



Instructor Guide to Specific Factors and Labor Mobility

Laboratory implementation, theoretical foundations,
experimental evidence, and variants

Behavioral and Experimental Economics Research Lab
Department of Economics



Revised edition | October 2026

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

How to use this guide

This guide supports preparation, implementation and discussion of the BEER Lab specific-factors and labor-mobility family. It is intended for instructors in international trade, microeconomics and labor economics with different levels of familiarity with laboratory experiments.

Operational chapters explain access and decisions. Economic foundations develop formulas, intuition and worked examples. Extensions let instructors choose a specific comparison without repeating common rules. Report interpretation connects classroom data with model predictions and their limits.

The activity is individual and requires no partners. One guide covers basic and extended editions; the Spanish version preserves the same parameters and options. Questions and answer guidance support feedback by nonspecialists. Graphs distinguish wages, resource income and production rather than reducing every result to a score.

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For the instructor

Check configuration, language and schedule before creating a session. Separate monetary endowments from physical inputs. Reserve optimizing references for discussion. ECU do not promise real-money payments; specific-resource incomes belong to simulated owners.

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Preparing access and choosing an activity

1.1 What this family teaches

This laboratory makes a distinction that is easy to miss in a first course on international trade. An economy may gain productive opportunities while particular groups lose purchasing power. The reason is not necessarily that workers make mistakes or that production becomes less efficient. Resources differ in their ability to move. Labor can be assigned to either sector, but each sector's specific resource remains attached to its own production technology. A change in a product price therefore affects allocation and the distribution of income simultaneously.

Each student manages an independent numerical economy. Students choose an allocation of whole labor units, observe production and factor incomes, and discuss aggregate classroom results afterward. They do not negotiate wages, own an actual firm, or trade with other participants. This design is deliberately different from the competitive labor-market game. It isolates allocation and comparative statics so an instructor can use any positive number of students without creating employers, partners, or waiting groups. Prices come from the configuration rather than from a classroom auction.

The basic economy has ten labor units and sixteen units of a specific resource in each sector. A student chooses labor in A and the program assigns the remainder to B. Each production function has diminishing marginal returns to labor with the other input fixed. The computer also imputes wage and specific-resource income from the same technology. These are diagnostic quantities of the model, rather than additional payments to human owners. When the allocation is inefficient, its two imputed wages can differ; the program does not silently move workers to eliminate that difference.

The learning objectives are to distinguish an initial monetary endowment from productive resources, calculate output value, explain the labor-allocation condition, identify winners and losers from a price change, separate nominal from real returns, and understand why costly movement changes adjustment. The two-economy extensions add migration and nationality-based accounting. In an introductory class, begin with the resource constraint and the graph. In an advanced trade course, derive the equilibrium and discuss how the numerical adaptation differs from a decentralized market.

For the instructor

One family contains three basic modes and nineteen extended treatments in each language: forty-four configurations and four rooms. The three basic modes are one allocation, five

prices in fixed order, and the same five prices in individual random order. No pairing or group-size multiple is required. Choose extensions by the concept to teach; a complete catalog is not a recommendation to run every treatment in one lesson.

1.2 Family summary

Purpose	Allocate labor across sectors with fixed specific resources; compare production, wages, resource income, relative prices, real returns and mobility constraints.
Experimental unit	One student managing an independent simulated economy; other students' decisions do not affect its outcomes.
Participants	Any positive integer number; no partners, market groups or waiting pages.
Suggested duration	15–25 minutes of activity and 20–30 minutes of discussion; allocate additional time for ten decisions or multiple extensions.
Basic edition	One allocation, five price scenarios in fixed order, or the same five scenarios in individual random order.
Extended edition	Relative and general prices; specific resources; labor supply; productivity; immobility; moving costs, limits and support; consumption baskets; international migration; ten-decision learning.
Decision	Whole labor units in A, with the remainder in B; migration conditions ask how many workers to move from B to A.
Outcome	100 ECU per decision plus total output value minus private moving costs; factor-income diagnostics are not added again.
Topics	Specific factors, labor mobility, relative prices, real wages, income distribution, international migration.
JEL	A22, C91, F11, F16, F22.

1.3 From the laboratory website to the session

Begin at <https://beer-lab.org/en/>. Its teaching section leads to <https://teaching.beer-lab.org/en/>. Use the *Specific Factors and Labor Mobility* family to identify the activity, edition and language. The institutional and directory screenshots illustrate this navigation. The directory is a catalog of families: selecting a family takes the instructor to its own instance, rather than to a project that mixes all games together. The catalog entry and the oTree session are related but distinct steps.

For English participants, the basic room is https://specificfactors.beer-lab.org/room/specific_factors_en; the extended room is https://specificfactors.beer-lab.org/room/specific_factors_extended. Spanish rooms are https://specificfactors.beer-lab.org/room/factores_es and https://specificfactors.beer-lab.org/room/factores_extendido. Students enter the room for the language and edition announced by the instructor. A room link is reusable; a temporary demonstration link identifies a particular session and is not a substitute for a persistent class room.

