DE GRUYTER The B.E. Journal of Theoretical Economics. 2022; 22(2): 603–620

Research Article

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Injurers versus Victims: (A)Symmetric Reactions to Symmetric Risks

https://doi.org/10.1515/bejte-2020-0101
Received June 23, 2020; accepted September 19, 2021

Abstract: Tort models assume symmetry in the behavior of injurers and victims when faced by a threat of liability and a risk of harm without compensation, respectively. This assumption has never been empirically validated. Using a novel experimental design, we study the behavior of injurers and victims when facing symmetric accident risks. Experimental results provide qualified support for the symmetric behavior hypothesis.

Keywords: precautions, tort theory, laboratory experiment

JEL Classifications: K13, C91

1 Introduction

Economic models of tort law assign specific roles to the parties in an accident, namely injurers or victims. These two parties are conventionally assumed to be unacquainted, risk-neutral, identical in that they both maximize expected utility, and free from any behavioral bias. Given these assumptions, tort theory predicts that injurers and victims would exhibit symmetric behavior – i.e. the same investments on accident prevention – when facing symmetric accident risks (Brown 1973; Shavell 1980, 1987). We refer to this theoretical prediction as the "symmetric behavior hypothesis."

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Specifically, Brown's (1973) and Shavell's (1980, 1987) models of unilateral care (wherein only the injurer or only the victim can take care) predict that under no liability, the victim – who will receive no compensation, and hence bear the full cost of harm – is incentivized to invest in optimal precaution levels, whereas under strict liability, the injurer – who will have to fully compensate the victim, and hence bear the full cost of the harm – has incentives to invest in optimal precaution levels. Strict liability creates precaution incentives on the injurer with the *threat of liability*, while no liability creates precaution incentives on the victim by leaving him/her with the *risk of an uncompensated loss* (Cooter and Ulen 2016, p. 228–229; Miceli 2004).[1]

The symmetric behavior hypothesis has not yet been empirically tested. This lack of validation is important because tort models assume that individual decision-making is not systematically affected by one's role (Brown 1973; Nussim and Tabbach 2009; Shavell 1980, 1987); instead, evidence suggests that individuals are subject to role-induced bias, i.e. they often act in accordance with their role (Egli Anthonioz et al. 2019; Janis and King 1954; Landeo 2009, 2018; O'Brien 2009; Simon, Snow, and Read 2004, 2015; Schweizer 2019; Sunstein 1996; Zimbardo 1965). The fact that people undertake decisions in the role of victims or injurers may produce role-induced effects, which can emerge unintentionally and cannot easily be reversed (Engel and Glöckner 2013). This paper uses an experimental study designed to tackle the following question: Do injurers and victims behave symmetrically as economic theory predicts? The answer is *on average* a qualified yes.

Despite the extensive number of tort models – of either unilateral care or bilateral care – very little is known about individuals' actual precaution investments. This is partly explained by the fact that precautions are difficult to observe and practically impossible to measure empirically (Guerra 2021; van Velthoven 2009). The experimental methodology can overcome this empirical shortcoming since it enables observing precaution investments at the individual level, absent of any endogeneity and selection issue present in the field. Notwithstanding the advantages of the experimental methodology in overcoming observation and measurement difficulties, only a few experiments to date have been conducted to test some of the theoretical predictions of tort models (Angelova et al. 2014; Deffains, Espinosa, and Fluet 2019; Kornhauser and Schotter 1990, 1992; Wittman et al.

1 Injurers and victims are also expected to exhibit symmetric behavior in situations with bilateral care choices – wherein both the injurer and the victim can take care – and under other liability rules (e.g. strict liability rule with contributory negligence defense *versus* negligence rule; Schäfer and Müller-Langer 2009). For an extensive taxonomy of liability rules, see Dari-Mattiacci and Parisi (2020).

