



# Instructor's Guide to Accident Prevention and Liability

Laboratory implementation, theoretical foundations,  
experimental evidence, and variants

Behavioral and Experimental Economics Research Lab  
Department of Economics



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<https://beer-lab.org/>

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# How to use this guide

This guide supports the preparation, implementation, and classroom discussion of the family of accident prevention and liability games prepared for the Behavioral and Experimental Economics Research Lab (BEER Lab) at the Department of Economics of Tecnológico de Monterrey. It is intended for instructors with different levels of familiarity with experimental and behavioral economics.

The document offers three reading paths. The **quick guide** is enough to launch a session. The operational chapters explain each screen used by instructors and students. The conceptual chapters present the theories, predictions, and empirical findings needed to lead the post-game discussion.

Access instructions and common screens are explained once. Each variant then focuses only on what changes relative to the basic game: configuration, group size, decisions, predictions, relevant outcomes, and academic literature.

## Author

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### For the instructor

This guide follows the English-language interface. Spanish configurations use the same logic. Never project individual codes or connect outcomes to names, student identification numbers, or seats in the room.

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# Preparation and access

## 1.1 Access through the updated laboratory website

Start at <https://beer-lab.org/en/>. Select **CLASSROOM** in the top navigation menu; it opens <https://teaching.beer-lab.org/en/>. In the **Classroom experiments** catalog, use the search box to locate the activity by name. You can also filter by **Topic** or **JEL code**. Clear any filters left from an earlier search before looking for another game.

Each family's card distinguishes **Español** and **English** access links. The **Show extended version** checkbox selects that edition before following a link. Catalog language and session language are separate choices: verify both. Students use the room specified by the instructor; the instructor prepares and monitors the session through this family's own administrative pages.

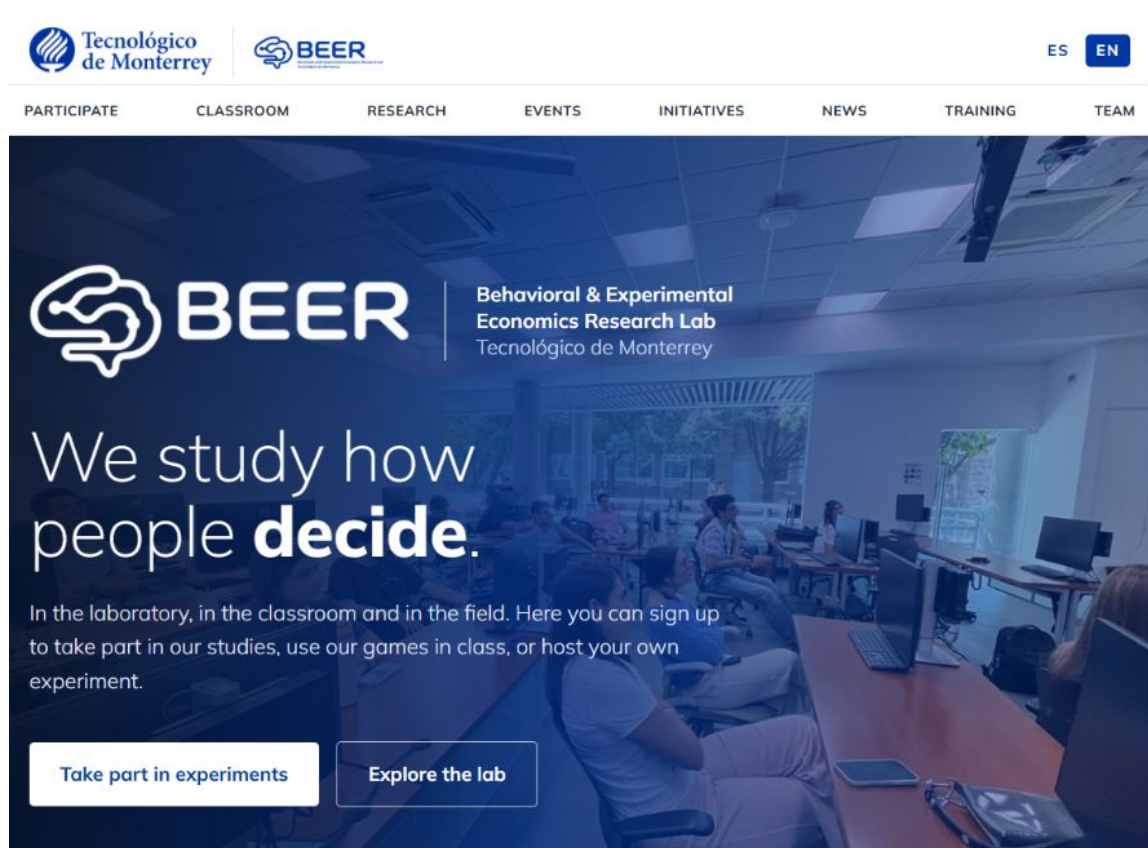


Figure 1.1: Current institutional website. Select CLASSROOM in the top navigation menu to open the teaching experiments. Captured on October 7, 2026.



Figure 1.2: Current catalog: search by title, topic, or JEL code. Then locate this family's card and select language and edition. Captured on October 7, 2026.

## Checking resources, comprehension, and participant requirements

Before opening the room, check the selected configuration and the number of students present. The session-creation form states the group size and minimum required by that configuration. An individual activity accepts any positive participant count; an interactive activity must satisfy its stated requirement: complete groups when size is fixed, or a minimum participant count when size is flexible. Requirements may change across treatments, for example when adding a third party or changing an institution's size. If you edit a grouping parameter, check the requirement for the edited configuration, rather than relying only on the demo's suggested count.

In the instructions, ensure that students can identify what each role receives, what they can decide, and how the outcome is calculated. An initial account, a distributable budget, and final earnings need not be the same amount. Refer to the resources panel and the example for the selected treatment. Do not carry the basic edition's endowment into a treatment that changes accounts or introduces additional positions.

ECU stands for *Experimental Currency Units*: the activity's unit of account. An outcome of 100 ECU does not automatically equal 100 pesos or 100 dollars. Conversion depends on the session configuration. Before announcing a payment, confirm with the laboratory whether money is paid, the conversion rate, and which decisions count for payment. In hypothetical modules, describe amounts as outcomes in the stated situation.

When a comprehension check is included, an incorrect response receives an explanation beside that question, identifying the submitted answer and the correct answer. Other answers remain in the form. Ask the student to return to the example, locate the relevant rule, and redo the calculation before correcting the response. Avoid revealing answers to the entire class for an individual error, and do not interpret a comprehension mistake as an economic choice in the game.

areja fija

areja fija

arejas reasignadas

abilidad: referencia

dad estricta

perfecta

uerto: revelación posterior

uerto: revelación previa

Filateral

ia fija

ia según riesgo

imitado

ixed partner

eassigned partners

reference

y

rforcement

andard: disclosure after choice

andard: disclosure before choice

vention

xed premium

sk-rated premium

sts

Figure 1.4: Demo contains only the configurations of this game family, in both languages and editions. Continuation 2/2.

## Rooms

### Current rooms:

|                                       |
|---------------------------------------|
| [ES] Responsabilidad civil: básica    |
| [EN] Civil liability: basic           |
| [ES] Responsabilidad civil: extendida |
| [EN] Civil liability: extended        |

Figure 1.5: Rooms contains the four rooms for this family: basic and extended editions in Spanish and English.

## Room: [EN] Civil liability: basic

### Create a new session

Session Config

[EN] one round

Number of participants

Complete groups of 2 participants. Use a multiple of 2; minimum 2.

Create

[Configure session](#) 

### App sequence

**liability\_game (10 rounds)**

Real pairs, accident prevention, liability, enforcement and insurance.

Figure 1.6: Session-creation form for the basic English room. Check the selected configuration and participant requirement before creating the session.

## Downloading a session with several rounds

### For the instructor

Open **Data** within the relevant session and use that session's CSV or CSV-for-Excel download link. The general export has one row per participant and columns for the different rounds. Ten rounds do not necessarily mean ten rows per person. When the family provides its own long-format export, observations may instead be organized by participant and round or another unit defined by the design.

Save the original file together with the configuration name, session code, and active-round count. Check that columns for the last active round are present and that the data belong to the selected session. Empty cells can represent inactive rounds, a pending decision, or a field that does not apply to a role; do not automatically recode them as zeros. To compare learning, preserve round and group identifiers alongside participant identifiers. Share only anonymous aggregates in class, and record session incidents before constructing derived tables.

## 1.2 Summary

|                           |                                                                                                   |
|---------------------------|---------------------------------------------------------------------------------------------------|
| <b>Purpose</b>            | Understand how liability, information and coverage affect prevention and risk allocation.         |
| <b>Experimental unit</b>  | A real pair of two people; interactive activity.                                                  |
| <b>Basic edition</b>      | No liability: one round, ten fixed-partner rounds or ten reassigned-partner rounds.               |
| <b>Extended edition</b>   | Seven mechanisms and ten presets, including the reference and internal comparisons.               |
| <b>Decision</b>           | A chooses prevention 0, 1 or 2; B chooses additional prevention only in bilateral.                |
| <b>Payoff</b>             | Per-round ECU balance and total across all active rounds; conversion announced by the instructor. |
| <b>Topics</b>             | civil liability; accident prevention; negligence; compensation; insurance; asset recovery.        |
| <b>JEL</b>                | C92; D62; D81; K13.                                                                               |
| <b>Suggested duration</b> | Forty minutes for introduction, one round and discussion; allow more for ten rounds.              |
| <b>Participants</b>       | Even number, minimum two; four or more allow effective reassignment.                              |

## 1.3 What this family can teach

Accident Prevention and Civil Liability examines how a payment rule changes incentives to invest in prevention. Two real people form a pair. A chooses an action that reduces the probability of a loss for B; B receives the monetary consequences of that action. The basic activity leaves the loss with B. Extensions change the obligation to compensate, the probability of collection, information about a required standard, and insurance coverage. Bilateral prevention adds a separate decision by B with its own effect on accident risk.

Learning begins before legal treatment names are introduced. Participants receive operational instructions describing costs, probabilities, and payments. After the activity, the instructor introduces strict liability, negligence, moral hazard, and recoverable assets. This sequence grounds discussion in actual choices and avoids using a label to signal which response might seem socially desirable. The activity models general economic mechanisms rather than a particular jurisdiction. It does not determine liability in a real dispute. Preserve this distinction when connecting classroom results with traffic, production, or product-safety examples.

