



Instructor guide for big push and persistent capital

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 the preparation, implementation, and classroom discussion of the big push and persistent capital family available through 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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Purpose, concepts and scope

1.1 An economy that needs joint decisions

This activity examines a macroeconomic question: why might an economy remain at a low investment level when sufficiently large investment would be profitable? The difficulty arises when the return to one person's choice depends on other people's actions. Each participant controls their own resources, but the relevant productivity depends on a collective condition. Nobody can command the other investments. A profitable opportunity for the economy as a whole can therefore coexist with a prudent individual decision to invest nothing. The class observes coordination and then examines what that process implies for economic outcomes.

A big push describes a joint change in activity that exploits a complementarity or overcomes an indivisibility. The basic game represents this idea with a visible threshold: productivity rises when the four investments add up to at least forty. This rule concentrates the mechanism in a discontinuity that students can calculate. It does not represent all economic sectors, their trade or income distribution. Its teaching value is to show how a sensible choice under pessimistic expectations can help produce an inferior collective outcome. Participants encounter a strategic problem before receiving the theoretical terminology used to interpret it.

An investment externality means that one person's decision changes others' opportunities without that effect being fully compensated through a price. Investing here can help change the returns earned on other investments. Strategic complementarity means that investing becomes more attractive when the others invest enough. These concepts are related but should be distinguished. The externality describes an effect on other people; the complementarity describes how incentives for one's own choice change. The threshold creates both relationships within a particular range, although it does not make the entire payoff function linear or smooth. This distinction helps students avoid treating every beneficial spillover as an identical strategic problem.

The dynamic extension adds another question: does temporary support change only the immediate outcome, or does it alter the subsequent path? Each person retains capital and chooses how much output to consume and invest. Productivity depends on the economy's mean capital. Current investment can raise future capital and contribute to a different productive regime. The instructor must distinguish crossing the threshold, producing more while above it and remaining there after support ends. The activity observes those facts over ten periods. That observation window is finite and does not establish that the economy will stay in the high regime indefinitely.

Theoretical foundation

The static core teaches coordination failure. Persistence requires capital that survives between periods. In the extension, productivity depends on its mean stock rather than on investment made in the same period.

1.2 Family summary

Purpose	Coordinate investments to reach a collective threshold and examine persistence after a temporary intervention.
Participants	A multiple of four; at least eight for rematching.
Suggested duration	30–45 minutes for one interaction; 50–60 for static repetition; 60–75 for dynamics.
Experimental unit	An economy of four participants; repeated periods within an economy, or rematching in the static core.
Basic edition	One interaction; ten periods with a fixed group; ten periods with rematched groups.
Extended edition	Reference and ten extensions: announcements, observable first choice, partial reimbursement, temporary subsidy, external contribution, persistent capital, capital and announcements, one-time capital grant, high initial capital and announced destruction.
Decision	Investment from 0 to 20 ECU; in the dynamic game, the percentage of output invested from 0 to 80. A forecast of others' mean choice is also elicited.
Payoff	Endowment less investment plus return and transfers in the core; logarithmic consumption score in the dynamic game.
Topics	big push; investment externalities; thresholds; coordination; capital accumulation; temporary interventions.
JEL	A22; C72; C92; D62; E22; O41.

The JEL codes refer to undergraduate teaching, noncooperative games, group experiments, externalities, investment and growth models. They were checked against the American Economic Association's official classification. These are public subject tags used in the catalog. Production references used by the laboratory team do not belong in instructions, titles or guides. In class, identify an edition through its game name and the rule that changes. This lets students focus on their choices and allows instructors to locate a treatment without learning an internal numbering system. Round numbers remain useful because they identify actual events within an economic trajectory.

1.3 Learning outcomes and conceptual preparation

By the end, students should be able to calculate their own payoff, explain why others' behavior matters and distinguish an equilibrium from a collective recommendation. They should also recognize the cost of externally financed intervention, separate flows from stocks and interpret a trajectory with a known terminal date. Discussion should start with observed decisions before introducing theoretical labels. A useful sequence asks students to explain a choice, reconstruct the budget and then consider what would have changed had the other three participants acted differently. This makes theory a tool for interpreting the experience, rather than a script prescribing behavior before play.

The activity requires basic arithmetic and table reading. The dynamic part adds square roots and logarithms, both calculated by the application. The instructor can introduce the logarithm without developing differential calculus: doubling a small consumption level produces the same score difference as doubling a large level, whereas adding one unit has different value at the two

levels. Introductory courses should begin with the static core. Intermediate macroeconomics courses can devote another session to accumulation, conditional steady states and terminal effects. In either setting, distinguish the implemented score from the physical quantities that generate it.

1.4 Scope relative to other catalog activities

The laboratory catalog already contains individual growth and investment coordination with smooth returns. This family adds a discontinuous collective threshold and, in its extensions, shared productivity based on persistent mean capital. The difference is more than a change of label. In individual growth, another student's choice does not directly alter one's technology. Under a smooth complementarity, gradually raising others' decisions gradually changes the return. Here, a small change around the threshold can switch the regime for the whole economy, while capital carries part of its history into later periods. These features justify a separate Macro family.

The game does not incorporate monetary markets, trade bargaining or institutions belonging to other subject areas. Observable first decisions study information and timing within macroeconomic investment. Announcements are structured messages about quantities, rather than a political persuasion exercise. External support is a recorded resource intervention, rather than a new strategic actor. This boundary allows instructors to compare mechanisms across the catalog while avoiding duplicate families or claiming a broader model than the activity actually implements. Analogies with development should follow the experience and acknowledge that a small laboratory economy represents only selected economic relationships.

Access and classroom preparation

2.1 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.

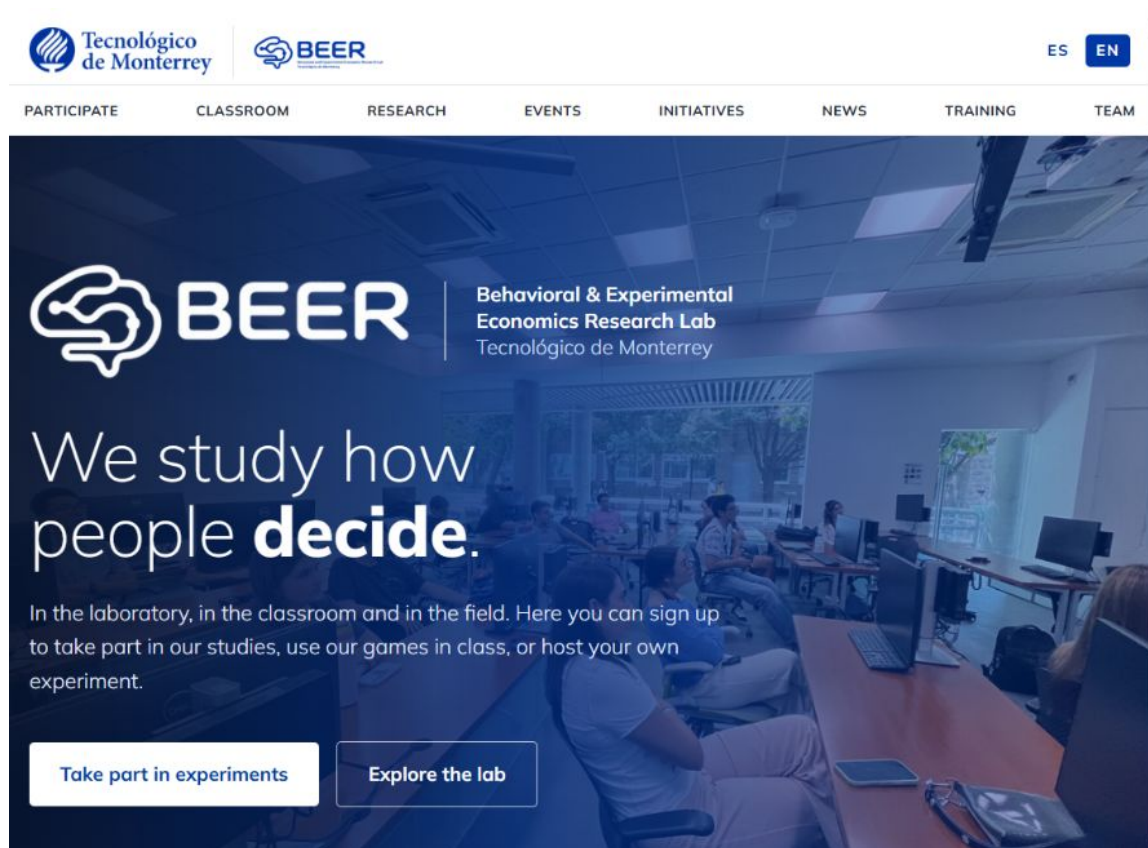


Figure 2.1: Current institutional website. Select CLASSROOM in the top navigation menu to open the teaching experiments. Captured on October 7, 2026.

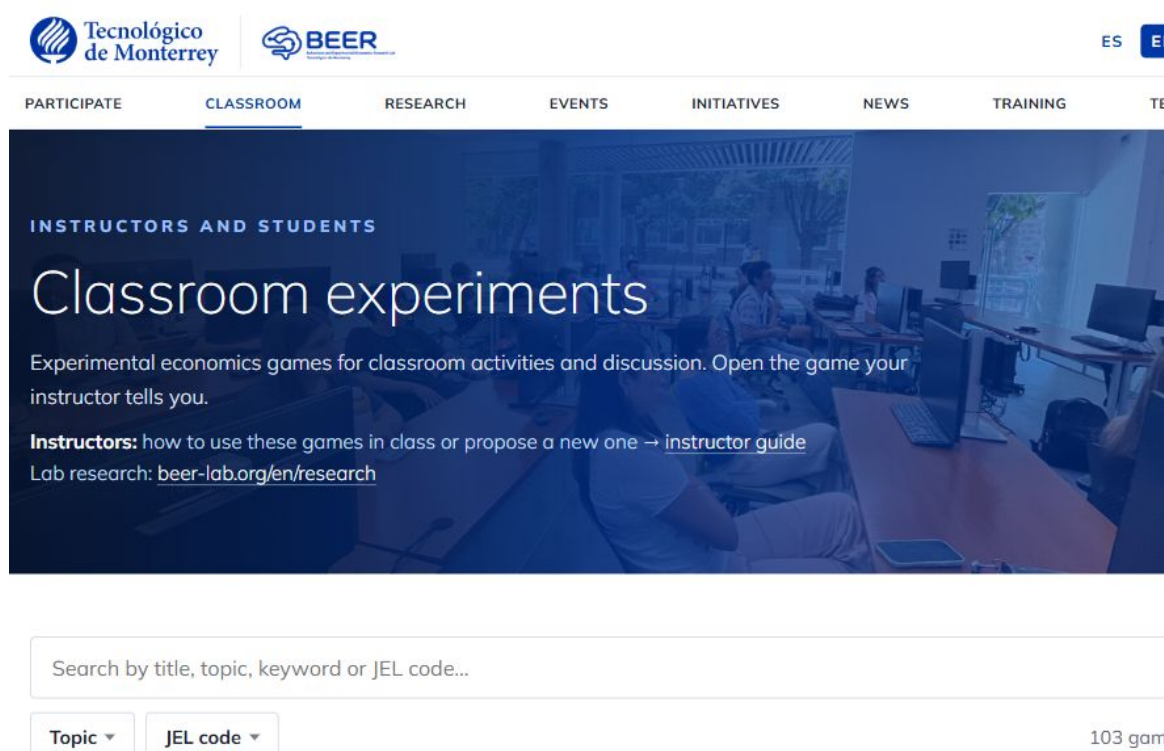


Figure 2.2: Current catalog: search by title, topic, or JEL code. Then locate this family's card and select language and edition. Captured on October 7, 2026.

