



Instructor Guide to Alliances, Burden Sharing, and Collective Defense

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/>

How to use this guide

This guide supports an international-relations activity about common defense provision, burden sharing, and alliance commitments. Four people finance protection; one variant adds a fifth with a separate decision and payment. It is intended for instructors connecting rules, accounts, and institutions with observable outcomes.

Six chapters organize the reading. The first prepares the class and access. The second derives the reference mechanism. The third compares threat, announcements, inequality, and technologies. The fourth develops sequential choices involving an attacker, assistance, and commitment. The fifth explains the report and data. The sixth provides cases, exercises, answers, and a rubric. Each extension identifies concrete changes without repeating the common sequence.

All amounts are Experimental Currency Units (ECU), which are not automatically money or grades. The design is an original teaching adaptation informed by academic literature. Software checks support a local preview; a student pilot and public deployment require their own validation milestones. Participant choices should not be used to assign political intentions or national identities.

Author

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For the instructor

This guide follows the English interface. Spanish versions share rules and accounts. Project only progress during decisions, reveal aggregates after closure, and keep individual links and data private.

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Preparation and implementation

Purpose	Examine collective defense, coordination, and burden sharing.
Experimental unit	Four people per group; five in attacker, including a real external position.
Basic edition	One encounter, ten fixed-group rounds, or ten rematched rounds retaining positions.
Extended edition	Six-round reference and nine configurations: low and high threat, announcements, inequality, attacker, assistance, commitment, weakest link, and best shot.
Decision	Integer contributions from 0 to 20 ECU; variant-specific additional stages.
Payoff	Budget less spending and realized loss, with applicable stage costs and bonuses.
Resources	Reference: 40 per person, threshold 40, loss 20, unprotected probability 0.75.
Topics	Collective defense, burden sharing, coordination, promises, assistance, and alliance commitments.
JEL	A22, C72, C92, D74, F52, H56.
Participants	Multiples of four or five; rematching requires two groups. Demonstrations use eight or ten.
Suggested duration	45–60 minutes for reference; 60–90 for repetition and discussion. Estimate awaiting a pilot.
Availability	Validated local preview. Proposed host and deployment pending.

1.1 Access links

Institutional website and catalog: <https://beer-lab.org/> and <https://teaching.beer-lab.org/>.

Local preview: <http://localhost:8199/demo> and <http://localhost:8199/rooms>.

Proposed host, deployment pending: <https://alliances.beer-lab.org/>.

- https://alliances.beer-lab.org/room/alanzas_es
- https://alliances.beer-lab.org/room/alliances_en
- https://alliances.beer-lab.org/room/alanzas_extendido
- https://alliances.beer-lab.org/room/alliances_extended

1.2 Teaching question and experimental unit

An alliance may provide common protection while depending on private spending choices. This game studies why a collective improvement does not ensure that each member contributes, how burdens are distributed, and which institutions change coordination. The experimental unit is a group of four real participants in positions A, B, C, and D. No position represents a nationality, current government, or personal characteristic. One extension adds a fifth real person, E, who chooses an external action and receives a separate payment. This person changes the strategic environment rather than supplying an automatic message or decorative role.

The activity belongs to international relations through its questions about collective defense, alliances, cost sharing, credibility, and participation in contingencies. Participant screens describe accounts and choices neutrally so that a hypothesis does not become an instruction. The instructor introduces the international interpretation after choices are observed. This separates the economic mechanism from opinions about historical alliances. The rules are an original teaching adaptation informed by academic literature, not a reproduction of a war or an estimate of political intentions. Students can calculate an outcome without first agreeing on a historical interpretation.

1.3 Access, rooms, and selection

From the institutional laboratory website, select CLASSROOM to reach the teaching catalog. Search the family title or topics such as collective defense and burden sharing. The public host in this guide is proposed and requires deployment; confirm availability before scheduling a class. The local preview operates only on the computer running the server. Demo lists this family's configurations; Rooms lists four rooms divided by language and edition. A room manages admission. The configuration selected inside its form determines the actual rules.

The basic room contains one encounter, ten fixed-group rounds, and ten rematched rounds. The extended room contains a six-round reference and nine comparison configurations. Low and high threat are two values of one extension; other comparisons change announcements, resources, external action, assistance, commitment, or technology. Do not choose merely by list position. Verify the descriptive name, language, rounds, and participant requirement. Open a test session before admission and retain the administrative report on your device. Share only the room or entry link belonging to the current session. Individual participant links and administrator access have different purposes.

1.4 Participants, positions, and rematching

Most configurations require multiples of four. The attacker variant requires multiples of five because each group contains four members and one external position. Demonstrations use eight or ten participants, respectively, giving two complete groups. Basic rematching requires at least eight people: a single group has no other counterparts. The form and server apply the requirement of the effective treatment, including edited selections. Do not fill a missing position with an invented

participant or leave it without decisions. If attendance is incompatible, assign observers outside the software or reorganize before creating the session.

Positions remain fixed across rounds. Fixed groups also retain counterparts. Rematching independently shuffles each position pool and forms new groups; a previous counterpart can reappear. The program does not promise an algorithm excluding all repeat matches. Fixed positions support comparisons of A, B, C, and D, particularly with unequal resources. They also impose a limitation: position differences can reflect experience or selection as well as incentives. The attacker variant retains E; the commitment variant retains A as initiator. Explain these rules without recommending behavior. A new group is not a new role, and participants should use their original session link after reconnection.

1.5 A reference class

Allow approximately 45 to 60 minutes for admission, rules, comprehension, one decision, and discussion. A possible allocation is ten minutes for preparation, five for the example, ten for decisions and waiting, twenty for discussion, and five for closing. Repetition or an additional decision sequence may require 60 to 90 minutes. These are planning estimates awaiting validation with students. A group struggling with the account needs assistance before proceeding; a faster interface does not remove that difficulty. The aim is for each student to explain a choice and its consequence, not to run every configuration in one class.

Before play, announce only operational requirements: remain silent, read each screen, respond privately, and ask for help if necessary. Do not announce that ten is a correct contribution or describe low contributions as selfishness. After completion, first ask what happened to the total and payments. Then derive the expected value without contributions and a protected profile. Compare observable outcomes before discussing cooperation. If another institution follows in the same class, record the order and explain that learning and experience may affect the second comparison. Leave time for students to distinguish an account calculation from an explanation of why someone chose that action.

1.6 Resources, comprehension, and closure

ECU means Experimental Currency Units and is the exercise's unit of account. It is not automatically real money or a grade. The instruction body states each position's controlled budget, maximum contribution, and possible loss. Each round begins with a new budget; balances do not carry over from the previous round. The final sum combines payments across rounds but does not become capital for the next choice. If the laboratory authorizes real incentives, separately announce the conversion and payment-selection rule before starting.

Comprehension checks an example account, the protection criterion, and the absence of contribution refunds. Each error explains its correction and retains correct responses. The example is a declared accounting situation rather than a strategic recommendation. Check that students distinguish a spent contribution from a subsequent loss. Position E uses an attempt cost and bonus; E does not bear the loss applied to A–D. At completion, the final page confirms closure and displays the participant's own sum. No further choice must be submitted to finish. Keep that page open while conducting the discussion, and use the instructor report rather than individual participant screens to present class data.

1.7 Comparisons and interpretation limits

Reference comparisons with low or high threat preserve the threshold while changing loss probability conditional on insufficient protection. Announcements preserve accounting while adding prior information. Unequal resources jointly change budgets and losses; they support discussion of heterogeneity without separately identifying each component. The attacker and commitment variants change sequence and incentives rather than one number. Weakest link and best shot change technology and its minimum cost. Retain these distinctions when selecting a teaching question. An additional condition should answer a hypothesis that the course can explain clearly.

The activity observes decisions, announcements, commitments, activation, losses, and payments. It does not automatically measure trust, political preferences, willingness to fight, or beliefs about another person. If two groups receive different payments, inspect contributions and the draw first. If outcomes differ across treatments, also inspect exposure, order, and information. A small classroom sample supports learning how to describe a mechanism; it does not establish a generalization about countries. An instructor may connect the exercise to an international case while identifying institutions in that case that are absent from the model. The distinction is useful evidence of understanding rather than an obstacle to interpretation.

Checkpoint

Verify language, variant, horizon, and complete groups before admission. Keep aggregates hidden.

