	11.58%	11.37%	8.87%	6.83%
West	25.43%	25.40%	25.64%	24.98%	23.16%	10.89%
Pacific	0.20%	0.18%	0.29%	0.22%	0.57%	0.32%
Claimant Characteristics						
Claimant Type						
Firm/Business	2.2%	1.5%	6.8%	6.1%	10.1%	1.5%
Individual	76.6%	75.1%	87.0%	89.1%	86.3%	92.1%
Unknown	21.2%	23.4%	6.2%	4.8%	3.6%	6.4%
Part of Body						
Fatality	0.7%	0.5%	2.5%	2.0%	2.2%	1.6%
Head	8.2%	8.4%	6.8%	6.4%	5.8%	8.4%
Lower Extremities	9.5%	9.2%	11.4%	12.5%	13.0%	14.2%
Multiple Injuries	2.5%	2.6%	2.0%	1.5%	3.2%	1.1%
Neck	22.9%	24.1%	14.3%	13.8%	13.0%	9.4%
Spinal	2.1%	1.6%	6.2%	7.2%	4.4%	10.7%
Trunk	27.4%	27.2%	28.7%	30.5%	24.3%	38.3%
Upper Extremities	8.1%	8.0%	9.3%	10.1%	8.2%	12.7%
Personal Injury	0.9%	0.4%	4.4%	3.5%	4.8%	1.1%
Unreported	17.6%	18.0%	14.5%	12.4%	21.2%	2.6%
Average Claim Characteristic						
Duration of Claim (months)	9.20 (11.28)	6.76 (7.84)	26.19 (15.99)	28.98 (15.71)	28.45 (19.02)	37.27 (18.48)
Initial Reserve	\$7,345 (17,804)	-- --	\$7,345 (17,804)	\$7,163 (13,933)	\$7,010 (13,469)	\$7,049 (12,413)
Loss Paid	\$9,948 (46,796)	\$5,442 (23,366)	\$41,325 (111,862)	\$47,026 (114,476)	\$31,997 (125,482)	\$92,119 (172,360)
Total Litigation Costs	\$1,039 (8,414)	-- --	\$8,277 (22,449)	\$10,674 (24,927)	\$13,872 (34,268)	\$14,191 (31,762)
Policy Limit (per person)	\$737,428 (2,101,470)	\$726,009 (2,210,010)	\$816,986 (1,071,733)	\$786,141 (848,211)	\$974,257 (879,168)	\$631,473 (739,790)
Policy Limit (per event)	\$886,051 (1,170,250)	\$855,077 (1,138,832)	\$1,097,010 (1,346,331)	\$1,078,306 (1,067,606)	\$1,388,664 (2,393,859)	\$876,832 (801,237)

Notes: All figures are computed from machine data or litigation notes provided by the insurer. All financial figures are reported in 2008 dollars. "Administrative Claims" are claims that involve no legal expenses and in which no complaint has been filed. "Claims in Dispute" involve some minimal legal expenses and/or (narrow/broad) the filing of a legal complaint. Litigated claims are those claims that are eventually adjudicated either in trial or arbitration. Standard deviations are reported in parentheses.

**Table A3: Consideration of a High-Low Agreement for All Claims in Dispute**

	Claims in Dispute Resolved by Trial or Arbitration with No High-Low Discussion	Claims in Dispute Resolved by Settlement with No High- Low Discussion	Claims in Dispute Involving a High-Low Discussion
Total Number of Claims	2,492	42,863	937
Claims by Year (when closed)			
2004	297	4,821	138
2005	432	7,170	151
2006	529	8,553	181
2007	537	9,676	206
2008	576	11,036	230
2009	121	1,607	31
Type of Claim			
Auto Liability	882	23,435	592
General Liability	1,610	19,428	345
Accident Characteristic			
Region Where Claim Arose			
Northeast	39.85%	31.95%	67.98%
South	26.81%	30.28%	13.98%
Midwest	8.83%	11.93%	6.83%
West	23.96%	25.50%	10.89%
Pacific	0.52%	0.27%	0.32%
Claimant Characteristics			
Claimant Type			
Firm/Business	10.7%	6.8%	1.5%
Individual	86.2%	89.8%	92.1%
Unknown	3.1%	3.4%	6.4%
Part of Body			
Fatality	2.2%	2.6%	1.6%
Head	5.9%	6.8%	8.4%
Lower Extremities	12.8%	11.4%	14.2%
Multiple Injuries	3.3%	1.9%	1.1%
Neck	13.2%	14.9%	9.4%
Spinal	4.0%	6.4%	10.7%
Trunk	23.5%	29.6%	38.3%
Upper Extremities	7.9%	9.4%	12.7%
Personal Injury	5.0%	4.4%	1.1%
Unreported	22.2%	12.8%	2.6%
Average Claim Characteristic			
Duration of Claim (months)	27.63 (18.66)	26.10 (15.61)	37.27 (18.48)
Initial Reserve	\$7,043 (13,603)	\$7,355 (16,228)	\$7,049 (12,413)
Loss Paid	\$28,153 (117,658)	\$41,508 (109,358)	\$92,119 (172,360)
Total Litigation Costs	\$13,231 (32,865)	\$7,765 (20,578)	\$14,191 (31,762)
Policy Limit (per person)	\$1,003,179 (887,140)	\$798,397 (894,999)	\$631,473 (739,790)
Policy Limit (per event)	\$1,423,470 (2,447,770)	\$1,059,359 (1,252,906)	\$876,832 (801,237)

Notes: All figures are computed from machine data or litigation notes provided by the insurer. All financial figures are reported in 2008 dollars. The three categories are designed to capture the "first move" made by the parties. If a high-low agreement was not discussed by the parties, then the claim ultimately resolved either through settlement or through trial or arbitration. Standard deviations are reported in parentheses.