Four questions organize the family. What prevention would someone choose to maximize an expected balance? What prevention minimizes the resources lost by the pair as a whole? Who bears residual risk when an accident occurs? What changes when a formal obligation cannot be collected or is covered by someone outside the pair? These questions complement one another. Two rules may induce the same prevention while allocating risk differently. Full compensation can protect B without itself lowering accident frequency. The report therefore displays social costs alongside balances and uncompensated losses.

The aggregate observation is one pair in one round. A's and B's choices and payments belong to that observation. Ten rounds create dependence among observations involving the same participant; they are not ten independent people. The activity remains interactive when B has no choice, because B's balance depends on A's actual decision. No demographic questions are asked. Roles remain constant throughout a session, allowing changes in A's choices to be interpreted without mixing learning with a change of position in the pair.

#### For the instructor

Prepare the model prediction before inspecting results, but do not announce it while participants choose. The report supports a comparison between a prediction and classroom behavior. A descriptive difference between separate sessions is not automatically an identified causal effect.

## 1.4 Participants, time, and materials

An even number of participants is required, with a minimum of two. Four people are enough to test reassignment, although a larger class produces more informative distributions. With only one pair, reassignment necessarily preserves the same two people. With two pairs, preventing consecutive meetings determines an alternating pattern. These restrictions follow from the number of possible partners rather than a platform failure. Explain them when comparing fixed partners and reassignment, and record the effective class size.

Allow roughly twenty minutes for introduction, comprehension, and a single round, followed by another twenty for discussion. Ten rounds require more time, especially with bilateral prevention. These durations are planning suggestions rather than measured performance estimates. Test a session beforehand using two devices or independent browser contexts. Check connectivity, language, table readability, and the waiting screen. A participant who leaves can prevent the partner's current round from reaching its result, which also affects the report denominator.

Each person uses a browser and an individual participation code. Do not ask two students to submit separate choices through one shared tab. The instructor needs administrative access and a screen for projecting aggregates. Keep Monitor and Report open, and reserve individual-data inspection for after class. If decisions receive monetary incentives, announce the conversion from ECU to money and any fixed payment before starting. The implementation sums balances from all active rounds. It does not randomly select one round for payment.

Each person starts every round with 100 ECU. A previous loss does not reduce the next round's

endowment. Repetition represents fresh opportunities under a stable payment structure, rather than accumulated wealth available for investment. Participants see their current-round balance and a total at completion. If the instructor changes endowments, damage, or prevention costs, predictions must be recalculated and the new structure communicated. Program validation rejects calibrations that could produce a negative individual balance in the states considered by the activity.

## 1.5 Routes and package status

The package is prepared for a separate liability-family instance. Its local test address is <http://localhost:8072/demo>, accessible from the same computer. Other devices require an authorized deployment or network setup. Addresses under [liability.beer-lab.org](https://liability.beer-lab.org) are proposed publication routes. Printing those addresses here does not establish that the public service has already been enabled. Before teaching remotely, the coordinator must confirm the public instance and its administrative access.

[https://liability.beer-lab.org/room/liability\\_en](https://liability.beer-lab.org/room/liability_en) [https://liability.beer-lab.org/room/liability\\_extended](https://liability.beer-lab.org/room/liability_extended)

Use Demo for quick trials and Rooms to associate a teaching session with a stable student entry point. The instance must display exactly 26 configurations and four rooms: basic and extended editions in Spanish and English. A basic room offers three configurations; an extended room offers ten. If another family appears, check instance isolation before admitting participants. Configuration names begin with the exact corresponding room name, allowing the selector to filter language and edition automatically.

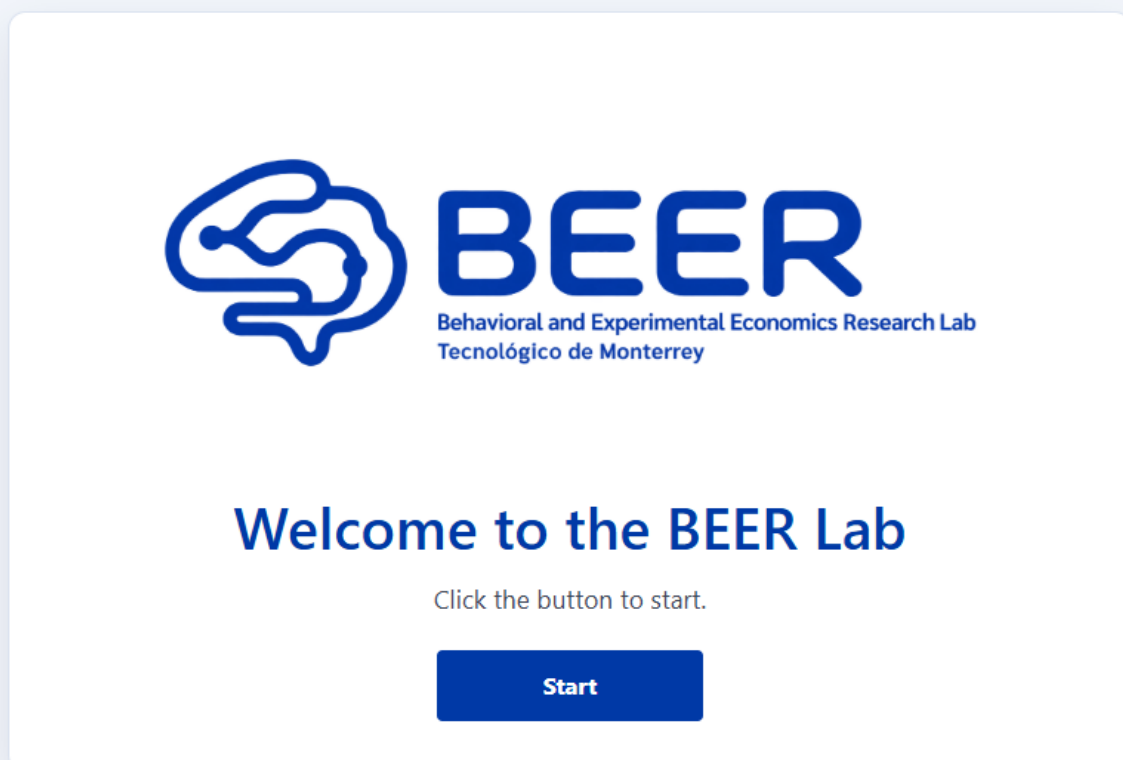


Figure 1.7: Public entry to the basic room before a session is assigned.

Create a session by choosing the room and then the configuration. Check language, number of rounds, and matching before confirming participant count. Demo creates four test participants;

a teaching session can contain any compatible even number. Do not reuse old individual-session links for a new class. A new session receives fresh codes and draws while preserving the room's public address. Keep individual participation codes out of classroom projection and materials intended for public distribution.

The local database for this family is separate from other games. Restarting the service does not require deleting it. The launcher refuses to initialize a database that already contains stored data. Application and template changes require restarting the local instance so oTree loads them. A schema change may require a specific migration or intervention; deleting sessions is not a routine response to every problem. Record the configuration and export required data before modifying an installation that has received participants.

### Checkpoint

Before opening a class, verify four rooms, 26 configurations, the correct language, an even participant count, and a successful test closure. Also confirm that aggregates are hidden when the report opens.

---

# Participant screens and sequence

## 2.1 Welcome and instructions

The welcome presents the BEER Lab and working rules. Participants are asked to remain silent, avoid communication, and request help from the instructor when needed. Acceptance is required before continuing. These rules support interpretation of choices under the intended information conditions; they do not replace any institutional procedure that might apply to research. In an ordinary teaching activity, explain what information is recorded and how it will be used in discussion.

Instructions identify the participant's role, round count, and matching. A table displays A's three prevention levels, costs, and loss probabilities. Bilateral prevention adds the probability when B purchases prevention. Risk-rated insurance adds the premium for each level. The payment rule appears in an operational callout. Numerical values in that rule are drawn from the session parameters and should agree with the table. Instructors should check this correspondence after editing a calibration.

Levels are labeled 0, 1, and 2. They are discrete options rather than a continuous amount of effort. Level 0 costs nothing and leaves a 40% accident probability. Level 1 costs 10 ECU and reduces probability to 10%. Level 2 costs 14 ECU and reduces it to 5%. An accident causes a 60-ECU loss for B before compensation. Every level retains positive risk. Choosing the greatest prevention does not guarantee that the pair avoids the event.

Explain probability separately from certainty. A pair choosing 0 may avoid an accident by chance, while a pair choosing 2 may experience one. Neither outcome changes the opportunity set at the time of choice. If a student interprets 10% as exactly one accident in their own ten rounds, clarify that this is a probability for each opportunity rather than a required personal quota. Choices change the threshold used to transform that round's fixed random draw into an accident.

## 2.2 Comprehension and choices

The comprehension check asks for the cost of level 1, damage before compensation, and pair size. Reference answers are 10, 60, and 2. An incorrect answer keeps the participant on the screen and requests a review of instructions. The check covers features common to all configurations; it does not prove complete understanding of every liability rule. Remain available for questions about the payment callout without recommending a prevention choice.

A confirms one prevention level. Its cost is deducted whether or not an accident occurs. The application rejects choices outside the three allowed values. B receives no artificial form when the configuration contains no choice for B; B proceeds to a waiting screen and receives a balance



BEER Lab

Round 1 of 1

**Role B: may incur the loss**

## Welcome to the BEER Lab

You will participate with another person. A prevention decision changes the probability of a loss. Read the rules for your session before deciding.

Work silently. Do not communicate with others or share your screen. Do not refresh while submitting. Raise your hand if you have a question. Decisions are recorded under a code; we do not ask demographic questions.

☐ I have read the rules and am ready to participate.

**Continue**

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Figure 2.1: Institutional welcome and acceptance of working rules.



BEER Lab

Round 1 of 1

**Role A: chooses prevention**

## Instructions

### Resources and unit of account

**Each participant's initial endowment: 100 ECU.**

ECU stands for Experimental Currency Units. It is the unit of account for this activity.

This session does not convert ECU into real money.

You will participate in one round.

Your role remains the same throughout the session. You will not learn your partner's identity.

