Split-awards and disputes: An experimental study of a strategic model of litigation

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Abstract

This paper studies experimentally the impact of the split-award statute, where the state takes a share of the plaintiff’s punitive damage award, on litigation outcomes. Our findings indicate that dispute rates are significantly lower when bargaining is performed under the split-award institution. Defendants’ litigation losses and plaintiffs’ net compensation are significantly reduced by the split-award statute.

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1. Introduction

Tort reform in the U.S. has typically been motivated by the common perception that excessive punitive damage awards have contributed to the escalation of liability insurance premiums. Some reforms take the form of caps or limits on punitive damage awards while others mandate that a
portion of the award be allocated to the plaintiff with the remainder going to the state. These latter reforms, called “split-awards,” have been implemented in Alaska, California, Georgia, Illinois, Indiana, Iowa, Missouri, Oregon, and Utah. In addition, New Jersey and Texas have contemplated, but not yet adopted, split-award statutes (White, 2002).

Theoretical models of litigation have been developed to study the effects of split-awards on litigants’ behavior and likelihood of trial. However, there are no empirical tests of these models, perhaps because most litigation outcomes are partially or totally unobserved by researchers so that data sources are rarely available (Daughety, 2000). The proposed research is an attempt to test, using experimental methods, the effect of the split-award institution on the likelihood of trial and the level of care chosen by potential injurers. We adopt a simplified version of Landeo and Nikitin’s (2005) model as a theoretical framework.

Among previous formal studies of the split-award statute is the work of Kahan and Tuckman (1995). They construct a simultaneous-move game between a plaintiff and a defendant and find that, in the absence of agency problems between plaintiffs and lawyers, split-awards reduce the plaintiff’s litigation effort and expenses and, consequently, reduce the expected amount paid by the defendant. Their framework does not allow for an analysis of the effects of split-awards on the likelihood of trial because the pre-trial bargaining stage is not explicitly modeled. Daughety and Reinganum (2003) examine the effects of the split-award reform on the likelihood of trial and settlement amounts by modeling the pre-trial bargaining as a strategic game of incomplete information between two Bayesian players, an informed defendant and an uninformed plaintiff, using signaling and screening games set-ups. They find that holding filing constant, split-award statutes simultaneously lower settlement amounts and the likelihood of trial.

The magnitude of the resources currently spent in the U.S. tort and, therefore, diverted from economic activities, has generated an urgency for further reform of the tort system. The 2004 Economic Report of the President devotes a whole chapter to the tort system, describing its effects and proposing reforms. “Expenditures in the U.S. tort system were $233.4 billion in 2002, equal to 2.2 percent of gross domestic product (GDP), more than twice the amount spent on new automobiles in 2002. The expansive tort system has a considerable impact on the U.S. economy. Tort liability leads to lower spending on research and development, higher health care costs, and job losses” (Economic Report of the President, 2004, p. 203).

On August 16, 2004, Governor Arnold Schwarzenegger signed the state budget legislation SB 1102 as an “urgency” matter, becoming effective immediately instead of 1 January of next year. The SB 1102 provided that 75 percent of all punitive damages were payable to the state; that is, split-awards were enacted in that legislation (Metropolitan News Enterprise, 2004). Given that California has approximately 10 percent of the U.S. population, the effects of this statute may have a great impact on the U.S. tort system.

Statutes vary with the state: the base for computation of the state’s share can be the gross punitive award or the award net of attorney’s fees, the state’s share can be 50, 60 or 75 percent and, the destination of the state’s funds can be the Treasury, the Department of Human Services or indigent victims funds. For details, see Dodson (2000), Epstein (1994), Stevens (1994), and Sloane (1993). Legal commentators have focused their analyses of these statutes on their effects on the plaintiff’s windfall (i.e., any amount in excess of the costs of pursuing the punitive claim) and the constitutionality of the reform (Evans, 1998; Epstein, 1994; Stevens, 1994; Sloane, 1993). Commentators argue that in contrast to caps that reduce both the plaintiff’s windfall and the deterrence effect of the punitive awards, the split-award statute constitutes a “move toward effectuating the true purpose of punitive damages” (Sloane, 1993, p. 473). They claim that split-awards reduce the plaintiff’s windfall but maintain adequate levels of deterrence and punishment. In addition, split-awards allow the plaintiffs to receive a share of the awards for payment of attorney fees and rewards for their civil duty as “private attorney generals” (CN, 1993; Dodson, 2000; Evans, 1998; Epstein, 1994; Stevens, 1994; Sloane, 1993).

If agency problems exist, the effects of split-awards are indeterminate.

The defendant knows the true probability that he will be found liable for gross negligence and made to pay punitive damages should the case go to trial.
Landeo and Nikitin extend the analysis of the split-award reform by exploring its effects not only on litigation outcomes but also on the potential injurer’s level of care.\textsuperscript{8} They construct a strategic model of litigation consisting of two stages. First, there is a potential injurer’s optimization stage, where a level of care is chosen by the potential injurer according to its cost of preventing accidents and the expected litigation loss in case of an accident. The level of care determines the probability that an accident occurs. If an accident occurs, a litigation stage begins. It is modeled as a signaling-ultimatum game where two Bayesian risk-neutral parties, an uninformed plaintiff and an informed defendant,\textsuperscript{9} negotiate prior to a costly trial.

Consistent with Daughety and Reinganum, their model predicts that under certain conditions, a decrease in the plaintiff’s share of the award decreases the probability of trial. Given that the split-award statute applies only when the case is settled in court, the parties have an incentive to settle out of court in order to cut out the state. In addition, they find that a reduction in the plaintiff’s share of the award increases the probability of accidents. This effect arises because a decrease in the plaintiff’s share reduces expected litigation costs. The potential injurer reacts to these lower expected costs by reducing expenditures on safety.\textsuperscript{10} Despite the higher likelihood of accidents under the split-award statute, they find, however, that the overall effect of the reform can be welfare improving if the harm caused by accidents is below some threshold.\textsuperscript{11}

We try here to further Landeo and Nikitin’s research by investigating experimentally the effects of the split-award statute institution. In assessing the validity of the qualitative theoretical predictions, our experimental study analyzes the effect of a reduction in the plaintiff’s share of punitive award on potential injurer’s level of care and litigation outcomes using a two-treatment between-subjects design.

This experimental investigation is important for two reasons. First, from a theoretical perspective, these experimental conditions allow us to verify whether the theoretical model has captured the main variables that determine litigation outcomes and level of care choice. Hence, our findings provide information that might contribute to the improvement of game theoretic models of litigation. Second, the theoretical model shows the impact of the split-award statute on reducing the likelihood of dispute but at the expense of increasing the likelihood of accidents (by reducing the potential injurer’s level of care). However, this tort reform has not been previously subjected to any experimental or field-testing. Given that data on the process of decision-making of the participants involved in lawsuits are not available or are incomplete, conducting an experiment to evaluate the effects of this litigation institution seems to be a valuable alternative.