1997). These contributions have investigated the *deterrent effect* of specific legal rules.[2] In particular, Kornhauser and Schotter (1990) compared strict liability and negligence in a unilateral care accident context, while Kornhauser and Schotter (1992) compared simple negligence and negligence with contributory negligence in a bilateral care accident context. Wittman et al. (1997) compared contributory negligence, comparative negligence, and no-fault rules in a dynamic perspective, Angelova et al. (2014) compared no liability, strict liability, and negligence, and Deffains, Espinosa, and Fluet (2019) analyzed social norms under no law, strict liability, and negligence when rule enforcement is either mild or severe. Except for Kornhauser and Schotter (1990) and Deffains, Espinosa, and Fluet (2019), these experiments generally confirmed theoretical predictions.

To the best of our knowledge, this is the first experimental analysis to test the simple but important theoretical prediction of the symmetric behavior of injurers and victims. Our research is different from the previous experimental contributions with respect to both the aim of the study and the design implemented. Unlike other experimental studies, the problem here is no longer comparing tort incentives under different liability rules, but instead analyzing whether precautionary behavior is affected by the role played by individuals in an accident – as either the injurer or victim – under symmetric financial incentives. From a methodological perspective, unlike previous experiments in tort law analyzing unilateral care accidents (e.g. Kornhauser and Schotter 1990), in our study the accident harm and related compensation is on a *real* participant, and not on a hypothetical person.[3] This makes the experiment design better aligned with the theoretical model that we are testing (Plott 1999).

The remainder of the paper is organized as follows. Section 2 presents the theory and derives the main hypothesis. Section 3 describes the experimental design and procedure. Section 4 reports the results. Finally, Section 5 concludes with ideas for future research. The experiment instructions to participants (English translation), the dataset, analysis scripts, and additional documents used in this

2 Other contributions have experimentally tested the deterrent effect of tort liability (e.g. Cardi, Penfield, and Yoon 2012; Eisenberg and Engel 2014). See also DeJong , Forsythe, and Uecker (1985) and King and Schwartz (1999, 2000) on auditors' liability, and Landeo, Nikitin, and Babcock (2007) on split-award statutes in a litigation context.

3 The unilateral care setting analyzed in this paper shares some structural similarities with experiments on loss aversion and financial compensation (e.g. De Cremer 2010; Haesevoets et al. 2013; Kahneman, Knetsch, and Thaler 1991; Tversky and Kahneman 1991), and dictator games (e.g. Roth 1995). For a review of this literature, see Arlen and Talley (2008), Eisenberg and Engel (2016), Sullivan and Holt (2017).

research and useful for replicability purposes are available in the supplementary material.

2 Theory

The experiment conducted in this paper closely implements the structural unilateral care tort model (Brown 1973; Shavell 1980, 1987). In this section, we briefly describe the model to clarify the structure of the experiment and define the symmetric behavior hypothesis.

Let us consider two parties: a potential injurer (I) and a potential victim (V). They are assumed to be identical except for their role in the accident, unacquainted, risk-neutral, and free from any type of behavioral bias. We assume that the parties' initial endowments are exogenous and denoted by E_{I} for the injurer and E_{V} for the victim. We consider a unilateral care accident: only one party – the victim or injurer – can reduce the probability of an accident by investing in precaution. This leads to two possible scenarios.

In the first scenario, only the injurer can reduce accident risks by investing in precautions. Let x denote the injurer's precaution investments, $c(x)$be the precaution cost, which is increasing and convex in x, and $p(x)$ be the probability of an accident that causes harm $L > 0$, where p is declining and weakly convex in x. Let $D = L$ denote the amount of damage compensation paid by the injurer to the victim. Consider the strict liability rule (ISL), under which injurers are required to pay damages whenever an accident occurs. The injurer's payoff becomes ${\Pi_{\mathrm{I}}}^{\mathrm{ISL}}(x) = E_{\mathrm{I}} - c\,(x) - p\,(x)\,D$, whereas the victim's payoff is ${\Pi_{\mathrm{V}}}^{\mathrm{ISL}} = E_{\mathrm{V}} - p\,(x)\,L + p\,(x)\,D = E_{\mathrm{V}}$. The social planner's task is to maximize the total surplus of the parties, expressed by the sum of parties' utilities, with respect to precaution investments. Throughout the paper, the precaution investment maximizing the total surplus is referred to as the efficient [precaution] level or investment. Accordingly, under strict liability the potential injurer is induced to make efficient precaution investments.