**Starting balance for each person: 100 ECU.** Each round starts with a fresh balance. Results are added together; a loss in one round does not reduce the starting balance in the next.

Figure 2.2: Current instructions for the basic edition: initial resources, decision rules, and Loss if the event occurs: 60 ECU, experimental units. Continuation 1/2.

| A's prevention level | A's cost (ECU) | Probability of loss |
|----------------------|----------------|---------------------|
| 0                    | 0              | 40%                 |
| 1                    | 10             | 10%                 |

This session does not convert ECU into real money.

You will participate in one round.

Your role remains the same throughout the session. You will not learn your partner's identity.

**Starting balance for each person: 100 ECU.** Each round starts with a fresh balance. Results are added together; a loss in one round does not reduce the starting balance in the next.

Loss if the event occurs: 60 ECU.

| A's prevention level | A's cost (ECU) | Probability of loss |
|----------------------|----------------|---------------------|
| 0                    | 0              | 40%                 |
| 1                    | 10             | 10%                 |
| 2                    | 14             | 5%                  |

#### Payment rule for this session

If the loss occurs, B bears it. A pays no compensation.

All balances and costs are in ECU. Any conversion to money will be announced by the instructor.

Continue

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Figure 2.3: Current instructions for the basic edition: initial resources, decision rules, and experimental units. Continuation 2/2.



Review the marked questions. Each shows your answer and an explanation; your other answers are retained.

BEER Lab

Round 1 of 1

Role B: may incur the loss

### Check your understanding

#### Resources and unit of account

ECU stands for Experimental Currency Units. It is the unit of account for this activity.

This session does not convert ECU into real money.

Answer with numbers. You may consult the instruction table.

| A's prevention level | A's cost (ECU) | Probability of loss |
|----------------------|----------------|---------------------|
| 0                    | 0              | 40%                 |
| 1                    | 10             | 10%                 |
| 2                    | 14             | 5%                  |

How many ECU does A's level 1 cost?

11.0

Figure 2.4: Current comprehension check with an incorrect answer, its specific explanation, and retained responses. Continuation 1/2.

ECU stands for Experimental Currency Units. It is the unit of account for this activity.  
This session does not convert ECU into real money.

Answer with numbers. You may consult the instruction table.

| A's prevention level | A's cost (ECU) | Probability of loss |
|----------------------|----------------|---------------------|
| 0                    | 0              | 40%                 |
| 1                    | 10             | 10%                 |
| 2                    | 14             | 5%                  |

How many ECU does A's level 1 cost?

Your answer: 11. The correct answer is 10. Review the instructions: one or more answers are incorrect.

How many ECU does B lose if the event occurs, before any compensation?

How many people form a pair?

[Continue](#)

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Figure 2.5: Current comprehension check with an incorrect answer, its specific explanation, and retained responses. Continuation 2/2.

after A confirms. In bilateral prevention, B decides whether to pay two ECU for an additional risk reduction. A and B choose without observing each other's current decision. The order in which devices reach the server does not turn this activity into a sequential game.

The standard is displayed before choosing only in the prior-disclosure configuration. In disclosure after choice, its realized value remains on the server until results. Sending it in a hidden label or page source would alter treatment information; this implementation does not transmit it to that decision screen. Draws are fixed once for each pair-round. Refreshing the browser cannot create another opportunity or improve the probability of avoiding a loss.

### What participants will see

Participants receive costs, probabilities, rules, and consequences. They do not see equilibrium predictions, the social minimum, or labels such as moral hazard while choosing. Those concepts are introduced during the later discussion.

## 2.3 Waiting, results, and completion

Waiting connects actual decisions to the result calculation. In unilateral configurations, B waits for A. In bilateral prevention, both participants must finish. An incomplete pair does not enter the aggregate report. Monitor helps the instructor identify an operational delay, but the instructor should not submit a participant's choice on their behalf. Recording an exclusion and explaining its denominator is preferable to attributing an outcome to a pair that never obtained it.

Results display prevention, loss occurrence, and a payment breakdown. Compensation owed and compensation received appear separately, making collection failures and asset limits visible. The

BEER Lab

Round 1 of 1

Role A: chooses prevention

## Choose your prevention

Choose a level. Its cost is deducted whether or not the loss occurs.

| A's prevention level | A's cost (ECU) | Probability of loss |
|----------------------|----------------|---------------------|
| 0                    | 0              | 40%                 |
| 1                    | 10             | 10%                 |
| 2                    | 14             | 5%                  |

### Payment rule for this session

If the loss occurs, B bears it. A pays no compensation.

A's prevention level

☐ A's prevention level 0 · 0 ECU

☐ A's prevention level 1 · 10 ECU

☐ A's prevention level 2 · 14 ECU

Confirm decision

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Figure 2.6: A's choice in the basic edition.

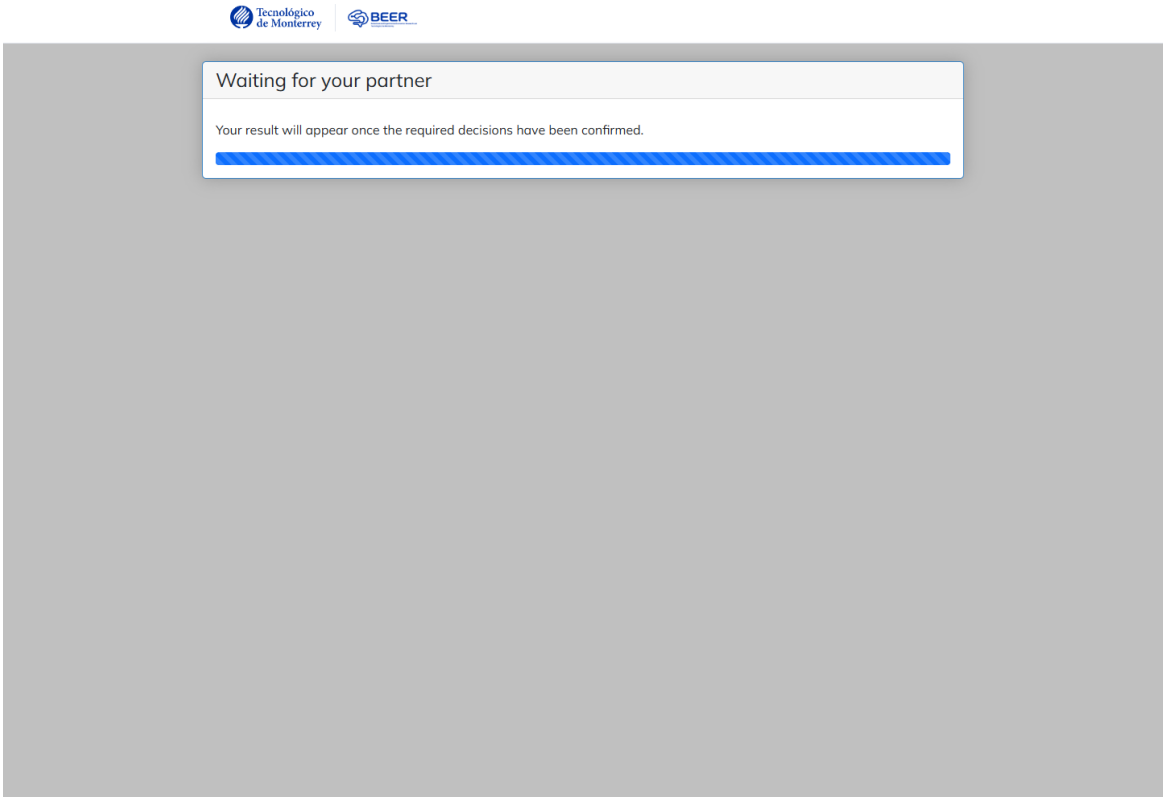


Figure 2.7: B waits while A confirms a decision.

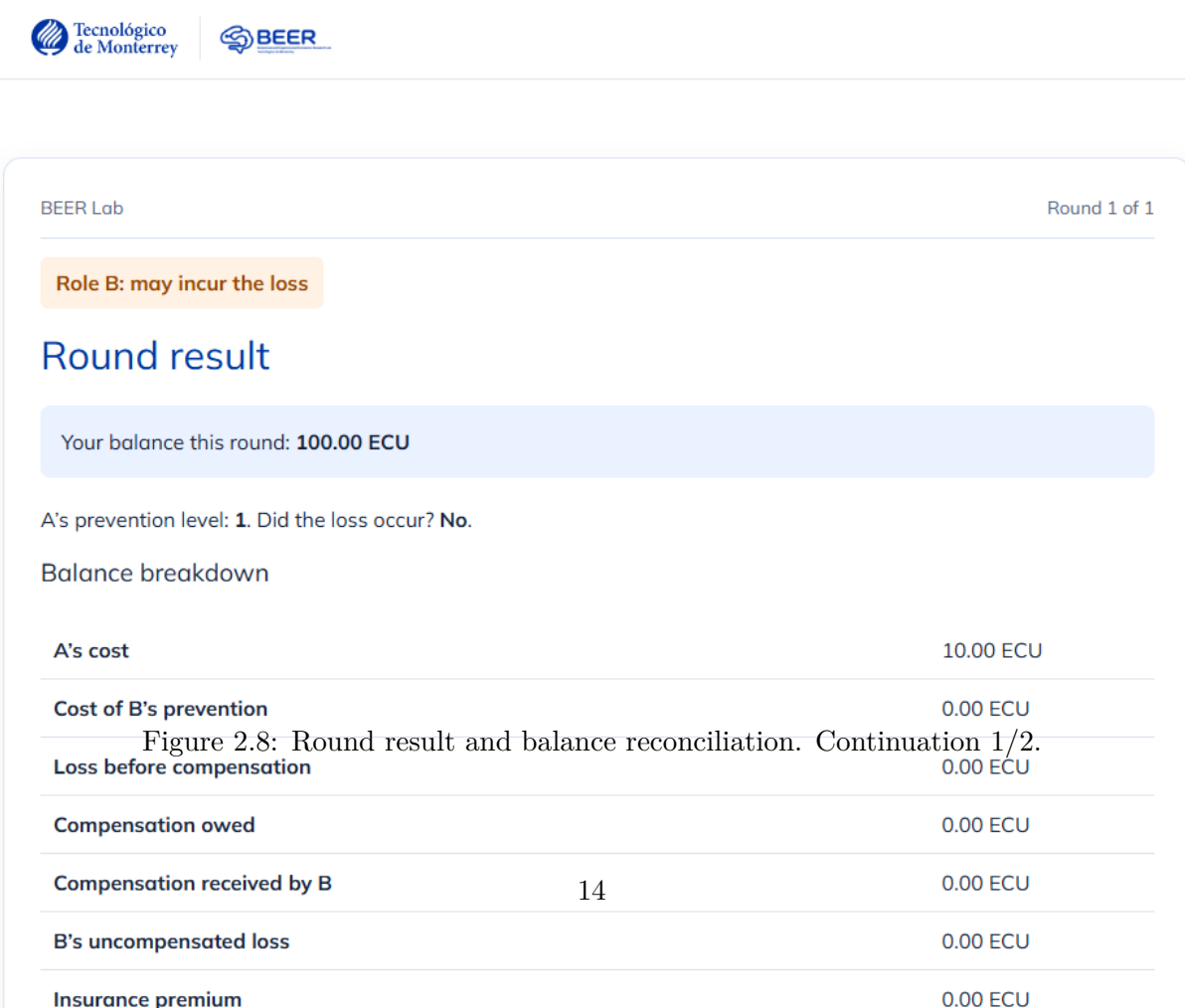


Figure 2.8: Round result and balance reconciliation. Continuation 1/2.