\textsuperscript{8} We will use the terms firm, defendant and potential injurer interchangeably.
\textsuperscript{9} The defendant possesses private information about its cost of preventing accidents and, therefore, about its level of care and decision of the court should the case go to trial.
\textsuperscript{10} Polinsky and Che (1991) propose a liability system where the award to the plaintiff differs from the payment by the defendant (i.e., awards are decoupled). This system makes the defendant’s payment as high as possible, and therefore, it allows the award to the plaintiff to be lowered. The authors claim that this policy reduces the incentives to sue without affecting the firm’s incentives to take care. Note that the reduction in the plaintiff’s award resembles the split-award statute. However, the split-award reform does not involve an increase in the award paid by the defendant. Choi and Sanchirico (2004) show that the system proposed by Polinsky and Che may still have a negative effect on deterrence. Given that the award paid by defendants is increased, they will spend more on legal advice. This will force plaintiffs to spend more on attorneys as well and discourage some plaintiffs from filing a lawsuit.
\textsuperscript{11} If the harm to society due to accidents is low enough, the positive welfare effects of the split-award of lowering the likelihood of trial (and therefore, reducing the resources spent on litigation) and reallocating economic resources from expenditures on safety to productive activities may offset the negative welfare effect of increasing the likelihood of accidents.
Our findings indicate that dispute rates are significantly lower when bargaining is performed under the split-award institution. Defendant’s litigation expenses and plaintiff’s net compensation are significantly reduced by the split-award statute. The examination of subjects’ decisions suggests strategic behavior.

The rest of the paper is organized as follows. Section 2 outlines the theoretical model and predictions. Section 3 presents a parameterization of the model. Section 4 describes the experimental design. Section 5 examines the results from the experimental sessions. Section 6 concludes the paper.

2. The theoretical model

Landeo and Nikitin study theoretically the effects of split-awards on the potential injurer’s level of care and litigation outcomes. They construct a strategic model of litigation that consists of two stages. First is a potential injurer’s optimization stage, where a level of care is chosen by the potential injurer according to its cost of preventing accidents (i.e., type) and the expected litigation loss in case of an accident. The level of care determines the probability that an accident occurs. If an accident occurs, a litigation stage begins; modeled as a signaling-ultimatum game between two Bayesian risk-neutral parties, an uninformed plaintiff and an informed defendant12 negotiate prior to a costly trial. In their model there is a continuum of potential injurer’s types.

To test experimentally the effects of the split-award institution on level of care and litigation outcomes, we do not require, however, a continuum of potential injurer’s types. Therefore, we adapt Landeo and Nikitin’s model by allowing for only two types of potential injurers, avoiding in this way to add unnecessary complexity to the experimental design.13

2.1. A simplified version of Landeo and Nikitin’s model

Nature first decides the efficiency type \( i \) of the potential injurer from two possible types \( (i = 1, 2) \). The potential injurer’s type determines its cost \( c_i(y) \) of achieving a given level of care \( y \). Type 1 potential injurers are less efficient than type 2 potential injurers, so for any level of care \( y \), \( c_1(y) > c_2(y) \) (i.e., potential injurers of type 1 need to spend more to achieve the same level of care). The share of type 1 potential injurers is \( \phi < 1 \). The realization of \( i \) is revealed only to the potential injurer, but \( \phi \) is common knowledge. We define \( \lambda(y) \) as the probability of an accident that depends on the level of care \( y \), and assume that the higher the level of care \( y \), the lower the probability of an accident (i.e., the probability of accident is a decreasing function of the level of care).

After observing its type, the potential injurer then decides its optimal level of care, that is, the one that minimizes its total expected loss \( L \). We define the defendant’s total expected loss function as \( L' = c_i(y) + \lambda(y)l \), where \( l \) is the expected loss from legal action, different for careful and negligent defendants. The potential injurer is careful if the chosen level of care is greater than or equal to the due standard of care \( \bar{y} \) (exogenous and common knowledge parameter); otherwise, the potential injurer is negligent.14

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12 The defendant possesses private information about its cost of preventing accidents and, therefore, about its level of care and decision of the court should the case go to trial.
13 The theoretical predictions derived from this simplified model are consistent with the predictions from the original model.
14 In real-world settings, punitive damages are awarded only in cases where the defendant is found grossly negligent. This implies that a care standard is applied. We refer to firms who just meet or exceed the care standard for gross negligence as careful firms and firms who fail to meet the standard as negligent firms.
If an accident occurs, the litigation stage starts. The plaintiff first decides whether to file a lawsuit. This decision is based on her beliefs about the negligence of the defendant conditional on the occurrence of an accident: with probability $q$ she believes that the defendant is negligent, and with probability $(1 - q)$ she believes that the defendant is careful. We assume that the plaintiff’s expected payoff from suing is positive. Therefore, every injured plaintiff has an incentive to file a suit. The pre-trial bargaining negotiation is modeled as a signaling-ultimatum game. The defendant has the first move and makes a settlement proposal. After observing the proposal, the plaintiff, who knows only $\phi$, decides whether to drop the case, to accept the defendant’s proposal (out-of-court settlement) or to reject the proposal (bring the case to the trial stage). The plaintiff’s decision is based on her updated beliefs about the type of defendant she is confronting after observing the defendant’s proposal. If the plaintiff drops the case, both players incur no legal costs. If the plaintiff accepts the defendant’s proposal, the game ends, the defendant pays to the plaintiff the proposed amount, and neither player incurs legal costs.

If the plaintiff rejects the proposal, the plaintiff and the defendant incur legal costs ($K_P > 0$ and $K_D > 0$, respectively). If the defendant is negligent, the court awards punitive damages $A > 0$ to the plaintiff. Under the split-award regime, the plaintiff receives only a fraction $f$ of the total punitive award, and the state gets a share $(1 - f)$ of the award. If the plaintiff rejects the proposal and the defendant is careful, no punitive damages are awarded.

Note that the total harm caused by an accident includes: (1) the private harm caused to the plaintiff, which we assume is fully compensated with the compensatory damage award and, (2) the social harm $H$, generated by the defendant’s wanton behavior and which warrants punitive damages. $H$ may include additional losses directly caused to the plaintiff but not compensated with the compensatory award such as time spent on and emotional distress caused by the compensatory damages lawsuit and social losses such as undermining of society’s moral standards and institutions due to the wanton behavior of the defendant.

Note also that without loss of generality, for the sake of mathematical tractability and given that our primary goal is to explore the effect of the split-award statute, which applies to the punitive damage award only, we abstract from compensatory damages.

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15 These beliefs are taken as parametric for the analysis of the litigation subgame; however, the equilibrium values for $q$ and $(1 - q)$ will ultimately be determined as part of the overall equilibrium. These equilibrium values depend on the optimal levels of care chosen by all firms in the first stage of the game, according to their types and expected litigation costs (that correspond to the equilibrium in the litigation stage). Note that the values of $q$ and $(1 - q)$ are common knowledge, but the firm’s type and the chosen level of care are known only by the firm.

16 Note that $K_P$, $K_D$, $A$ and $f$ are exogenous and common knowledge parameters of the model.

17 We have restricted the proposal space to $[0, fA - K_P]$ (i.e., a proposal cannot be negative or greater than the maximum amount the plaintiff can get in court).