The instructor accesses <https://specificfactors.beer-lab.org/demo> to explore configurations and <https://specificfactors.beer-lab.org/rooms> to prepare a room session. Administrative

authentication is supplied through the laboratory's coordination process. A student link does not grant access to the report or exports. Keep administration on the instructor's screen and distribute participant links only. The family instance should contain forty-four Demo configurations and four rooms; each basic room offers three configurations and each extended room nineteen.

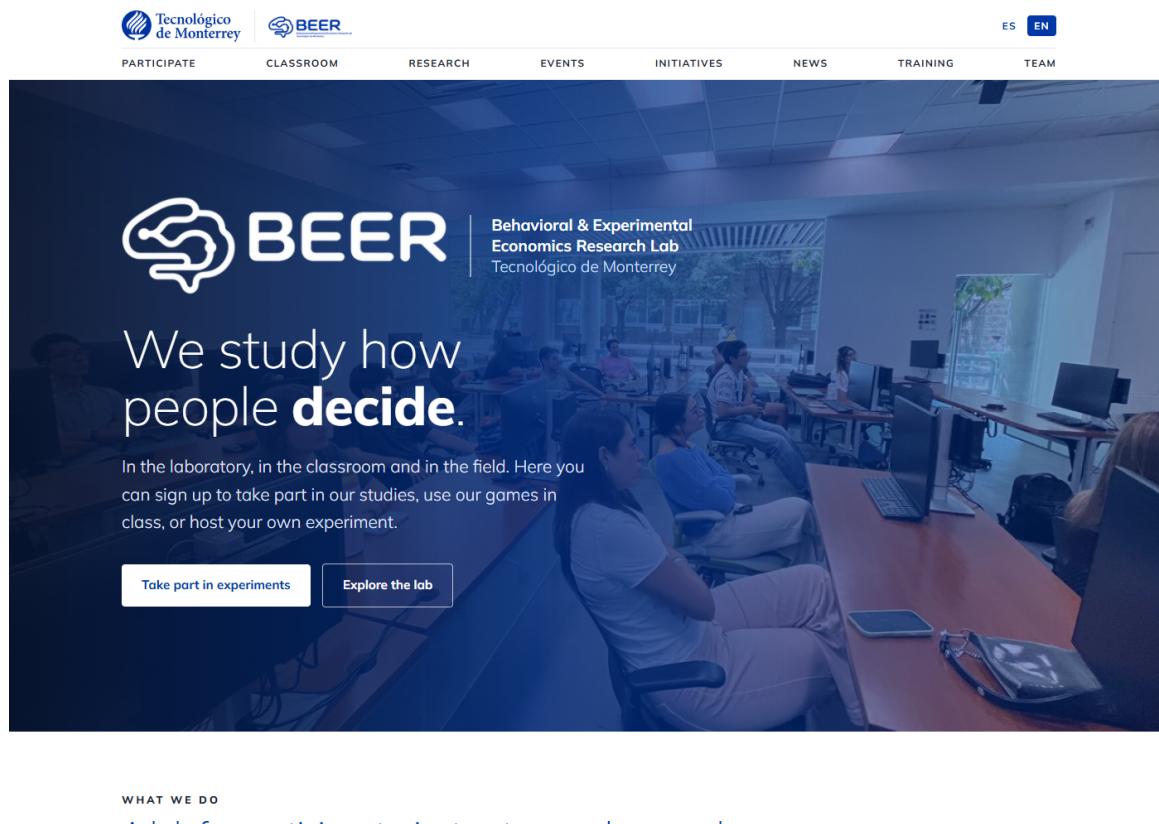


Figure 1.1: Find the teaching section on the institutional website.

1.4 Creating and rehearsing a class

Before creating a session, record the language, treatment and intended number of students. One participant is enough to rehearse because the activity has no strategic partner. A demonstration normally creates four independent participants so the instructor can compare different allocations. Four is a convenience, not a required multiple. A class of seventeen can use seventeen participants without adding dummy students. Each participant must retain one own link; sharing a link would share one economy and overwrite the meaning of individual records.

Choose the configuration before starting. The five-price modes contain five decisions; the learning extension contains ten; most extended comparisons contain two, and migration treatments contain one. The schedule is part of the treatment and is validated by the app. Changing an active-round field to an inconsistent number is not a way to create a new comparison. If a different schedule is needed, it should be specified and checked before producing a class session. Do not edit an ongoing session's parameters.

Rehearse both the decision page and the report. Enter one interior allocation and one corner in separate demonstration windows to see how the display treats an empty sector. Test a moving-cost comparison so the second page displays its previous allocation. The initial choice anchors that comparison; it is not replaced by five automatically. In random-price mode, each person's order is retained in the data. Different students may see different prices in the same technical round,