In the second scenario, only the potential victim can reduce the probability of an accident by investing in precautions. By symmetry, let y denote the victim's precaution investments and $p(y)$ be the probability of an accident that yields harm L, where p is declining and weakly convex in y. Let $c(y)$ be the precaution cost, which is increasing and convex in y. Consider the no liability rule ("VNL"), under which injurers are never required to compensate victims for the harm caused by an accident. In this case, the potential victim bears the full accident loss, plus the cost of precaution $c(y)$. Thus, the victim maximizes ${\Pi_{\mathrm{V}}}^{\mathrm{VNL}}\,(y) = E_{\mathrm{V}} - c(y) - p\,(y)\,L$, whereas the injurer's payoff remains constant at ${\Pi_{\mathrm{I}}}^{\mathrm{VNL}} = E_{\mathrm{I}}$. The social planner's task is to maximize the total surplus of the parties with respect to y. Accordingly, under no liability the potential victim is induced to make efficient precaution investments.

Injurers under strict liability (ISL) and victims under no liability (VNL) bear the full accident and precaution costs, and thus they have identical precaution incentives. This simple theoretical result provides the first, main hypothesis for the experimental analysis, as stated below:

Hypothesis: Symmetric Behavior
All else being equal, ISL and VNL exhibit the same precautionary behavior.

3 Experiment

We use a novel experiment that builds in all necessary assumptions of the theory that it designed to test (Plott 1999). Put simply, the theoretical model that we are testing assumes that players actually suffer harm, pay costs of taking precautions, and are made to pay or receive compensation.

3.1 Design

In our Accident Game, we used a within-subject design with two treatments: ISL and VNL (more details in Section 3.1.1).[4] The game comprised two stages, with one treatment in each stage. Each stage comprised ten independent and identical periods (subjects' earnings in one period were not affected by their choices and earnings in the other periods).[5]

At the beginning of the experiment, half of the participants were randomly assigned the role of Player A and the other half were assigned the role of Player B. The roles remained fixed throughout the study. At the beginning of

4 The overall experiment comprised three main parts: the Accident Game, followed by a Risk Aversion test and a Social Value Orientation test. At the end of the experiment, subjects were asked to answer a survey on socio-demographic information. Given the purpose of this paper and the within-subject design of the Accident Game, we have omitted any analysis on risk aversion, social value orientation, as well as individuals' characteristics. For more information on the two tests and the post-experiment survey, see the experiment instructions in the supplementary material.

5 At the end of the study, the computer randomly selected two of the overall periods at the subject level for actual payment. Participants were informed that they would not know in advance which period was going to be selected to determine the actual payment, and that each period had an equal probability of being selected.

the first period, the computer randomly formed two-member groups with one Player A and one Player B. In each of the following periods, each player was randomly and anonymously re-matched with another player of the opposite role.

At the beginning of each period, each player received an initial endowment of 140 tokens (1 token = € 0.01). In each period, Players A were asked to decide how many tokens they wanted to invest in precautions to avoid an accident with their matched Players B. Given the unilateral care setting, Players B could not take any action to avoid the accident and remained passive throughout the experiment (for a similar design with "active" and "passive" players, see e.g. Eisenberg and Engel 2016).

At the end of each period, participants learned whether an accident happened or not,[6] their own period payoff, and their matched player's period payoff. Players A's precaution investments were therefore private information. After receiving this information, subjects moved to the next period. After the ten periods in the first stage, participants were given a new set of instructions for the second stage and learned that they would play another ten periods, albeit under a different scenario.