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.

Básica — Una interacción	Gran impulso y capital
Básica — Diez períodos, grupo fijo	
Básica — Diez períodos, grupos reasignados	Gran impulso y capital persistente / Big Push and Persistent Capital — BEER Lab
Extendida — Referencia: inversión simultánea	
Extendida — Anuncios no obligatorios	Seleccione una variante de este juego. Select a version of this game.
Extendida — Primera decisión observable	
Extendida — Reembolso parcial de pérdida	
Extendida — Transferencia temporal a la inversión	
Extendida — Aporte externo de un período	
Extendida — Capital persistente	
Extendida — Capital y anuncios	
Extendida — Aporte único de capital	
Extendida — Capital inicial alto	
Extendida — Destrucción anunciada de capital	
— One interaction	
— Ten periods, fixed group	
— Ten periods, rematched groups	
nded — Reference: simultaneous investment	
nded — Nonbinding announcements	
nded — Observable first decision	
nded — Partial loss reimbursement	
nded — Temporary investment transfer	
nded — One-period external contribution	
nded — Persistent capital	
nded — Capital and announcements	
nded — One-time capital grant	
nded — High initial capital	
nded — Announced capital destruction	

Figure 2.4: Demo contains only the configurations of this game family, in both languages and editions. Continuation 2/2.

Rooms

Current rooms:

Gran impulso — Básica
Big push — Basic
Gran impulso — Extendida
Big push — Extended

Figure 2.5: Rooms contains the four rooms for this family: basic and extended editions in Spanish and English.

Room: Big push — Basic

Create a new session

Session Config

Big push — Basic — One interaction



Number of participants

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

Create

[Configure session](#) 

App sequence

big_push_game (10 rounds)

Figure 2.6: 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.

2.2 From the portal to the correct room

Navigation begins at <https://beer-lab.org/>. The teaching section leads to <https://teaching.beer-lab.org/>, where cards organize activities by topic. Look for Big Push and Persistent Capital. The card should describe the basic and extended editions, languages, purpose and topics. Before sharing a link, check the descriptive title: another activity involving investment may study a different mechanism. Topic tags help locate this family but do not replace reading the rules that the group will actually see. Instructors should rehearse the participant route as well as the administrative route before bringing the activity to class.

The proposed canonical routes use <https://bigpush.beer-lab.org/>. Four stable participant rooms separate language and edition.

Spanish basic room:

https://bigpush.beer-lab.org/room/gran_impulso_es

English basic room:

https://bigpush.beer-lab.org/room/big_push_en

Spanish extended room:

https://bigpush.beer-lab.org/room/gran_impulso_extendido

English extended room:

https://bigpush.beer-lab.org/room/big_push_extended

Creating the local package does not confirm that the public domain is configured or that the production server contains the new code. Laboratory coordination checks those steps when publishing the activity. Distinguish a prepared route from an observed functioning public deployment.

The verified preview on this computer is <http://localhost:8089/demo>. The `/demo` route presents configurations, and `/rooms` organizes the four rooms. On the game's own domain, Demo and Rooms should contain only this family. If other games appear, do not start the classroom session; consult laboratory coordination. Private administration requires instructor access. The participant room admits people to the assigned session and does not allow them to choose treatments or open administrative results. Students do not need technical configuration names to participate correctly. Share the participant address, rather than a screenshot of the teacher panel.

For the instructor

Use Demo to rehearse and Rooms to organize classroom admission. A shared room and an individual link serve different purposes: the room admits people to a session, whereas the individual link resumes an already created game identity. Do not distribute the report address or administrative credentials to participants.

2.3 Participants, duration and equipment

An economy requires four people. The rematching core requires at least eight so that more than one economy exists; total participation must be a multiple of four. One interaction usually supports a thirty to forty-five minute class including discussion. Ten static episodes require roughly fifty to sixty minutes. Allow sixty to seventy-five minutes for persistent capital and trajectory analysis. These are planning estimates, rather than times measured in a student sample. If comparing two treatments, shorten the opening presentation or use a second class so that discussion does not become rushed. The economic interpretation needs time after the final choices are recorded.

Each participant needs a browser and a connection to the instance. One device per person helps prevent premature disclosure through another person's page. The instructor should have a separate screen for monitoring and a projector if the report will be discussed collectively. Prepare a worksheet with space for a prediction, an outcome and an explanation. Demographic collection is unnecessary. The principal comparison concerns economies and periods, rather than personal characteristics. Before starting, announce whether ECU are classroom points or converted into incentives, and give the exact conversion rule. Keep this announcement consistent across groups whose outcomes will be compared.

2.4 Create and monitor a session

In the instructor panel, choose a configuration by language, edition and rule. Enter a compatible participant count and create the session. The system generates individual links, provides monitoring and allows access to the private report. Before admitting the class, read the selected name again. Basic rooms exclude extended configurations; extended rooms include a static reference and all ten extensions. The reference supports a comparison with the same horizon and matching arrangement. It prevents an institutional change from being confounded with a shorter activity, while keeping the experimental logic shared within the same application.

Monitoring shows the page where each participant remains. Waiting does not establish that an error occurred: someone else in the economy may still be reading or deciding. Ask students to report the difficulty without displaying their choice. First check missing entrants, forms and comprehension responses. The instructor should not choose for absent students merely to release a result. If an economy stays incomplete, it does not contribute to completed-period aggregates and final revelation remains blocked. Progress reporting makes that condition visible without exposing individual choices to the class. Resolve the admission problem before interpreting what looks like low participation as economic behavior.

2.5 Prepare an interpretable comparison

When comparing modes, hold payment rules, explanation time and access conditions constant. Change only the matching rule or institution being studied. If splitting a class across treatments,

oTree Demo Sessions Rooms Data Server Check Logout

Create session

Tip: consider creating your session in a [Room](#), for more stable start links that are not opened accidentally.

Session Config

Big push — Basic — One interaction

Number of participants

4

Must be a multiple of 4

Create

[Configure session](#) ⚙️

App sequence

big_push_game (10 rounds)

Figure 2.7: Check the configuration and participant count before generating links. Four people form a complete economy.

oTree Demo Sessions Rooms Data Server Check Logout

Big push — Basic — One interaction: rehearsal session

 Edit  Links  Monitor  Data  Payments  Report

 Description

You can either use the session-wide link, persistent links, or single-use links.

Session-wide link

If it's not practical for you to use a Room, you can distribute the following link to participants.

[Session-wide link](#)

Persistent links

For a real session, you should use a [room](#).

Single-use links

Below are single-use links.

P1	Individual link
P2	Individual link
P3	Individual link
P4	Individual link

Figure 2.8: The panel distributes individual entry links. Visible identifiers in this capture are replaced with impersonal participant labels.

assign whole economies and avoid telling any group that it should invest more. If the same class plays treatments successively, record their order and acknowledge learning. Playing after experiencing another institution can change expectations even when current parameters are identical. A classroom difference provides descriptive evidence and a basis for discussion; it does not replace an experimental design with adequate assignment and statistical power. The strongest classroom conclusion usually concerns the mechanism that makes a difference possible.

Checkpoint

Before starting, check four isolated rooms, correct language, a participant count divisible by four, an announced horizon, a stated incentive rule, private access and a completed rehearsal economy. For persistent capital, verify that students were told about the absence of terminal capital payment and the schedule of any support or destruction.

Preserve the local database when restarting the server to apply a correction. Restarting a process and deleting its database are different actions. Individual links depend on the stored session: if that database is removed, they no longer refer to an existing activity and a new session must be created. During class, do not reset a database as a remedy for waiting. Recorded choices are part of the exercise's evidence. Technical review should preserve that evidence and distinguish a connection problem from an economy that has not completed a stage. Keep students informed about which stage is pending without revealing other participants' decisions.

The participant journey

3.1 Welcome, rules and comprehension

Participants enter through a room or individual link and see the institutional welcome. The application speaks about investment decisions, describes an economy of four people and presents the laboratory rules. This wording supplies what is needed to act without announcing a coordination hypothesis or recommending an outcome. The instructor should likewise avoid explaining in advance which profile is considered superior. Budget questions can be answered while allowing expectations to develop during play. Acceptance confirms that the rules have been read; it is neither an economic choice nor a request for demographic information. Participants then proceed to the activity's specific instructions.

Instructions present the complete sequence, endowment, permitted range and a worked example. In the core, every period starts anew: an outcome of 110 does not become an endowment of 110 in the next episode. In the dynamic game, capital does carry over. This distinction must be understood before play because it changes the relationship between periods. Ask students which magnitude resets and which survives. If they cannot answer, return to the rules before moving forward. Clarifying the accounting should not become a recommendation about how much to invest or which outcome to pursue.

Comprehension has two questions. The first distinguishes current-period investment from mean starting capital; the second distinguishes fresh endowments from the absence of terminal capital payment. In the core, the correct answers are the effective investment sum and no accumulated capital. In the dynamic game, they are mean starting capital and no salvage value. An incorrect response requests both answers again with a message in the activity's language. Explain the part of the rule that was misread and let the person correct their response. Do not choose an economic action on their behalf or use comprehension to steer investment.

3.2 Simultaneous investment and forecasts

The decision screen shows the current rule and two numerical fields: own investment and a forecast of the other three people's mean investment. In the core, both accept values from zero to twenty. The expected mean is not a forecast of the total: if all three are expected to invest ten, the answer should be ten. The forecast does not affect the score and does not become public information before choices are made. Its teaching role is to distinguish low investment accompanied by pessimism from low investment accompanied by favorable expectations. Neither interpretation should be inferred from the investment field alone.

Out-of-range values are rejected before a valid choice is recorded. Empty fields also require correction. The application permits decimals and does not restrict students to zero or twenty.



Period 1 / 1

Investment decisions

You belong to an economy of four people. Your decisions and those of the other three determine your outcomes.

General laboratory rules

- Make your own decisions. Do not use other tabs or exchange information outside the enabled screens.
- Amounts are expressed in ECU. The instructor will announce before starting whether points are converted into payments.
- Collective results will be discussed at the end. No personal information is requested.

☐ I have read the rules and will follow them.

Continue

Figure 3.1: The welcome uses a descriptive activity name and requests acceptance of general laboratory rules.



Period 1 / 1

How to decide

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.

Each period you receive a fresh 100 ECU. Choose an investment from 0 to 20. The four investments are added together. If the effective total reaches 40, each invested ECU returns 1.5 ECU; otherwise it returns 0.5 ECU. Your outcome is 100 minus investment plus return, plus any announced transfer. Capital does not carry over between periods.