A's prevention level: **1**. Did the loss occur? **No**.

#### Balance breakdown

|                                                   |            |
|---------------------------------------------------|------------|
| A's cost                                          | 10.00 ECU  |
| Cost of B's prevention                            | 0.00 ECU   |
| Loss before compensation                          | 0.00 ECU   |
| Compensation owed                                 | 0.00 ECU   |
| Compensation received by B                        | 0.00 ECU   |
| B's uncompensated loss                            | 0.00 ECU   |
| Insurance premium                                 | 0.00 ECU   |
| Insurance payment to B                            | 0.00 ECU   |
| External account: premium minus insurance payment | 0.00 ECU   |
| A's balance                                       | 90.00 ECU  |
| B's balance                                       | 100.00 ECU |

Continue

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Figure 2.9: Round result and balance reconciliation. Continuation 2/2.



BEER Lab

Round 1 of 1

Role B: may incur the loss

## Activity completed

Your total balance: **100.00 ECU**

Completed rounds: 1.

You have completed all rounds. Stay on this screen and wait for the instructor's directions.

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Figure 2.10: Explicit completion screen with accumulated balance.

insurance account identifies resources entering or leaving A and B from outside the pair. A relevant standard appears after choice in the disclosure-after configuration. The final screen adds balances and asks participants to remain there for the instructor's directions. No button leads onward to the generic no-more-pages message.

Ten-round sessions preserve each participant's role. Fixed matching also preserves the partner. Reassignment redraws the correspondence between roles while avoiding consecutive encounters when alternatives exist; later meetings may repeat. This rule reduces immediate relationship continuity without guaranteeing perfect anonymity or independence across rounds. The class knows the ten-round horizon, which can affect learning and strategies. Record these features before interpreting distributional differences across matching modes.

One practical check is to ask a test participant to describe the rule using only the information visible on their screen. If that description leaves out who pays, the instructor should clarify the operational rule before admitting the class. Do not solve the payoff-maximization problem for the participant. Clarification should concern the mapping from actions and events to payments, whereas choosing among the permitted levels remains the participant's task.

# Model and benchmark predictions

## 3.1 Efficient prevention and social cost

The model distinguishes three objects: prevention expenditure, physical damage, and compensation. Prevention uses resources paid by the decision maker. Physical damage reduces B's balance when an accident occurs. Compensation transfers resources from A or an external account to B. Confusing these objects distorts welfare accounting: adding compensation to damage as a second social loss counts the same consequence twice. A liability rule can change damage through prevention choices, even though the transfer itself does not destroy resources.

Let  $c$  denote A's level,  $k(c)$  its cost, and  $q(c)$  accident probability. With damage of 60 ECU, expected unilateral social cost equals  $k(c)$  plus  $q(c)$  times 60. Reference values are 24 ECU at level 0, 16 at level 1, and 17 at level 2. The efficient choice is therefore 1. This is not the option that minimizes accident probability. Level 2 reduces risk further, but its additional four-ECU cost exceeds the additional three-ECU reduction in expected damage.

$$C(c) = k(c) + q(c)D, \quad C(0) = 24, \quad C(1) = 16, \quad C(2) = 17.$$

Moving from 0 to 1 costs ten and reduces expected damage by eighteen, producing a social net benefit of eight. Moving from 1 to 2 costs four and reduces expected damage by three, producing a negative net benefit of one. Because the menu is discrete, this marginal comparison requires no derivatives. Ask students to calculate both changes separately. Simply observing that level 2 has the lowest probability does not answer the economic question of whether that additional reduction is worth its cost.

Private predictions below assume risk neutrality and maximization of one's own expected balance. Participants need not have these preferences. They may care about others, dislike uncertainty, or interpret an obligation as a norm. The prediction is a precise benchmark for organizing discussion rather than a claim about every individual. A departure does not uniquely reveal motivation. Choosing 1 does not demonstrate that someone calculated the social optimum either. Several different lines of reasoning can lead to the same action.

### Theoretical foundation

Under the reference calibration, efficient unilateral prevention is level 1 with expected social cost of 16 ECU. In bilateral prevention, it is  $A=1$  and  $B=1$  with cost 13.2. These values are model calculations and must be recomputed when costs, probabilities, or damage change.

### 3.2 Balances and resource conservation

Without insurance, A's balance equals 100 minus prevention cost and compensation actually paid. B's balance equals 100 minus B's prevention cost, physical damage, and then plus compensation received. B's prevention cost is zero outside the bilateral configuration. Adding the balances yields 200 minus total prevention and physical damage. In the basic activity, A may retain 100 while B ends with 40 following an accident. That distributive difference is not an additional prevention expenditure.

With insurance, A pays a premium to an external account and that account compensates B. The account's net balance equals premiums received minus claims paid. Adding A, B, and the external account preserves the resource identity. Looking only at A plus B can make an insurer's payment appear to create wealth. The report includes the external account to prevent that interpretation. It may be negative in a round: the implementation assumes an external reserve able to honor coverage and does not model insurer bankruptcy.

Consider level 1 under strict liability with an accident. A pays ten for prevention and sixty in compensation, ending with thirty. B loses sixty and receives sixty, ending with one hundred. The pair's total is one hundred thirty. The seventy resources lost consist of ten prevention and sixty damage. Without an accident, A has ninety and B one hundred, losing only ten. Weighting these states by probabilities of 10% and 90% yields 184 ECU for the pair, corresponding to expected cost of sixteen.

Negligence with level 1 produces a different allocation in the same accident state: A retains ninety and B ends with forty. The total remains one hundred thirty. Thus two rules may produce identical expected efficiency while allocating residual risk differently. This comparison separates compensation, prevention, and victim protection. An accident without compensation need not indicate a violation. Under negligence, a person who meets the standard retains the exemption specified by that rule.

For another reconciliation, use level 0 under limited assets and an accident. A pays twenty and keeps eighty; B loses sixty and recovers twenty, keeping sixty. Their total is one hundred forty. Full liability would allocate the same total as forty for A and one hundred for B. The cap changes the distribution in this realized state. Its behavioral effect comes from the lower expected payment before the accident, which changes A's reason to invest in prevention.

### 3.3 Basic edition and its three matching modes

The basic edition uses no liability. A's expected balances are 100, 90, and 86 for levels 0, 1, and 2. Because A does not pay damage, own-balance maximization favors 0. B's expected balances are 76, 94, and 97. The externality arises because A bears prevention costs while B receives the monetary benefit of reduced risk. Expected cost of 24 under A's private choice exceeds the social minimum of 16. This is the starting point for assessing how a payment rule can align the two margins.

A single interaction presents the problem without repeated experience. Ten rounds with a fixed partner permit adjustment following accidents or expectations concerning the same person. Ten rounds with reassignment reduce immediate relationship continuity. None of these configurations gives B a choice or an informal punishment opportunity. An adjustment by A after past outcomes can reflect learning, social preferences, or perceived risk; it should not be described as directly observed reciprocal behavior by B.

Keep costs, damage, information, and language constant when comparing modes. A difference between first and last rounds may reflect experience, the composition of participants remaining active, or chance. The report locates changes across completed rounds but does not eliminate

these alternatives. Ask students to offer at least two explanations consistent with a pattern. This discipline prevents every difference from becoming automatic confirmation of a preferred theory.

An exercise can hold A's action fixed across all ten rounds and calculate the distribution of losses rather than only its mean. At level 1 the expected number of accidents for a pair is one, but zero or several remain possible. Students can then compare that simulated distribution with the classroom realization. The purpose is to develop intuition about sampling variation, without suggesting that actual participants were required to produce a particular number of accidents.

# Liability, negligence, and enforcement

## 4.1 Strict liability

Strict liability requires compensation for all damage if an accident occurs, whatever prevention level was chosen. A faces prevention cost plus expected damage. Expected balances are 76, 84, and 83. The private optimum is 1, matching the social minimum. B is protected against the monetary loss and receives one hundred in either accident state, even though physical damage remains in resource accounting. The implicit insurance provided to B is financed by the accident risk borne by A.

Compensation is not an additional fine. It leaves A's balance and enters B's balance. A fine paid outside the pair would require a separate account and could have different incentives. Strict liability also does not imply maximal prevention. The relevant margin includes the extra cost of additional care. Under this calibration, level 2 lowers A's expected balance by one compared with 1. A student choosing 2 may be cautious, but that action does not maximize expected money under the reference assumptions.

Begin discussion by asking for A's expected balance in every table row. Then ask whether a higher level reduces the legal amount owed once an accident has happened. It does not: the obligation remains sixty at every level. What changes is the probability that the obligation is activated. The distinction between a conditional amount and its probability explains how liability can reduce accidents without explicitly requiring a minimum level of care.

## 4.2 Negligence with a known standard

The negligence configuration requires level 1. A pays damage after choosing 0, but not after choosing 1 or 2. Expected balances are 76, 90, and 86. A has a discrete incentive to meet the standard and no monetary incentive to exceed it. Choosing 1 again attains the social minimum. Unlike strict liability, B bears residual accidents when A complies. At that level B's expected balance is 94 and A's is 90. The pair's expected total remains 184.