18 Given that we have not assumed that the court perfectly estimates the social harm caused by the negligent behavior of the defendant, our model allows for $H$ and $A$ to be different.

19 The model can be modified to incorporate compensatory damages without altering the qualitative predictions presented here in the following way. Assume that the court awards compensatory damages, CDA (common-knowledge) whenever the accident happens (i.e., strict liability applies), but it awards punitive damages $A$ only if the firm fails to achieve the care standard for gross negligence. Assume also bifurcation of trial: two separate trials decide on compensatory and punitive damage awards, that the compensatory damages game has the same structure as the punitive damages game presented here, and that legal costs, $K_{PCDA}$ and $K_{PSCDA}$, are paid by the plaintiff and defendant, respectively, only in case of trial. Then, in case of an accident, the plaintiff and the defendant do not have asymmetric information with regard to prospective compensatory damage awards, and therefore, they settle out of court. Thus, every defendant will offer $CDA - K_{PCDA}$, and every plaintiff will accept. Thus, the total loss function is given by $L = c(y(n), n) + \lambda y(n)(CDA - K_{PCDA} + l)$, where
The sequence of events in the game is shown in Fig. 1.

The model is solved backwards. We start by finding the solution of the litigation stage, using the perfect Bayesian equilibrium concept and the universal divinity refinement (Banks and Sobel, 1987). Second, we analyze the defendant’s optimization problem and find the defendant’s opti-
mal level of care. This level of care depends on the defendant’s type and the litigation stage equilibrium.\(^{20}\)

In equilibrium: (1) the more efficient firms (type 2 firms) choose to be careful (optimal level of care greater than or equal to the due care standard)\(^ {21}\) while the less efficient firms (type 1 firms) choose to be negligent (optimal level of care lower than the due care standard), and (2) some lawsuits are dropped, some are resolved out-of-court, and some go to trial.

2.2. Qualitative predictions

The qualitative predictions of the model are summarized in Propositions 1–5.\(^ {22}\)

**Proposition 1.** A decrease in the plaintiff’s share of the punitive award, \(f\), reduces the aggregate level of care.

A reduction in \(f\) decreases the expected litigation loss for the defendant, and it reacts by lowering its level of care.

**Proposition 2.** A decrease in the plaintiff’s share of the punitive award, \(f\), increases the probability of an accident.

By assumption, the probability of an accident is negatively related to the level of care. By Proposition 1, a decrease in \(f\) reduces the aggregate level of care. Then, the probability of an accident will increase.

We can make unambiguous predictions about the unconditional and conditional probabilities of trial if type 2 potential injurers just meet the due care standard. It is important to note, however, that this condition is sufficient (but not necessary) for the results of Proposition 3 to hold.

**Proposition 3.** A decrease in the plaintiff’s share of the punitive award, \(f\), reduces the unconditional and the conditional probabilities of trial if type 2 potential injurers just meet the due care standard.

Given that the split-award statute applies only when the case is settled in court, the parties have an incentive to settle out of court in order to cut out the state. Note that given that litigation costs are paid by the parties only in case of a trial, split-awards also reduce the expected total litigation costs paid by both parties.

We define the plaintiff’s rejection threshold as the proposal level below which all (positive) proposals are rejected by the plaintiff.\(^ {23}\)

**Proposition 4.** A decrease in the plaintiff’s share of the punitive award, \(f\), reduces the plaintiff’s rejection threshold and the defendant’s equilibrium (positive) proposal.

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\(^{20}\) The solution to the model is presented in Appendix A, available on the JEBO website at [http://www.elsevier.com/locate/econbase](http://www.elsevier.com/locate/econbase). The solution of the litigation stage is the same for both the original model and the simplified version presented here. The proofs related to the optimization problem of the defendant and to the qualitative predictions, presented in Appendices A and B, are different from the original model proofs. However, the qualitative predictions are the same for both models.

\(^{21}\) If type-2 firms are very efficient, then their optimal level of care will be greater than the due care standard; otherwise, their optimal level of care will be equal to the due care standard.

\(^{22}\) The proofs of the propositions are presented in Appendix B, available on the JEBO website at [http://www.elsevier.com/locate/econbase](http://www.elsevier.com/locate/econbase).

\(^{23}\) We do not consider here proposals equal to 0.
Under the split-award, the plaintiff expects to obtain a lower payoff at trial, so the plaintiff is more willing to accept lower out-of-court settlement proposals and the defendant, anticipating the behavior of the plaintiff, will make lower settlement offers.

**Proposition 5.** A decrease in the plaintiff’s share of the punitive award, \( f \), reduces the defendant’s expected loss from legal action.

Under the split-award, the plaintiff’s rejection threshold (and the defendant’s equilibrium proposal) and the dispute rate are lower. Therefore, the split-award reduces the defendant’s expected loss from legal action.

Note that a welfare analysis of the split-award tort reform should consider all its individual effects, such as, the effect on the aggregate expenditure on care, the harm that an accident causes to society, and the costs of litigation.24

Define the social cost of accidents as the sum of aggregate expenditures on accident prevention, unconditional expected damage that accidents cause to society, and unconditional expected litigation costs. A decrease in \( f \) reduces the level of care of low-type firms and does not affect the level of care of high-type firms. Therefore the aggregate expenditures on accident prevention must decrease. In addition, given that a decrease in \( f \) lowers the level of care and, therefore, increases the probability of an accident, we can conclude that a decrease in \( f \) increases the unconditional expected damage that accidents cause to society. Finally, assuming that the high-type firms just meet the standard of care, a reduction in \( f \) reduces the unconditional probability of trial. Hence, if the level of the harm an accident causes to society is sufficiently low (for a particular value of \( f \)), we may expect that split-awards decrease the social costs of accidents.

Finally, note that when \( y \) is large enough (which can be interpreted as overdeterrence), the positive effect of the split-award reform outweighs the negative effect. In fact, for sufficiently large values of \( y \), the probability of an accident approaches 0, so, a marginal change in \( f \) has almost no impact on the probability of an accident and, therefore, almost no effect on the unconditional expected damage that accidents cause to society. In addition, given that \( \lambda(y) \) is very close to 0, a marginal reduction in \( y \) due to a reduction in \( f \) has a negligible effect on the probability of an accident caused by a careful defendant. Therefore it has a negligible impact on the unconditional probability of trial and on the expected litigation costs.25 Hence the only non-negligible (and positive) welfare effect of lower \( f \) will be the effect on reducing the aggregate expenditures on accident prevention.

### 3. Model parameterization

The model parameterization presented in this section will be used in the experimental design. The functional forms and parameter values chosen follow the assumptions on primitives of the model26 and are presented below.

Let \( n^i \) denote the efficiency factor associated with the type \( i \) potential injurer. Assume that the expenditures-on-care function is \( c^i(y) = (1 - n^i)y^3 / 10^5 \) and the probability of an accident is \( \lambda(y) = (1 - 0.001y)^2 \). Therefore, the potential injurer’s total expected loss is \( L = (1 - n^i)y^3 / 10^5 + (1 - 0.001y)^2 l \), where \( l \) is the expected litigation cost in case of an accident;

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25 Note that this analysis does not rely on the assumption that the high-efficiency type just meets the standard.