This activity has a single period.

All four decisions are simultaneous and private until the outcome.

Period outcome

Example: if you invest 10 and the other people invest a total of 30, the total is 40 and you receive 105 ECU. If the others invest a total of 20, the total is 30 and you receive 95 ECU. Investing 0 always preserves 100 ECU before transfers.

Continue

Powered by oTree

Figure 3.2: Current basic-edition instructions, with initial resources and experimental units.

Period outcome

Example: if you invest 10 and the other people invest a total of 30, the total is 40 and you receive 105 ECU. If the others invest a total of 20, the total is 30 and you receive 95 ECU. Investing 0 always preserves 100 ECU before transfers.

Figure 3.3: The example verifies that the same own investment can generate 95 or 105 ECU depending on others' actions.



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



Period 1 / 1

Check the rules

What determines productivity?

Mean capital at the start of the period ▼

Your answer: Mean capital at the start of the period. The correct answer is The effective sum of this period's investments.
Review the rules and answer both questions correctly.

What happens to capital at the end?

Endowments reset; there is no accumulated capital ▼

Continue

Powered by [oTree](#)

Figure 3.4: Current comprehension check with an incorrect answer, its specific explanation, and retained responses.



Period 1 / 1

Your decision

Each period you receive a fresh 100 ECU. Choose an investment from 0 to 20. The four investments are added together. If the effective total reaches 40, each invested ECU returns 1.5 ECU; otherwise it returns 0.5 ECU. Your outcome is 100 minus investment plus return, plus any announced transfer. Capital does not carry over between periods.

All four decisions are simultaneous and private until the outcome.

Investment (ECU, from 0 to 20)

Mean investment you expect from the other three people (ECU)

This prediction does not change your score. If you choose later, include the person who chose first as well.

Continue

Figure 3.5: Own choice and the forecast of others have separate fields. Check that students use the mean of the other three people.

This is useful for observing attempts to reach the threshold through intermediate investment. During discussion, do not automatically classify an intermediate choice as an error. It can reflect a calculation of the required amount, uncertainty about others or an attempt to limit a loss. First reconstruct the forecast and outcome, then compare the action with a best response under complete information. Strategic reasoning is easier to assess when the relevant belief is made explicit.

After submitting a choice, the participant waits for the others in their economy. The screen does not show incomplete choices or provisional outcomes. The instructor can observe administrative progress but should not tell the group how much investment is still needed. That would change a decision designed to be simultaneous. If a student asks what others have done, refer back to the information rule. Waiting ends once the stage is complete. There is no economic timer penalizing slow reading, so connection differences are not part of the payoff mechanism and should not be interpreted as strategic behavior.

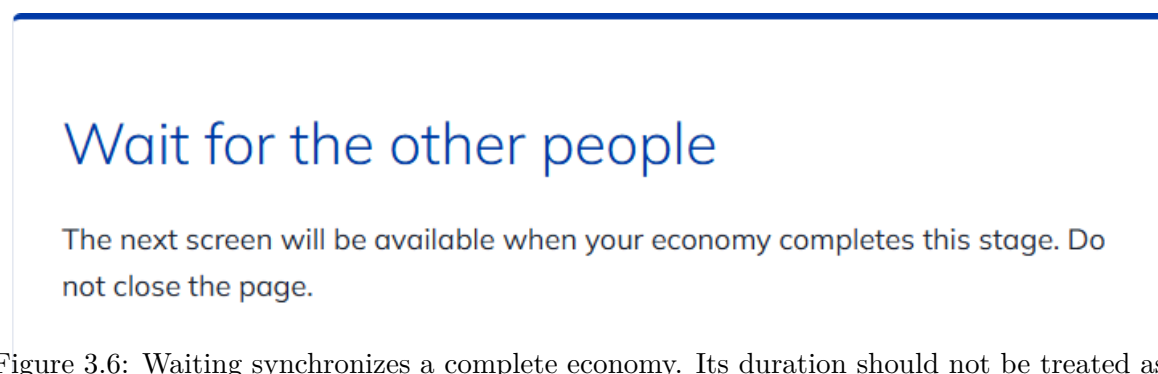


Figure 3.6: Waiting synchronizes a complete economy. Its duration should not be treated as a signal of others' choices.

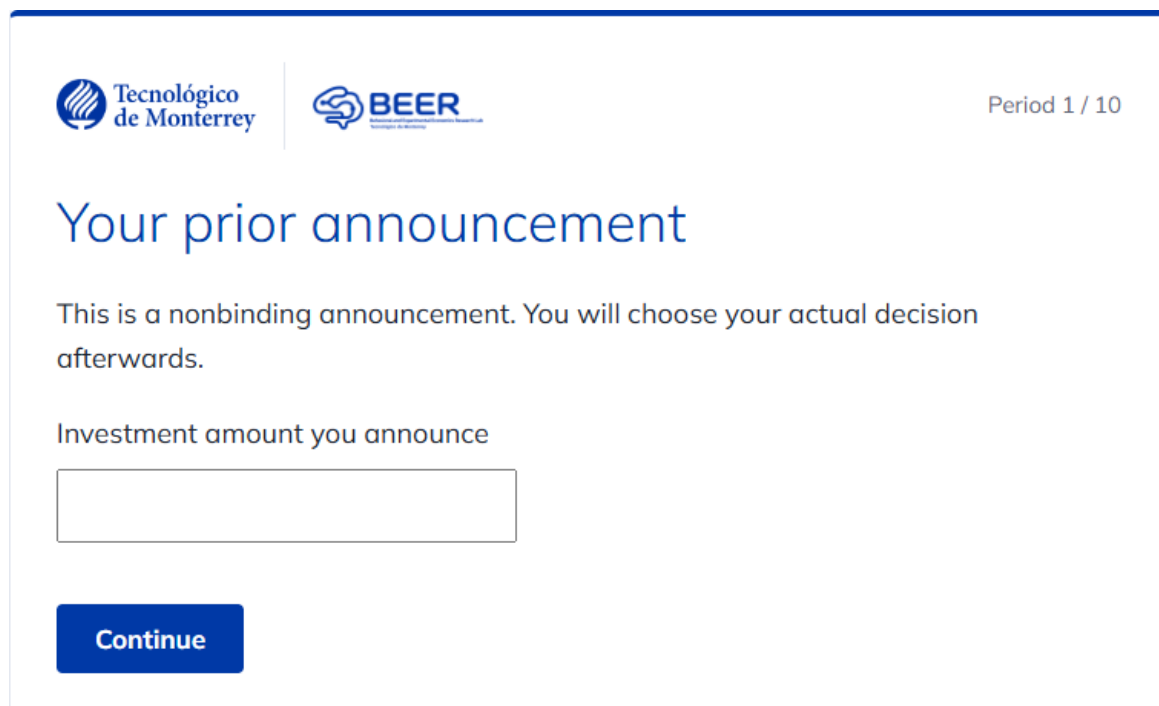
3.3 Announcements and an observable first choice

Under announcements, every person first declares an amount. Once the stage is complete, all four declarations appear without names on the investment screen. They are nonbinding and do not reward accuracy. Explain the difference between intention, expectation and action: announcing twenty can serve as a message, whereas forecasting twenty describes what is expected from other people. These are separate records. In the dynamic game, the announcement concerns a saving percentage rather than physical units. People with different capital can therefore announce the same percentage and invest different physical quantities. This is not an inconsistency; it follows from their different output levels.

The observable first choice introduces a sequence. One person invests first; the other three wait and then observe that investment before deciding simultaneously. The first position rotates across periods. It does not grant authority to choose for others or a different payoff. Investing twenty can both contribute resources and provide information. Investing zero can discourage others or induce them to take on more investment. The later movers' screen reminds them of the observed amount and retains the forecast field. That forecast must include the person who has already chosen, because it still concerns the other three people's mean decision.

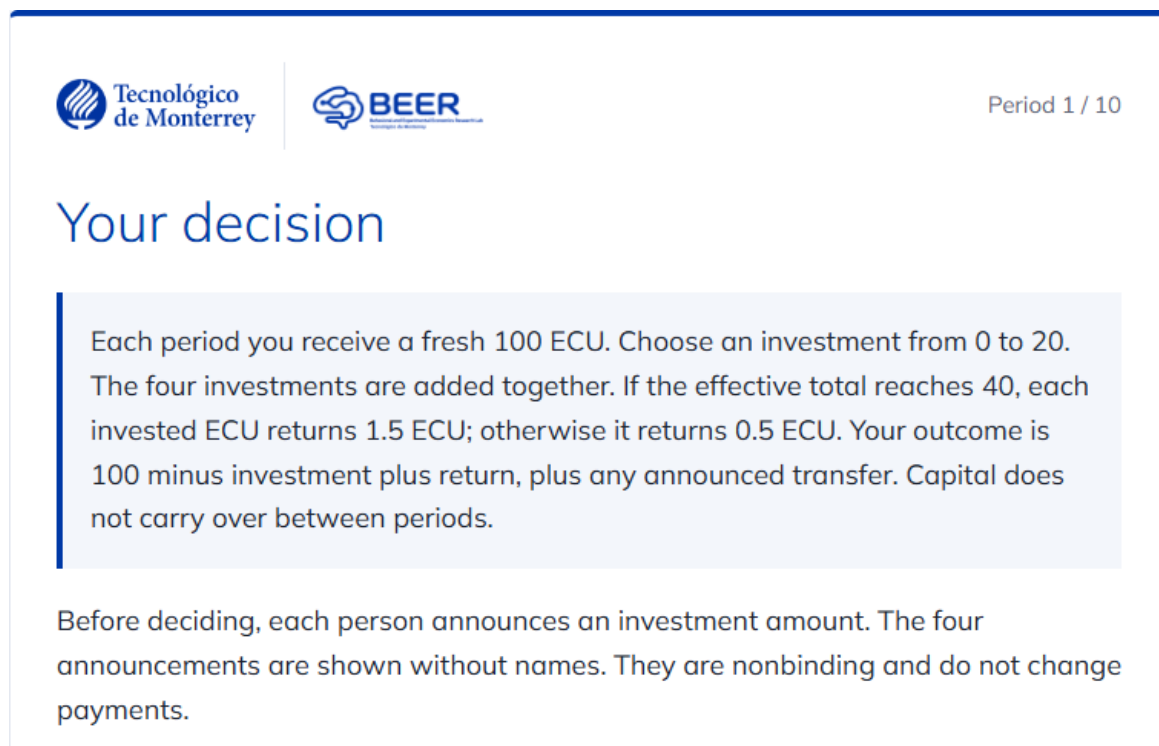
3.4 Persistent capital, outcomes and completion

Dynamic decision screens show own capital, mean capital, output and current productivity. A saving percentage divides output between investment and consumption; it is not an instruction to invest that numerical amount in physical units. Results show consumption, next capital and



The screenshot shows the 'Your prior announcement' screen. At the top left are the logos for 'Tecnológico de Monterrey' and 'BEER'. At the top right, it says 'Period 1 / 10'. The main heading is 'Your prior announcement'. Below it, a text block states: 'This is a nonbinding announcement. You will choose your actual decision afterwards.' Further down, there is a label 'Investment amount you announce' followed by an empty rectangular input box. At the bottom left, there is a blue button with the word 'Continue' in white text.