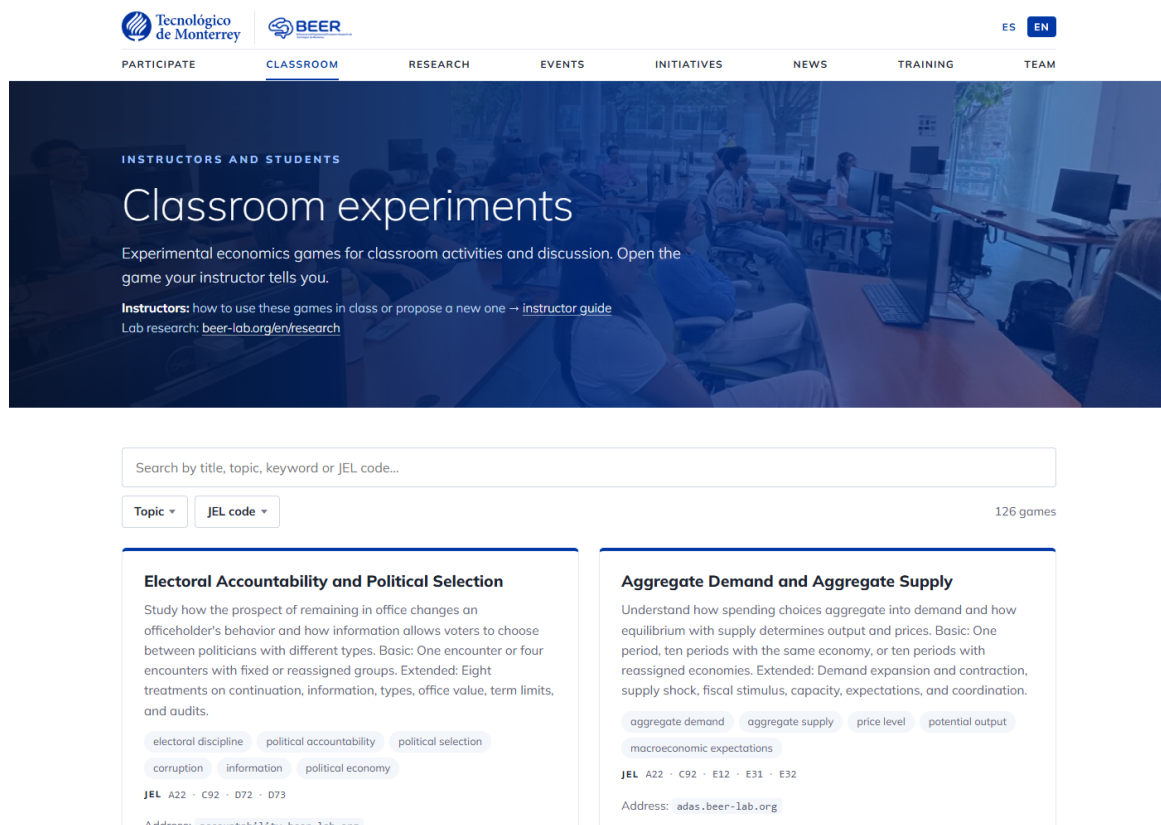


Figure 1.2: Select a family and its language in the teaching directory.

which matters when interpreting the report.

Prepare the debrief before play. Write the resource identity on the board and reserve the equilibrium prediction until after students submit. Explain units without recommending an allocation. Have students bring a way to record a numerical explanation, since the quality of learning cannot be measured by their ECU total alone. Allow time for comprehension correction. The interface returns the correct rule alongside each wrong answer, so students can repair an arithmetic or resource-confusion error without waiting for a public explanation.

Checkpoint

Check family, edition, language, decision count and participant count. Verify that the basic room selects a basic configuration in the correct language. Open the report privately, confirm that revelation is locked, and identify its session-specific CSV button. Keep a record of the version and configuration used for class.

Specific Factors and Labor Mobility · Basic · EN · One allocation
Specific Factors and Labor Mobility · Basic · EN · Five prices in fixed order
Specific Factors and Labor Mobility · Basic · EN · Five prices in individual random order
Specific Factors and Labor Mobility · Extended · EN · Higher relative price of A
Specific Factors and Labor Mobility · Extended · EN · Lower relative price of A
Specific Factors and Labor Mobility · Extended · EN · Proportional increase in both prices
Specific Factors and Labor Mobility · Extended · EN · More A specific resources
Specific Factors and Labor Mobility · Extended · EN · More B specific resources
Specific Factors and Labor Mobility · Extended · EN · Larger labor supply
Specific Factors and Labor Mobility · Extended · EN · Smaller labor supply
Specific Factors and Labor Mobility · Extended · EN · Higher A productivity

Figure 1.3: Family configurations: first part.

Specific Factors and Labor Mobility · Extended · EN · Fixed allocation after a price change
Specific Factors and Labor Mobility · Extended · EN · Moving with a half-ECU cost
Specific Factors and Labor Mobility · Extended · EN · Moving with a two-ECU cost
Specific Factors and Labor Mobility · Extended · EN · Movement of at most two units
Specific Factors and Labor Mobility · Extended · EN · Moving with 1.5-ECU support
Specific Factors and Labor Mobility · Extended · EN · Basket intensive in good A
Specific Factors and Labor Mobility · Extended · EN · Basket intensive in good B
Specific Factors and Labor Mobility · Extended · EN · Mobility between two economies
Specific Factors and Labor Mobility · Extended · EN · Costly mobility between economies
Specific Factors and Labor Mobility · Extended · EN · Mobility between economies limited to two
Specific Factors and Labor Mobility · Extended · EN · Ten decisions with unchanged parameters

Figure 1.4: Family configurations: second part.

oTree
Demo
Sessions
Rooms
Data
Server Check
Logout

Rooms

Current rooms:

Factores específicos y movilidad laboral · Básica · ES
Factores específicos y movilidad laboral · Extendida · ES
Specific Factors and Labor Mobility · Basic · EN
Specific Factors and Labor Mobility · Extended · EN

Figure 1.5: Choose one of four edition-and-language rooms.

oTree Demo Sessions Rooms Data Server Check Logout

Room: Specific Factors and Labor Mobility · Basic · EN

Create a new session

Session Config

Specific Factors and Labor Mobility · Basic · EN · One allocation

Number of participants

Individual decisions: any positive participant count is allowed.