The rule distinguishes an accident from a violation. Results display both action and event. An accident at level 1 triggers no compensation; an accident at 0 does. Avoid treating B's loss as evidence of a poor personal choice, since B does not control A's action here. Likewise, an A who chooses 0 and avoids an accident has not complied merely by being fortunate. Care is evaluated from the action rather than retrospectively inferred from the outcome.

Consider a counterfactual standard of 2. A would compare level 1 with expected liability and level 2 with exemption. Under the current parameters, A would prefer 2 even though 1 remains socially preferable. A standard does not create efficiency simply by existing; its location relative to



BEER Lab Round 1 of 10

Role A: chooses prevention

## Choose your prevention

Choose a level. Its cost is deducted whether or not the loss occurs.

| A's prevention level | A's cost (ECU) | Probability of loss |
|----------------------|----------------|---------------------|
| 0                    | 0              | 40%                 |
| 1                    | 10             | 10%                 |
| 2                    | 14             | 5%                  |

**Payment rule for this session**

If the loss occurs, A pays B compensation equal to the loss, regardless of the prevention level.

A's prevention level

☐ A's prevention level 0 · 0 ECU

☐ A's prevention level 1 · 10 ECU

☐ A's prevention level 2 · 14 ECU

Confirm decision

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Figure 4.1: Prevention choice when every accident must be compensated.

BEER Lab Round 1 of 10

Role A: chooses prevention

## Choose your prevention

Choose a level. Its cost is deducted whether or not the loss occurs.

| A's prevention level | A's cost (ECU) | Probability of loss |
|----------------------|----------------|---------------------|
| 0                    | 0              | 40%                 |
| 1                    | 10             | 10%                 |
| 2                    | 14             | 5%                  |

Payment rule for this session

If the loss occurs and A chose a level below 1, A compensates B for the entire loss. With level 1 or 2, B bears the loss.

A's prevention level

☐ A's prevention level 0 · 0 ECU

☐ A's prevention level 1 · 10 ECU

☐ A's prevention level 2 · 14 ECU

Confirm decision

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Figure 4.2: A payment rule with a known minimum of level 1.

costs and benefits matters. This question prepares the uncertainty extension, but first resolve the deterministic rule so students do not mix two sources of variation.

### 4.3 Imperfect enforcement

Imperfect enforcement preserves strict liability but collects payment with probability 50% after an accident. The collection draw is independent of the accident draw. A faces prevention plus half of expected damage, with expected balances of 88, 87, and 84.5. Level 0 becomes privately optimal despite a formal obligation to compensate. B bears damage when collection fails. The amount owed remains sixty, while the payment received can be zero.

This extension distinguishes a rule's existence from effective application. Lower collection changes neither accident technology nor physical damage or prevention costs, so the social minimum remains 1. With level 0 and an accident, A ends with forty if collection succeeds and one hundred if it fails. B ends with one hundred or forty respectively. The pair loses sixty in either state. Enforcement distributes damage; it does not restore the physical resource lost.

Comparing levels 0 and 1 identifies a threshold. Prevention costs ten and saves eighteen in expected damage. If collection probability is  $e$ , A's expected saving is eighteen times  $e$ . Level 1 beats 0 when  $e$  exceeds ten divided by eighteen, approximately 55.6%. At 50%, that threshold is not reached. This is a calculation for the classroom calibration, not a universal estimate of judicial effectiveness. Different damages, prevention costs, or motivations would change it.

#### Feedback script

Ask what could make a weakly enforced obligation induce prevention again. Separate higher collection, greater compensable damage, and lower care costs. Then identify which alternatives also change the allocation of risk.

Classroom participants may prevent even when own expected money favors 0. Concern for B, normative interpretation, risk aversion, or calculation errors could all explain this. The activity does not separately elicit those motives. Discuss them as hypotheses and consider another design to distinguish them, rather than assigning a motivation to identified students. Aggregated discussion permits examination of behavior without turning the exercise into a personal moral judgment.

A useful assessment asks students to distinguish the probability that compensation is owed from the probability it is collected. At level 1 in the imperfect-enforcement configuration, an accident occurs with probability 10%, and collection succeeds conditionally with probability 50%. The unconditional probability of paying sixty is 5%, giving expected payment of three. The other outcomes matter for distribution but do not change this expectation. Writing the two probabilities separately prevents a common confusion between enforcement conditional on an accident and accident occurrence itself.



BEER Lab Round 1 of 10

Role A: chooses prevention

### Choose your prevention

Choose a level. Its cost is deducted whether or not the loss occurs.

| A's prevention level | A's cost (ECU) | Probability of loss |
|----------------------|----------------|---------------------|
| 0                    | 0              | 40%                 |
| 1                    | 10             | 10%                 |
| 2                    | 14             | 5%                  |

**Payment rule for this session**

If the loss occurs, A owes compensation. The payment is collected with probability 50% through an independent draw. If it is not collected, B bears the loss.

A's prevention level

☐ A's prevention level 0 · 0 ECU

☐ A's prevention level 1 · 10 ECU

☐ A's prevention level 2 · 14 ECU

Confirm decision

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Figure 4.3: A compensation obligation with probabilistic collection.

# Information and further extensions

## 5.1 An uncertain standard and disclosure timing

The uncertain-standard extension contains two configurations with the same distribution. Each pair-round draws level 2 with probability 75% and level 1 with probability 25%. One configuration reveals the value after choosing; the other reveals it beforehand. The compensation rule stays constant: A pays damage if prevention falls below the drawn standard. Holding the distribution fixed separates information timing from a change in average severity.

With disclosure after choice, level 0 always falls short and gives expected balance 76. Level 1 complies when the standard is 1 and remains liable when it is 2. A's expected damage payment is 10% times sixty times 75%, or 4.5 ECU. Expected balance is 85.5. Level 2 always complies and leaves 86. Thus 2 is privately optimal even though its expected social cost is 17 and the social minimum remains 16 at level 1. The private difference between 1 and 2 is small, which matters when interpreting heterogeneous choices.

When a standard of 1 is disclosed beforehand, A compares 76, 90, and 86, choosing 1. When a standard of 2 is disclosed, A compares 76, 84, and 86, choosing 2. Under those choices, expected social cost is 25% of sixteen plus 75% of seventeen, or 16.75. Disclosure lowers cost relative to always choosing 2 under uncertainty, but does not fully restore the minimum. Some rounds require more care than is efficient. Knowing a rule does not guarantee that the rule itself is well calibrated.

For a more informative analysis, separate choices by the realized standard in prior disclosure. Average prevention combines responses to two different requirements. Comparing it with another treatment's average without considering composition can conceal the mechanism. The export records the standard for reconstruction. Under disclosure after choice, classifying decisions by realized standards can check assignment, but cannot be interpreted as reaction to information participants did not have when choosing.

A further exercise compares the expected balance of level 1 as the probability of a high standard changes. Each extra percentage point of that probability increases expected liability by 0.06 ECU. The threshold at which level 2 becomes preferable is two thirds. This shows that uncertainty does not mechanically produce maximal care. The conclusion follows from a particular relationship between the cost difference, residual accident probability, and liability triggered by the higher standard.

### Attention

Do not interpret this extension as uncertainty about current law in any jurisdiction. A random standard is a classroom adaptation for studying information and incentives. Its announced distribution and controlled disclosure are part of the experimental rule.



BEER Lab Round 1 of 10

Role A: chooses prevention

## Choose your prevention

Choose a level. Its cost is deducted whether or not the loss occurs.

| A's prevention level | A's cost (ECU) | Probability of loss |
|----------------------|----------------|---------------------|
| 0                    | 0              | 40%                 |
| 1                    | 10             | 10%                 |
| 2                    | 14             | 5%                  |

**Payment rule for this session**

Each round a minimum is drawn: level 2 with probability 75% and level 1 with probability 25%. It is shown after the choice. If the loss occurs and A chose below that minimum, A compensates it.

A's prevention level

☐ A's prevention level 0 · 0 ECU

☐ A's prevention level 1 · 10 ECU

☐ A's prevention level 2 · 14 ECU

Confirm decision

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Figure 5.1: The distribution is known, but its realized minimum is disclosed after choice.



BEER Lab

Round 1 of 10

Role A: chooses prevention

## Choose your prevention

Choose a level. Its cost is deducted whether or not the loss occurs.

| A's prevention level | A's cost (ECU) | Probability of loss |
|----------------------|----------------|---------------------|
| 0                    | 0              | 40%                 |
| 1                    | 10             | 10%                 |
| 2                    | 14             | 5%                  |

### Payment rule for this session

Each round a minimum is drawn: level 2 with probability 75% and level 1 with probability 25%. It is shown before the choice. If the loss occurs and A chose below that minimum, A compensates it.

Required minimum level: 2

A's prevention level

☐ A's prevention level 0 · 0 ECU

☐ A's prevention level 1 · 10 ECU

☐ A's prevention level 2 · 14 ECU

Confirm decision

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Figure 5.3: The drawn minimum appears before the decision is confirmed. Continuation 2/2.

## 5.2 Bilateral prevention

Bilateral prevention adds B's simultaneous choice to pay two ECU or not. Paying multiplies A's risk by 0.5 at level 0 and by 0.2 at levels 1 or 2. Without B's prevention, probabilities are 40%, 10%, and 5%; with it, they are 20%, 2%, and 1%. A's negligence standard remains 1. B retains compensation when A falls short, regardless of B's own choice. This configuration does not implement a contributory-negligence defense.

Calculate expected social cost for all six combinations. Without B's prevention, costs are 24, 16, and 17. With it, they are 14, 13.2, and 16.6. The efficient combination is A=1 and B=1: ten paid by A, two by B, and expected damage of 1.2. B's prevention complements A's care in this calibration by reducing risk from 10% to 2% when A complies. The multiplier pattern is an explicit teaching choice, not a parameter estimated from actual accidents.

Strategic reasoning requires best responses. When B does not prevent, A compares balances 76, 90, and 86, preferring 1. When B prevents, A compares 88, 90, and 86, again preferring 1. With A=1, B compares expected balance 94 without prevention and 96.8 with it, so paying two is worthwhile. With A=0, B is fully compensated and prefers to avoid the additional cost. With A=2, B compares 97 without prevention and 97.4 with prevention; the net gain is small but positive.