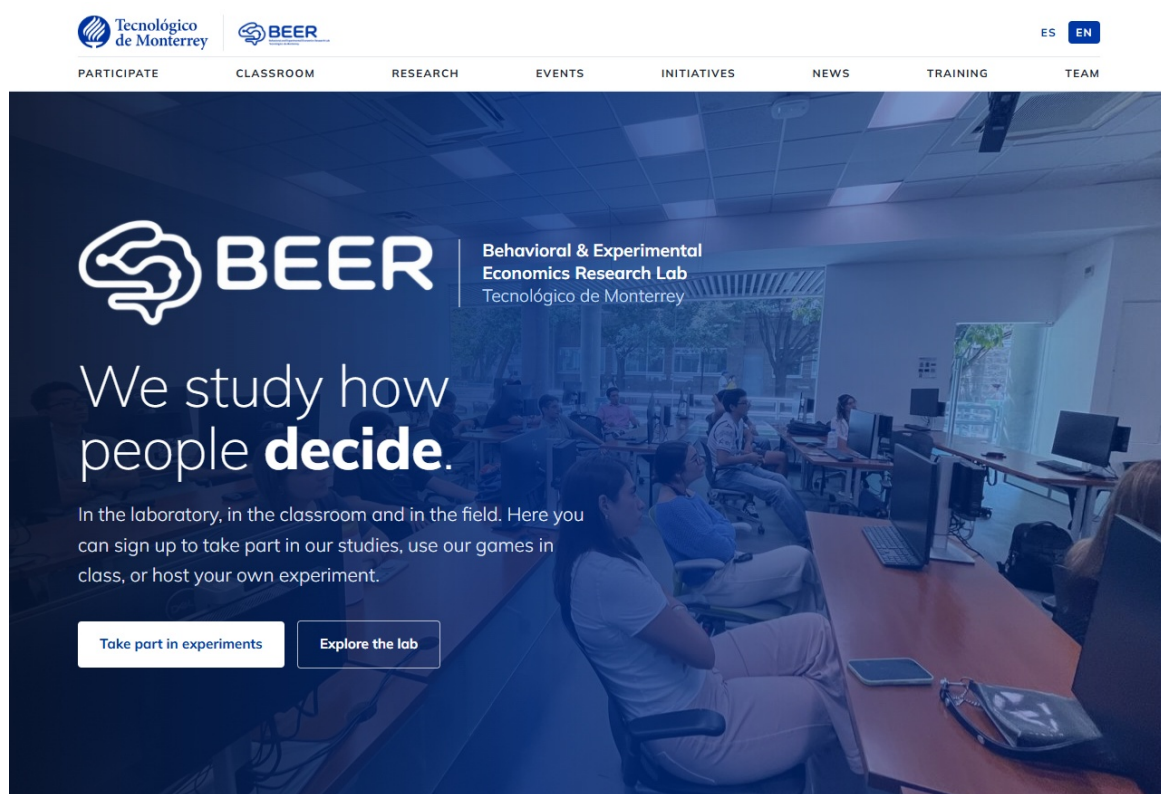


Figure 1.1: Institutional website: access through CLASSROOM.

Tecnológico de Monterrey **BEER** ES EN

PARTICIPATE CLASSROOM RESEARCH EVENTS INITIATIVES NEWS TRAINING TEAM

INSTRUCTORS AND STUDENTS

Classroom experiments

Experimental economics games for classroom activities and discussion. Open the game your instructor tells you.

Instructors: how to use these games in class or propose a new one → [instructor guide](#)
 Lab research: beer-lab.org/en/research

Search by title, topic, keyword or JEL code...

Electoral Accountability and Political Selection

Study how the prospect of remaining in office changes an officeholder's behavior and how information allows voters to choose between politicians with different types. Basic: One encounter or four encounters with fixed or reassigned groups. Extended: Eight treatments on continuation, information, types, office value, term limits, and audits.

electoral discipline political accountability political selection
 corruption information political economy

Aggregate Demand and Aggregate Supply

Understand how spending choices aggregate into demand and how equilibrium with supply determines output and prices. Basic: One period, ten periods with the same economy, or ten periods with reassigned economies. Extended: Demand expansion and contraction, supply shock, fiscal stimulus, capacity, expectations, and coordination.

aggregate demand aggregate supply price level potential output
 macroeconomic expectations

JEL A22 · C92 · E12 · E31 · E32

Figure 1.2: Current teaching catalog; choose language and consult topics and JEL.

Demo

[ES] Alianzas y defensa colectiva — un encuentro
[ES] Alianzas y defensa colectiva — 10 rondas, grupo fijo
[ES] Alianzas y defensa colectiva — 10 rondas, grupos aleatorios
[ES] Extendido — Referencia de suma
[ES] Extendido — Amenaza baja
[ES] Extendido — Amenaza alta
[ES] Extendido — Anuncios no vinculantes
[ES] Extendido — Recursos y pérdidas diferentes
[ES] Extendido — Atacante con decisión propia
[ES] Extendido — Asistencia posterior
[ES] Extendido — Compromiso y activación
[ES] Extendido — Eslabón más débil
[ES] Extendido — Proveedor decisivo
[EN] Alliances and collective defense — one encounter
[EN] Alliances and collective defense — 10 rounds, fixed group
[EN] Alliances and collective defense — 10 rounds, random groups
[EN] Extended — Sum reference
[EN] Extended — Low threat
[EN] Extended — High threat
[EN] Extended — Nonbinding announcements
[EN] Extended — Different resources and losses
[EN] Extended — Attacker with own decision
[EN] Extended — Subsequent assistance
[EN] Extended — Commitment and activation
[EN] Extended — Weakest link
[EN] Extended — Best shot

Alianzas, reparto de cargas y defensa colectiva / Alliances, Burden Sharing, and Collective Defense — BEER Lab

Selecione una variante de este juego. Select a version of this game.

Figure 1.3: Isolated Demo with twenty-six bilingual configurations.

Rooms

Current rooms:

[ES] Alianzas y defensa colectiva
[EN] Alliances and collective defense
[ES] Alianzas y defensa colectiva — Extendido
[EN] Alliances and collective defense — Extended

Figure 1.4: The four family rooms.

Room: [EN] Alliances and collective defense

Create a new session

Session Config

[EN] Alliances and collective defense — one encounter

Number of participants

Complete groups of 4 participants. Use a multiple of 4; minimum 4.

Create

[Configure session](#) 

App sequence

alliance_defense_game (10 rounds)

Alliances, Burden Sharing, and Collective Defense / Alianzas, reparto de cargas y defensa colectiva.

0 participants present

Start links

These URLs will stay constant for new sessions, even if the database is recreated.

Room-wide URL

Here is the room-wide URL anyone can use. Don't use this link when testing in multiple tabs on the same browser, because all tabs will be assigned to the same participant, using a cookie.

http://127.0.0.1:8199/room/alliances_en

Figure 1.5: Basic room with three configurations in the selected language.

Mechanism and predictions

2.1 Budget, contribution, and loss

In reference, each person has forty ECU and chooses an integer contribution from zero to twenty. A contribution leaves the person's account; it is not transferred as income to another participant. The sum determines whether the forty-ECU threshold is reached. Reaching it prevents loss. Below it, a common draw produces a twenty-ECU loss for every member with probability 0.75. The loss is a fixed amount rather than seventy-five percent of the remaining balance. The maximum contribution leaves twenty in the account, enough to bear the loss without debt.

Let c_i denote an individual contribution, C the sum, and L the realized-loss indicator. The reference payment is $40 - c_i - 20L$. If $C \geq 40$, expected payment is $40 - c_i$. If $C < 40$, it is $40 - c_i - 0.75(20) = 25 - c_i$. This is an expectation before the draw; realized individual payment remains either $40 - c_i$ or $20 - c_i$. All four people share the same event. There are not four independent draws or a pooled loss subsequently distributed among members. Calculating the account does not require estimating another participant's personal characteristics.

2.2 Three fully worked profiles

With contributions ten, ten, ten, and ten, the total is forty. Each person retains thirty, and no loss draw is made. Joint payment is one hundred twenty. With contributions zero, zero, zero, and zero, every member retains forty if loss does not occur and twenty if it does. Individual expected payment is $0.25(40) + 0.75(20) = 25$; joint expected payment is one hundred. Realized joint payments are one hundred sixty or eighty, never one hundred in that particular realization. This distinction prevents treating an expectation as a payment made by the software.

Now consider twenty, twenty, zero, and zero. The group is again protected. The first two members receive twenty, while the others receive forty. Joint payment remains one hundred twenty, but its distribution changes. Contribution shares are one half, one half, zero, and zero; concentration is $0.5^2 + 0.5^2 = 0.5$. Equal provision gives four one-quarter shares and concentration 0.25. These measures do not identify a moral attitude. They describe how the same forty ECU were financed and who retained more budget. Ask students to distinguish equal provision, equal payments, and equal proportional sacrifice.

2.3 Marginal incentives and pivotal position

A member is pivotal when lowering their contribution moves the total from protection to exposure. If the other three contribute ten, A needs ten to reach forty. Contributing ten pays thirty.