3.1.1 Treatments

The experiment used a within-subject design with two treatments: ISL and VNL. In two out of four experimental sessions, those assigned the role of Player A played ISL in the first stage (first ten periods), and VNL in the second stage (last ten periods). The treatment order was reversed in the other two experimental sessions: Players A played VNL in the first stage and ISL in the second stage.

If an accident occurred in the ISL treatment, Player B would suffer the initial loss, but Player A would fully compensate him/her for the damage suffered. In the VNL treatment, if an accident occurred the loss would fall upon Player A and he/she would not receive any compensation. The expected payoffs of Player A in the two treatments were thus identical: in the event of an accident, Player A would always face the full accident loss either as liability toward Player B (ISL treatment) or as uncompensated loss to him-/herself (VNL treatment). Identical screens and payoffs were presented to Players A – when acting as injurers and victims – to reaffirm the identity of financial incentives that they faced (see supplementary material).

6 For each two-member group, the computer rolled a number between 0 and 100. If the number was between 0 and the probability of having an accident, an accident would occur between the matched pairs.

3.1.2 Parameters

Table 1 shows the parameters upon which Players A were asked to decide.

Table 1: Parameters.

Precaution Level z	Precaution investment $c(z) = 4z + z^2$	Probability of accident $p(z) = 0.85 - 0.10z$	Expected earnings player A $140 - c(z) - p(z)L$	Earnings player B
0	−0 tokens	85% accident	60 tokens	140 tokens
		15% no accident	140 tokens	140 tokens
1	−5 tokens	75% accident	55 tokens	140 tokens
		25% No accident	135 tokens	140 tokens
2	−12 tokens	65% accident	48 tokens	140 tokens
		35% no accident	128 tokens	140 tokens
3	−21 tokens	55% accident	39 tokens	140 tokens
		45% no accident	119 tokens	140 tokens
4	−32 tokens	45% accident	28 tokens	140 tokens
		55% no accident	108 tokens	140 tokens
5	−45 tokens	35% accident	15 tokens	140 tokens
		65% no accident	95 tokens	140 tokens
6	−60 tokens	25% accident	0 tokens	140 tokens
		75% no accident	80 tokens	140 tokens

In each treatment, Players A were asked to decide the investment in precautions, z, that they wanted to undertake in a range from 0 to 6 precaution units. Each additional unit of precaution yielded a constant marginal benefit by reducing the probability of an accident by 10%, and it entailed an increasing marginal cost. The probability of an accident was given by the following function: $p(z) = 0.85 - 0.10z$, where $z \in [0, 6]$. The probability of a loss thus ranged between 25% (if Player A chose the maximum amount of precautions) and 85% (if Player A chose not to invest in precautions).[7]

The cost of precautions was defined by the following function: $c(z) = 4z + z^2$, with $z \in [0, 6]$. The cost of precautions thus ranged from 0 (if Player A chose not to invest in precautions) to 60 (if Player A chose the maximum amount of precautions). If an accident occurred, the monetary loss L was 80. Negative payoffs were not possible.

7 We chose constant instead of decreasing marginal benefits to mitigate individual biases in judgments about risk and probabilities (cf. Camerer and Kunreuther 1989).

In both treatments, Player A's expected earnings were computed as the initial endowment minus precaution costs, minus expected accident loss, i.e. $140 - c(z) - p(z)L$. Assuming risk neutrality,[8] Player A's optimal investment in precaution is $z = 2$, which is equivalent to an investment in precaution of twelve tokens.

Player B's earnings were always equal to 140 tokens, because they either received full compensation from Player A for the accident loss under the ISL treatment or never had to pay compensation to Player A for the accident loss under the VNL treatment.