Figure 3.7: The announcement precedes the actual choice and does not itself change payment.



The screenshot shows the 'Your decision' screen. At the top left are the logos for 'Tecnológico de Monterrey' and 'BEER'. At the top right, it says 'Period 1 / 10'. The main heading is 'Your decision'. Below the heading, there is a light blue shaded box containing the following text: 'Each period you receive a fresh 100 ECU. Choose an investment from 0 to 20. The four investments are added together. If the effective total reaches 40, each invested ECU returns 1.5 ECU; otherwise it returns 0.5 ECU. Your outcome is 100 minus investment plus return, plus any announced transfer. Capital does not carry over between periods.' Below this box, there is another text block: 'Before deciding, each person announces an investment amount. The four announcements are shown without names. They are nonbinding and do not change payments.'

Figure 3.8: Announcements are displayed without their authors' identities. The actual choice remains individual.

Economy announcements, without names

20.0 20.0 20.0 20.0

Investment (ECU, from 0 to 20)

Mean investment you expect from the other three people (ECU)

This prediction does not change your score. If you choose later, include the person who chose first as well.

Continue

Figure 3.9: Announcements are displayed without their authors' identities. The actual choice remains individual. Continuation of the same screen.



Period 1 / 10

Your decision

Each period you receive a fresh 100 ECU. Choose an investment from 0 to 20. The four investments are added together. If the effective total reaches 40, each invested ECU returns 1.5 ECU; otherwise it returns 0.5 ECU. Your outcome is 100 minus investment plus return, plus any announced transfer. Capital does not carry over between periods.

One person chooses first. The other three observe that investment before choosing simultaneously. The first position rotates each period; everyone has the same payoffs.

Figure 3.10: The first person chooses without seeing investment from the current period.

You choose first this period.

Investment (ECU, from 0 to 20)

Mean investment you expect from the other three people (ECU)

This prediction does not change your score. If you choose later, include the person who chose first as well.

Continue

Figure 3.11: The first person chooses without seeing investment from the current period.
Continuation of the same screen.



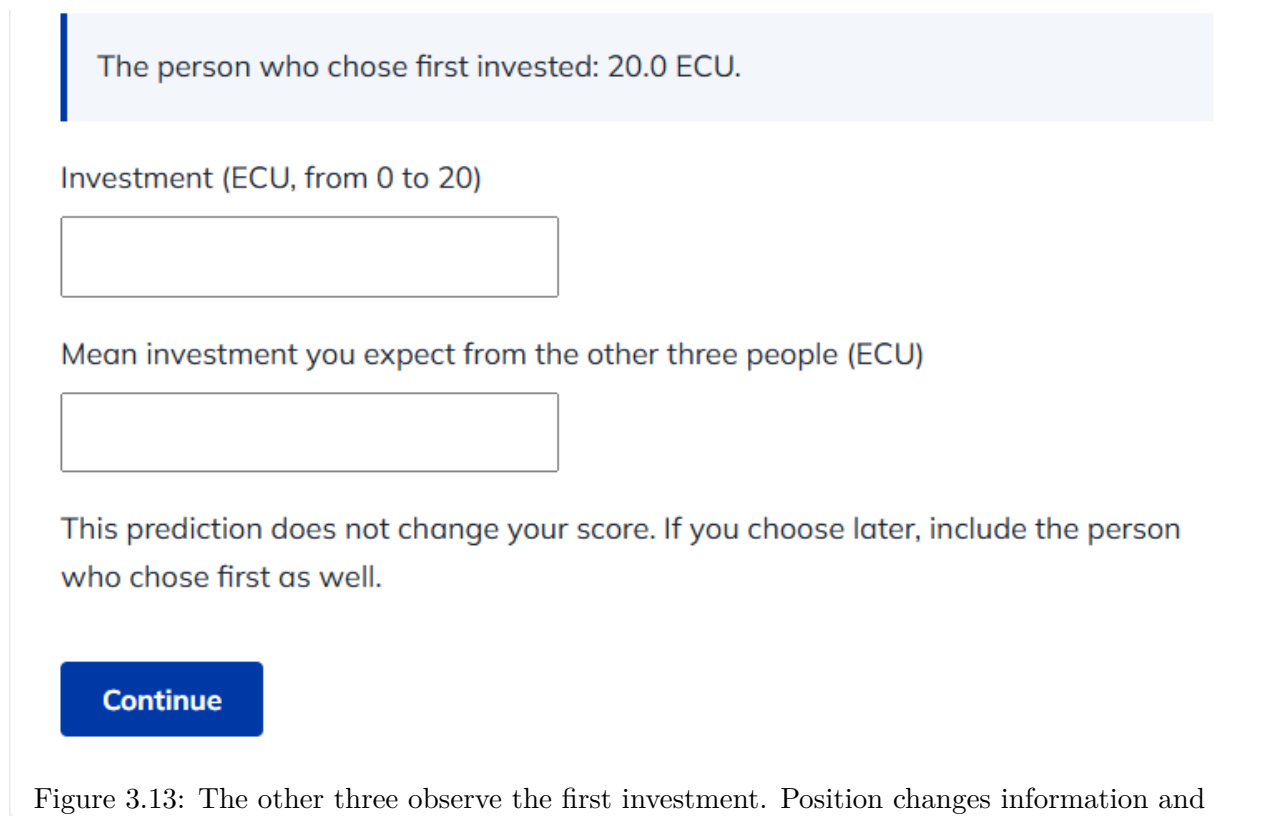
Period 1 / 10

Your decision

Each period you receive a fresh 100 ECU. Choose an investment from 0 to 20. The four investments are added together. If the effective total reaches 40, each invested ECU returns 1.5 ECU; otherwise it returns 0.5 ECU. Your outcome is 100 minus investment plus return, plus any announced transfer. Capital does not carry over between periods.

One person chooses first. The other three observe that investment before choosing simultaneously. The first position rotates each period; everyone has the same payoffs.

Figure 3.12: The other three observe the first investment. Position changes information and timing, while payoffs remain equal.



The person who chose first invested: 20.0 ECU.

Investment (ECU, from 0 to 20)

Mean investment you expect from the other three people (ECU)

This prediction does not change your score. If you choose later, include the person who chose first as well.

Continue

Figure 3.13: The other three observe the first investment. Position changes information and timing, while payoffs remain equal. Continuation of the same screen.

score. The one-time grant is applied at the beginning of period three and affects productivity before production. Announced destruction occurs at the start of period six. Both schedules are presented in the initial instructions. Nobody should learn a budget rule only after making the choice that the rule affects. The timing is part of the economic design and must remain consistent in explanation and analysis.

Results allow a participant to check a payoff before moving to the next period. The closing page presents the personal history and total score, confirms that choices were recorded and asks the participant to remain for discussion. It does not end on an empty page or a technical message saying that no pages remain. In the single-interaction core, completion follows the first result; in repeated modes it follows the tenth. Dynamic terminal capital appears as a physical datum but creates no additional payment. Its presence in the history table does not alter the announced terminal rule or extend the decision horizon.




Period 1 / 10

Your decision

Your starting capital 1.0	Mean starting capital 1.0
Your output (units) 1.0	Productivity 1.0

The period score is $100 + 20 \times \ln(\text{consumption})$. Consumption of 1 gives 100 ECU. The ten scores are added without discounting. Capital remaining after period 10 receives no payment or salvage value; the activity ends there. Score ECU and physical units of output or capital are different measures.

Figure 3.14: The dynamic panel distinguishes capital, output and the chosen percentage.

Each person starts with capital 1. At the start of period 3, an external fund adds 2.2 units to your capital. Productivity is calculated after this addition. There are no further grants. The fund pays 100 ECU per unit: 880 ECU for the entire economy.

Percentage of output you invest (from 0 to 80)

Mean saving percentage you expect from the other three people

This prediction does not change your score. If you choose later, include the person who chose first as well.

Continue

Figure 3.15: The dynamic panel distinguishes capital, output and the chosen percentage.
Continuation of the same screen.




Period 3 / 10

Your decision

Your starting capital 3,598	Mean starting capital 3,598
Your output (units) 3,794	Productivity 2.0

The period score is $100 + 20 \times \ln(\text{consumption})$. Consumption of 1 gives 100 ECU. The ten scores are added without discounting. Capital remaining after period 10 receives no payment or salvage value; the activity ends there. Score ECU and physical units of output or capital are different measures.

Figure 3.16: In the grant period, productivity uses the already increased capital stock. Support is not repeated afterwards.

Each person starts with capital 1. At the start of period 3, an external fund adds 2.2 units to your capital. Productivity is calculated after this addition. There are no further grants. The fund pays 100 ECU per unit: 880 ECU for the entire economy.

Percentage of output you invest (from 0 to 80)

Mean saving percentage you expect from the other three people

This prediction does not change your score. If you choose later, include the person who chose first as well.

Continue

Figure 3.17: In the grant period, productivity uses the already increased capital stock. Support is not repeated afterwards. Continuation of the same screen.

Your score (ECU) 110.00	Productivity 1.5
Investment by all four people 80.0	Effective total for the threshold 80.0

Investment (ECU, from 0 to 20)	20.0
Return on your investment (ECU)	30.0
Reimbursement (ECU)	0.0
Transfer (ECU)	0.0
External fund cost (ECU)	0.0

Figure 3.18: Results separate total investment, productivity and own score.



Period 1 / 1

Activity completed

Your decisions have been recorded. Stay on this screen for the instructor's discussion.

Cumulative score (ECU): 110.0

Period	Choice	Your score (ECU)
1	20.0	110.0

Figure 3.19: Completion confirms that play has ended and preserves a personal summary for discussion.

The static threshold and interventions

4.1 Reconstructing the budget

Let I_i denote own investment, S the sum of all four investments and $a(S)$ the return per invested ECU. The basic rule is

$$0 \leq I_i \leq 20, \quad S = \sum_{i=1}^4 I_i, \quad a(S) = \begin{cases} 0.5, & S < 40, \\ 1.5, & S \geq 40, \end{cases} \quad p_i = 100 - I_i + a(S)I_i.$$

The endowment is not paid twice. Investing means giving up the retained ECU and then receiving its corresponding return. Someone who invests twenty when the total is below forty keeps eighty and receives ten, ending with ninety. If the threshold is reached, the person keeps eighty and receives thirty, ending with one hundred and ten. Switching regimes can change the outcome of that same choice by twenty ECU. The budget displays strategic risk without requiring an external lottery or an unannounced productivity shock.

Consider the profile $(20, 10, 5, 0)$. Its sum is thirty-five, producing payoffs of ninety, ninety-five, ninety-seven and a half, and one hundred. If the last person changes from zero to five, the total reaches forty. Payoffs become one hundred and ten, one hundred and five, one hundred and two and a half, and one hundred and two and a half. The fourth person gains two and a half relative to the previous choice, and the other three also benefit. That contribution is pivotal for switching regimes, but the payment rule does not assign its maker the entire external benefit generated for the others.