26 Primitives of the model are all the conditions stated at the beginning of Section 2.1 and in the Appendix A.
$l = fA - K_P$ for the negligent potential injurer ($y < \bar{y}$), and $l = [(fA + K_P)/(A + K_D)]K_D$ for the careful one ($y \geq \bar{y}$).

Differentiating the total expected loss function with respect to $y$ and setting to 0, we obtain:

$$\frac{\partial L}{\partial y} = \frac{30(l - n^i) y^2 - 2(1000 - y)l}{10^6} = 0. \quad (1)$$

Solving for $y$, in case the potential injurer chooses an interior solution, yields the optimal level of care:

$$y = \frac{-l + \sqrt{l^2 + 60,000l(1-n^i)}}{30(1-n^i)}. \quad (2)$$

Assume the following parameter values: $n^2 = 0.99, n^1 = -0.6$; the share of the low-skill potential injurers (type 1 potential injurers) $\phi = 0.8$; $A = 500$, $K_D = K_P = 100$, $\bar{y} = 290$. Assume also that the potential injurer’s proposal $S$ can be $S = 0$ or $S > 100$.\(^{27}\) Consider two values for $f$: $f = 1$ (no split-award regime, all punitive damages award going to the plaintiff) and $f = 0.5$ (split-award regime, only half of the punitive damages award going to the plaintiff).\(^{28}\)

Under the no-split award regime ($f = 1$), the unique divine perfect Bayesian equilibrium (PBE) is as follows. For the type 2 potential injurer: (1) the optimal level of care will be $y^2 = 480 > \bar{y}$, that is, the high-skilled potential injurer chooses to be careful and its level of $y$ is above the standard; this level of care corresponds to a level of expenditure on care equal to 11, and (2) the defendant will propose $S = 0$ with certainty. For the type 2 potential injurer: (1) the optimal level of care will be $y^1 = 121 < \bar{y}$, that is, the low-skilled potential injurer chooses to be negligent; this level of care corresponds to a level of expenditure on care equal to 28, and (2) the defendant will randomize between a compensation proposal $S = 0$ ($P = 0.02$) and $S = 400$ ($P = 0.98$). The plaintiff will randomize between accepting ($P = 0.33$) and rejecting ($P = 0.67$) an offer $S = 0$ and will always accept an offer $S = 400$.

Under the split-award regime ($f = 0.5$), the unique divine PBE is as follows. For the type 2 potential injurer: (1) the optimal level of care will be $y^2 = 333 > \bar{y}$ (i.e., the high-skilled potential injurer still chooses a level of $y$ above the standard), a level of care corresponding to a level of

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\(^{27}\) We have limited the set of possible offers to $S = 0$ and $S > 100$ in order to rule out the separating PBE that do not survive the Banks and Sobel’s divinity refinement. See Appendix A for description of these other PBE that are not divine PBE. Therefore, under this set of possible offers, there is a unique PBE.

\(^{28}\) Our model parameterization satisfies all the model assumptions on primitives and, therefore, the predictions derived from these assumptions. In addition, this examination satisfies the theoretical prediction stated in Proposition 3 without relying on the sufficient (but not necessary) condition (which implies that the type-2 defendants just meet the due care standard). Instead, it assumes the existence of two very different types of defendants characterized by very different values for the parameter $n$, the efficiency factor. Type 1, the low efficiency type chooses to be negligent in equilibrium, and type 2, the very efficient type, exceeds the due care standard in equilibrium. The chosen functional forms for the expenditure-on-care $c(y)$ and probability of an accident $\lambda(y)$ functions are the simplest possible forms that satisfy the theoretical assumptions. In addition, these functional forms restrict the expenditure-on-care function to take positive and easy-to-comprehend values (i.e., real numbers between 0 and 1000) and the probability of accident function to take values between 0 and 1. Note also that given the functional form for $\lambda$, the maximum value that the level of care $y$ can take is $y_{\text{max}} = 1000$. Note also that this model parameterization permits us to meet the requirements of the experimental design: (1) two experimental treatments (split-award and no split-award) sufficiently different from each other (in particular, the value of $f$ in the case of the split-award needed to be much less than 1 in order to have a plaintiff’s award in case of trial substantially smaller under the split-award condition), and (2) a probability of an accident sufficiently high, in order to have an efficient collection of data related to the litigation stage. Finally, note that the parameters chosen provide empirically relevant predictions, such as a low probability of trial.
Table 1
Expected direction of the effects of the split-award statute

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<tr>
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<th>Split-award</th>
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<tr>
<td>Expenditure on care</td>
<td>Decreases</td>
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<tr>
<td>Conditional probability of trial</td>
<td>Decreases</td>
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<tr>
<td>Expected total litigation costs</td>
<td>Decreases</td>
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<tr>
<td>Defendant’s proposal</td>
<td>Decreases</td>
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<tr>
<td>Plaintiff’s rejection threshold</td>
<td>Decreases</td>
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<tr>
<td>Defendant’s expected litigation loss</td>
<td>Decreases</td>
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<tr>
<td>Plaintiff’s expected net compensation</td>
<td>Decreases</td>
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expenditure on care equal to 4, and (2) the defendant will propose $S = 0$ with certainty. For the type 1 potential injurer: (1) the optimal level of care will be $y_1 = 76 < \bar{y}$ (i.e., the low-skilled potential injurer chooses to be negligent), a level of care that corresponds to a level of expenditure on care equal to 7, and (2) the defendant will randomize between a compensation proposal $S = 0 (P = 0.07)$ and $S = 150 (P = 0.93)$. The plaintiff will randomize between accepting ($P = 0.75$) and rejecting ($P = 0.25$) an offer $S = 0$ and will always accept an offer $S = 150$.

The qualitative effects of the split-award statute are summarized in Table 1. Split-awards will reduce the conditional probability of trial (and the expected total litigation costs) but will also reduce the expenditure on care and, therefore, will increase the probability of accidents. In addition, the defendant’s equilibrium (positive) proposal and the plaintiff’s rejection threshold will be lower under the split-award statute. Finally, the defendant’s expected litigation loss from legal action and the plaintiff’s expected net compensation (net of litigation cost) will be reduced by the split-award statute.29

4. Experimental design

In assessing the validity of the qualitative theoretical predictions, our experimental study analyzes the effect of a reduction in the plaintiff’s share of punitive award on the potential injurer’s level of care and probability of trial using a two-treatment between-subjects design.

We have specified the experimental setting in a way that satisfies the assumptions of the theory.30 Although our experiment cannot predict the effects of decreasing the plaintiff’s share of punitive award in richer environments, the experiment can provide a reasonable amount of evidence regarding whether the reduction of plaintiff’s share of punitive award in an environment such as the one we have structured here will have the predicted effects.

The experimental design consists of two conditions corresponding to two levels of plaintiff’s share of punitive award $f$: $f = 0.5$, which implies that 50 percent of the punitive award goes to the plaintiff (split-award condition), and $f = 1$, which implies that the total punitive award goes to the plaintiff (no split-award condition).

29 The effect of split-awards on plaintiff’s expected net compensation is in general ambiguous. However, under this model parameterization, split-awards unambiguously reduce the plaintiff’s expected net compensation.