Create

[Configure session](#) ⚙️

App sequence

specific_factors_game (10 rounds)

0 participants present

Start links

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

Room-wide URL

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

http://127.0.0.1:8182/room/specific_factors_en

Figure 1.6: Select the treatment and participant count.

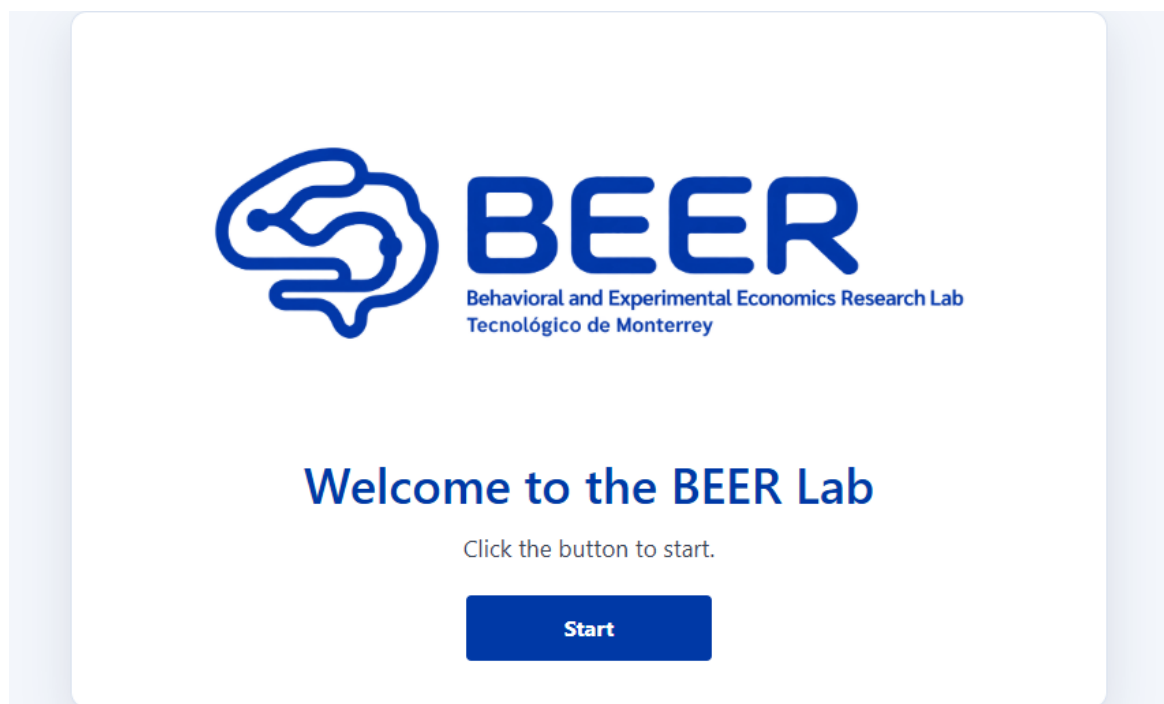


Figure 1.7: Start from the room welcome screen.

oTree Demo Sessions Rooms Data Server Check Logout

Specific Factors and Labor Mobility · Basic · EN · One allocation: session 'mwiga8j8' (demo)

 New  Links  Monitor  Data  Payments  Report  Description

Below are temporary links for testing and demonstration. To launch a real study, either create persistent links by setting up a [room](#), or create a session through the [sessions page](#).

Choose one of the following options to play the session:

Combined views

 Split-screen view
[Launch](#)

 Grid view
[Launch](#)

Session-wide testing link

Open the below link in up to **4** browser tabs.

<http://127.0.0.1:8182/join/baruhava>

Single-use links

Open each link in its own browser tab.

P1	http://127.0.0.1:8182/InitializeParticipant/arq40imk
P2	http://127.0.0.1:8182/InitializeParticipant/59e48emg
P3	http://127.0.0.1:8182/InitializeParticipant/gzgyfkl
P4	http://127.0.0.1:8182/InitializeParticipant/7ts5rp0c

Figure 1.8: Distribute individual links and retain the report privately.

Guiding the participant sequence

2.1 Welcome, resources and instructions

The room welcome provides the institutional logo and a Start button. The next page explains the laboratory's purpose, requests silence and independent decisions, and asks participants to confirm the rules. This is a teaching activity; the rules checkbox does not by itself constitute consent to a separate research study. If the session will also support research, the laboratory must organize the relevant protocol independently of this interface.