Theoretical foundation

Strategic risk comes from other people's choices. Technology and the threshold are known. An external random shock is unnecessary for investment to be risky when participants do not know whether others will invest enough.

4.2 Equilibria and choices under expectations

A Nash equilibrium is a profile where nobody can improve by changing their own choice alone, holding the others' choices fixed. All-zero investment is an equilibrium: one person can invest at most twenty and cannot reach forty alone, so any investment creates a loss. All-twenty investment is also an equilibrium: the other three already contribute sixty, so lowering one's investment preserves the high regime but reduces the positive net return. These profiles pay one hundred and one hundred and ten per person respectively. The inferior equilibrium does not imply misunderstanding; it can be sustained by consistent expectations about what other people will do.

Successful intermediate profiles need not be equilibria. When everyone invests ten, everyone receives one hundred and five. One person can increase investment to twenty without losing the high regime and raise their own payoff to one hundred and ten. Reaching the threshold does not prove that nobody wants to deviate. Likewise, a failed sum with positive investments is not a complete-information equilibrium: someone making a loss can retain more by choosing zero. These arguments concern the one-interaction game with own-payoff preferences. Repetition, learning and messages can change observed selection without changing the elementary budget calculations underlying those profiles.

The forecast of others' mean is useful but does not describe all uncertainty. Suppose a participant assigns probability q to success and compares investing twenty with zero. The expected payoff change is $20(q - 0.5)$ when the probability concerns success under investment of twenty. For a risk-neutral person, investment is attractive above one half. An expected sum does not itself determine that probability: two distributions can have the same mean and different chances of crossing the threshold. Do not interpret the forecast field alone as a measure of risk aversion or trust. It records a numerical expectation, not a full probability distribution or preference parameter.

4.3 Announcements and timing

Announcements leave the payoff function unchanged. They can coordinate expectations by making intentions visible, but they do not guarantee compliance. Compare announcements with choices in the export if studying consistency. A difference may reflect revised expectations after seeing other messages, calculation of the contribution needed or a strategic declaration. The report does not claim to identify honesty from that difference. A useful question asks what additional information the announcement supplied and what remained uncertain when the final decision was sent. This separates the possible informational function of a message from any unsupported moral interpretation of its author's behavior.

The observable first choice also leaves returns unchanged. It removes uncertainty about one of the other three investments and displays a contribution already made. If the first person invests twenty, the other three need a combined twenty to reach forty. Coordination among them is still necessary. If the first person invests zero, they need forty; that remains feasible because their combined maximum is sixty. The initial position can facilitate or hinder success, but does not mathematically determine the result. Rotating that position lets discussion focus on information and timing without turning it into a permanent comparison among particular people.

4.4 Partial reimbursement and temporary subsidy

The guarantee reimburses half of the investment loss under the low regime. Since the original loss is $0.5I_i$, reimbursement equals $0.25I_i$. Investing ten in a failed economy pays ninety-seven and a half, while the fund pays two and a half. No guarantee payment occurs in the high regime. The uncertain payoff gain from investing twenty instead of zero becomes $20(0.75q - 0.25)$, lowering the critical probability to one third under the risk-neutral calculation above. A loss remains when success is impossible. The all-zero equilibrium therefore does not disappear entirely merely because a partial guarantee is offered.

The subsidy adds $0.25I_i$ in periods three, four and five, whether investment succeeds or fails. Investing twenty pays ninety-five in the low regime and one hundred and fifteen in the high regime during that window. Outside it, the same choice pays ninety or one hundred and ten. The critical success probability between those alternatives falls to one quarter during support. This

Each period you receive a fresh 100 ECU. Choose an investment from 0 to 20. The four investments are added together. If the effective total reaches 40, each invested ECU returns 1.5 ECU; otherwise it returns 0.5 ECU. Your outcome is 100 minus investment plus return, plus any announced transfer. Capital does not carry over between periods.

The same four people remain together for ten periods.

If the effective total remains below 40, an external fund reimburses 50% of your investment loss: 0.25 ECU per invested ECU. If 40 is reached, no guarantee is paid. There is no premium or tax within this activity; the instructor will record the fund's cost.

Figure 4.1: Instructions state the reimbursement, its payment condition and the external fund that finances it.

formula does not establish that students will use that calculation or maintain high investment after withdrawal. The teaching interest is whether selection changes and whether the change survives when the incentive returns to its original rule. Examine later periods rather than inferring persistence from the subsidized window alone.

Each period you receive a fresh 100 ECU. Choose an investment from 0 to 20. The four investments are added together. If the effective total reaches 40, each invested ECU returns 1.5 ECU; otherwise it returns 0.5 ECU. Your outcome is 100 minus investment plus return, plus any announced transfer. Capital does not carry over between periods.

The same four people remain together for ten periods.

An external fund adds 0.25 ECU per invested ECU only in periods 3, 4 and 5, whether 40 is reached or not. Other periods receive no subsidy. No taxes are charged within the activity.

Figure 4.2: The support window is announced in advance and ends after period five.

4.5 External contribution and resource accounting

The external contribution adds twenty to the effective total only in period three. If everyone invests five, private investment totals twenty and the effective total reaches forty. Each person receives one hundred and two and a half. The fund spends twenty, while private surplus above endowments is ten; net surplus for that episode is minus ten. If everyone invests twenty, private

surplus is forty and external cost is twenty, giving net surplus of twenty. These examples show why reaching the high regime does not establish that every intervention exceeds its cost. The answer depends on induced investment and the resources used to support it.

Each period you receive a fresh 100 ECU. Choose an investment from 0 to 20. The four investments are added together. If the effective total reaches 40, each invested ECU returns 1.5 ECU; otherwise it returns 0.5 ECU. Your outcome is 100 minus investment plus return, plus any announced transfer. Capital does not carry over between periods.

The same four people remain together for ten periods.

In period 3, an external fund adds 20 ECU to the effective total. This helps reach 40, but is not part of your investment and creates no own return for you. In other periods the contribution is zero.

Figure 4.3: The contribution changes the effective total, but is not own investment and creates no separate private return.

The static report calculates private surplus less external cost, measured above endowments. This is exercise accounting rather than a complete estimate of social welfare. It omits administrative costs, distortionary taxes, external distributional effects and opportunity costs beyond the announced price. Transfers are financed outside the class; students are not taxed. With guarantees or subsidies, subtracting external cost avoids treating a transfer as resource creation simply because someone receives additional ECU. Instructors can discuss alternative financing arrangements, but should not attribute them to the played treatment if those arrangements were never implemented. Keep the accounting interpretation tied to the actual rules students faced.

Feedback script

Ask who gained and who paid. Then compare private returns with external spending. Finally distinguish facilitating profitable coordination from transferring resources. A policy can do both, but observing a higher private payoff does not establish how much of the change comes from each mechanism.

Capital, consumption and persistence

5.1 From investment flows to productive stocks

The dynamic game uses individual capital K_{it} , mean capital $\bar{K}_t$, output Y_{it} , investment I_{it} and consumption C_{it} . Subscripts identify a person and a period. The equations are

$$A(\bar{K}_t) = \begin{cases} 1, & \bar{K}_t < 3, \\ 2, & \bar{K}_t \geq 3, \end{cases} \quad Y_{it} = A(\bar{K}_t)\sqrt{K_{it}}, \quad I_{it} = \frac{s_{it}}{100}Y_{it},$$

$$C_{it} = Y_{it} - I_{it}, \quad K_{i,t+1} = 0.8K_{it} + I_{it}, \quad 0 \leq s_{it} \leq 80.$$

The percentage s_{it} is the recorded choice. A physical capital unit is not a score ECU. Productivity is set using starting capital, after any announced intervention has been applied. Investment in the same period changes next capital and may affect future productivity, but does not retroactively recalculate current production. This timing rule distinguishes the capital-stock mechanism from the current-flow threshold used in the static core.

Twenty percent depreciation represents capital that does not survive a period. With capital one and investment zero, next capital is eight tenths. Investing two tenths exactly replaces depreciation and keeps capital at one. Higher investment increases it. The square root produces diminishing returns within a regime: doubling capital does not double output. The productivity jump instead changes output discretely when mean capital crosses three. Keeping both relationships separate is useful. One is a smooth production curve within the current regime; the other is a change of regime affecting the economy's productive possibilities. Neither relation alone describes the entire transition.

5.2 Two steady states under a specified rule

A steady state is a capital level reproduced under a given saving rule. Suppose capital is symmetric and saving is fixed exogenously at twenty percent. The condition $K_{t+1} = K_t$ implies $0.2K = 0.2A\sqrt{K}$, and positive capital therefore satisfies $K = A^2$. With productivity one, capital one reproduces the low regime because it is below three. With productivity two, capital four reproduces the high regime because it is above three. These are two consistent steady states under that particular saving rule. Corresponding consumption is eight tenths in the low state and three point two in the high state.

This calculation is conditional. Students freely choose percentages and know the horizon is ten periods, so the application does not impose twenty percent saving. Nor does any agent guarantee symmetric capital. Calling one and four equilibria of the freely chosen dynamic game would require solving the complete strategic decision problem. This guide uses them as transparent benchmarks

showing how technology can reproduce different levels under a common rule. If an economy leaves the low state by saving more, that demonstrates the importance of the decision rule rather than contradicting capital accumulation. Distinguish an imposed saving benchmark from the incentives actually faced by participants.

Attention

Do not infer inevitable poverty from a low initial capital stock. The mechanism allows chosen investment and has a finite horizon. Observed low persistence can reflect expectations, terminal incentives, learning or consumption choices. The twenty-percent steady states are not a general solution to the freely chosen game.

5.3 A complete one-time-grant example

Suppose everyone saves twenty percent in the first two periods and starts at capital one. In both periods they produce one, invest two tenths, consume eight tenths and maintain capital one. At the start of period three the fund adds two point two units per person. Capital becomes three point two and productivity becomes two. Individual output is approximately 3.578, investment 0.716, consumption 2.862 and next capital 3.276. The total grant is 8.8 units and its announced cost is 880 ECU. Each quantity can be checked separately, making clear which resources belong to the economy and which costs belong to the fund.

There is no grant in period four, but inherited capital remains above the threshold. Under twenty percent saving, output is approximately 3.620, investment 0.724 and next capital 3.344. The path approaches four if that saving rule continues. This example verifies persistence after support ends because capital transmits the intervention. If people consume all output immediately after the grant, the path changes. A high outcome in period three verifies only a contemporaneous crossing, not subsequent reproduction. The distinction should guide how the instructor reads the report and how students describe what a temporary intervention achieved during the observation window.

For comparison, start with capital four and no intervention. Twenty percent saving gives output four, consumption 3.2, investment 0.8 and next capital four. Destroying half of capital four leaves two and moves the economy to the low regime before production. Output then equals the square root of two, approximately 1.414. At twenty percent saving, investment is below depreciation of 0.4, and next capital falls to about 1.883. This is a solved counterfactual, not an observed classroom finding. Use it to test the timing of the technology switch and to compare replacement investment with the amount of capital that disappears.