Contributing zero leaves the total at thirty and gives expected payment twenty-five. Spending ten avoids an expected loss of fifteen, giving a private net gain of five. Contributing eleven instead of ten adds no protection and reduces payment to twenty-nine. The threshold creates a discontinuity: the final contribution securing protection may matter more than spending within an already protected or still insufficient region.

If the other three contribute zero, A's maximum twenty cannot reach forty alone. Any positive contribution preserves the same loss probability and lowers A's account. The monetary best response is zero. The same contribution can therefore be attractive when cooperation is expected and unattractive when inaction is expected. The program does not elicit beliefs. Do not read a zero contribution as proof that protection was valued little; the person may have expected their decision not to change the outcome. This is a precise reason to distinguish an observed action from an inferred motive.

2.4 Reference equilibria

Four zeros form a Nash equilibrium of the reference game: no member can secure protection alone, and isolated spending reduces expected payment. Protected equilibria also exist. At a profile totaling exactly forty, each contribution must be no greater than fifteen, the expected loss avoided. A member contributing more than fifteen would prefer to withdraw all spending even though the group becomes vulnerable. With a contribution below fifteen, withdrawing worsens the expected account; a partial reduction also loses protection while saving less. At exactly fifteen, indifference is possible.

Ten each is one such equilibrium rather than a unique prediction. Five, ten, ten, and fifteen also total forty and satisfy the condition. Twenty, twenty, zero, and zero do not: a twenty-ECU contributor saves twenty by withdrawing and faces expected loss fifteen, improving by five. A total above forty is not a protected reference equilibrium if someone can reduce one unit while preserving the threshold. This prediction assumes monetary objectives, known rules, and consistent expectations; it does not mean students automatically coordinate on a profile. The multiplicity itself explains why communication or history can become relevant without changing the underlying account formula.

2.5 Expected efficiency and realized luck

In reference, joint payment before the event is one hundred sixty minus contributions. Without protection, expected joint loss is additionally eighty times 0.75, or sixty. The zero profile therefore has expected joint payment one hundred. A protected profile with the minimum spending forty has expected payment one hundred twenty; greater spending reduces that amount without additional technical protection. Reaching the threshold offers a twenty-ECU expected joint gain over zero, although a particular distribution need not benefit everyone relative to every alternative. Efficiency and distribution are separate questions.

An unprotected group avoiding loss can receive one hundred sixty. That realization exceeds the protected payment but does not show that foregoing protection had greater expected value. Before the draw, the group faced a possible joint loss of eighty. The report separates technical protection, event activation, and realized loss. For mechanism comparisons, use contributions, expected accounts, and rates conditional on the relevant event. For description of the class, also show realizations and variation. Do not select only lucky groups or treat an observed loss rate of zero as evidence that the programmed probability was zero. A small sample can depart substantially from its probability parameter.

2.6 Repetition, learning, and literature

Ten fixed-group rounds reveal adjustment after previous outcomes. A trajectory may show stabilization, declining contributions, unequal coordination, or alternating providers. Rematching retains positions while renewing counterparts and changes the scope for relying on a particular relationship. Neither configuration carries budgets forward or provides a public reputation across all groups. Repetition makes observations dependent. A ten-round chart is not ten independent experiments and cannot separate learning, reciprocity, and expectations without additional information. Compare the timing of changes with what participants actually observed.

Olson and Zeckhauser connect alliances with public-good provision and unequal burdens. Sandler and Hartley organize how composition, technology, and threat condition that analysis. These sources motivate the international question rather than the program's forty- and twenty-ECU parameters. Assurance-problem literature, including Isaac, Schmidt, and Walker, supports discussion of how expected cooperation affects decisions. This adaptation uses a discrete threshold and a fixed common loss. Cite those connections as conceptual foundations, not evidence that the class will reproduce a particular historical or experimental result. The software's conditional calculations can be derived directly from its stated rules and should remain distinct from the literature's empirical claims.

Theoretical foundation

A protected profile may be efficient while zero contributions also form an equilibrium. Coordination and cost distribution determine the relevant comparison.



BEER LAB · TEACHING GAMES

Shared Resources and Group Decisions

The Behavioral and Experimental Economics Research Lab in the Department of Economics at Tecnológico de Monterrey is a place to learn about economic decisions through controlled activities.

Read the rules, make private decisions, and see how outcomes are calculated.

Participation rules

- Remain silent and avoid communicating with other participants.
- Make decisions individually and privately.
- Follow the instructions on each screen.
- Do not refresh, close, or leave the page.
- If you need help, raise your hand or contact staff privately.

I have read the rules and agree to follow them.

- ☐ Yes
☒ No

Start

Figure 2.1: Welcome and laboratory rules.

Instructions

Resources and unit of account

Each member controls 40 ECU, renewed every round. You may contribute from 0 to 20 ECU. Contributions are spending and are not refunded. If the common loss occurs, your account decreases by 20 ECU.

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

Before the session starts, the instructor will explain which decisions are paid and how ECU convert into real money, if applicable.

Your budget

40 ECU

Loss if the event occurs

20 ECU

Maximum contribution

20 ECU

Protection criterion

40 ECU

Positions A, B, C, and D choose contributions simultaneously. Resources renew every round. The additional stages below then apply, and payments are calculated.

Member payment = budget – initial contribution – additional contribution – stage cost + own bonus – realized loss. Only applicable components are included.

With a contribution sum of at least 40 ECU, no loss occurs. Below that amount, one common draw gives a 75% probability of loss.

Accounting example: your contribution is 10 ECU and no loss, stage cost, or bonus is applied. Your payment in this example:

30 ECU

There is one encounter with this group.

Position	Budget (ECU)	Possible loss (ECU)	Initial contribution
A	40	20	—
B	40	20	—
C	40	20	—
D	40	20	—

Continue

Figure 2.2: Instructions with public resources and an accounting example.



SHARED RESOURCES AND GROUP DECISIONS · ROUND 1 OF 1



Comprehension check

Resources and unit of account

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

Before the session starts, the instructor will explain which decisions are paid and how ECU convert into real money, if applicable.

Use the example and active rule. Correcting an answer does not reduce your payment.

Accounting example: your contribution is 10 ECU and no loss, stage cost, or bonus is applied.

What is your payment in the displayed example?

What amount appears in this version's protection criterion?

Are initial contributions refunded if protection is not achieved?

Continue

Figure 2.3: Comprehension of account, criterion, and no refund.



SHARED RESOURCES AND GROUP DECISIONS · ROUND 1 OF 1

Comprehension check

Resources and unit of account

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

Before the session starts, the instructor will explain which decisions are paid and how ECU convert into real money, if applicable.

Use the example and active rule. Correcting an answer does not reduce your payment.

Accounting example: your contribution is 10 ECU and no loss, stage cost, or bonus is applied.

What is your payment in the displayed example?

Your answer: 0. The correct answer is 30. Budget 40 minus spending 10: 30 ECU. No loss or bonus applies in this example.

What amount appears in this version's protection criterion?

Are initial contributions refunded if protection is not achieved?

Your answer: Yes. The correct answer is No. No. A contribution is irreversible spending, including when protection is not achieved.

Continue

Figure 2.4: Question-specific corrections retain correct responses.

Your position in this round

Position C

There is one encounter with this group.

Your budget

40 ECU

Loss if the event occurs

20 ECU

Maximum contribution

20 ECU

Protection criterion

40 ECU

With a contribution sum of at least 40 ECU, no loss occurs. Below that amount, one common draw gives a 75% probability of loss.

Continue

Figure 2.5: Retained position and matching before decisions.

Waiting for the group

Please wait while the other participants complete this stage. Decisions are revealed only when appropriate.



Figure 2.6: Neutral wait while the common stage completes.

Your contribution

Your budget

40 ECU

Loss if the event occurs

20 ECU

Maximum contribution

20 ECU

Protection criterion

40 ECU

With a contribution sum of at least 40 ECU, no loss occurs. Below that amount, one common draw gives a 75% probability of loss.

Initial contribution (ECU)

[Confirm decision](#)

Figure 2.7: Simultaneous initial contribution with visible budget and criterion.

Round result

The protection criterion was met: no loss occurred.

Your round payment

30 ECUExpected value before the
draw**30 ECU**

Stage cost

0 ECU

Bonus

0 ECU

Initial contribution: 10 ECU · Additional contribution: 0 ECU · Realized loss: 0 ECU.

Total group contributions: 40 ECU · Effective total for protection: 40 ECU.

Joint payment of A–D: 120 ECU.

[Continue](#)

Figure 2.8: Reference result: contribution, loss, and payment separated.



SHARED RESOURCES AND GROUP DECISIONS · ROUND 1 OF 1



Session complete

The activity is complete. Keep this screen open and wait for the instructor's directions.