3.2 Procedure

We conducted four experimental sessions – comprised of twenty periods each – each with 50 participants (25 Players A and 25 Players B). A total of 200 Spanish participants were involved in the experiment. The relevant data were collected only from 100 "active" Players A, while the other 100 Players B were involved and paid, but "passive".[9]

Two of the four sessions started with ten periods of ISL and ended with ten periods of VNL. The other two sessions started with ten periods of VNL and ended with ten periods of ISL. We ran two sessions of each ordering. No subjects participated in more than one session.

The experimental sessions were conducted during the 2017–2018 academic year at the Laboratory for Research in Experimental and Behavioral Economics

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8 The complete experiment included a risk aversion test after the Accident Game (see the experiment instructions in the supplementary material). We tested individuals' risk preferences using a lottery choice à la Holt and Laury (2002). We found no significant effect of the parties' level of risk aversion on their levels of precautions between the two treatments. Results are available upon request.

9 A power analysis was not conducted – neither prospective nor retrospective – because insufficient and not comparable published data are available to support sample size determination (Gelman and Carlin 2014). Our per session/treatment sample size is comparable to other, related tort experiments: e.g. see Kornahuser and Schotter (1990, 1992) with approx. 10 and 20 subjects per treatment, respectively; Wittman et al. (1997) and Angelova et al. (2014) with 12 and 32 subjects per session, respectively. Our current data and results can be fruitfully used for power analysis and other design calculations in future, similar research. On null results and power analyses, see, e.g. Good and Hardin (2012), Drichoutis, Lusk, and Nayga (2015), Kingsley (2015), Nikiforakis and Slonim (2015), and van de Ven and Villeval (2015). On a critical discussion on performing ex-post design calculations, see e.g. Gelman and Carlin (2014).

(LINEEX) of the University of Valencia in Spain.[10] The experiment was designed using zTree (Fischbacher 2007) and participants performed all of the experimental tasks via computer.[11]

Subjects were recruited using the LINEEX lab participant database.[12] The "active" participants (Players A) were 51.00% males, were aged in the range of 18–30 years (on average 20.22 years old), and were undergraduate students from different fields, mainly Economics (24.00%) and other Social Sciences (21.00%).

As is standard in economics experiments, individuals' decisions were kept anonymous and confidential. To assure participants about anonymity vis-à-vis the experimenter, before starting the session they were asked to sign a consent form – of which an English translation is provided in the supplementary material – where we informed them about their rights, including the anonymity of their decisions.[13] To ensure anonymity in practice, when entering the lab subjects were randomly assigned to one workstation number, with no way of linking their identities to their workstation number and the associated decisions gathered by the software. In addition, the payments were made in cash at the end of the session, confidentially to one participant at a time.

Instructions in Spanish (see the supplementary material for English translation) were displayed both on each participant's computer screen and the laboratory computer screen, as well as being read aloud. Questions were answered in private. To control for experimenter effects, the same lab assistant conducted all of the sessions.

At the end of the instructions for each stage of the Accident Game, and before starting the game, subjects were asked a set of computerized control questions to check their understanding of the instructions. To ensure understanding and prevent similar mistakes during the experiment, participants were provided with prompt feedback via computer and were asked to raise their hand when they had

10 The experiment was conducted in line with LINEEX's ethics policies. Participants were permitted to opt out at any time with no penalty and were allowed to withdraw their data subsequent to participating. LINEEX operates under the methodological paradigm of experimental economics, where participant deception is not allowed.

11 Computer clients at LINEEX are partitioned to avoid eye contact and communication between participants, and ensure confidentiality. During the experiment, no form of communication was allowed between participants.

12 LINEEX has an existing database of active participants, who are undergraduate and graduate students. LINEEX has strict policies on the confidentiality of the data provided by participants. See https://lineex.es/en/home/ (Last accessed: April 2021).