The reference best-response combination is A=1, B=1, coinciding with efficiency. This depends on the full matrix and compensation rule. It is insufficient to say that both parties ought to prevent. Full insurance for both, combined with premiums unrelated to care, would create different incentives. Simultaneity also does not imply ignorance of the partner's possibilities. Each participant knows the table's actions and probabilities while not observing the partner's current choice.

Ask B to distinguish receiving compensation from preventing a loss. With A=0, B's prevention lowers social damage but B's own balance is already protected. Allocating risk can therefore remove one party's private incentive to prevent. The efficient outcome emerges here because A chooses compliance and returns residual risk to B. The interaction between both parties' responses is the strategic content of this extension.

A classroom analysis can also construct a contingency table of A and B decisions rather than examine their separate means. Separate histograms do not reveal whether B's prevention occurred specifically when A complied. To reconstruct joint frequencies, retain one record per pair-round from the export. This exercise connects strategic reasoning to data structure. It also makes clear that a mean response for B is not evidence that B observed A's simultaneous current action.

## 5.3 Mandatory insurance with a fixed premium

With a fixed premium, A pays twelve ECU each round and an external account fully compensates B if a loss occurs. A retains prevention cost but no longer personally pays accident damage. Expected balances are 88, 78, and 74, so own-balance maximization favors 0. B receives one hundred in every state. Coverage protects B's monetary balance while weakening A's incentive to reduce risk. This is the moral-hazard comparison provided by the family.

The premium is mandatory. There is no choice to buy coverage and no selection among privately known risk types, so the extension does not identify adverse selection. It also contains no deductible. Without an accident, the external account gains twelve. With an accident, it receives twelve and pays sixty, ending at minus forty-eight. At level 0 its expected balance is minus twelve, because the reference premium is below expected damage of twenty-four. The model allows this expected subsidy and does not require financial break-even.

Two comparisons serve different purposes. Relative to uninsured strict liability, coverage changes



BEER Lab

Round 1 of 10

Role B: may incur the loss

## Choose your prevention

Choose whether to pay for additional prevention. A and B decide without observing each other's current choice.

| A's prevention level | A's cost (ECU) | Probability of loss | Probability if B pays for prevention |
|----------------------|----------------|---------------------|--------------------------------------|
| 0                    | 0              | 40%                 | 20%                                  |
| 1                    | 10             | 10%                 | 2%                                   |
| 2                    | 14             | 5%                  | 1%                                   |

### Payment rule for this session

A pays for the loss if A chose below level 1. B may pay 2 ECU to reduce its probability as shown in the table. Decisions are simultaneous. B's choice does not change the compensation rule.

Cost of B's prevention: 2 ECU

☐ Do not pay for additional prevention

☐ Pay for additional prevention · 2 ECU

Confirm decision

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Figure 5.4: B's additional decision with the six relevant probabilities.



BEER Lab Round 1 of 10

Role A: chooses prevention

## Choose your prevention

Choose a level. Its cost is deducted whether or not the loss occurs.

| A's prevention level | A's cost (ECU) | Probability of loss |
|----------------------|----------------|---------------------|
| 0                    | 0              | 40%                 |
| 1                    | 10             | 10%                 |
| 2                    | 14             | 5%                  |

**Payment rule for this session**

A pays a mandatory premium of 12 ECU each round. If the loss occurs, an external account pays all compensation to B. A makes no additional loss payment.

A's prevention level

☐ A's prevention level 0 · 0 ECU

☐ A's prevention level 1 · 10 ECU

☐ A's prevention level 2 · 14 ECU

Confirm decision

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Figure 5.5: Full coverage with a premium independent of prevention.

A's exposure to marginal accident cost. Relative to risk-rated coverage, it changes price sensitivity to prevention. Do not assign any behavioral difference exclusively to payment variance: the actions also face different prices. To discuss aggregate actuarial balance under a fixed premium, explicitly choose another premium and recompute both behavior and accounts.

For example, raising the fixed premium to twenty-four would balance the insurer in expectation if A continued choosing 0. It would not restore A's incentive to prevent, because the premium still does not depend on the action. A's balance would fall equally at every level. This counterfactual separates financing from marginal incentives and prevents the misleading claim that any financially balanced insurance scheme necessarily produces efficient care.

## 5.4 Risk-rated insurance

In the second insurance configuration, the premium equals the chosen level's accident probability times sixty. Premiums are 24, 6, and 3 ECU. A does not pay damage after an accident but faces its expected cost through the price of coverage. Balances are 76, 84, and 83, matching expected balances under strict liability. The optimum returns to 1. B remains fully protected and the external account has expected balance zero for each action. A's payment is certain conditional on the choice, unlike uninsured liability.

The platform observes the action and calculates a premium using its objective probability. There is no insurer secretly inferring effort. Observability is essential: if coverage prices could not depend on care, this would no longer be the implemented comparison. Results put premiums and claims on separate rows. A low premium at level 2 does not imply the greatest balance, because its prevention cost exceeds that of level 1.

A closing question asks what is identical across strict liability and risk-rated coverage: A's expected balance for each action. Then ask what differs: A's realized exposure to accidents and the external account's balance. If decisions differ, risk preferences are one possible explanation, but are not isolated without additional controls. This comparison connects prevention with insurance theory and with the practical importance of observable actions.

The zero expected account balance does not mean zero realized balance in every round. At level 1 an accident produces six minus sixty, or minus fifty-four, while no accident produces six. Averaging with the relevant probabilities yields zero. The same distinction between realized and expected quantities applies to insurer finances and to social costs. Students should reconcile the individual round first, then average across possible states.

## 5.5 Limited recoverable assets

Limited assets preserve the obligation to compensate sixty but allow collection of at most twenty. A still starts with one hundred, separating recoverability from lower wealth available for prevention. The cap represents resources recoverable under this model rather than a measurement of total wealth. B bears forty uncompensated ECU in every accident. A's expected balances are 92, 88, and 85, making 0 optimal under the own-money benchmark.

The extension illustrates an obligation exceeding recoverable resources. The cap lowers private expected accident cost while leaving social cost unchanged. Moving from 0 to 1 costs ten and lowers A's expected payment by six, since a thirty-percentage-point risk reduction is multiplied by twenty. Prevention is privately unattractive. With certain collection, the cap must exceed ten divided by 0.3, approximately 33.33 ECU, to make that change worthwhile.

Compare asset limits and imperfect enforcement carefully. The former creates a certain partial

BEER Lab

Round 1 of 10

Role A: chooses prevention

## Choose your prevention

Choose a level. Its cost is deducted whether or not the loss occurs.

| A's prevention level | A's cost (ECU) | Probability of loss | Insurance premium (ECU) |
|----------------------|----------------|---------------------|-------------------------|
| 0                    | 0              | 40%                 | 24                      |
| 1                    | 10             | 10%                 | 6                       |
| 2                    | 14             | 5%                  | 3                       |

### Payment rule for this session

A pays a mandatory premium equal to the loss probability of the chosen level multiplied by 60 ECU. The table shows each premium. If the loss occurs, an external account compensates it in full.

A's prevention level

☐ A's prevention level 0 · 0 ECU☐ A's prevention level 1 · 10 ECU☐ A's prevention level 2 · 14 ECUPowered by [oTree](#)

Figure 5.6: Premiums calculated from the probability associated with each level.



BEER Lab Round 1 of 10

Role A: chooses prevention

## Choose your prevention

Choose a level. Its cost is deducted whether or not the loss occurs.

| A's prevention level | A's cost (ECU) | Probability of loss |
|----------------------|----------------|---------------------|
| 0                    | 0              | 40%                 |
| 1                    | 10             | 10%                 |
| 2                    | 14             | 5%                  |

**Payment rule for this session**

A owes compensation for the entire loss, but at most 20 ECU can be collected. B bears the uncollectible part. This limit does not change A's starting balance.

A's prevention level

☐ A's prevention level 0 · 0 ECU

☐ A's prevention level 1 · 10 ECU

☐ A's prevention level 2 · 14 ECU

Confirm decision

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Figure 5.7: The obligation and recovery limit are communicated before choice.

payment of twenty after each accident. The latter creates payments of sixty or zero by chance. Expected payments could be brought closer with another calibration, but their state distributions would remain distinct. A class intending to compare only expectations must align parameters while acknowledging the remaining risk difference. Both extensions are included to illustrate different routes from formal obligation to effective recovery.

The asset-limit configuration does not permit borrowing, hiding wealth, or changing the cap through a participant choice. Adding those decisions would require a different sequence and new predictions. Keeping the cap exogenous lets the class examine the prevention margin clearly. The observed level 0, if common, would be consistent with the monetary prediction, but would not establish how people respond to actual insolvency institutions outside the classroom.

# Report and data interpretation

## 6.1 Controlled disclosure and denominators

The report opens with aggregates hidden. The instructor decides when to reveal them, after relevant choices are complete or when discussing partial progress. The button hides them again, and each reload begins with disclosure closed. This feature organizes projection rather than replacing administrative access control. Do not share the report address with participants. Aggregate information remains teaching material requiring interpretation within the session's configuration.

Progress displays completed pair-rounds against planned pair-rounds. Four people over ten rounds yield twenty planned observations because two pairs play each round. The denominator is not forty, despite forty individual payment records. A one-round session has two planned observations. A pair still awaiting a decision enters neither the completed count nor the averages. Ten technical application rounds do not increase the denominator of a one-active-round configuration. The report explicitly retrieves active periods even when the administrator opens the last technical period.