30 Even though the theoretical model assumes risk neutrality of players, we have decided not to control for risk preferences. If the behavior of subjects deviates systematically from the qualitative theoretical predictions based on risk neutrality, then the model will not capture essential elements of bargaining such as risk preferences. Therefore, a modification of the game theoretic model should be pursued (see Davis and Holt, 1993; Smith, 1989).
4.1. The games

Procedural regularity is accomplished by developing a software program that permits subjects to play the game by using networked personal computers. The software consists of two versions of the game, reflecting the two experimental conditions. The software includes two information boxes (one containing the role and type of the subject, and the other containing the current balance). Subjects are provided with written instructions and a simple calculator. The instructions contain information about the possible choices for each player at each stage of the game, a graphical representation of the stages of the game, and payoff tables.31

The experiment is a multi-stage game. Subjects play the role of player A (the potential injurer)32 or player B (the plaintiff). We motivate the game to the subjects using a litigation context.33 We use a laboratory currency called the “token” (1 token = 2 Canadian cents).34 The parameter values used in this experiment follow the numerical examination presented in the previous section. Subjects are each given 800 tokens at the beginning of the game. After roles are randomly assigned to subjects, the type of potential injurer is drawn by the computer from a binomial distribution (low-type probability equal to 0.8 and high-type probability equal to 0.2). This type is revealed only to the potential injurer. The plaintiff knows only the probability distribution from which the type is chosen.

The game consists of at most two stages. In the first stage (potential injurer’s decision-making stage), the potential injurer chooses the level of expenditure on safety (called “investment level” in the experiment), which is not revealed to the plaintiff. In order to facilitate the understanding of the game, we simplify the sets of possible expenditure levels for each potential injurer’s type. These sets, similar in both conditions, consist of three options for the low-type potential injurer (7, 28 and 390 tokens) and three options for the high-type potential injurer (2, 4 and 11 tokens). Each set contains the equilibrium expenditures specified by theory (i.e., 7 and 28 for the low-type potential injurer in conditions 1 and 2, respectively, and 4 and 11 for the high-type potential injurer in conditions 1 and 2, respectively). Note that, in order to achieve the standard of care $\bar{y} = 290$, and given the strong efficiency difference between both types, the high-type injurer needed to spend 4 tokens, and the low-type injurer needed to spend 390 tokens.

The chosen expenditure on care (that determines the probability that an accident occurs) is subtracted from the potential injurer’s initial endowment. The possible expenditure levels for each type of potential injurer and the associated probabilities of accident are common knowledge. Given the level of investment chosen, the computer randomly decides if an accident happens and informs both players of the result. If the accident does not occur, the game ends. The payoff for the plaintiff is equal to his initial endowment, and the payoff for the potential injurer is equal to her initial endowment minus the chosen level of investment.

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31 Software screens and written instructions are available from the authors upon request.
32 The potential injurer becomes the defendant after an accident occurs.
33 Research on cognitive psychology indicates that subjects may seem like zero intelligence agents when they are placed in the unfamiliar and abstract context of an experiment, even if they function quite adequately in familiar settings. In these cases, subjects will apply their own labels (Loewenstein, 1999). Also a study conducted by experimental economists (Cooper and Kagel, 2003) reports compelling evidence for the existence of context effects. However, we use neutral labels for the subjects’ roles (Players A and B) because we consider that the use of more realistic labels (i.e., potential injurer and plaintiff) will not contribute to the subjects’ understanding of the game and may generate noise in the subjects’ responses due to the degree of identification with the role described by the label.
34 The use of tokens allows us to create a fine payoff grid that underlines the payoff differences among actions.
If the accident happens, the second stage (litigation stage) starts and a level of damage equal to 200 tokens (equal in both conditions) is deducted from the plaintiff’s initial endowment, then the defendant proposes a level of compensation \( S \) (\( S = 0 \) or \( 100 < S \leq \) defendant’s current balance) to the plaintiff. The plaintiff needs then to decide whether to accept or reject it. If the plaintiff rejects the defendant’s proposal, the court decides the award based on the level of investment chosen by the defendant. If the defendant is negligent, he loses an amount equal to \( A + K_D \) and the plaintiff receives a compensation equal to \( fA - K_P \); if the defendant is careful, he loses \( K_D \), and the plaintiff loses \( K_P \). Then the game ends. If the plaintiff accepts the proposal, the defendant pays the plaintiff the proposed amount and the game ends.

4.2. The experimental sessions

We ran eight 80-min sessions of 8–12 subjects each (70 subjects in total) at the experimental laboratory of the University of Alberta School of Business. The subject pool was recruited from undergraduate classes at the University of Alberta, mostly by posting advertisements on public boards and on an electronic bulletin board.

At the beginning of each session, written instructions were provided to the subjects. The instructions about the game and the software used were presented aloud by the experimenter to create common knowledge. Subjects were informed about the random process of allocating roles and about the randomness and anonymity of the process of forming pairs. Game structure, initial endowment, possible levels of investment and probabilities of accident associated, payoffs, prior beliefs about the distribution of player A’s types were common knowledge among subjects. Subjects were informed only about the game version they were assigned to play. Subjects were also instructed that they would receive the dollar equivalent of the tokens they held at the end of the experiment, and they were informed about the token/dollar equivalence. Subjects were then required to fill out a short questionnaire to ensure their ability to read the information tables.

To ensure subjects’ understanding of the task to be performed, 30 practice games were played before the play of the actual game. The structure of the practice games and computer screens used were similar to the actual game; the only difference was that the practice games were played against a computer partner while the actual game was played against a human partner. During the first 15 practice games the subjects played the role of player A and during the last 15 practice games they played the role of player B. The structure of the practice games allowed subjects to

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35 Note that the deduction of 200 tokens can be interpreted as the additional losses directly caused to the plaintiff but not compensated with the compensatory award. Empirically, the argument of uncompensated losses is used by supporters of punitive damages. They state that given that plaintiffs are not fully compensated with the compensatory award, they deserve at least part of the punitive damage award. In this way, our experimental design resembles the situation experienced by plaintiffs in lawsuits involving punitive damages. Note also that the deduction of 200 tokens after an accident occurs makes the task more understandable to subjects without violating the theory. Finally note that given that both conditions are similar except for the value of \( f \), any difference between these conditions can be attributed to the effects of the split-award tort reform.

36 The values used are as follows: \( A = 500 \), \( K_D = K_P = 100 \), \( f = 1 \) in the no-split-award condition and \( f = 0.5 \) in the split-award condition.

37 Given that we needed to explain the payoff structure in detail and aloud and given that the payoff structure in case of trial is different for each condition, we run only one version of the game per session. However, internal validity was preserved by random assignment of subjects to conditions. Also, sessions under both conditions were run each day and similar populations of subjects were used in both conditions. Finally, independence of observations was guaranteed by the one-shot game characteristic of the experiment.
familiarize themselves with the structure of the game, the likelihood to confront any of the two types of player A, and the consequences of the decisions of both players in terms of payoffs, without conditioning subjects’ behavior.