13 In case a participant would have not completed the consent form, we would have asked him/her to leave the session, and we would have replaced him/her with another new participant. This case did not happen in any of our experimental sessions.

an incorrect answer. In this case, the lab assistant approached the student who raised the hand and explained the answer in private to ensure that they knew the reason for their mistake. No problems or major issues were encountered. The detailed deliverable about the experimental sessions – with results from the check questions as well as any other questions raised by participants in each session and stage – is available in the supplementary material.[14]

Two periods of the Accident Game (one period from the first stage and one period from the second stage) were randomly selected for payments.[15] The exchange rate (1 token = 1 cent of Euros) was calibrated such that the average hourly earnings to participants would be approximately equal to the average hourly wage for student employment.

It is worth remarking that the experiment's framing and wording needed to convey four fundamental elements: (a) the accident scenario; (b) the respective roles of the parties in the accident; (c) the purely financial and monetary nature of the accident; and (d) the symmetric effects of the actions and the consequences of the loss. The framing of the experiment and the wording of the instructions reflected these objectives. The wording was carefully chosen to ensure that the subjects identified themselves with the role assigned to them in the accident scenario while avoiding any framed setting that evoked any potential link to physical pain or bodily injuries associated with a tort accident. The instructions included the terms "precautions" and "accident". However, the terms "harm," "victim," and "injurer" were replaced with the terms "monetary loss", "party suffering the monetary loss" and "party causing the monetary loss", respectively. It is worth clarifying that not with standing the use of those terms, we are uncertain about whether subjects *actually* perceived the monetary loss as being caused by Player A in the ISL treatment or Player B in the VNL treatment.[16]

14 It is worth reporting that overall, 14.5% of subjects (29 out of 200) incorrectly answered question C ("If an accident occurs, who suffer the accident loss – Player A or Player B?"). The lab assistant conducting the experiment adequately explained the reason why the answer was wrong, and we are confident that subjects understood the explanation.

15 Final earnings were calculated as the sum of earnings in two random periods of the accident experiment, one random period of the Risk Aversion test, and one random period of the Social Value Orientation test. In addition, each participant received a participation payment (show-up fee) of 5 Euros. The sessions lasted approximately 90 min (including welcome and exit). Players A (Players B) earned an average of 11.43 (12.5) Euros including the participation payment, with a minimum payment of 8.5 (10.3) Euros and a maximum payment of 14.4 (14.6) Euros.

16 We thank two anonymous referees for highlighting this.

4 Results

Table 2 reports summary statistics of Players' A precaution investments, both by treatment ("Injurer Strict Liability" and "Victim No Liability" columns) and pooled across treatments ("Pooled sample" column).

Table 2 shows that on average across periods, injurers and victims spent the same amount of approximately eighteen tokens on precautions (18.504 for injurers *versus* 17.918 for victims; two-sample Wilcoxon rank-sum test, p value = 0.676; two-tailed t-test, p value = 0.444; n = 2000). Similar results hold if comparing injurers and victims' precaution investments in each stage and each period, and they are robust to tests for the equivalence of means within a symmetric equivalence interval using a two one-sided t-test approach (Dinno 2017; Schuirmann 1987). On average across periods, no significant differences are detected neither in the mean nor in the variance of precaution investments between treatments (17.454 for injurers *versus* 16.818 for victims; Two-sample variance-comparison test p value = 0.241; Levene's robust test statistic p value = 0.201).

These statistics are confirmed by regression analyses, whereby the results are reported in Table 3. The dependent variable is *Precaution Investment*, which represents Players' A precaution investments and can take seven values, i.e. 0, 5, 12, 21, 32, 45, or 60. The key explanatory variable – *Victim* – is a dummy equal to 1 for the VNL treatment and 0 for the ISL treatment. Columns 2 and 3 respectively add *Second Stage* – equal to 1 for the second stage, and 0 for the first stage – and its interaction with *Victim*. We estimate the models using random-effects panel ordered logistic regressions, with robust standard errors clustered at the individual level to adjust for heteroscedasticity and dependency of observations across periods.