The instruction page distinguishes three things: money used to express outcomes, labor units that can be assigned, and specific resources that cannot be transferred. Every decision begins with one hundred ECU. ECU means Experimental Currency Units. A labor unit is a model input rather than one hundred ECU or one actual student. A specific-resource stock is also a physical quantity in the model, not money that students can spend. This distinction prevents the common error of treating sixteen resource units as another monetary endowment.

The student chooses whole labor units in A. B receives total labor minus that choice. All labor is used; there is no separate unemployment decision. Production is computed from the displayed stocks and productivity. Prices are given in ECU per unit of output. A student can select a corner, placing all labor in one sector. That produces zero in the other sector and leaves its wage undefined. The interface preserves that distinction rather than displaying an arbitrary zero wage.

2.2 Comprehension and specific corrections

Three questions check the initial monetary amount, the mobile resource and the resource constraint. For a sector activity, assigning six of ten labor units to A leaves four in B. For a migration activity, moving two of B's ten workers to A leaves eight in B and twelve in A. The question changes with the mechanism, so the migration version does not ask students to apply the wrong ten-worker aggregate constraint.

An incorrect answer retains the submitted response and gives the correct answer with its explanation. The instructor should distinguish a student confusing monetary and productive resources from one subtracting incorrectly. Neither error is evidence against trade theory. Ask the student to read the relevant sentence and resubmit. The app records attempts in the session data. Use these counts to identify unclear teaching or a difficult question, not to infer an ability measure that the activity was not designed to elicit.



Welcome to the BEER Lab

The Behavioral and Experimental Economics Research Lab in the Department of Economics at Tecnológico de Monterrey is a space designed for learning about economic decision-making through controlled activities.

In this activity you will allocate labor units in a simulated economy.

Laboratory rules

- Remain silent and do not talk to other participants.
- Decide individually and do not look at other screens.
- Keep this page open and raise your hand if you need help.

☐ I have read the instructions and will follow the rules.

Start

Figure 2.1: Confirm the laboratory rules before continuing.

BEER LAB

How this activity works

Resources and unit of account

You receive 100 initial ECU in EACH decision. ECU stands for Experimental Currency Units. Your outcome is a classroom score; it is not converted into real money. Labor and specific-resource units are physical model inputs, not ECU.

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

This session does not convert ECU into real money.

Initial endowment per decision

100 ECU

Total labor units

10

A specific resource

16

B specific resource

16

You manage labor allocation; you do not negotiate with other participants. Each decision is private and does not depend on their choices.

Choose how many whole labor units to allocate to A. The remainder works in B. A's specific resource produces only in A and B's only in B. The program computes production and income; it does not move

Figure 2.2: Resources and labor allocation.

these resources between sectors.

Output = $4 \times \text{productivity} \times \sqrt{(\text{specific resource} \times \text{labor})}$. Output value = price $\times$ output. Prices are given: you do not bid or sell to other students.

Outcome = 100 + the output value of A and B – private moving cost. The endowment is renewed in each decision; the cumulative outcome adds your decisions. Do not add wages and resource income again: they are already included in output value.

Half of output value accrues to labor and half to the specific resource. The wage per worker depends on how many work there. With no labor there is no output or income, and that sector's wage is undefined.

Rule example

With 10 labor units, 16 specific-resource units per sector, productivity 1, and prices 1, assigning 5 to each sector produces 35.78 units of each good. Total value is 71.55 ECU and, without moving costs, the outcome is 171.55 ECU. Calculations retain decimals and displays are rounded.

Check resources, prices, and constraints on every screen. Unless a previous allocation is stated, a decision starts without a prior move. You see your result after confirming. There are no partners or waiting pages.

Continue

Figure 2.3: Production, account and example: continued.

Check the rules

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.

You receive 100 initial ECU in EACH decision. ECU stands for Experimental Currency Units. Your outcome is a classroom score; it is not converted into real money. Labor and specific-resource units are physical model inputs, not ECU.

How many initial ECU do you receive in each decision?

Your answer: 10. The correct answer is 100. The answer is 100 ECU per decision. The monetary endowment differs from labor and specific resources.

Which resource can you allocate or move?

- ☐ Labor
- ☒ A's specific resource
- ☐ The initial ECU endowment

Your answer: A's specific resource. The correct answer is Labor. You allocate or move labor only. Each specific resource stays in its sector or economy.

With 10 total units, if you assign 6 to A, how many remain in B?

Your answer: 10. The correct answer is 4. 4 remain: $10 - 6 = 4$. All labor is used and units cannot be duplicated.

Continue

Figure 2.4: Use the correction beside each wrong answer.

2.3 Decision, own result and closure

The decision page restates the one-hundred-ECU amount in the body and shows labor and specific-resource stocks in separate cards. Its parameter table gives prices, productivity, the real moving cost, support and the resulting private cost. A restriction panel shows the previous allocation when it matters. A selector contains only permitted choices. In the immobile treatment, the second selector has one valid option: students still confirm the decision, but cannot change the earlier allocation.

After confirmation, the page shows labor, output, output value, moving cost and the ECU account. Its factor table reports wages per worker, total specific-resource income and wage purchasing power using a normalized basket index. These quantities explain distribution within the model; they are already part of output value. Adding them again would double-count income. The student sees own outcomes and can learn from them, while exact optimizing benchmarks remain in the private instructor report.