Note that the practice games were not stationary repetitions of the real game. They present enough variation in roles and decisions of the computer partner to help subjects to understand the mechanics of the game, while avoiding conditioning their behavior. The number of practice games was chosen (i) to allow the computer-partner to choose the same number of times each of the three investment levels per type and, therefore, avoid conditioning the behavior of subjects, (ii) to help subjects to understand, through the realizations of types, the meaning of the probabilities of encountering low and high types (80 and 20 percent, respectively), and (iii) to allow subjects to play as players A or B the same number of times. The realization of the random variables “actions of the computer-partner” and the realization of the random variable “accident occurrence” (determined by the level of investment chosen by player A, computer or human subject) were fixed for each practice game, across conditions, subjects and experimental sessions.

During the first 15 practice games, where the subject was player A: (i) 12 times the subject was a low-type player A (80 percent of the time player A was low type) and 3 times the subject was a high-type player A (20 percent of the time player A was high type), and (ii) the computer-partner played the acceptance/rejection decision according to the realization of the binomial random variable “acceptance of proposal” (with probability equal 0.5 that the realization be acceptance) that was fixed for each practice game, across conditions, subjects and sessions. During the last 15 practice games, where the subject was player B: (i) 12 times the computer partner was a low-type player A and chose 7, 28, and 390 as a level of investment 4 times each (80 percent of the time player A was a low type and each level of investment was played an equal number of times) and 3 times the computer partner was a high-type player A and chose 2, 4 and 11 as a level of investment 1 time each (20 percent of the time player A is high type and each level of investment was played an equal number of times), and (ii) if an accident occurred, the computer made a proposal according to the realization of the uniform random variable “proposal”, which was fixed for each practice game, across conditions, subjects and sessions.

After the last practice game was played, every participant was randomly assigned a role and randomly and anonymously paired with another participant and played a one-shot game. Each player was equally likely to have the role A or B and to be paired with any other participant, and players were completely anonymous to one another. Communication between players was done through a computer terminal.38

We decided to use a one-shot game because the analysis of how people learn in highly repetitive situations (learning in games) was not the focus of this study. We were interested in the predictive power of the theoretical model on the effects of the split-award tort reform in real-world settings where stationary replications are almost impossible and, therefore, the type of learning studied in the laboratory under stationary repetitions is not present.39 In addition, psychological research

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38 This experimental environment did not permit the formation of reputations. Given that the purpose of the practice games was to facilitate the understanding of the mechanics of the experiment (game structure, payoffs and consequences of the decisions), we made subjects play practice games against a computer terminal. Subjects were informed that their partner during these practice games was a computer and that they should not expect that their human partner in the real game would necessarily behave as the computer did and that they would not necessarily need to behave as the computer did. In this way, the experience to play against a human partner was a one-shot experience.

39 As noted by Camerer (1997) and stressed by Loewenstein, “the situation that participants face in experiments of this type [resembles] that of the protagonist in the film ‘Groundhog Day’, who repeatedly relives the same day until he ‘gets it
shows that people’s behavior at the end of a series of stationary repetitions is not necessarily more representative of their behavior in economic settings than their behavior at the beginning. “Repetition tends to repress certain types of psychological motives that may play a prominent role in early period play [and may be important in real-world settings]” (Loewenstein, 1999, p. F29; comments added in parenthesis).

The participation fee was CA $5.00, and the average game payoff was CA $13.50. At the end of each experimental session, subjects received their monetary payoffs in cash.

5. Results

In general, our findings are consistent with the qualitative theoretical predictions of the litigation stage. Tables 2–5 summarize the experimental results.40

The first column of Table 2 presents information regarding the effect of the split-award institution on potential injurer’s level of care. Contrary to the theoretical predictions, the results do not suggest a significant difference between the expenditures on care chosen under the two conditions.41 Given that subjects understood the structure of the payoff tables, the structure of the game, and the consequences of their choices (i.e., they understood the link between the choice of investment in care, the probability of an accident and the litigation outcomes),42 this finding may suggest an inability of subjects to incorporate the future implications of their decisions in their current decisions due to their limited computational abilities.43 In addition, the complexity of the decision on care44 might induce subjects to make decisions about the investment on care

right”. Outside of this fictional film, how many people are exposed to the situation of repeatedly, and in close succession, bidding on the same good? Stationary replication is simply not a common feature of economic life” (Loewenstein, 1999, p. F28; comments in brackets).

40 The information presented in these tables correspond to data pooled on defendant’s type. Given the small number of observations and to avoid the t-test normality assumptions, we used the robust rank-order test. This non-parametric test was chosen instead of the more commonly used Mann–Whitney test because the Mann–Whitney test assumes that the samples come from distributions with identical second (dispersion) and higher order moments, whereas the robust rank-order test makes no such assumption. In general, this test has the same power as the Mann–Whitney test (when the assumptions of that test are met); however, this test appears to approach the normal distribution somewhat faster as the number of observations gets larger (Siegel and Castellan, 1988). In case of the analysis of the defendant’s proposal, the number of observations was smaller than 13. Then, we used the small-sample distribution of $U$ rather than the normal approximation. In this case, we were constrained to use only four significant levels: 0.10, 0.05, 0.025, and 0.01, rather than the near-continuum available for the normal approximation (Fligner and Policello, 1981). Because of the small number of observations, we used the Fisher exact test (instead of the $\chi^2$-test) to perform the median test of accepted proposals and to evaluate the null hypothesis of independence between experimental conditions and dispute rates (Siegel and Castellan, 1988).

41 Given the results on expenditures on care and given that the probability of accidents depends on the level of expenditures on care chosen, we have not included here the analysis of the probability of accidents.

42 The results from the questionnaire filled out by subjects before the beginning of the game indicated that subjects understood the structure of the payoff tables, the structure of the game, the consequences of their choices, and the links between their decisions.

43 Previous experimental tests of game-theoretic models report similar results. Referring to the play of games by experimental subjects, Camerer and Johnson (2004) state that, “motivated intelligent subjects behave sensibly, but do not exhibit the extent of strategic reasoning which is commonly assumed when game theory is applied to understand... political maneuvering, incentive design, and so forth” (p. 15). Also Camerer (2003) reports that “[his work with Johnson et al. (2002) indicates that] players in a three round game [do] not look ahead to the second and third rounds as much as backward induction requires” (p. 197; comments added in brackets).

44 Note that the decision on care and the realization of the litigation losses were separated by the random realization of the accident and the pre-trial bargaining negotiation.
Table 2
Mean expenditures on care, dispute rate and mean total litigation costs

<table>
<thead>
<tr>
<th></th>
<th>Expenditures on care</th>
<th>Dispute rate</th>
<th>Total litigation costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split-award [n = 17]</td>
<td>38.47 (22.11)</td>
<td>0.314 (0.13)</td>
<td>61.54 (26.65)</td>
</tr>
<tr>
<td>No split-award [n = 18]</td>
<td>37.44 (20.89)</td>
<td>0.88 (0.08)</td>
<td>176.47 (16.11)</td>
</tr>
<tr>
<td>Ū</td>
<td>0.14</td>
<td>–</td>
<td>–3.60</td>
</tr>
<tr>
<td>P</td>
<td>0.889</td>
<td>0.002</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Note: Standard errors are in parentheses; sample sizes are in brackets; for the first and third columns, P-values correspond to two-sided robust rank-order statistic test; for the second column, P-value corresponds to two-sided Fisher exact statistic test.