The regression estimates show that all coefficients are not statistically significant, thus revealing a null average treatment effect, which supports the hypothesis on symmetric behavior, as described in Section 2.

Result: Injurers *versus* Victims

On average, ISL and VNL undertook the same investments in precautions.

Table 2: Summary statistics of precaution investments.

Stage	Period	Injurer strict liability (n = 50 per period)						Victim no liability (n = 50 per period)					
		$\bar{z}_{ISL}$	s_{ISL}	Min	Median	Max	N	$\bar{z}_{VNL}$	s_{VNL}	Min	Median	Max	N
First stage	1	19.620	15.671	0	21	60	50	17.220	16.332	0	12	60	50
	2	17.680	14.222	0	12	60	50	20.520	15.571	0	21	60	50
	3	17.960	13.902	0	16.5	45	50	19.000	17.578	0	12	60	50
	4	20.020	18.089	0	21	60	50	15.800	14.813	0	12	60	50
	5	20.560	17.164	0	21	60	50	17.060	17.184	0	12	60	50
	6	18.120	16.952	0	16.5	60	50	16.100	19.416	0	5	60	50
	7	18.260	19.110	0	12	60	50	17.920	17.866	0	12	60	50
	8	15.420	17.507	0	8.5	60	50	20.920	19.498	0	21	60	50
	9	17.980	17.486	0	12	60	50	19.200	18.061	0	12	60	50
	10	13.020	15.172	0	5	60	50	17.040	17.015	0	12	60	50
Average		17.864	16.528	0	14.550	58.5	500	18.078	17.333	0	13.100	60	500
Second stage	11	21.920	18.984	0	21	60	50	19.760	17.834	0	21	60	50
	12	22.640	19.281	0	21	60	50	17.020	16.477	0	12	60	50
	13	19.340	17.167	0	21	60	50	15.660	15.087	0	12	60	50
	14	20.460	18.536	0	21	60	50	16.900	15.618	0	12	60	50
	15	20.100	19.404	0	21	60	50	18.980	15.144	0	21	60	50
	16	21.620	17.669	0	21	60	50	17.840	15.894	0	21	60	50
	17	19.820	18.987	0	16.5	60	50	16.920	15.015	0	16.5	60	50
	18	15.980	17.684	0	12	60	50	18.920	17.564	0	16.5	60	50
	19	13.940	16.269	0	5	60	50	16.360	16.852	0	12	60	50
	20	15.620	17.944	0	12	60	50	19.220	18.272	0	12	60	50

Table 2: (continued)

Stage	Period	Injurer strict liability (n = 50 per period)						Victim no liability (n = 50 per period)					
		$\bar{z}_{ISL}$	s_{ISL}	Min	Median	Max	N	$\bar{z}_{VNL}$	s_{VNL}	Min	Median	Max	N
Average		19.144	18.193	0	17.150	60	500	17.758	16.376	0	15.600	60	500
Total		18.504	17.454	0	12	60	1000	17.918	16.818	0	12	60	1000

$\bar{z}$ and s represent the mean and standard deviation of Players' A precaution investments, respectively; $\bar{z}_{ISL}$ and $\bar{z}_{VNL}$ represent the mean of Players' A precaution investments in the Injurer Strict Liability (ISL) and Victim No Liability (VNL) treatments, respectively; s_{ISL} and s_{VNL} represent the standard deviation of Players' A precaution investments in the ISL and VNL treatments, respectively.

Table 3: Injurers *versus* victims.