At the end, a permanent closing screen states that the activity is complete and shows a history and cumulative outcome. There is no next button to send participants to an empty oTree ending. Students should keep the page open until discussion begins. Cumulative scores add renewed endowments across decisions, so they are not appropriate for comparing a one-decision configuration with ten-decision learning without first putting them on the same per-decision basis.

What participants will see

A useful introduction is: “You receive 100 ECU in each decision. Your physical resources are listed separately. Choose labor in A; the remainder goes to B. Prices and production rules determine output value. Subtract any private moving cost once. Confirm only after checking this decision’s resources and restriction.”

BEER LAB · DECISION 1 OF 1

Allocate labor

Initial endowment per decision

100 ECU

Total labor units

10

A specific resource

16

B specific resource

16

You receive 100 initial ECU in EACH decision. ECU stands for Experimental Currency Units. Your outcome is a classroom score; it is not converted into real money. Labor and specific-resource units are physical model inputs, not ECU.

Choose how many whole labor units to allocate to A. The remainder works in B. A's specific resource produces only in A and B's only in B. The program computes production and income; it does not move these resources between sectors.

Outcome = 100 + the output value of A and B – private moving cost. The endowment is renewed in each decision; the cumulative outcome adds your decisions. Do not add wages and resource income again: they are already included in output value.

Price of good A	1 ECU per unit of good
Price of good B	1 ECU per unit of good
A productivity	1
B productivity	1
Resource cost per moved unit	0
Support per moved unit	0
Private cost per moved unit	0 ECU

To express wages in a basket, the index uses a 50% weight on good A. This measure does not change your score.

Permitted options: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Labor units in A

Figure 2.5: Review resources and constraints before allocating labor.

BEER LAB · DECISION 1 OF 1

Your decision result

Labor in A 0	Labor in B 10	A output 0	B output 50.6
Total output value 50.6	Total private moving cost 0	Private net value 50.6	ECU outcome 150.6

Wage per worker in A	—
Wage per worker in B	2.53
Total A specific-resource income	0
Total B specific-resource income	25.3
A wage / basket index	—
B wage / basket index	2.53

Wages and resource income describe the model's output-value distribution. They are not additional payments to your outcome. A blank wage means there are no workers in that sector.

Continue

Figure 2.6: Read production, the ECU account and factor incomes.



Activity completed

You have completed every decision. Keep this screen open and wait for the instructor's directions.

Cumulative ECU outcome

150.6

Decision history

Decision	Labor units in A	Private net value	ECU outcome
1	0	50.6	150.6

Figure 2.7: Wait for discussion from the explicit closing screen.

Economic foundations and worked predictions

3.1 Specific resources and diminishing marginal products

A specific factor is an input that cannot be reassigned between the two sectors during the horizon under study. It need not be a machine in a literal sense. Land suitable for one activity, sector-specific skills or installed equipment can motivate the assumption. Labor is the mobile input in the core model. The adjective specific describes a restriction on use; it does not mean the resource has zero value or that its stock must be numerically different across sectors.

Our numerical technology is an original Cobb–Douglas adaptation:

$$Q_A = 4z_A\sqrt{K_AL_A}, \quad Q_B = 4z_B\sqrt{K_BL_B}, \quad L_A + L_B = \bar{L}.$$

Here K is the fixed specific-resource stock, L is labor and z is productivity. Doubling labor with fixed K multiplies output by $\sqrt{2}$, rather than by two. The extra output from another labor unit becomes smaller as the sector accumulates labor. Conversely, doubling both inputs doubles output. Thus diminishing returns to one input should not be confused with decreasing returns to scale when all inputs can expand.

At given product prices, total output value is $V = p_AQ_A + p_BQ_B$. The resource constraint lets the student evaluate every feasible allocation without solving a bargaining problem. The private ECU account is $100 + V - C_p$, where C_p is the private moving cost. The initial hundred is a teaching endowment. It is not part of the production function, the wage bill or an estimate of the economy's welfare. Its renewal makes each displayed account transparent but also makes raw cumulative scores depend on the number of decisions.

Theoretical foundation

This activity teaches a short-run allocation model with given output prices and fixed sector-specific resources. It does not implement general equilibrium commodity-price determination, actual labor contracts, unemployment, an auction, or a vote on trade policy. A sector's wage is its model value marginal product, including when the submitted allocation is not an equilibrium.

3.2 Deriving the labor-allocation reference

Differentiate output value with respect to labor in A, remembering that a unit assigned to A is removed from B. The marginal gain in A is $p_A\partial Q_A/\partial L_A = 2p_Az_A\sqrt{K_A/L_A}$. The marginal

loss in B is $2p_B z_B \sqrt{K_B/L_B}$. With positive labor in both sectors, no cost and continuous units, maximizing value equates these quantities. The textbook wage-equality condition therefore has an opportunity-cost interpretation: another unit moved cannot increase total output value.