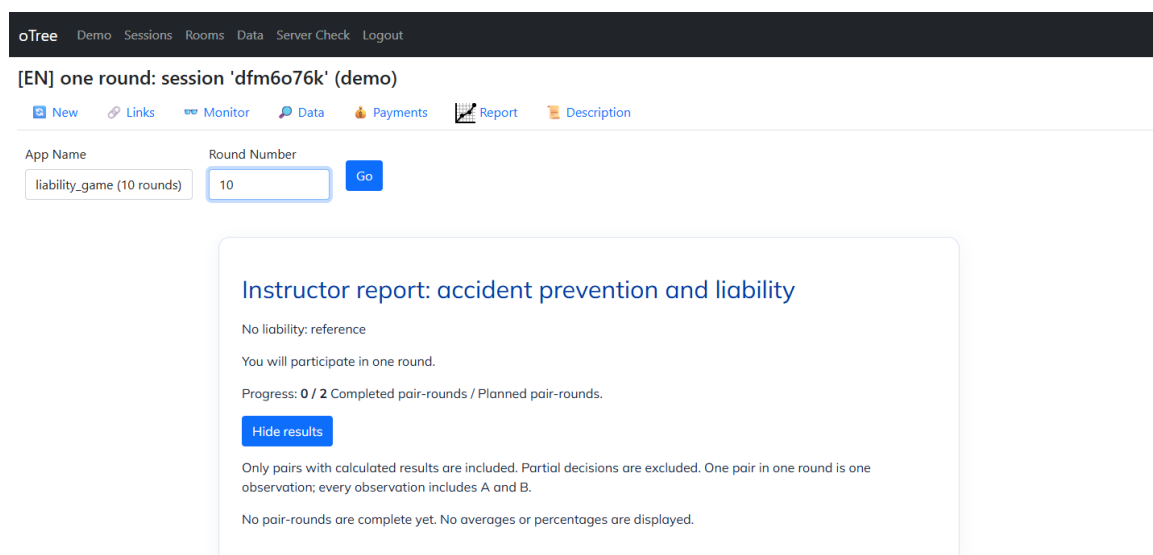


Figure 6.1: A revealed report without complete observations does not invent averages or percentages.

A's mean prevention ranges from zero to two. A mean of one could describe everyone choosing one, or a mixture of zeros and twos. The histogram distinguishes these distributions. Loss frequency uses completed pair-rounds as its denominator. Standard violations use the same observations and appear only where a standard is part of the rule. Strict liability does not require a minimum, so violation is marked not applicable. In bilateral prevention, a second histogram shows the proportion of B participants purchasing prevention.

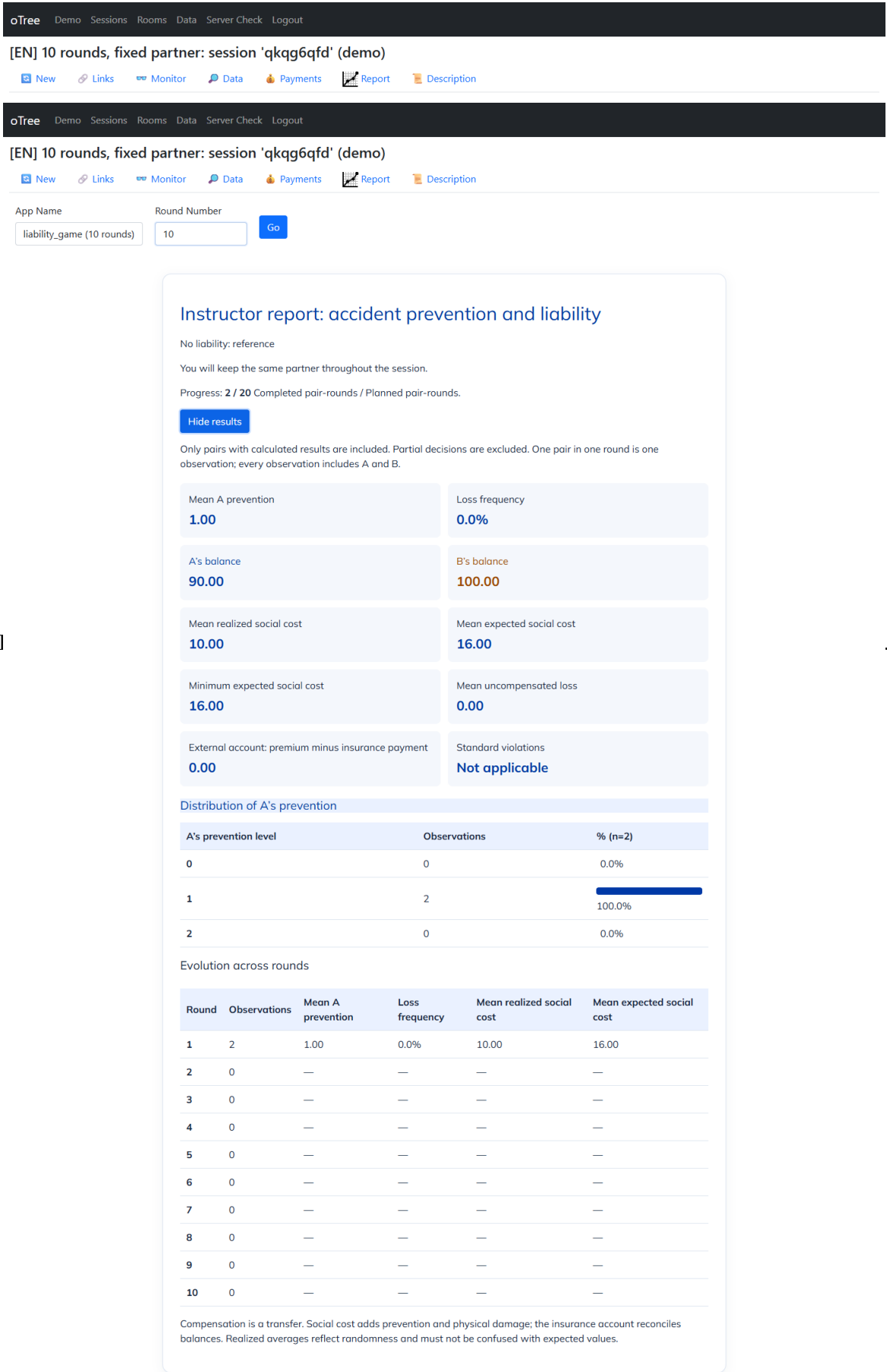


Figure 6.3: A partial report retains the planned pair-round denominator. Continuation 2/2.

## Instructor report: accident prevention and liability

### Bilateral prevention

Your partner is reassigned between rounds within the opposite role. With only one pair, you keep the same person; with few pairs, you may meet again.

Progress: **20 / 20** Completed pair-rounds / Planned pair-rounds.

Hide results

Only pairs with calculated results are included. Partial decisions are excluded. One pair in one round is one observation; every observation includes A and B.

|                                                                  |                                           |
|------------------------------------------------------------------|-------------------------------------------|
| Mean A prevention<br><b>1.00</b>                                 | Loss frequency<br><b>20.0%</b>            |
| A's balance<br><b>82.80</b>                                      | B's balance<br><b>96.00</b>               |
| Mean realized social cost<br><b>21.20</b>                        | Mean expected social cost<br><b>16.10</b> |
| Minimum expected social cost<br><b>13.20</b>                     | Mean uncompensated loss<br><b>3.00</b>    |
| External account: premium minus insurance payment<br><b>0.00</b> | Standard violations<br><b>30.0%</b>       |

### Distribution of A's prevention

| A's prevention level | Observations | % (n=20)                                                                                    |
|----------------------|--------------|---------------------------------------------------------------------------------------------|
| 0                    | 6            |  30.0% |
| 1                    | 8            |  40.0% |
| 2                    | 6            |  30.0% |

Figure 6.4: Role-specific distributions and round evolution in bilateral prevention. Indicators and distributions.

## Distribution of B's prevention

|          |    |                                                                                    |       |
|----------|----|------------------------------------------------------------------------------------|-------|
| <b>0</b> | 10 |  | 50.0% |
| <b>1</b> | 10 |  | 50.0% |

## Evolution across rounds

| Round     | Observations | Mean A prevention | Loss frequency | Mean realized social cost | Mean expected social cost |
|-----------|--------------|-------------------|----------------|---------------------------|---------------------------|
| <b>1</b>  | 2            | 1.00              | 0.0%           | 12.00                     | 13.20                     |
| <b>2</b>  | 2            | 2.00              | 50.0%          | 44.00                     | 17.00                     |
| <b>3</b>  | 2            | 0.00              | 50.0%          | 32.00                     | 14.00                     |
| <b>4</b>  | 2            | 1.00              | 0.0%           | 10.00                     | 16.00                     |
| <b>5</b>  | 2            | 2.00              | 0.0%           | 16.00                     | 16.60                     |
| <b>6</b>  | 2            | 0.00              | 100.0%         | 60.00                     | 24.00                     |
| <b>7</b>  | 2            | 1.00              | 0.0%           | 12.00                     | 13.20                     |
| <b>8</b>  | 2            | 2.00              | 0.0%           | 14.00                     | 17.00                     |
| <b>9</b>  | 2            | 0.00              | 0.0%           | 2.00                      | 14.00                     |
| <b>10</b> | 2            | 1.00              | 0.0%           | 10.00                     | 16.00                     |

Compensation is a transfer. Social cost adds prevention and physical damage; the insurance account reconciles balances. Realized averages reflect randomness and must not be confused with expected values.

Figure 6.5: Role-specific distributions and round evolution in bilateral prevention. Round evolution.

Realized social cost adds prevention expenditure and accidents that actually occurred. It can lie above or below its expectation through chance. Expected cost uses the probability associated with actual choices regardless of the draw. The minimum expected cost is calculated over every allowed action combination. These measures distinguish a good decision before the outcome, a fortunate realization, and an efficient benchmark. A class can have low realized cost because few accidents occurred while still choosing less than efficient care.

Round evolution presents the number of observations, mean care, loss frequency, and realized and expected costs. A round without completed pairs displays no averages rather than assigning zero. The table permits comparisons across fixed and reassigned sessions but does not automatically pool different classes. Export sessions to construct a common comparison retaining configuration, size, and order. Use identical scales and consistent role colors when presenting them: blue for A and orange for B.

One informative comparison subtracts the minimum expected cost from the cost associated with actual choices. In the unilateral calibration this gap is eight for level 0, zero for level 1, and one for level 2. It evaluates choices using the same objective probabilities while avoiding accidental rewards for favorable draws. The report displays the two necessary quantities, so students can calculate the gap themselves. Do not call the gap a monetary loss experienced by a specific participant: it is a model-based efficiency comparison for the pair.

## 6.2 Contents of the export

The application-specific export contains one row per person and completed round. Fields include session and participant codes, pair, language, edition, treatment, matching, role, A's care, B's care, and own balance. It also includes accident probability, event occurrence, standard, costs, physical damage, compensation owed and received, uncompensated damage, premium, insurer payment, external account, and social costs. Internal numerical random draws are excluded from this export. Standard oTree data access may contain additional administrative fields and requires review before sharing.