DV: Precaution investment	(1)	(2)	(3)
Victim	−0.073	−0.074	−0.068
	(0.124)	(0.123)	(0.310)
Second stage		0.101	0.107
		(0.124)	(0.353)
Victim × second stage			−0.012
			(0.630)
σ^2	2.269***	2.275***	2.275***
	(0.476)	(0.478)	(0.478)
Loglik	−3352.163	−3351.391	−3351.391
$\chi^2(1)$	0.346	0.926	0.969
Prob > χ^2	0.557	0.629	0.809
N	2000	2000	2000
N clusters	100	100	100

The dependent variable (DV) represents precaution investment by Players A, and can take seven values, i.e. 0, 5, 12, 21, 32, 45, or 60. The key explanatory variable – *Victim* – is a dummy equal to 1 for the Victim No Liability treatment and 0 for the Injurer Strict Liability treatment. Columns (2) and (3) respectively add *Second Stage* – equal to 1 for the second stage, and 0 for the first stage – and its interaction with *Victim*. Parameter estimations are from random-effects panel ordered logistic models, with robust standard errors clustered at the individual level in parentheses. $+p < 0.10$ $^{*}p < 0.05$ $^{**}p < 0.01$ $^{***}p < 0.01$.

5 Conclusion

This paper has tested one of the core theoretical predictions of tort models, namely that injurers and victims are expected to have symmetric reactions to symmetric accident risks (i.e. making identical precaution investments). For this purpose, we used a novel experimental framework to evaluate individuals' precaution choices in the lab. Our results provide qualified support for the symmetric behavior hypothesis, laying empirical foundations for the prediction generated by the economic models of tort law.

Our research calls for further investigations into the motivations driving precaution investments under different roles. Among others, open questions for future research follow from the choice variables available to participants. Specifically, in our design – as in other similar experiments (e.g. Kornhauser and Schotter 1992) – participants can only choose precaution investments, but neither whether nor the extent to which to engage in risky activities. This allows us to depict a causal connection between the injurer's care choice and the resulting harm, but not a causal connection between the injurer's activity and the resulting harm. Future research should delve into this important aspect; for example, by providing subjects with the possibility to choose risky activity levels, in addition to precaution investments. This would improve the design's adherence to the implicit assumptions of standard tort models, i.e. that a duty of care runs from the injurer to the victim and that there is a causal connection between the injurer's activity and the resulting harm.

By considering our paper alongside the rather scarce literature on laboratory experiments in the realm of tort law (e.g. Angelova et al. 2014; Guerra 2021; Kornhauser and Schotter 1992; Wittman et al. 1997), we start to observe the consolidation of a body of literature confirming the robustness of tort theory to experimental validations (cf. Zamir 2020). Applying experimental methods to further test tort theory is a valuable strategy to improve our understanding of individual behavior in a wider range of accident situations (e.g. bilateral care scenarios) and strengthen our confidence in the predictive value of the existing economic theory of tort law.

Acknowledgments: This paper is dedicated to the memory of Theodore Eisenberg, for inspiring conversations at the very outset of this research. We owe special thanks to Burkhard C. Schipper – the editor of this journal – and two anonymous referees for their insightful comments, as well as William H. J. Hubbard, Lee Fennell, Stephanie Didwania, Cree Jones, Daniel Hemel, Daniel Porat, Todd Henderson, and the seminar audience at the Law and Economics Workshop at the University of Chicago Law School for their extremely valuable comments. We also thank Maria Bigoni, Stefania Bortolotti, Emanuela Carbonara, Marco Casari, Giuseppe Dari-Mattiacci, Christoph Engel, Luigi Alberto Franzoni, Orsola Garofalo, Tobias M. Hlobil, Henrik Lando, Alexander Lehner, Dean Lueck, Enrico Santarelli, Hans-Bernd Schäfer, and Louis T. Visscher, the audience at the Annual Meeting of the American Law and Economics Association, the Annual Conference of the European Law and Economics Association, and the Johns Hopkins University. We thank Ignacio Alastrué and Rebeca Parra of the Laboratory for Research in Experimental Economics, Ryan Fitzgerald of the University of Minnesota Law School, and Richard Forsythe for their invaluable assistance.

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Supplementary Material: The online version of this article offers supplementary material (https://doi.org/10.1515/bejte-2020-0101).