Let $a = (p_A z_A)^2 K_A$ and $b = (p_B z_B)^2 K_B$. The solution is

$$L_A^* = \bar{L} \frac{a}{a+b}, \quad L_B^* = \bar{L} \frac{b}{a+b}, \quad w^* = 2\sqrt{\frac{a+b}{\bar{L}}}, \quad V^* = 4\sqrt{\bar{L}(a+b)}.$$

The software permits whole labor units. It therefore enumerates the valid integers and reports all tied maximizing allocations. The continuous dashed line is a theoretical guide, not always an option in the selector. Do not penalize a student for failing to choose a fractional reference that the interface does not permit. With moving restrictions, the exact reference also uses that person's actual previous allocation.

In the baseline, $p_A = p_B = z_A = z_B = 1$, $K_A = K_B = 16$ and $\bar{L} = 10$. The reference is five labor units in each sector. Each produces $4\sqrt{80} \simeq 35.78$, giving total value 71.55. Each wage is $2\sqrt{16/5} \simeq 3.58$. An allocation of zero to A uses all labor in B and produces about 50.60 in total. It lies on the production frontier but does not maximize value at these prices. Being technologically feasible and being economically efficient at given prices are different statements.

3.3 Factor-income accounting

The labor income of sector j is $w_j L_j = p_j Q_j / 2$. The other half is total income accruing to its specific-resource stock. The rental return per specific-resource unit is $p_j Q_j / (2K_j)$. The identity $V = w_A L_A + w_B L_B + R_A + R_B$ holds for every allocation. These incomes distribute the same production value; they do not constitute four additional revenues to be added to the participant score.

In the baseline, each sector's wage bill and specific-resource income are about 17.89. The per-unit wage is about 3.58, while per-unit specific-resource income is about 1.12. A comparison between 3.58 and 17.89 mixes one worker with an entire resource stock. When discussing winners and losers, specify whether the object is income per unit, aggregate group income or income of an owner whose stock changes. More aggregate rent can coexist with less rent per resource unit.

With zero labor, output, the wage bill and specific-resource income are zero. The marginal-product formula for the wage has no finite value at that endpoint. The report excludes that observation from the sector's wage mean and shows the number of defined wages. It retains the allocation in production, rent, value and allocation statistics. This is not selective removal of a poor performer. It is a distinction between an economically defined zero quantity and an undefined price diagnostic.

3.4 A relative-price shock and real purchasing power

Raise p_A from one to 1.5, keeping p_B at one. With frictionless mobility, the continuous reference moves from five to $90/13 \simeq 6.92$ in A. The integer maximum is seven. The common continuous wage rises from approximately 3.58 to 4.56. Nominal income alone cannot tell us how much either group can purchase. In units of good A, the new wage is about 3.04, below its initial value; in units of good B it is 4.56, above its initial value.

The app also computes a normalized basket index $P = p_A^s p_B^{1-s}$ and reports w/P . The parameter s is the weight of A, not a measured preference elicited from students. The index equals one when both prices equal one. Constants in a Cobb–Douglas expenditure function are held fixed, so index

changes can be used for comparative purchasing power. A heavier A weight makes the A-price rise more consequential for the wage's basket purchasing power.

At the continuous reference, specific-resource income in A rises to about 31.57 and in B falls to about 14.03. A's specific-resource owner benefits from the higher product price and additional labor. B's loses labor and experiences lower output. These statements concern the model's fixed stocks and price comparison. A classroom's nonoptimal allocations may generate a different observed pattern. First compare like allocations or appropriate exact references, then ask how behavior changed adjustment.

3.5 Costs, restrictions and support

In the moving treatments, decision one establishes an allocation. Decision two changes A's price to 1.5. The number moved is $m = |L_A - L_A^{\text{previous}}|$. The real resource cost is cm and the private cost is $(c - u)m$, where u is support per moved unit. Private net value is $V - (c - u)m$; value net of resource costs is $V - cm$. Their difference is support expenditure um . Calling a transfer a resource loss would count it incorrectly, while ignoring its effect on choices would also be incorrect.

Suppose the previous allocation is five. At the new price, keeping five produces 89.44. Moving to six produces 90.79 before costs and moving to seven 91.21. With half an ECU per moved unit, six yields about 90.29 and seven about 90.21: the exact private optimum is six. With two ECU per unit, remaining at five is optimal. A gap between the two imputed wages can therefore survive a correct constrained choice.

With a two-ECU resource cost and 1.5 support, the private cost is again half an ECU. Six becomes privately optimal, but its resource-net value is approximately 88.79, below the 89.44 obtained without movement. The support expenditure is 1.50. This intentionally simple case shows why a policy that increases movement need not maximize net production in a model that already counts all benefits and costs. It does not establish that actual retraining support lacks benefits omitted here.

3.6 Migration between two economies

The migration extension uses one good in two economies, not two goods in one economy. Initially each has ten workers, while A has thirty-six specific-resource units and B four. The student chooses whole workers moving from B to A. A has $10 + m$ and B $10 - m$; total labor remains twenty. Specific resources stay where they began. The permitted range ends at nine so neither economy loses all workers. The production diagram describes output across locations, rather than a two-good consumption frontier.

Without costs, the continuous and integer maximizing transfer is eight. The receiving economy then has eighteen workers and the sending economy two, with wages equal at approximately 2.83. World output rises from about 101.19 to 113.14. A's initially higher wage falls and B's rises. A's specific-resource income increases while B's decreases. A gain in world output consequently does not mean every incumbent factor owner benefits.