Sum of your payments (ECU) **30 ECU**

Figure 2.9: Persistent final page and own payment sum.

Threat, announcements, inequality, and technology

3.1 Low threat and high threat

The threat configurations preserve budgets, fixed loss, and threshold while setting unprotected loss probability at 0.25 or 0.95. With four zeros, individual expected payment is thirty-five or twenty-one, respectively. With ten each, protected payment remains thirty. The same protection can therefore be less attractive than contributing nothing under low threat and more attractive under high threat. The change does not increase the realized twenty-ECU loss or turn probability into a share of the remaining balance.

For a pivotal member, the maximum spending compatible with protection in a monetary equilibrium is the expected loss avoided. Under low threat this is five; four members contributing no more than five cannot reach forty. No protected pure equilibrium of that form exists. Under high threat the bound is nineteen, and ten each can be sustained. This prediction is conditional on rules and monetary objectives. High contributions under low threat might reflect caution, distributional objectives, or mistakes; the activity does not distinguish those explanations. Compare expected accounts before attaching a interpretation to observed changes in provision.

3.2 Comparing probabilities and realizations

Use reference as an intermediate condition and ask what changed in the cost of remaining vulnerable. Retain the same protection criterion in all three conditions. Initially compare total contributions, technical protection, and expected payments. Then show realized losses. Two groups with identical funding may receive different accounts because of the draw. A low-threat group may lose while a high-threat group avoids loss; those possibilities are part of the rules rather than contradictions of probability.

With a small class, do not treat the observed loss frequency as a precise threat estimate. Programmed threat is a known parameter, not a quantity that must be inferred from six outcomes. Losses can occur only when protection is insufficient and the event is active. A treatment with greater funding can show fewer losses despite high conditional probability. A rigorous discussion first identifies the exposed set and denominator. International comparisons also require separating external threat, own investment, and observed consequences, which may change jointly in real data. Ask students which of these quantities the software fixes and which it generates from decisions.

3.3 Nonbinding announcements

Each member announces zero to twenty before contributing. The four announcements are revealed when that stage closes. Contributions are then simultaneous; partial choices by others remain hidden while someone is still deciding. An announcement does not bind, reserve funds, or create a sanction. Announcing twenty and contributing zero is admissible, and payment uses the actual zero contribution. The announcement-contribution gap is retained in the data. The report defines fulfillment as contributing at least the announced amount; it does not measure sincerity or identify when expectations changed.

Announcements may provide a coordination point: four announcements of ten suggest a protected profile without imposing a binding instruction. They may also raise expectations and create disappointment. Compare how often announcements total at least forty, what funding follows, and which deviations appear. Isaac and Walker's public-good communication experiments show that communication can change provision in their environments. This adaptation uses a restricted numerical message rather than free discussion and does not assume the same experimental effect. Discuss which information a number conveys and which questions about intentions remain unanswered.

3.4 Different resources and losses

The public budgets of A, B, C, and D are thirty, forty, fifty, and sixty. Their respective losses are ten, twenty, twenty-five, and thirty. Every maximum contribution remains twenty. Protection requires a sum of forty. A budget is not observed GDP, and a loss is not a measured estimate of national vulnerability. The amounts create positions with different payment capacities and different gains from avoiding the event. Retain both components in the description; this comparison changes two dimensions and also the group's aggregate budget and loss.

With four zeros, expected accounts are 22.5, 25, 31.25, and 37.5. Contributions five, ten, ten, and fifteen secure protection and payments twenty-five, thirty, forty, and forty-five. No contribution exceeds that position's expected loss avoided, so the profile can be a protected equilibrium. By contrast, ten each asks A to spend ten avoiding expected loss 7.5; A would prefer to withdraw. Distribution matters for stability even when two profiles total the same forty. Compare absolute contributions and contributions relative to budgets without treating either measure as the only reasonable burden norm.

3.5 Burden measures and normative arguments

The report shows contributions by position and the proportion of budget committed. Ten ECU is one third of A's budget but one sixth of D's. It can also be compared with expected loss avoided: ten against 7.5 for A and 22.5 for D. These perspectives describe absolute amounts, ability to pay, and expected benefit. They need not imply the same burden norm. Ask students to state which measure they use and why their chosen argument supports it. The program calculates accounts rather than selecting a principle of fairness.

High concentration may occur because one position finances protection while others retain resources. This can be efficient under one technology and unstable under another. In an alliance discussion, connect that observation to the possibility that larger or more exposed members bear a greater spending share. The connection with Olson and Zeckhauser is conceptual. It does not turn sixty ECU into an actual large country or guarantee a monotonic budget-contribution relationship in every group. Separate the prediction, observed pattern, and normative judgment before recommending a

burden-sharing policy. A clear disagreement about the norm can itself be a productive classroom outcome.

3.6 Weakest link

Protection requires every person to contribute at least ten. The decisive variable is the minimum. Ten, ten, ten, and ten secures protection; twenty, twenty, zero, and zero does not, despite also totaling forty. Additional spending by someone already at ten cannot compensate for another position's shortfall. The technical minimum for protected funding is forty and must be distributed across all members. With one member below ten, others may consider spending ineffective; if everyone is expected to reach ten, contributing ten avoids an expected loss of fifteen.

The comparison teaches complementarity. Each position can prevent the criterion from being met and can complete the system when it is the last missing component. A relevant international analogy is a system requiring all components rather than arbitrary defense spending. Ask which real institutions approximate that condition and which allow substitution. Harrison and Hirshleifer experimentally study weakest-link and best-shot technologies. This version adapts the distinction to discrete protection and a common loss rather than copying their payoff function. The contribution sum alone is insufficient to explain whether this system works.

3.7 Best shot and minimum costs

Protection requires at least one contribution of twenty. The maximum matters. Twenty, zero, zero, and zero protects the group with total spending twenty; ten each does not protect it despite spending forty. The technical minimum is now twenty, so excess-spending comparisons require a different benchmark. If one position already contributes twenty, another can contribute zero without losing protection. If nobody does, a twenty-ECU contribution avoids expected loss fifteen but costs twenty: a sole provider does not prefer funding under reference monetary objectives.

Technology therefore lowers the minimum joint cost without guaranteeing stable voluntary provision. This tension separates efficiency from individual incentives. Contributing twenty may reflect additional objectives, coordination, or expectations rather than an automatic Nash prediction. With sufficiently high threat and a different loss, the pivotal account would change, but this configuration retains 0.75 and twenty to compare technologies. The variants do not establish a universal ranking of sum, minimum, and maximum. Each represents a different technical condition whose relevance to an international situation must be explained. Compare both the feasible protected allocation and the incentives that would support it.

What participants will see

The screen states budget, loss, and effective criterion. Announcements are revealed before contributions; partial contributions remain hidden during simultaneous choices.

Instructions

Resources and unit of account

Each member controls 40 ECU, renewed every round. You may contribute from 0 to 20 ECU. Contributions are spending and are not refunded. If the common loss occurs, your account decreases by 20 ECU.

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

Before the session starts, the instructor will explain which decisions are paid and how ECU convert into real money, if applicable.

Your budget

40 ECU

Loss if the event occurs

20 ECU

Maximum contribution

20 ECU

Protection criterion

40 ECU

Positions A, B, C, and D choose contributions simultaneously. Resources renew every round. The additional stages below then apply, and payments are calculated.

Member payment = budget – initial contribution – additional contribution – stage cost + own bonus – realized loss. Only applicable components are included.

With a sum of at least 40 ECU, no loss occurs. Below it, a common draw gives a 25% loss probability.

Accounting example: your contribution is 10 ECU and no loss, stage cost, or bonus is applied. Your payment in this example:

30 ECU

There are 6 rounds with the same group and positions.

Position	Budget (ECU)	Possible loss (ECU)	Initial contribution
A	40	20	—
B	40	20	—
C	40	20	—
D	40	20	—

Continue

Figure 3.1: Low threat: conditional probability 25 percent.

Instructions

Resources and unit of account

Each member controls 40 ECU, renewed every round. You may contribute from 0 to 20 ECU. Contributions are spending and are not refunded. If the common loss occurs, your account decreases by 20 ECU.

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

Before the session starts, the instructor will explain which decisions are paid and how ECU convert into real money, if applicable.

Your budget

40 ECU

Loss if the event occurs

20 ECU

Maximum contribution

20 ECU

Protection criterion

40 ECU

Positions A, B, C, and D choose contributions simultaneously. Resources renew every round. The additional stages below then apply, and payments are calculated.

Member payment = budget – initial contribution – additional contribution – stage cost + own bonus – realized loss. Only applicable components are included.

With a sum of at least 40 ECU, no loss occurs. Below it, a common draw gives a 95% loss probability.