5.4 Scores and a known ending

The period score is $100 + 20 \ln C_{it}$. Consumption one gives one hundred; eight tenths gives about 95.54; consumption 3.2 gives about 123.26. The transformation preserves the ranking of consumption and represents diminishing marginal value of additional consumption. Total performance sums ten scores without discounting. Terminal capital has no salvage payment. Given output in the last period, choosing investment zero maximizes that period's consumption and score because no later production is rewarded. This is a well-defined terminal prediction, rather than advice that instructors should give participants before they make their choices.

The ending can induce saving to fall before the final period and affect the observed regime. The report therefore retains every period. An economy that is high from periods four through nine but low in ten should not be summarized as complete failure of support. Nor should period ten be

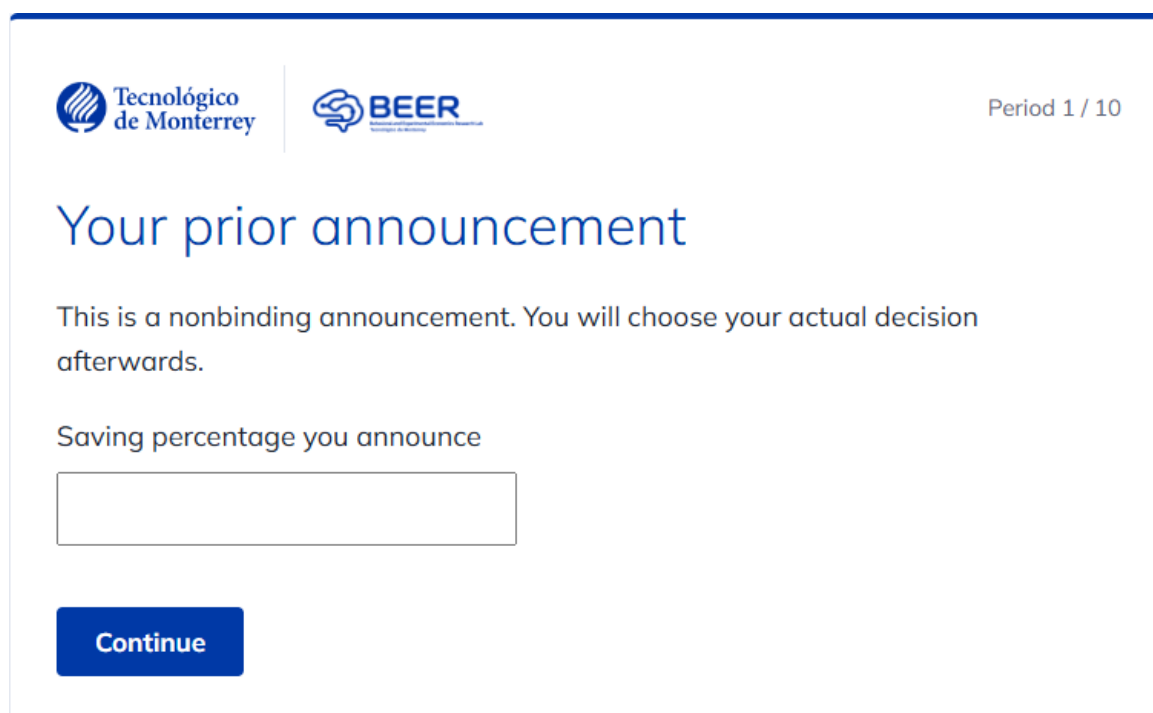
removed to claim permanent success. Present both descriptions: six of seven subsequent periods were high, and uninterrupted high status was not maintained throughout the whole window. Then discuss how the terminal rule may contribute to the behavior. Keep the distinction between the experimental horizon and a real economy's horizon visible throughout the interpretation.

What participants will see

Participants see current resources, current productivity, investment percentage, consumption and next capital. The interface announces the ending and scheduled events from the start. Claims about traps or permanent success belong to instructor analysis, rather than suggestions displayed on a decision screen.

5.5 The five dynamic variants

Persistent capital is the accumulation reference with initial capital one. Capital and announcements preserves that technology and adds nonbinding saving-percentage declarations. The one-time capital grant adds 2.2 units per person at the start of period three. High initial capital starts at four without later support. Announced destruction starts at one and removes half the stock at the beginning of period six. All five share consumption, depreciation, horizon and score. This structure supports discussion of information, initial conditions and state changes without confounding them with a different preference transformation or activity duration. Students can explain which equation changes and which remains common.



The screenshot shows a web interface for the BEER Lab. At the top left are the logos for 'Tecnológico de Monterrey' and 'BEER'. At the top right, it says 'Period 1 / 10'. The main heading is 'Your prior announcement'. Below this, a message states: 'This is a nonbinding announcement. You will choose your actual decision afterwards.' The next line is 'Saving percentage you announce' followed by a text input field. At the bottom left is a blue 'Continue' button.

Figure 5.1: Dynamic announcements concern a percentage, whose physical amount depends on own output.

Choices do not incorporate credit, transfers among participants or capital trading. The budget requires consuming at least twenty percent of output, ensuring the logarithm is defined. This avoids zero consumption, which would make the score undefined, and limits the speed of accumulation. Do not interpret an active upper bound as an unrestricted preference for exactly eighty percent saving. Someone may have wanted to invest more. During discussion, identify the constraint together with the state and information, because all three determine which choices were possible. A boundary

Each person's capital produces units of output. Output equals $A \times \text{square root of capital}$. A is 1 if the economy's mean starting capital is below 3, and 2 if it reaches 3. Choose the percentage of output to invest, from 0 to 80. Consume the remainder. Next capital equals $0.8 \times \text{current capital} + \text{investment}$. The four people remain together.

The period score is $100 + 20 \times \ln(\text{consumption})$. Consumption of 1 gives 100 ECU. The ten scores are added without discounting. Capital remaining after period 10 receives no payment or salvage value; the activity ends there. Score ECU and physical units of output or capital are different measures.

The same four people remain together for ten periods.

Each person starts with capital 1. At the start of period 3, an external fund adds 2.2 units to your capital. Productivity is calculated after this addition. There are no further grants. The fund pays 100 ECU per unit: 880 ECU for the entire economy.

Figure 5.2: The grant occurs once, with explicit cost and timing.

Each person's capital produces units of output. Output equals $A \times \text{square root of capital}$. A is 1 if the economy's mean starting capital is below 3, and 2 if it reaches 3. Choose the percentage of output to invest, from 0 to 80. Consume the remainder. Next capital equals $0.8 \times \text{current capital} + \text{investment}$. The four people remain together.

The period score is $100 + 20 \times \ln(\text{consumption})$. Consumption of 1 gives 100 ECU. The ten scores are added without discounting. Capital remaining after period 10 receives no payment or salvage value; the activity ends there. Score ECU and physical units of output or capital are different measures.

The same four people remain together for ten periods.

Each person starts with capital 4. No later grants are received.

Figure 5.3: High initial capital changes the starting state and supports trajectory comparisons without later grants.

Each person's capital produces units of output. Output equals $A \times \text{square root of capital}$. A is 1 if the economy's mean starting capital is below 3, and 2 if it reaches 3. Choose the percentage of output to invest, from 0 to 80. Consume the remainder. Next capital equals $0.8 \times \text{current capital} + \text{investment}$. The four people remain together.

The period score is $100 + 20 \times \ln(\text{consumption})$. Consumption of 1 gives 100 ECU. The ten scores are added without discounting. Capital remaining after period 10 receives no payment or salvage value; the activity ends there. Score ECU and physical units of output or capital are different measures.

The same four people remain together for ten periods.

Each person starts with capital 1. At the start of period 6 half of each person's capital is destroyed, before productivity is calculated. This event is known from now.

Figure 5.4: Destruction precedes production in period six and is known from the beginning.

choice is a useful observation but should not be treated as direct evidence of an unconstrained optimum.

Reading the report and organizing feedback

6.1 Progress, privacy and revelation

The instructor report is private and initially displays progress. It counts completed economy-periods, pending periods and included decisions. One economy of four people over ten periods creates ten economy-period units and forty decisions. With three economies, expected denominators are thirty and one hundred and twenty. Aggregate outcomes remain hidden until the whole active horizon is complete. The reveal button lets the instructor decide when to project them. Reloading hides results again, preventing an open screen from reappearing with exposed outcomes when the classroom context changes. Completion enables revelation but never performs it automatically on the instructor's behalf.

Do not equate submitted choices with included observations. If an economy has not completed a stage, its partial choices do not enter period means. This avoids calculating an aggregate before productivity is defined. The exclusion is operational, not a claim that those people's behavior is irrelevant. Implementation problems should be studied through authorized monitoring and records separately. The instructor report does not expose participant codes or names. Captures for a presentation should preserve that separation and avoid displaying individual links or administrative identifiers. The report is suitable for collective feedback because it focuses on economic magnitudes rather than identifying who made a particular choice.

6.2 Means, forecasts and distributions

Mean choice is investment in ECU in the core and a percentage in the dynamic game. Mean score refers to one person in one completed period, rather than the session total. Forecast error is the absolute difference between the expected and realized mean of the other three choices, averaged over completed observations. Low average error does not establish a precise belief distribution or show that expectations caused the choice. Learning, coincidence or a homogeneous decision path that is easy to anticipate can also produce low error. State what the indicator actually computes before proposing a behavioral explanation for its value.

The histogram groups investments or percentages into five equal intervals. Core intervals run from zero to four, above four through eight, above eight through twelve, above twelve through sixteen and above sixteen through twenty. The first includes zero; subsequent intervals exclude the lower endpoint and include the upper endpoint. Dynamic limits are sixteen, thirty-two, forty-eight, sixty-four and eighty. Name the measurement unit before comparing bars. Concentration at both endpoints can represent coordination on very different profiles, while an intermediate mean can

Instructor report: big push and persistent capital

Reference: simultaneous investment

Session progress

Completed economy-periods

0 / 1

Pending

1

Decisions in completed economies

0

Aggregate results are hidden. Reveal becomes available after every active period is complete. Reloading hides them again.

Reveal aggregate results

Figure 6.1: The report begins with progress; revelation is disabled while decisions are missing.