Table 3
Plaintiff’s rejection threshold and mean defendant’s proposal

<table>
<thead>
<tr>
<th></th>
<th>Plaintiff’s rejection threshold</th>
<th>Defendant’s proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split-award [n = 12]</td>
<td>130 (–)</td>
<td>165.58 (13.06)</td>
</tr>
<tr>
<td>No Split-Award [n = 12]</td>
<td>310 (–)</td>
<td>211.67 (26.55)</td>
</tr>
<tr>
<td>Ū</td>
<td>–</td>
<td>–1.12</td>
</tr>
<tr>
<td>P</td>
<td>–</td>
<td>&gt;0.10</td>
</tr>
</tbody>
</table>

Note: Standard errors are in parentheses; sample size are in brackets; P-value corresponds to two-sided robust rank-order statistic test.

Table 4
Mean defendant’s litigation loss and mean plaintiff’s net compensation

<table>
<thead>
<tr>
<th></th>
<th>Defendant’s litigation loss</th>
<th>Plaintiff’s net compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split-award [n = 13]</td>
<td>229.38 (47.13)</td>
<td>129.38 (29.73)</td>
</tr>
<tr>
<td>No split-award [n = 7]</td>
<td>542.06 (34.03)</td>
<td>365.59 (29.58)</td>
</tr>
<tr>
<td>Ū</td>
<td>–4.82</td>
<td>–8.12</td>
</tr>
<tr>
<td>P</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Note: Standard errors are in parentheses; sample size are in brackets; P-values correspond to two-sided robust rank-order statistic test.

by applying heuristic-based-reasoning. Given the random assignment of subjects to conditions, it is expected that the use of heuristic-based-reasoning was common to both conditions.

The second column of Table 2 reports the findings on dispute rates conditional on the occurrence of an accident. Dispute rate was defined as the percentage of total cases that proceed to the stage

45 Findings from cognitive psychology suggest that human subjects present limited computational abilities. When confronting complex situations, people make use of heuristic reasoning, such as, shortcuts used by individuals to make decisions. Tversky’s (1972) theory of “elimination by aspects,” for example, states that individuals choose among alternatives, not only by comparing alternatives in all aspects at once, but rather by the heuristics of comparing one randomly chosen aspect at a time, eliminating alternatives along the way. Simon (1955, 1987) hypothesizes that agents perform only limited searches, accepting the first satisfactory decision, process coined as “bounded rationality.” Heuristics are rational in the sense that they appeal to intuition and avoid deliberation cost, but boundedly rational in the sense that they often lead to biased choices (Conlisk, 1996). Applying the findings from cognitive psychology to the study of the law, Korobkin (in press) finds that “difficult decisions. . . are resolved by making easier choices. . . Reliance on a heuristic implies neglect of at least some potentially relevant information, and if the heuristic is not precisely suited to the relevant problem, suboptimal outcomes will result” (p. 3).
of a trial. As predicted by the model, dispute rates were significantly reduced by the split-award institution. In fact, 88 percent of the pairs in the no split-award condition went to trial, but only 31 percent of cases in the split-award condition were resolved at the trial stage, a strongly significant difference ($P = 0.002$). The third column of Table 2 outlines the findings on total litigation costs conditional on accident occurrence. We defined total litigation costs as the sum of costs incurred by each litigant. Our findings provide strong support for the theoretical prediction of the effect of the split-award in reducing the total litigation costs. We found that when pairs bargained under the split-award institution, the total litigation costs were 65 percent lower than those without a split-award, a significant difference ($P = 0.000$).

The first column of Table 3 shows the plaintiff’s rejection threshold. As predicted by the theory, we found that the split-award reduced this threshold by 58 percent. The threshold under the split-award was equal to 130 and the threshold under the no-split award was equal to 310. This effect may suggest strategic behavior of plaintiffs in forming their rejection decision. If plaintiffs were strategic, they would form their rejection decision on the basis of the payoff at trial. Given that the payoff at trial in case of confronting a negligent defendant is reduced by the split-award, they would reduce their rejection threshold under the split-award institution. The strategic behavior of plaintiffs is also suggested by the median accepted proposal 3 under both conditions. In fact, the median accepted proposal under the split-award was 53 percent lower than the median accepted proposal under the no split-award condition, a significant difference ($P = 0.055$).

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**Table 5**
Quantitative theoretical predictions and experimental results

<table>
<thead>
<tr>
<th></th>
<th>Predicted</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Split-award</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditures on care</td>
<td>6.40</td>
<td>38.47</td>
</tr>
<tr>
<td>Dispute rate</td>
<td>0.048</td>
<td>0.31</td>
</tr>
<tr>
<td>Total litigation costs</td>
<td>9.60</td>
<td>61.54</td>
</tr>
<tr>
<td>Defendant’s proposal</td>
<td>150.00</td>
<td>165.58</td>
</tr>
<tr>
<td>Plaintiff’s rejection threshold</td>
<td>150.00</td>
<td>130.00</td>
</tr>
<tr>
<td>Defendant’s litigation loss</td>
<td>135.61</td>
<td>229.38</td>
</tr>
<tr>
<td>Plaintiff’s net compensation</td>
<td>121.21</td>
<td>129.38</td>
</tr>
<tr>
<td><strong>No split-award</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditures on care</td>
<td>24.60</td>
<td>37.44</td>
</tr>
<tr>
<td>Dispute rate</td>
<td>0.067</td>
<td>0.88</td>
</tr>
<tr>
<td>Total litigation costs</td>
<td>13.41</td>
<td>176.47</td>
</tr>
<tr>
<td>Defendant’s proposal</td>
<td>400.00</td>
<td>211.67</td>
</tr>
<tr>
<td>Plaintiff’s rejection threshold</td>
<td>400.00</td>
<td>310.00</td>
</tr>
<tr>
<td>Defendant’s litigation loss</td>
<td>373.18</td>
<td>542.06</td>
</tr>
<tr>
<td>Plaintiff’s net compensation</td>
<td>359.77</td>
<td>365.59</td>
</tr>
</tbody>
</table>

---

46 The analysis in this table refers to positive proposals from the defendant (i.e., proposals greater than 0).
47 In condition 1, all proposals greater than or equal to the rejection threshold were always accepted by the plaintiff except for the proposal equal to 200 that was proposed by four defendants and rejected by one plaintiff; in condition 2, all proposals greater than or equal to the rejection threshold were always accepted by the plaintiff.
48 Note that in equilibrium, the plaintiff should expect that only negligent defendants make a positive proposal.
49 The median accepted proposals were equal to 167 and 357.5 for the split-award and no split-award conditions, respectively. The $P$-value corresponds to the Fisher exact probability for a median test.
The second column of Table 3 provides information about the defendant’s mean proposals under the two institutions. The findings provide some support for the theoretical predictions about the effect of the split-award in reducing the defendant’s mean proposal. In fact, the defendant’s mean proposal under the split-award was 22 percent lower than the one without a split-award (but not significantly different, \( P > 0.10 \)).