Accounting example: your contribution is 10 ECU and no loss, stage cost, or bonus is applied. Your payment in this example:

30 ECU

There are 6 rounds with the same group and positions.

Position	Budget (ECU)	Possible loss (ECU)	Initial contribution
A	40	20	—
B	40	20	—
C	40	20	—
D	40	20	—

[Continue](#)

Figure 3.2: High threat: conditional probability 95 percent.



SHARED RESOURCES AND GROUP DECISIONS · ROUND 1 OF 6

Advance announcement

Your budget	Loss if the event occurs	Maximum contribution	Protection criterion
40 ECU	20 ECU	20 ECU	40 ECU

The announcement is visible before contributions. It does not require you to contribute that amount.

Announced contribution (ECU)

Confirm decision

Figure 3.3: Nonbinding numerical announcement before contributing.



SHARED RESOURCES AND GROUP DECISIONS · ROUND 1 OF 6



Your contribution

Your budget

40 ECU

Loss if the event occurs

20 ECU

Maximum contribution

20 ECU

Protection criterion

40 ECU

Before contributing, each member announces an amount from 0 to 20. Everyone sees the announcements. They are nonbinding messages: no fine applies for departing from the announcement. A sum of at least 40 prevents loss; below it, common loss probability is 75%.

Initial contribution (ECU)

Position	Budget (ECU)	Possible loss (ECU)	Announcement	Initial contribution
A	40	20	10	—
B	40	20	10	—
C	40	20	10	—
D	40	20	10	—

Confirm decision

Figure 3.4: Public announcements with partial contributions still hidden.

Instructions

Resources and unit of account

Each member controls 60 ECU, renewed every round. You may contribute from 0 to 20 ECU. Contributions are spending and are not refunded. If the common loss occurs, your account decreases by 30 ECU.

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

Before the session starts, the instructor will explain which decisions are paid and how ECU convert into real money, if applicable.

Your budget

60 ECU

Loss if the event occurs

30 ECU

Maximum contribution

20 ECU

Protection criterion

40 ECU

Positions A, B, C, and D choose contributions simultaneously. Resources renew every round. The additional stages below then apply, and payments are calculated.

Member payment = budget – initial contribution – additional contribution – stage cost + own bonus – realized loss. Only applicable components are included.

The four budgets and losses differ and are public in the table. Every position's maximum contribution is 20. A sum of at least 40 prevents loss; below it, common loss probability is 75%.

Accounting example: your contribution is 10 ECU and no loss, stage cost, or bonus is applied. Your payment in this example:

50 ECU

There are 6 rounds with the same group and positions.

Position	Budget (ECU)	Possible loss (ECU)	Initial contribution
A	30	10	—
B	40	20	—
C	50	25	—
D	60	30	—

[Continue](#)

Figure 3.5: Different budgets and losses, public for all four positions.

Your contribution

Your budget

40 ECU

Loss if the event occurs

20 ECU

Maximum contribution

20 ECU

Protection criterion

10 ECU

Protection requires every contribution to reach at least 10 ECU: the minimum matters, not the sum. If any contribution falls below it, common loss probability is 75%.

Initial contribution (ECU)

Confirm decision

Figure 3.6: The individual minimum determines protection.

Your contribution

Your budget

40 ECU

Loss if the event occurs

20 ECU

Maximum contribution

20 ECU

Protection criterion

20 ECU

Protection requires at least one contribution of 20 ECU: the maximum matters, not the sum. If no contribution reaches that amount, common loss probability is 75%.

Initial contribution (ECU)

Confirm decision

Figure 3.7: The individual maximum determines protection.

Sequential decisions and commitments

4.1 The attacker is a fifth person

This variant adds position E with a separate forty-ECU budget. A–D contribute first, and E observes all four contributions before deciding whether to attempt an action. Attempting costs eight. If the group meets the forty-ECU sum criterion, it cannot lose, and E receives thirty-two. If protection is insufficient and E attempts, the common draw retains probability 0.75. Group loss gives E a thirty-ECU bonus, producing a payment of sixty-two. Without loss, E receives thirty-two. Not attempting pays forty and prevents the event for all four members.

E does not contribute to the fund or lose twenty when the group loses. E's account and opportunities are disclosed before the decision. A–D know E's incentives but observe the action only in the outcome. This sequence supports discussion of endogenous deterrence: funding affects whether attempting is attractive. It does not assume every threat originates in an exogenous lottery. Do not interpret E's action as a preference for real conflict. It is a decision under explicit experimental costs and bonuses, made by another person with verifiable consequences. Five real participants are necessary to retain that strategic interaction.

4.2 External choice and expected payments

Without protection, attempting gives E expected payment $40 - 8 + 0.75(30) = 54.5$, compared with forty for not attempting. With protection, attempting gives thirty-two, compared with forty for not attempting. A monetary actor knowing these rules attempts in the first case and abstains in the second. The alliance can anticipate that response, but the prediction does not make abstention automatic. E retains the ability to choose an action that does not maximize the account. The draw occurs after the external decision and is never revealed first so E can condition on a known realization.

The report's joint payment includes A–D. E has a separate row because counting E's bonus as an alliance benefit would combine opposing interests. With four zeros and realized loss, members total eighty and E receives sixty-two. Without loss, members total one hundred sixty and E receives thirty-two. Explain both accounts when comparing outcomes. The experimental bonus is not a transfer deducted from the members; it is added by the stated rule. Do not treat the sum of five payments as an automatic measure of social welfare or the real cost of war. The boundaries of the reported group account are part of the model.

4.3 Assistance after insufficient funding

In assistance, all four first make initial contributions. If the sum already reaches forty, the second opportunity is skipped; no unnecessary additional request occurs. With a shortfall, everyone observes the contributions and simultaneously chooses an additional amount. Each maximum is the smaller of twenty and budget minus possible loss minus initial contribution. With budget forty, possible loss twenty, and initial contribution five, at most fifteen can be added. An initial contribution twenty leaves an additional maximum of zero. This reserve prevents funding assistance with resources needed for a subsequent loss.

Four initial contributions of five total twenty. If each person adds five, final funding reaches forty and every payment is thirty. With no additions, funding remains twenty and individual expected payment is twenty: forty minus five minus expected loss fifteen. Assistance that fails to complete the threshold is still spent. There is no refund, credit, external bailout, or automatic creation of resources. Assistance uses the same people's remaining budgets and studies whether observing a shortfall changes coordination, rather than introducing a donor whose incentives are undefined. The complete pathway includes both successful additional funding and an unresolved shortfall.

4.4 Anticipated assistance and causal comparison

Knowing that a second opportunity exists may change initial contributions. One person may wait for others to reveal the shortfall; another may contribute early to facilitate coordination. High final funding therefore does not prove that assistance availability increased total effort relative to a condition without assistance. Compare initial contribution, additional contribution, and final sum. The first captures possible anticipation adjustments; the second identifies resources actually used in the new stage; the third determines protection. Also retain the set offered assistance: already protected groups did not face that decision.

The report counts initial plus additional contributions as contribution spending. Its main distribution retains initial contributions so that a common simultaneous stage is not mixed with a conditional second opportunity. Both amounts remain separate in round-level data. To discuss international assistance, ask whether recipients anticipate help and whether providers retain resources of their own. This adaptation does not identify external-transfer effects, multilateral conditionality, or lending. Its mechanism is an additional opportunity for internal provision after public information about a shortfall. A comparison must state both the information change and the timing change rather than attributing every difference to generosity.

4.5 Commitment before activation

The commitment variant uses sixty-ECU budgets to cover maximum contributions, loss, and stage cost without negative accounts. A–D contribute zero to twenty. B, C, and D then simultaneously decide whether to commit to a second stage. Responses stay hidden until all three decisions close. A observes contributions and commitments and decides whether to activate. Without activation, each person retains sixty minus their contribution; no loss, charge, or bonus applies. Initial contributions are not refunded.

With activation, A and every committed position pay eight; A receives an individual bonus of twelve. Only A's contribution and those of committed positions count toward the forty-ECU criterion. Contributions by noncommitted positions remain spending but do not enter effective capacity. Without protection, the common twenty-ECU loss may affect all four, including those who did not commit. Separating common exposure and costly participation supports discussion of

consequences that an initiator's choice imposes on others. The account does not formally equate commitment, protection, and consent of the entire group. The public sequence makes the initiator's information and the followers' obligations explicit.

4.6 A private gain with shared cost

Consider contributions twenty by A, twenty by B, and zero by C and D, with B committed and C and D uncommitted. Effective funding is forty. Without activation, payments are forty, forty, sixty, and sixty, totaling two hundred. If A activates, A receives $60 - 20 - 8 + 12 = 44$; B receives $60 - 20 - 8 = 32$; C and D retain sixty. Joint payment falls to one hundred ninety-six. Relative to no activation, A gains four, B loses eight, and the joint difference is minus four. The example reveals a private activation incentive while another person bears a cost.