Each pair appears in two individual rows. Adding damage or the insurance account directly across those rows doubles the corresponding pair quantity. To reconstruct pair statistics, retain one row for each session-round-pair or use only A rows. To sum individual payments, keep both people. Under reassignment, pair number identifies a position within a round rather than one stable relationship across a session. Analysis keys must match the unit being examined.

Codes help link rounds during private review, but should not accompany names or student numbers in a public table. Omitting demographic questions does not automatically anonymize data that someone can connect to seats or individual links. Share classroom examples as aggregates with identifiers removed. Keep a private record of exclusions, configuration, and parameter changes. Those notes allow another person to understand why completed observations fall below planned opportunities.

### Checkpoint

When reconstructing a report, filter active rounds and complete outcomes. Use one row per pair for social costs and one per person for payments. Check conservation including the external insurance account.

# Discussion, exercises, and readings

## 7.1 A discussion script

Begin with the distribution of care without attributing intentions. Ask students to describe each level's frequency and then calculate expected social cost. Factual description comes before explanation. If mean care is near one, examine the histogram before saying most students chose the efficient level. If accidents were rare, display expected risk and ask whether a different random realization would change evaluation of choices. This sequence makes behavior, consequence, and criterion of evaluation visibly distinct.

Next introduce the payment rule's legal name. Without liability, ask why A would pay for care when its monetary benefit belongs to B. Under strict liability, ask how expected payments track social cost. Under negligence, ask which risk B retains when A complies. Under weak collection or limited assets, contrast obligations with recovery. With insurance, include the external account before discussing financial efficiency. Economic vocabulary should explain a concrete feature of the activity.

Do not require identified students to defend a harmful choice publicly. Ask for arguments about hypothetical profiles or invite voluntary reflection. The objective is understanding incentives and model limitations. Choosing 0 does not diagnose someone's ethics; choosing 2 does not demonstrate altruism. Different motives can generate the same behavior, and distinguishing them requires additional evidence. This approach improves the analysis while allowing discussion of social preferences without personal classification.

A short class can compare one basic round with strict liability. A longer class can assign separate groups to negligence and insurance and finish by reconciling balances. When the same class plays successive treatments, order can influence learning and expectations. Vary orders if exploring that issue and record assignment. Order rotation alone does not turn the exercise into formal research: procedures and analysis must also fit the research objective.

### Feedback script

Ask students to complete three statements: care changes probability; compensation changes who pays; the insurance account identifies who finances coverage. Then ask which rule altered the private choice and which assumption supports that prediction.

## 7.2 Exercises and indicative answers

Exercise 1. A no-liability pair chooses level 0 and avoids an accident. Both balances are one hundred. Does this establish efficiency of level 0? No. Realized cost is zero, but expected cost is twenty-four,

while level 1 has expected cost sixteen. Efficiency is assessed before the draw. A complete answer mentions the expected damage reduction of eighteen against prevention expenditure of ten in moving from 0 to 1.

Exercise 2. Under strict liability, A chooses 2 and a loss occurs. Calculate balances and social cost. A ends with twenty-six after paying fourteen and sixty. B ends with one hundred after full compensation. Realized social cost is seventy-four, prevention plus physical damage. Do not add compensation again. A's expected balance is eighty-three, below the eighty-four from level 1. The greatest prevention is not the expected-money optimum.

Exercise 3. Under negligence, A chooses 1 and a loss occurs. A retains ninety and B forty. Compensation owed is zero and realized cost is seventy. Compare with strict liability at level 1 in the same accident state. Individual balances change, but total resources remain one hundred thirty. A correct response explains why identical efficiency does not imply identical victim protection. The standard is met even though a harmful event occurred.

Exercise 4. Use collection probability of 80% under imperfect enforcement. Expected private costs for A are 19.2, 14.8, and 16.4 at levels 0, 1, and 2. Expected balances are 80.8, 85.2, and 83.6, so 1 is preferred. The social minimum stays at 1 because physical technology has not changed. The calculation shows a rule crossing the deterrence threshold without altering physical damage or making every accident evidence of insufficient care.

Exercise 5. In the hidden-standard configuration, lower the probability of standard 2 to 50%. Expected balance at level 1 becomes eighty-seven, while level 2 remains eighty-six. The private benchmark now selects 1. For level 2 to exceed level 1, six times the high-standard probability must exceed four. The threshold is two thirds. This demonstrates that uncertainty does not always produce excessive care; the result depends on its distribution and the cost structure.

Exercise 6. Evaluate  $A=0$  and  $B=1$  in bilateral prevention. Accident probability is twenty percent, expected social cost fourteen, and A's expected balance eighty-eight. B receives compensation if an accident occurs and always pays two, retaining ninety-eight. B would prefer not to prevent if A remained at 0. A would prefer 1 if B continued preventing. The combination is not an equilibrium even though its expected cost is lower than several other combinations. Efficiency and best responses are different criteria.

Exercise 7. Under fixed-premium insurance, A chooses 0 and an accident occurs. A ends with eighty-eight, B one hundred, and the external account minus forty-eight. The expanded total is one hundred forty, equal to two hundred minus sixty. Adding only A and B gives one hundred eighty-eight and conceals external financing. Explain how complete victim compensation can coexist with substantial physical loss and weak prevention incentives.

Exercise 8. With recovery capped at twenty, level 1 and an accident leave A seventy and B sixty. The obligation was sixty, collection twenty, and uncompensated damage forty. Realized cost is seventy. Ask what cap makes the move from 0 to 1 attractive. It must exceed about 33.33 with certain collection. Keep recoverable resources distinct from A's endowment available for prevention.

Exercise 9. Two classes have identical mean care of one. In class X everyone chose one; in class Y half chose zero and half two. With the reference calibration, class X has expected social cost sixteen, while class Y averages 20.5. Thus mean care alone does not identify efficiency. Ask students to explain the role of the nonlinear mapping from discrete actions to social cost. The histogram contains the information needed for this calculation, whereas the mean discards it.

Exercise 10. A ten-round session has four participants, but only eighteen of twenty pair-rounds are complete. An individual export contains thirty-six rows. Explain the denominator for the report and the relevant number of independent people. Eighteen is the descriptive pair-round denominator; four is the participant count. Repeated observations are linked across rounds. A statistical analysis cannot claim thirty-six independent people merely because that many payment

records exist.

### 7.3 Assessing learning

A brief assessment can request a table listing private prediction, social minimum, and bearer of residual risk. A strong response computes at least one expected balance and explains why maximal care can exceed efficient care. For data understanding, present two histograms with the same mean and ask students to distinguish them. For causal reasoning, describe separate classes playing different rules and ask what information is missing to attribute a difference to liability.

These tasks evaluate observable concepts without rewarding a particular personal choice during the game. Students who selected 0 can demonstrate excellent understanding after calculating its incentives, and students who selected 1 may still confuse chance with efficiency. Separate the activity's payment from academic assessment. If grading includes a reflection, announce its criteria in advance: correct accounting, coherent use of assumptions, and recognition of evidence limitations are more useful than compliance with an unstated preferred strategy.

End by connecting the activity to broader institutional choices: verifiable information about care, collection, coverage, and recoverable resources. The model omits litigation, proof of causation, productive activity levels, nonmonetary harm, and administrative costs. These omissions define its scope and motivate subsequent game families. Do not orally add a mechanism after a session starts. A future extension requires its own rules, exported information, and predictions to preserve an interpretable comparison.

### 7.4 Primary readings and adaptation

Kornhauser and Schotter's 1990 *An Experimental Study of Single-Actor Accidents* provides an experimental antecedent for examining care and liability in unilateral accidents. This implementation does not replicate its protocol or claim its parameters. Costs of 0, 10, and 14, probabilities of 40%, 10%, and 5%, and damage of sixty are a teaching calibration chosen to distinguish private prevention, social efficiency, and compliance.

Shavell's *Liability for Accidents* organizes economic analysis of incentives, risk allocation, insurance, and administrative costs. It motivates inclusion of bilateral prevention, uncertainty, and asset limits as accident-law mechanisms. Numerical conclusions here are deductions from the implemented calibration. They are not estimates of court performance or quantitative predictions for a jurisdiction. The question brought into the classroom concerns the decision maker's changed margin.

Deffains, Espinosa, and Fluet's 2019 *Laws and norms: Experimental evidence with liability rules* examines rules and enforcement in an environment with potentially harmful actions. It offers related evidence about institutional responses. Its menu and additional elements differ from this activity, so classroom outcomes should not be announced as a replication. Local observations are teaching data, while published findings should be consulted in their original source.

- Kornhauser, L. and Schotter, A. (1990). *An Experimental Study of Single-Actor Accidents*. The Journal of Legal Studies, 19(1), 203–233. <https://doi.org/10.1086/467848>.
- Shavell, S. (2005). *Liability for Accidents*. NBER Working Paper 11781; published version in Handbook of Law and Economics (2007). <https://www.nber.org/papers/w11781>.
- Deffains, B., Espinosa, R., and Fluet, C. (2019). *Laws and norms: Experimental evidence with liability rules*. International Review of Law and Economics, 60, 105858. <https://doi.org/10>

[.1016/j.irle.2019.105858.](#)

## 7.5 Delivery, catalog card, and operational limits

The package contains one bilingual application, three basic configurations per language, ten extended configurations per language, and four rooms. Extended configurations represent one reference and seven conceptual extensions, with two extensions containing internal comparisons. Their number reflects teaching usefulness and technical specification rather than a numerical ceiling imposed by the thematic plan. Verification covers payment states, bots for all 26 configurations, and browser journeys with real screenshots.

Catalog topics are civil liability, accident prevention, negligence, compensation, insurance, and asset recovery. JEL codes are C92 for laboratory group experiments, D62 for externalities, D81 for decisions under risk and uncertainty, and K13 for tort law. Classification describes the mechanism rather than legal certification. Publication should link both guides, all four rooms, and administrative access once the coordinator enables the public instance.

LaTeX sources, figures, and PDFs are kept by language in the repository and copied to the teaching-guide folder in Dropbox. Screenshots show trial sessions, illustrative choices, and actual draws from that execution. They are not research results or population evidence. When changing the guide, update the application first, verify journeys, and replace affected captures. Synchronizing documentation and screens prevents an instructor from describing a rule that participants no longer receive.