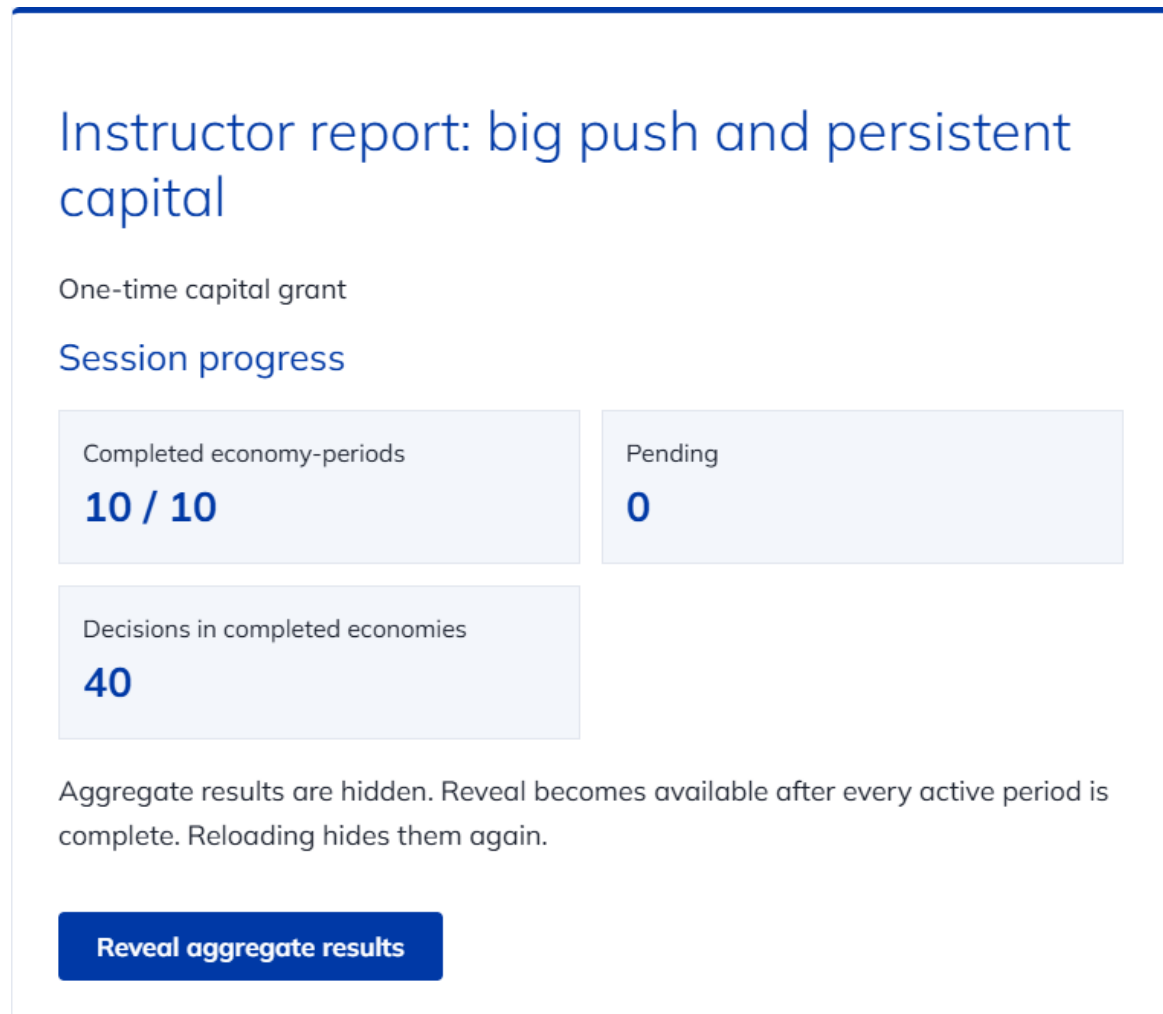


Figure 6.2: Completion enables the button but keeps results hidden until the instructor explicitly reveals them.

Means and denominators

Mean choice 20,0	Mean score per decision (ECU) 110,0
Mean absolute forecast error 0,0	Share of economy-periods in the high regime 1

Decisions in completed economies: 4. Completed economy-periods: 1.

External fund cost (ECU): 0,0.

Private surplus less external cost, above endowments (ECU): 40,0.

Each row uses only completed economies in that period. N counts decisions; E counts economies. Forecasts: error relative to the mean of the other three choices. Bars group intervals closed at their upper endpoint. Participant names and codes are not shown.

Figure 6.3: The static summary displays surplus above endowments after external cost. It differs from the dynamic logarithmic score.

Means and denominators

Mean choice 36,0	Mean score per decision (ECU) 116,469
Mean absolute forecast error 4,0	Share of economy-periods in the high regime 0,8

Decisions in completed economies: 40. Completed economy-periods: 10.

External fund cost (ECU): 880,0.

Logarithmic scores are not netted against monetary costs. Compare physical consumption, capital and financing costs separately. An observed high regime does not prove indefinite persistence.

Each row uses only completed economies in that period. N counts decisions; E counts economies. Forecasts: error relative to the mean of the other three choices. Bars group intervals closed at their upper endpoint. Participant names and codes are not shown.

Figure 6.4: The summary aggregates choices and productive regimes with visible denominators. Dynamic scores, physical quantities and financing remain separate.

conceal those two groups. The distribution therefore adds information that the mean alone cannot supply.

Decision distribution

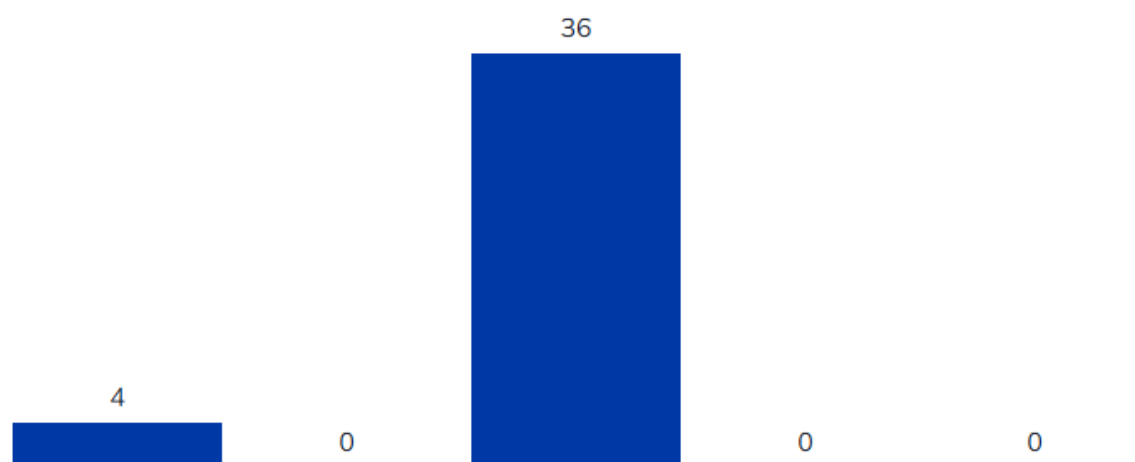


Figure 6.5: Bars show decision frequencies rather than success percentages. Identify the choice unit before comparing concentration.

The high-regime share uses economy-periods as its denominator. It does not count students who personally invested large amounts. If two economies reach the threshold and one does not, the share is two thirds even when all twelve participants choose different investments. Mean investment uses individual decisions and therefore has a different denominator. Displaying both helps examine choices and collective outcomes in the same class. Do not multiply the success rate by mean investment to create an indicator without justification. Those quantities use different analysis units and do not automatically reconstruct output or welfare. Their relationship must be established through the model's accounting.

6.3 Paths and persistence

The period table retains decision count, economy count, mean choice, score, high-regime share and external cost. Dynamic tables add mean capital and consumption. The regime graph shows a proportion from zero to one each period; a rising line alone does not imply that every economy improved. Different economies may change in different directions. Under rematching, it also does not follow the same social unit. Use fixed-group paths when discussing history, and rematching when discussing incentives under changing composition. Periods with zero denominators are shown with a dash instead of an invented mean. This convention distinguishes missing outcomes from genuinely low numerical values.

After the one-time grant, the report distinguishes two indicators. One counts economies that remain high in every period from four through ten. The other counts high economy-periods within that window. With two economies and seven periods, the second denominator is fourteen. An economy can contribute six high periods to the second indicator while failing to count as uninterrupted persistence in the first. Both are correct but answer different questions. Neither proves permanence after period ten. The withdrawal schedule and the known ending should accompany any sentence summarizing treatment success. A clear report makes the strength and the limitation of each description visible.

Evolution by period

High regime: share



Period	N / E	Choice	Mean starting capital	Your consumption (units)	Your score (ECU)	High regime: share	External fund cost (ECU)
1	4 / 1	40,0	1,0	0,6	89,78	0	0,0
2	4 / 1	40,0	1,2	0,657	91,61	0	0,0

Figure 6.6: The graph and table preserve time order. Read capital and consumption together with the regime.

3	4 / 1	40,0	3,598	2,276	116,45	1	880,0
4	4 / 1	40,0	4,396	2,516	118,45	1	0,0
5	4 / 1	40,0	5,194	2,735	120,12	1	0,0
6	4 / 1	40,0	5,979	2,934	121,53	1	0,0
7	4 / 1	40,0	6,739	3,115	122,73	1	0,0
8	4 / 1	40,0	7,468	3,279	123,75	1	0,0
9	4 / 1	40,0	8,161	3,428	124,64	1	0,0
10	4 / 1	0,0	8,814	5,938	135,63	1	0,0

Figure 6.7: The graph and table preserve time order. Read capital and consumption together with the regime. Continuation of the same screen.

After the capital grant

High regimes are observed from period 4 through 10, after the one-time grant in period 3. The sustained share requires all seven periods to be high; a late decline may reflect the absence of salvage payment.

Economies with every subsequent period in the high regime: 1 / 1.

Subsequent economy-periods in the high regime: 7 / 7.

Figure 6.8: Complete continuity and the proportion of high post-grant periods are calculated separately.

6.4 Feedback from an observed pattern

Start with a short description students can verify: for example, most invested little initially and the high-regime share rose after announcements. Ask what information changed and what remained unchanged in payments. Avoid presenting this sequence as causal identification without acknowledging learning and order. For external support, add the financing question. For capital, reconstruct one period before and one after the event. Ending with a solved counterfactual helps turn a classroom episode into an economic argument whose assumptions are explicit. Invite multiple explanations where the observed data cannot distinguish them, then ask which additional comparison would be informative.

Feedback script

We can describe events without guessing intentions: these are the choices, this is the threshold and these are the costs. Now propose two explanations consistent with the pattern. What record or comparison could distinguish them? Which part depends on the ending rule, and which part on inherited capital?

Evidence, lesson sequence and discussion

7.1 What the literature contributes

Murphy, Shleifer and Vishny examine how complementarities across sectors can sustain different industrialization levels, and how joint activity can make investments profitable when isolated investment would not be [Murphy et al. \(1989\)](#). This family abstracts that idea into an explicit threshold. It does not reproduce the article's price system or sectors. The reference motivates the macroeconomic question; classroom numbers and budgets are transparent teaching adaptations. Explain the connection by comparing which economic relationship is retained and which parts of the original model are omitted. That makes the source useful without implying replication of an entire economy.

Lei and Noussair develop an experimental economy to study equilibrium selection [Lei and Noussair \(2007\)](#). Their article provides an antecedent for asking why macroeconomic paths differ. This implementation is not presented as a replication. It separates a static core from an extension with a persistent stock and announces a specific terminal rule. The theoretical calculations in earlier chapters follow from the implemented equations. Do not attribute the activity's parameters to the authors or present classroom observations as published findings from their experiment. The relationship is a research question and methodological inspiration, rather than identity between the experimental designs.