If B does not commit, effective funding is twenty. Activating gives A expected payment $60 - 20 - 8 + 12 - 0.75(20) = 29$, compared with forty for not activating. Commitment can therefore make an activation attractive that would not be attractive without support. The connection with Snyder's alliance dilemma is conceptual: support and fear of involvement may conflict. This is not a replication of the historical analysis or a claim that students share real leaders' preferences. It is an original sequence allowing reconstruction of who chooses, who pays, and who remains exposed. The incentive comparison should be derived before attaching a political interpretation.

4.7 Reading a sequence without inventing consent

In discussion, distinguish initial contribution, commitment, and activation choice. A large initial contribution is not a vote on later activation. Commitment does not itself activate the stage; A decides afterward. An uncommitted person can remain exposed to common loss while avoiding the eight-ECU participation charge. These are different rights and obligations. The file retains all three choices, and the report separates position payments. An aggregate protection rate does not show whether the initiator declined activation, capacity was sufficient, or a favorable draw prevented loss.

Compare activated and inactive groups descriptively. The initiator observes commitments before deciding, so these groups are selected through information and previous choices. A payment difference does not by itself identify the causal effect of activation. A different experimental question would require assigning a rule or opportunity before decisions, preserving comparability, and specifying incentives again. The teaching activity helps students recognize that selection problem and construct a complete accounting explanation. It does not remove selection by morally labeling those who committed or declined. Use the sequence to ask what evidence would be required to distinguish different interpretations of the same observed outcome.

Instructions

Resources and unit of account

Position E controls 40 ECU, renewed every round. Attempting the action costs 8 ECU. If an attempt is made and the group loses, E receives a 30 ECU bonus. E does not contribute to the fund or pay the loss borne by the four positions.

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

Before the session starts, the instructor will explain which decisions are paid and how ECU convert into real money, if applicable.

Your budget

40 ECU

Protection criterion

40 ECU

Positions A, B, C, and D choose contributions simultaneously. Resources renew every round. The additional stages below then apply, and payments are calculated.

E payment = budget – attempt cost + bonus if the group loses. No attempt preserves the entire budget.

E observes the four contributions and decides whether to attempt. Attempting costs 8 ECU. If the sum is at least 40, the attempt causes no loss. Below it, common loss probability is 75%. E receives 30 additional ECU only if an attempt is made and the loss occurs. Without an attempt, no loss occurs.

Example: E attempts the action, but the group is protected. E pays the attempt cost and receives no bonus. Your payment in this example:

32 ECU

There are 6 rounds with the same group and positions.

Position	Budget (ECU)	Possible loss (ECU)	Initial contribution
A	40	20	—
B	40	20	—
C	40	20	—
D	40	20	—

[Continue](#)

Figure 4.1: Resources and own account of E.

Position E decision

Your budget

40 ECU

Protection criterion

40 ECU

E observes the four contributions and decides whether to attempt. Attempting costs 8 ECU. If the sum is at least 40, the attempt causes no loss. Below it, common loss probability is 75%. E receives 30 additional ECU only if an attempt is made and the loss occurs. Without an attempt, no loss occurs.

Your decision

Position	Budget (ECU)	Possible loss (ECU)	Initial contribution
A	40	20	0
B	40	20	0
C	40	20	0
D	40	20	0

Confirm decision

Figure 4.2: E observes contributions before deciding.



SHARED RESOURCES AND GROUP DECISIONS · ROUND 1 OF 1



Round result

Protection was insufficient, but the draw caused no loss.

Your round payment

32 ECU

Expected value before the
draw

54.5 ECU

Stage cost

8 ECU

Bonus

0 ECU

Total group contributions: 0 ECU · Effective total for protection: 0 ECU.

Joint payment of A–D: 160 ECU.

Continue

Figure 4.3: E payment and expected value, separate from group A–D.



SHARED RESOURCES AND GROUP DECISIONS · ROUND 1 OF 6

Additional contribution

Your budget

40 ECU

Loss if the event occurs

20 ECU

Maximum contribution

20 ECU

Protection criterion

40 ECU

Your initial contribution was 5 ECU. The initial total was 20. You may add from 0 to 15 ECU; this limit reserves the possible loss.

Additional contribution (ECU)

Position	Budget (ECU)	Possible loss (ECU)	Initial contribution
A	40	20	5
B	40	20	5
C	40	20	5
D	40	20	5

Confirm decision

Figure 4.4: Additional assistance limited by budget and loss reserve.

Round result

The protection criterion was met: no loss occurred.

Your round payment

30 ECU

Expected value before the
draw

30 ECU

Stage cost

0 ECU

Bonus

0 ECU

Initial contribution: 5 ECU · Additional contribution: 5 ECU · Realized loss: 0 ECU.

Total group contributions: 40 ECU · Effective total for protection: 40 ECU.

Joint payment of A–D: 120 ECU.

Continue

Figure 4.5: Result of a one-encounter session: initial and additional contributions.

Commitment to the second stage

Your budget

60 ECU

Loss if the event occurs

20 ECU

Maximum contribution

20 ECU

Protection criterion

40 ECU

After contributions, B, C, and D decide whether to commit to a second stage. A observes these choices and decides whether to activate it. Without activation, no loss or charge applies. With activation, A and every committed position pay 8 ECU; A receives 12 additional ECU. Only A's contribution and those of committed positions count toward protection. If that sum is below 40, all four positions face common loss probability 75%, including those who did not commit.

Do you commit to the second stage if A activates it?

- ☐ Yes, bear the cost if activated
- ☐ Do not commit

Position	Budget (ECU)	Possible loss (ECU)	Initial contribution	Commitment
A	60	20	10	—
B	60	20	10	—
C	60	20	10	—
D	60	20	10	—

Confirm decision

Figure 4.6: B, C, and D choose commitment before A decides.

Position A decision

Your budget

60 ECU

Loss if the event occurs

20 ECU

Maximum contribution

20 ECU

Protection criterion

40 ECU

After contributions, B, C, and D decide whether to commit to a second stage. A observes these choices and decides whether to activate it. Without activation, no loss or charge applies. With activation, A and every committed position pay 8 ECU; A receives 12 additional ECU. Only A's contribution and those of committed positions count toward protection. If that sum is below 40, all four positions face common loss probability 75%, including those who did not commit.

Your decision

Position	Budget (ECU)	Possible loss (ECU)	Initial contribution	Commitment
A	60	20	10	—
B	60	20	10	Yes
C	60	20	10	Yes
D	60	20	10	Yes

Figure 4.7: A observes closed commitments and chooses whether to activate.

Round result

The protection criterion was met: no loss occurred.

Your round payment

42 ECU

Expected value before the
draw

42 ECU

Stage cost

8 ECU

Bonus

0 ECU

Initial contribution: 10 ECU · Additional contribution: 0 ECU · Realized loss: 0 ECU.

Total group contributions: 40 ECU · Effective total for protection: 40 ECU.

Joint payment of A–D: 180 ECU.

Continue

Figure 4.8: Result of a one-encounter session: separate costs and bonus.

Private report and data analysis

5.1 Progress, revelation, and incomplete observations

The administrative report opens with participants, complete encounters, and pending encounters. Aggregate contributions and payments remain hidden until the instructor selects Reveal results. Reveal after the relevant stage closes; projecting a distribution during decisions can change expectations. Hide results closes the panel again and preserves the state when reloading in the same tab. Access requires administrative authentication. Do not share that address as a student link or project credentials or individual codes.

An encounter is one group in one active round. Two groups over six rounds imply twelve expected encounters, not eight participants or ten technical periods. If a person has not completed the necessary stage, the encounter remains pending and is excluded from payment means. An empty comparison displays denominators and dashes rather than invented statistics. The report explicitly reads active rounds even when opened from the final technical period. A one-encounter configuration therefore retains its two complete groups instead of losing data because the application contains ten technical periods. Check the denominator before interpreting a mean and again after interruptions or reconnecting participants.

5.2 Distribution, concentration, and relative burden

The histogram uses five-ECU bins for initial contributions: zero to four, five to nine, ten to fourteen, fifteen to nineteen, and twenty. Each position has a consistent color and its own denominator of members with completed encounters. E is absent because E does not make that choice. An empty bin has frequency zero; a position without complete encounters has no empirical distribution. The report explains this difference. Examine whether identical averages come from similar contributions or from funding concentrated in a few positions.

Concentration is the sum of squared shares of final contributions, including additions. It is defined only with positive total funding. Four equal shares give 0.25; a sole provider gives one. Do not assign concentration zero to an entirely unfunded group because its shares would involve division by zero. The position table additionally reports final contributions relative to budgets. These indicators exclude bonuses and distinguish stage costs. One measure describes who financed protection and another who sacrificed a larger budget proportion; neither automatically establishes a legitimate distribution. Use the observation count beside concentration to see how many complete encounters supplied a defined value.