The first column of Table 4 provides information about the defendant’s expected total litigation loss. We defined the defendant’s total litigation loss as the accepted proposal that is transferred from the defendant to the plaintiff in case of an out-of-court settlement or as the deduction from the defendant’s payoff imposed by the court in case of trial plus the defendant’s litigation costs. We found a positive and strongly significant effect (\( P = 0.000 \)) of the split-award in reducing the defendant’s expected total litigation loss. This effect can be explained by the lower probability of trial and the lower plaintiff’s rejection threshold (and therefore, the lower out-of-court transfers on average) under the split-award institution. The second column of Table 4 summarizes the results about the plaintiff’s expected net compensation (net of litigation cost). We also found that the split-award reduced significantly (\( P = 0.000 \)) the plaintiff’s net compensation. This result is obviously related to the reduction of plaintiff’s rejection threshold (and lower out-of-court transfers on average) and to the lower plaintiff’s payoff at trial (in case of confronting a negligent defendant) under the split-award institution.

In the next step we will contrast the quantitative predictions of the model and the experimental results. Table 5 summarizes the quantitative theoretical predictions and the experimental results.

Under both institutions, the predicted values from the theory overestimate the empirical results for the plaintiff’s rejection threshold and underestimate the empirical results for the expenditures on care, dispute rate (and total litigation costs), defendant’s litigation loss and plaintiff’s net compensation. This might suggest that the experimental subjects did not satisfy the assumptions of the model as well as the existence of non-modeled factors that affect subjects’ decisions.

For instance, the patterns of the levels of care that defendants followed in the first stage of the game (under both conditions) and the comparison of these levels of care to the predicted values suggest risk-averse attitudes. More risk-averse subjects prefer to spend reasonably more (24 instead of 7 tokens, but not 390 tokens) on care in order to reduce the likelihood of an accident. In fact, the mean expenditure on care under the split-award was 38.47, a value higher than the predicted value (equal to 6.40), with 94 percent of these defendants spending more than the predicted value.

Similarly, under the no split-award condition, the mean expenditure on care chosen by the defendants was 52 percent higher than the predicted value (equal to 24.60), with 50 percent of these defendants spending more than the predicted value.

50 The data correspond to cases where the defendant made a positive proposal (i.e., proposals greater than 0).
51 Note that the proposals were located in the intervals [101, 250] and [101, 405] for the split-award and the no split-award conditions respectively. Note also that 33 percent of the defendants in both conditions chose a proposal equal to 200 (i.e., equal to the plaintiff’s loss due to an accident). This might suggest that the 200 worked as a focal point for some non-strategic defendants. However, given that 50 percent of offers made in condition 1 were lower than or equal to 150 and 33 percent of offers made in condition 2 were greater than 200, we still observe strategic behavior in some defendants. The analysis of the plaintiffs’ responses to offers equal to 200 suggests that strategic behavior prevailed over other considerations in plaintiffs’ behavior. In fact, 75 percent of offers equal to 200 were accepted in condition 1, while no offer equal to 200 was accepted in condition 2. The dispute rates under both conditions, without considering the offers equal to 200, are also significantly different (Fisher exact \( P = 0.026 \)).
52 The mean accepted proposals are equal to 175.78 and 357.5, under the split-award and no split-award conditions, respectively.
Anomalous plaintiff’s behavior (under both conditions) may be also a result of non-neutral attitudes toward risk. Since the theoretical model assumes risk-neutral players, the risk aversion may explain why observed plaintiff’s rejection thresholds under both conditions are more than 13 percent lower than those stated by the theory. More risk-averse plaintiffs prefer to accept a low settlement offer in order to avoid the risk of not receiving any award in court when confronting a careful defendant. In addition, the observed dispute rates (higher than the predicted rates under both conditions) may suggest that there are other non-modeled factors, such as decision errors that contribute to impasse, besides asymmetric information.

Finally, we will analyze the observed behavior of players in more detail and contrast it with the predictions about the equilibrium strategies. In general, these predictions are inconsistent with the experimental observations. For instance, when bargaining is performed under the split-award institution, the model predicts that there will be an equilibrium with out-of-court settlement for cases where proposals are equal to 150. The results show, however, that the proposal for cases that settle out-of-court are located in the interval [130, 250] and the mean accepted proposal is 175.78. In fact, only 22 percent of the cases that settled out-of-court had proposals equal to the level predicted by the theory, and 33 percent of those cases were located within 15 units of the prediction (i.e., in the interval [135, 165]). The model also predicts that only the negligent defendant will make an out-of-court settlement offer and that this offer will be equal to 150. However, we observed that 8 percent of defendants who made settlement offers were careful, that the settlement offers were located in the interval [101, 250], and only 18 percent of negligent defendants made an offer equal to 150.53

When bargaining is performed under the no split-award institution, the theory predicts an equilibrium with out-of-court settlement where the defendant’s proposal is equal to 400. The empirical results show, however, that the accepted offers are located in the interval [310, 405] and that the mean accepted proposal is 357.5. In addition, according to the theoretical predictions, we should observe that only the negligent defendant makes an out-of-court settlement proposal equal to 400. However, we found that 8 percent of defendants who made settlement offers were careful, settlement offers were located in the interval [101, 405], and no defendant made an offer equal to 400.

We can inquire now about the reliability of the theoretical model in helping us to understand the patterns of data. Our results indicate that the qualitative predictions of the model about the effect of the split-award on litigation outcomes are consistent with the observed behavior and outcomes. Therefore, the theoretical model contributes significantly to the understanding of the influence of the split-award institution on litigation outcomes. The significant qualitative effect that the split-award institution had on the observed litigation behavior provides some evidence of strategic behavior on the part of the subjects.

6. Conclusions

This study reports several important findings. In the experiment, the split-award institution affected the likelihood of disputes as predicted by the theoretical model. The dispute rate and total litigation costs were significantly lower under the split-award compared to the no split-award case. Defendants’ litigation losses and plaintiffs’ net compensation were positively and significantly influenced by the split-award institution. Contrary to the theoretical predictions, the experimental results do not suggest a significant difference between the expenditures on care chosen under

53 All proposals equal to 150 were accepted.
the two conditions. The significant qualitative effect that the split-award institution had on the observed litigation behavior suggests strategic behavior of the subjects. The examination of the subjects’ decisions also suggests risk-aversion.

Our findings provide useful information that can be used to improve game theoretic models of litigation. Directions for future theoretical research include enhancements to the current models to explain the discrepancies we found, perhaps by incorporating non-neutral attitudes toward risk in models of incomplete information and adding some relevant behavioral characteristics of subjects (i.e., the use of heuristics under limited computational abilities) that influence decisions. Our findings stress the importance of combining experimental and behavioral observation with theoretical modeling.

Our study shares a weakness in terms of external validity that is common to all laboratory experimental research. Although our experiment cannot predict the effects of the split-award institution on levels of care and settlement in richer environments, this experiment provides a reasonable amount of evidence regarding whether the addition of the split-award institution into the bargaining process we have structured here will have the predicted effects.

Acknowledgements

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jebo.2005.05.009.

References