Capra and coauthors study experimental economies with production, exchange and investment under a threshold externality. They report that public announcements and voting over policies can improve outcomes and favor escape from the low regime [Capra et al. \(2009\)](#). This package uses announcements as a comparable institution but does not implement their market or binding votes. Their evidence does not guarantee a particular classroom outcome. Capital support, reimbursements and observable timing are teaching adaptations for comparing mechanisms through explicit rules and costs. Instructors should describe those adaptations directly when connecting the activity to the research literature.

7.2 Predictions that can be examined

Before revelation, request a written prediction about a specific comparison. For announcements, one possibility is stronger concentration at high investment with more favorable forecasts. For an observable first choice, later decisions might respond to the value seen. Guarantees and subsidies might increase investment because they alter expected losses. These are possible predictions under assumptions, rather than outcomes the game is required to produce. A class can generate another

pattern and still provide a useful experience if students reconstruct the choices and constraints that produced it. Unexpected results offer an opportunity to compare explanations rather than a reason to declare the exercise invalid.

A prediction should identify an indicator and denominator. Instead of claiming that a guarantee improves everything, predict a higher economy-period high-regime share than the reference and then compare costs. Instead of saying that aid eliminates poverty, predict more economies remaining high during the post-grant window. Specify an observation that would weaken the claim. This practice distinguishes an economic question, an available measure and an interpretation. The game produces choices and states; reaching a conclusion requires an additional argument that can be discussed. Students should know which part of that argument follows mechanically from accounting and which part needs behavioral assumptions.

7.3 A lesson focused on the core

Allow the first ten minutes for access and rules. Explain the budget with an example different from the profile you expect to observe. Use five minutes for comprehension and check that nobody confuses a mean with a sum. Allow about fifteen minutes for ten repeated episodes, or a shorter decision stage for a single interaction. During choices, neither reveal aggregates nor suggest how much is still needed. Afterwards, allow two minutes of individual reflection: each student writes what they expected, what they received and whether the discrepancy changed their next choice. This record supports discussion without forcing public disclosure of personal decisions.

Use the closing block for revelation and interpretation. Show the distribution, then the high-regime share and finally the time path. Ask whether an intermediate mean represents similar decisions or a mixture of extremes. Reconstruct a successful and an unsuccessful profile with anonymous or hypothetical numbers. Introduce Nash equilibrium after explaining a unilateral change. Conclude by requesting one intervention that changes information and another that changes payments. This distinction prepares a later extension lesson without turning the first class into a list of policies disconnected from the budget. It also establishes why two institutions can affect the same outcome through different channels.

7.4 A lesson focused on accumulation

Begin with the distinction between a flow and a stock. Give a capital level and saving percentage, then request output, consumption, investment and next capital. Explain that all four choices affect future states and that participants remain together. The horizon and terminal capital rule must be announced before play. After ten periods, show capital and consumption alongside the regime. Ask the class to reconstruct the grant period and the first period without support. That transition identifies exactly which variable transmits the effect of support that has already ended. Keep the calculation separate from claims about the participants' unobserved intentions.

Compare the report's two persistence measures. If the last period changes the interpretation, use it to discuss the horizon rather than hide it. An additional exercise holds saving at twenty percent on paper and calculates the path the economy would have followed. That path is a conditional counterfactual, not an estimate of what participants would choose under another incentive. The comparison separates a specified accumulation model from a chosen behavioral rule. Ask each team to state both assumptions and explain which changed between calculations. A complete response should show where the capital path comes from rather than simply naming a steady state.

7.5 A progression of discussion questions

For the core, start with own investment, expectations and realized return. Continue by asking what one person could change alone and what required joint choices. Then ask whether reaching forty was sufficient for nobody to want to change investment. For institutions, add what each person knew before acting and who financed the payoff change. For capital, ask what survives, what depreciates and which moment determines productivity. Finish with an inference question: which claims describe the data, and which depend on a hypothesis about mechanisms? This progression helps students construct an explanation from observable choices before reaching broad conclusions about policy or behavior.

For the instructor

Do not label a person cooperative or selfish based only on investment. A low choice can reflect pessimistic expectations, and a high choice can reflect an expected private return. Ask for an explanation and check the budget before introducing motivational labels.

7.6 Assessment and conceptual transfer

A short assessment can request a correctly calculated payoff, an equilibrium explanation and an interpretation with its denominator. For dynamics, add a capital transition and the difference between crossing and continuity. A useful rubric credits identifying variables, respecting available information and distinguishing external cost from score. Do not reward only maximum investment: that choice does not demonstrate understanding in every treatment. The assessable objective is reasoning with the model and limited evidence, even when a personal choice does not match a successful profile. Written explanations can reveal understanding that is invisible in the investment field alone.

When transferring the intuition to infrastructure or industrialization, identify a counterpart for each magnitude: private investment, complementarity, threshold, public resources and the persistent variable. Then ask what real mechanism is missing, such as credit, markets, heterogeneity or technological uncertainty. That second question prevents the analogy from becoming a policy recipe. The game shows a logical coordination possibility and makes it observable in a small economy. Choosing a real policy requires evidence about relevant mechanisms, costs and population constraints. End with an investigable question rather than a universal conclusion that exceeds the design. This gives the classroom activity a clear role within economic analysis.

Data, troubleshooting and exercises

8.1 Export and integrity

The export records session, participant, period, language, edition, treatment, matching and economy. It includes announcements where applicable, choices, forecasts and others' mean choices. Core records preserve effective totals, productivity, returns, reimbursements, subsidies and scores. Dynamic records include own and mean capital, output, investment, consumption, next capital, grants and destruction. External cost belongs to an economy-period and is repeated on individual rows as context. When summing it for analysis, retain only one row per economy and period. Summing it across all four participant rows would count the same expenditure four times and distort the financing comparison.

Participant identifiers are technical administrative records used to connect choices over time. They should not be projected or included in public teaching captures. Before sharing data, remove links and keys that permit returning to a session. An anonymous classroom file can retain a separate artificial index for trajectory analysis if it cannot identify a person. This family's public histograms and reports use aggregates. Privacy does not require removing denominators or treatment information; it requires separating what is needed to interpret the exercise from information identifying participants. Keep the administrative dataset distinct from the version used for collective feedback or distributed course material.

The completion variable defines valid observations. A field containing zero does not prove that someone chose zero when the period is incomplete. Some outcome fields start at zero before settlement; empty choice and forecast fields indicate missing responses. Filter the active horizon and completed economies before calculating statistics. A single interaction still has additional technical periods supporting the application, but these are not ten realized decision opportunities. The report explicitly visits active periods. External analysis should follow that same rule so that sample size is not inflated and unplayed history is not filled with artificial zeros. A correct denominator is part of the substantive result.

8.2 Check accounting before interpretation

For the core, add the four investments and any external contribution in the period. Check whether the effective total reaches forty and apply the return. Recalculate own payment including the transfer. For dynamics, check the starting intervention, mean capital, productivity, output, consumption-investment split and next capital. Retain enough precision when comparing mean capital with three. Visually rounding 2.999 to three does not change the technology actually computed. The interface rounds quantities for readability, while transitions use stored values with greater precision. Explain this distinction if students attempt to reproduce an outcome from only

the displayed rounded numbers.

ECU are stored with two decimals. Physical quantities are normally displayed with three decimals, while accumulation uses internal precision. A last-digit discrepancy between a rounded manual calculation and the record does not necessarily imply an error. First check whether output was rounded before applying saving or capital before taking its mean. Do not alter data merely to match an approximate calculation. If a discrepancy exceeds these approximations, document the treatment, period and budget rule without student names, and consult laboratory coordination before using the result as evidence. Reproducibility starts with preserving the actual values and the sequence in which the rules were applied.

8.3 Common operational problems

If someone is waiting, check that every entry link in their economy was used and that others are not still answering comprehension or making announcements. Two students sharing a link control the same identity and do not fill two distinct places. Correct admission before proceeding. If a page reports a numerical error, check the permitted interval and the browser's accepted decimal separator. The instructor can explain which field is missing but should not provide a choice merely to move the session forward. If a device loses connection, resume its individual link and verify the current page before submitting another response.

If a room displays configurations from another language or edition, stop admission and review the chosen route. If Demo or Rooms displays other families, the instance is not properly isolated. The prepared local package keeps its own database and port, but public deployment needs the same separation. If a report seems empty after a completed single interaction, check the active horizon and economy completion rather than only the final technical period opened by administration. If reveal remains disabled, identify the missing economy-period before assuming a privacy problem or broken button. Progress information should help locate the unfinished stage without exposing economic choices.

Attention

A rehearsal session verifies access and accounting. Its outcomes are not published experimental evidence. Identify examples and rehearsal captures accordingly when preparing classroom material, and keep test decisions separate from any real sample.

8.4 An investment and threshold exercise

Give the profile (0, 20, 10, 10) and request the total, regime and payments. The sum forty produces productivity 1.5 and payments of one hundred, one hundred and ten, one hundred and five, and one hundred and five. Ask whether the first person should change their decision if others stay fixed. The others total forty, so investing twenty raises that person's payment to one hundred and ten without losing the high regime. The initial profile succeeds but is not an equilibrium. Ask for another profitable deviation and then contrast the profile with all-twenty investment. The goal is to separate a favorable collective outcome from individual strategic stability.

For a financing exercise, use investment five per person and an external contribution of twenty. The effective total forty gives each person one hundred and two and a half. Total private surplus is ten and cost is twenty, making the net balance above endowments minus ten. Remove the contribution while keeping choices unchanged: the total twenty pays ninety-seven and a half to each person. The intervention improves every payment by five, but a resource conclusion needs its

cost. Ask students to explain both statements without confusing an individual improvement with a complete social balance. Require the counterfactual choices to be stated explicitly.

8.5 An accumulation and horizon exercise

With capital one, productivity one and saving forty percent, output is one, investment 0.4, consumption 0.6 and next capital 1.2. If everyone repeats, the next period remains low because mean capital does not reach three. The example shows that growing capital need not change productivity immediately. Next give capital 3.2 with productivity two and request the transition under zero saving: next capital is 2.56. Consuming everything can leave the high regime in the next period even though the current period was productive. This exercise connects a choice, a surviving stock and the timing of the regime switch.

In the final period, compare zero and twenty percent saving at capital four. Output is four. Zero saving allows consumption four and a score of about 127.73; twenty percent allows consumption 3.2 and a score of 123.26. Next capital is 3.2 versus four, but neither amount is rewarded after completion. The first choice wins under the implemented terminal objective. Ask how the reasoning would change with a capital salvage payment; do not request an optimal number without specifying that new price. An adequate response identifies the missing incentive and the condition that must be defined before solving the modified problem.

8.6 A final classroom delivery check

Before closing, verify that every person reached the activity-completed screen. Save the report with indicators and denominators, and record the configuration, treatment order and access incidents. If the class did not finish, document the incomplete portion and do not describe a final rate as if everybody decided. Share only aggregate outcomes and necessary references. For reuse, keep guides with figures and editable sources. A PDF alone supports reading, while self-contained sources allow instruction updates without rebuilding institutional assets. End with a research question that the experience helped make more precise, so students understand what additional evidence would be needed to answer it beyond the classroom.

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