5.3 Protection, activation, and technical excess

Technical protection indicates whether the sum, minimum, or maximum criterion is met. Activation indicates whether the relevant event operates; it depends on E in attacker and A in commitment. Realized loss describes the draw when an active event lacks protection. Keeping these indicators separate prevents labeling a case where no stage was initiated as a victory. Protection and loss rates use active events as their denominator. Before comparison, state how many groups activated and which decisions determined that set.

Technical excess compares final contributions with the technology's minimum funding cost only when its criterion is met. The sum minimum is forty; weakest link is four times ten; best shot is twenty. Positive excess does not prove wasted spending from the perspective of someone who did not know others' choices. The program computes an ex post benchmark rather than eliciting beliefs at decision time. In commitment, spending by unsupported positions may remain paid while supplying no effective capacity. Compare final and effective contributions to locate that difference before adding participation costs or bonuses, which are separate account components. The interpretation of a technical indicator depends on information and timing.

5.4 Trajectories and announcements

The round table reports complete encounters, mean final contributions, joint payment, and protection conditional on active events. Read counts first: an average based on one group carries different information from one based on all groups. A trajectory can reflect learning, selection into active events, or luck. Fixed versus rematched groups preserve positions and rules while changing counterparts and relationship continuity. Do not attribute every difference to reputation, which is neither directly measured nor published as a general history.

In announcements, fulfillment uses people with an announcement and a completed encounter. The rule is an initial contribution at least as large as the announcement. A zero announcement followed by zero counts as fulfilled despite supplying no protection; separately show the announced magnitude. Compare total announcements, actual totals, and position-specific gaps. High announcements can raise a mean without changing funding. Contributions greater than an announcement also fulfill it. The indicator does not distinguish sincerity, revised expectations, or errors and should not become a moral assessment of students. A useful report interpretation states both the operational definition and what it leaves unobserved.

5.5 Wide download and round-level file

From the session's Data page, download that session's CSV. Its link includes the administrative session identifier and should not mix classes. The native file is wide: one row per participant with round fields in columns. The application has ten technical periods, while each configuration declares its active horizon. The custom export retains one row per participant and active round. It includes language, edition, treatment, position, matching, effective parameters, choices, event, and accounts. Administrative downloads and the protected custom export require appropriate authentication.

Unanswered fields remain blank. E has no initial contribution; that blank is structural rather than a zero choice. In pending rounds, completion status distinguishes partial decisions from valid results. Some native-file fields may have model initialization values; they are not observed payments without completion. Preserve blanks and filters before calculating averages. Do not download the entire server to resolve a row-count confusion. Compare selected session, active rounds, and actual

participant count; five-position sessions have a different row structure from four-position sessions. The session-specific download is the relevant starting point for an instructor's analysis.

5.6 Independent account reconstruction

Begin with each member's account: budget minus initial and additional contributions, minus stage charge, plus bonus, minus realized loss. Data retain effective parameters rather than reference values alone. Check that contributions sum to the group total and that the criterion matches the selected technology. Then inspect event activation. Only an active unprotected event permits loss; all four members share the same realization. For E, use budget minus attempt cost plus the loss-contingent bonus and keep this account separate from the A–D total.

A second check sums A–D accounts and compares them with joint payment. In assistance, reserve the possible loss when checking whether additional spending was admissible. In commitment, reconstruct which positions accepted, which contributions became effective, and who paid eight. A file can satisfy monetary addition while still being interpreted incorrectly about activation or exposure. Record both checks. Package validation independently reconstructs persisted payments from choices and parameters rather than relying on the principal payment function. That technical evidence does not replace checking incidents in an actual class. Retaining the calculation steps also makes an assignment assessable without asking students to trust a reported mean.

5.7 Unit of analysis and selection

For funding description, the group-round is a natural unit; for distribution, each position adds an account within that encounter. Those four observations are not independent because they share decisions and an event. Repetition also gives each person and group a history. If requesting a statistical comparison, require an explanation of dependence and denominators before selecting a test. A difference between row means does not automatically become a treatment effect, especially when activation or assistance eligibility follows earlier decisions.

Document condition order, interrupted connections, individual assistance, and participants who did not finish. A class may discuss affected observations when identified; formal research requires separate rules for assignment, exclusion, and consent. Do not merge complete samples and pending groups through zero imputations. Do not publish files connecting codes with names. The instructor report supports discussion of anonymous patterns; administrative data should follow laboratory procedures. Part of the teaching value is learning which inferences exceed what a small controlled activity can establish. The report supplies transparent descriptions rather than replacing the instructor's responsibility to assess the design behind a comparison.

Attention

A pending field is not a zero choice. Exclude incomplete encounters from payments and state exposure, activation, and protection denominators.

Instructor report: alliances and collective defense

Sum reference · There is one encounter with this group.
During decisions, project only progress. Reveal results after the relevant stage closes.

Participants	Completed encounters	Pending encounters
8	2 / 2	0

Aggregates remain hidden.

Reveal results

Figure 5.1: Private report: visible progress and hidden aggregates.

Total group contributions	Joint payment of A–D	Protection in active events (%)	Loss in active events (%)
20 ECU	100 ECU	50	50

Active events: 2 · Recorded contributions: 8.

Figure 5.2: Revealed aggregates with active-event denominators.

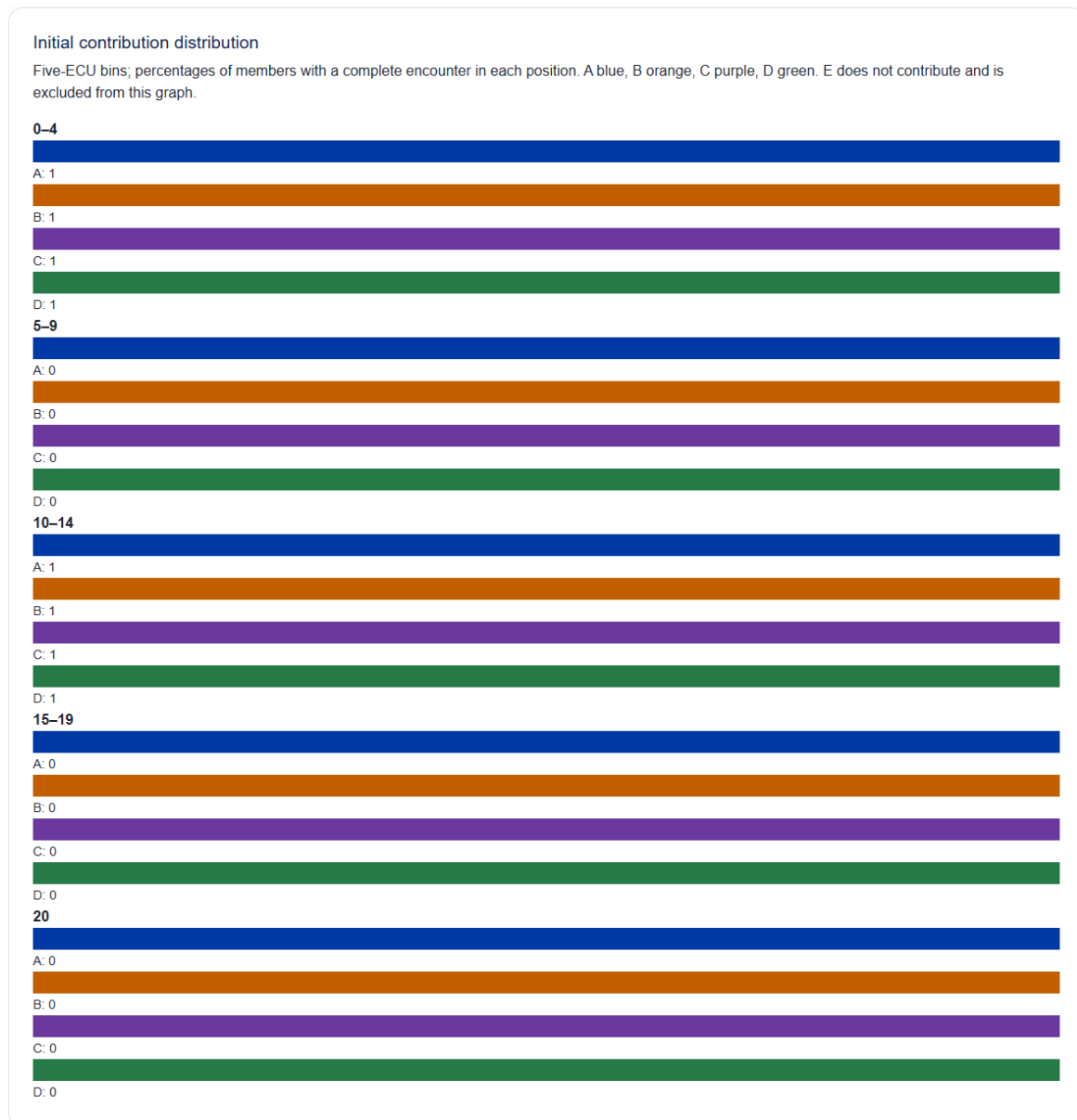


Figure 5.3: Distribution by position with colors and observation counts.

Discussion, exercises, and teaching use

Feedback script

First describe who funded, which criterion was met, and what each position received. Then compare the observed choice with an alternative and explain which institution changes the incentive.

6.1 A discussion beginning with observations

Reveal the report and request factual descriptions before interpreting motives. How many encounters completed? Which contributions appear in the distribution? How many met the protection criterion, and how many had an active event? Ask for one complete account. Then compare its realization with expected value. This sequence corrects mistakes without implying that one individual choice was the behavior the instructor wanted. A high payment may reflect low own burden, protection funded by others, or a favorable draw.

Once accounts are understood, turn to incentives: who was pivotal, what would withdrawing that contribution change, and who bore the cost? For an extension, require identification of a changed rule and a prediction depending on it. Close by asking what additional comparison would distinguish two explanations. The final question need not be whether students cooperated. It can ask which combination of information, technology, and incentives secured protection, why that allocation might persist, and which missing institutions limit its application to a real alliance. This keeps feedback tied to evidence students can inspect rather than a judgment about their character.

6.2 Coordination and deviation case

Present contributions five, ten, ten, and fifteen. The total is forty, and payments are thirty-five, thirty, thirty, and twenty-five. Each member compares withdrawing spending with exposure to expected loss fifteen. A, contributing five, moves from thirty-five to twenty-five by withdrawing, losing ten. D, contributing fifteen, moves from twenty-five to twenty-five and is indifferent. If D reduces only one unit, D contributes fourteen but loses protection and receives expected payment eleven: forty minus fourteen minus fifteen. Complete withdrawal is the relevant deviation for checking the largest saving.

This case shows why crossing the threshold with a small reduction is not enough analysis. Inspect the best complete alternative. Ask whether twenty, twenty, zero, and zero has the same stability. Protected funding is identical, but withdrawing twenty raises a provider's expected payment from twenty to twenty-five. Different allocations can produce the same initial collective outcome while

giving different incentives for continuation. This is useful after a round where one or two positions financed most contributions. Require both the protected account and deviation account rather than awarding credit for the word coordination alone.

6.3 Mean and distribution case

Imagine two groups: one contributes ten each and the other zero. Mean individual contribution is five, and half the groups obtain protection. Now consider two groups where everyone contributes five. Mean contribution is again five, but no group reaches forty. The same average can conceal different collective outcomes. The histogram and group records distinguish them. Ask why the class mean cannot be inserted into the threshold function to infer protection. The criterion applies to each alliance rather than an artificial group constructed from averages.

For threat, repeat the reasoning with losses: compare encounters eligible for loss and state the size of that set. For commitment, separate activated and inactive groups before interpreting a rate. These are general analysis skills with a specific institutional meaning here. An alliance missing a pivotal participant is not equivalent to the average of two different alliances. An explanation improves when it identifies the unit, eligibility condition, and denominator before presenting a proportion. A successful answer can be short if it specifies these elements accurately and reconstructs the relevant account.

6.4 Individual calculation problems

Exercise one: in reference, the other three contribute eight, ten, and ten. What minimum contribution by A protects the group, and what is A's payment? Compare with contributing zero. Exercise two: a group contributes seven each under high threat. Calculate the total, expected payment, and possible realized payments. Exercise three: in assistance, one position initially contributes eighteen; find its additional maximum with budget forty and possible loss twenty. Exercise four: in best shot, compare ten each with one contribution twenty and three zeros.

Exercise five: in attacker, funding totals thirty and E attempts. Calculate E's two possible payments and expected value, separately from member totals. Exercise six: in commitment, A and B contribute twenty, C and D zero, only B commits, and A activates. Reconstruct all four payments. Repeat with B uncommitted and a draw producing loss. Require the changed rule to be written beside each account. These problems assess mechanism comprehension rather than the choice someone should have made in class. They should not disclose a mandatory strategy before the game or reduce assessment to reproducing a label.

6.5 Answers and reasoning

One: others total twenty-eight, so A needs twelve and receives twenty-eight. With zero, A's expectation is twenty-five. Two: total funding is twenty-eight and protection is insufficient; each expectation is $40 - 7 - 0.95(20) = 14$, with realized payments thirteen or thirty-three. Three: the additional maximum is two because forty minus twenty minus eighteen leaves two for admissible spending. Four: ten each does not meet the maximum criterion twenty; each expected payment is fifteen. A sole twenty-ECU provider secures protection and receives twenty, while the other three receive forty.

Five: E receives sixty-two with loss and thirty-two without it, giving expectation 54.5. Members have their own contributions and losses, so E does not belong in their joint payment. Six: with

B's commitment, payments are forty-four, thirty-two, sixty, and sixty. Without B's commitment, effective capacity is twenty; with loss, payments are twenty-four, twenty, forty, and forty. A retains bonus twelve and pays cost eight; B avoids activation cost but already spent twenty; all four bear loss twenty. Explaining these components is part of the answer. A correct total without the correct exposure or activation pathway is incomplete reasoning.

6.6 Rubric, evidence, and difficult questions

A rubric can combine accounting, mechanism identification, denominators, and inference quality. Reward distinguishing expected from realized payment, contribution from commitment, and protection from activation. Require a group-round table, a distribution, and a conditional comparison. Recognizing that a cause is not identified can be a strong answer. Do not grade a contribution amount as correct or incorrect unless the problem specifies an objective and counterpart choices. Assess explanation rather than whether the student's choice produces the most attractive class average.

In best shot, ask whether risk aversion alone justifies a provider contributing twenty under reference rules. With zero and no other funding, the account can be twenty or forty; contributing twenty gives twenty with certainty. Zero offers an account that is never lower, so risk aversion alone does not explain the comparison under increasing monetary preferences. Concern for others, additional objectives, or mistakes are different possibilities. This question shows how an appealing explanation can fail once alternatives are reconstructed and why the argument should be derived before attaching a behavioral label. It also separates a group's efficient outcome from one member's private incentive to supply it.

6.7 Operational recovery and pilot

If a group waits, identify the stage: rules, comprehension, announcement, contribution, assistance, commitment, external action, or results. Do not invent choices to release waiting. After disconnection, open the same link in the same session. An obsolete link may belong to another database or previous session; check current admission before creating another session. Restarting this family's local server to reload code preserves the database. Do not erase data to resolve an interface question or stop instances serving other games.

Before general use, conduct a supervised pilot and record duration, comprehension difficulties, access, actual group sizes, and feedback clarity. Technical tests verify accounts and routes rather than teaching effectiveness. Adjust explanations and lesson sequence while retaining documented rules. Production, pilot, and publication are different milestones. A verified local copy does not imply that the public host is deployed. Preserve result privacy and language that does not assign nationalities or intentions to participants. Teaching success means explaining incentives and institutions using evidence, not necessarily obtaining high contributions. Keep a brief record of which comparisons clarified the mechanism and which needed more discussion.

Bibliography

- Olson, M., and Zeckhauser, R. (1966). *An Economic Theory of Alliances*. RAND, RM-4297-ISA. https://www.rand.org/pubs/research_memoranda/RM4297.html.
- Sandler, T., and Hartley, K. (2001). Economics of Alliances: The Lessons for Collective Action. *Journal of Economic Literature*, 39(3), 869–896. <https://doi.org/10.1257/jel.39.3.869>.
- Isaac, R. M., Schmidtz, D., and Walker, J. M. (1989). The assurance problem in a laboratory market. *Public Choice*, 62, 217–236. <https://doi.org/10.1007/BF02337743>.
- Isaac, R. M., and Walker, J. M. (1988). Communication and Free-Riding Behavior: The Voluntary Contribution Mechanism. *Economic Inquiry*, 26(4), 585–608. <https://doi.org/10.1111/j.1465-7295.1988.tb01519.x>.
- Harrison, G. W., and Hirshleifer, J. (1989). An Experimental Evaluation of Weakest Link/Best Shot Models of Public Goods. *Journal of Political Economy*, 97(1), 201–225. <https://doi.org/10.1086/261598>.
- Snyder, G. H. (1984). The Security Dilemma in Alliance Politics. *World Politics*, 36(4), 461–495. <https://doi.org/10.2307/2010183>.