Nationality accounting retains migrants in B's native group: their destination earnings accrue to B natives rather than being reassigned to A natives. A-native income includes ten original workers at A's new wage plus A's specific-resource income. B-native income includes remaining workers, migrants' destination earnings and B's specific-resource income, minus private moving costs. The two nationality totals sum to private net world value. They are not the same as income produced in each location, and neither includes the classroom's hundred-ECU endowment.

3.7 Academic basis and limits of the adaptation

Lin’s classroom design provides the pedagogical antecedent for combining resource allocation, price changes and factor-income discussion ([Lin, 2021](#)). Our digital activity uses independent allocation decisions, Cobb–Douglas technology, integer choices and separate migration conditions. Lin’s accessible working-paper protocol uses a different production specification and includes team production and trading. This package is therefore an adaptation of the teaching problem, not a literal reproduction or a claimed validation of the published experiment.

Neary’s analysis provides a reference for the importance of short-run specificity ([Neary, 1978](#)). Artuç, Chaudhuri and McLaren offer a structural empirical treatment of costly labor adjustment ([Artuç et al., 2010](#)). Their framework is dynamic and richer than a two-decision classroom comparison. Borjas discusses immigration gains through complementarities and their distribution ([Borjas, 1995](#)). These references help instructors place the simplified mechanisms in context; the numerical predictions above are derived from this app’s stated technology, not estimates extracted from those studies.

Reading the private report

4.1 Progress, revelation and observation units

The initial report shows participants, completed decisions and pending decisions. It does not expose submitted choices before the instructor reveals aggregates. Revelation is disabled until every active decision is complete. The CSV remains available with incomplete records, which is useful for diagnosing a session without projecting another student's answers. After new decisions arrive, refresh the report. An old browser view is not automatically a live monitor.

The unit is one individual decision. A participant who completes ten contributes ten records, not ten independent people. Technical oTree round ten can open the administration report even when the configuration activates one decision; the report explicitly reads all active periods. No data from inactive periods enters these aggregates. The same-family Data area can nevertheless contain several class sessions. Family isolation separates this activity from other games, while the report download selects the particular session.

BEER LAB

Instructor report: specific factors

One allocation

Participants 4	Completed decisions 0	Pending decisions 4
Reveal results	Hide results	Download this session's CSV
Complete all decisions before revealing aggregates. The CSV also includes pending decisions.		

This session's download includes responses and outcomes from all active periods; pending fields remain blank. Data also provides native and family-wide exports.

Figure 4.1: Monitor completion before revealing aggregates.

4.2 Allocation distribution and factor-income table

The allocation histogram counts whole units assigned to A. A migration histogram counts movers instead. They should not be interpreted as the same variable: seven units in sector A differs from seven people moving to an economy that already has ten. The displayed observation count includes completed decisions only. If labor totals change between decisions, the pooled distribution mixes different available totals. Use the decision-and-scenario table to separate those conditions rather than interpreting a pooled mean as one economy's allocation.

The comparison table groups decisions by period and actual parameters. It separates labor in A and B, gross production value, private net value, resource-net value and support. When orders are randomized, the same period may contain several prices. When prior choices determine constraints, the same period may contain several anchors. These rows are deliberately distinct. Averaging them without noticing the parameters can manufacture a comparison that no participant faced.

The factor table separates wage means, basket purchasing power and specific-resource income. Wages are per worker and resource incomes per stock. Each sector's defined-wage count appears beside its mean. Sector A retains the darker blue and B the lighter blue throughout the graphs. Explain the units before asking who gained. A class with many corner choices can have a wage mean based on fewer observations than its rent mean, even though both summaries are calculated correctly.

4.3 Textbook diagrams and exact benchmarks

The wage diagram places labor in A on the horizontal axis and the value marginal products on the vertical axis. B's labor is total labor minus A's, so B's curve rises from left to right. It is not a positively sloped demand curve in B's own labor. The intersection marks the continuous frictionless reference; dots mark submitted allocations. Select the parameter scenario before discussing the graph. With costs or limited mobility, a point away from the dashed line can be optimal within the actual permitted set.

The production frontier places A output horizontally and B output vertically. Every submitted allocation uses the full labor stock and lies on the technological frontier for its parameters, including a corner. A point can thus be technologically efficient but fail to maximize output value at the stated prices. The diagram alone does not rank the points: prices determine the supporting value line. In migration mode, both outputs are the same good in different economies, so read the panel as a location-allocation tradeoff instead of a consumption frontier.

The benchmark table enumerates permitted integers and includes ties. It reports a private-net maximum and a resource-net maximum separately. Moving comparisons condition on each actual anchor. Their benchmark answers "What is best now, given the earlier choice?" rather than "Which complete sequence would a forward-looking participant have chosen?" The app does not elicit knowledge of future shocks or solve that broader dynamic problem. The distinction prevents an instructor from labeling a myopically efficient second decision as a globally optimal plan.

4.4 Evolution and classroom inference

The evolution panel plots mean private net value and the corresponding mean exact reference by decision. It retains a point in one-decision sessions and identifies the complete count for each period. A declining gap in learning can indicate adjustment to this known numerical task, but does not prove a causal effect of feedback. A rising value after a price increase can reflect the

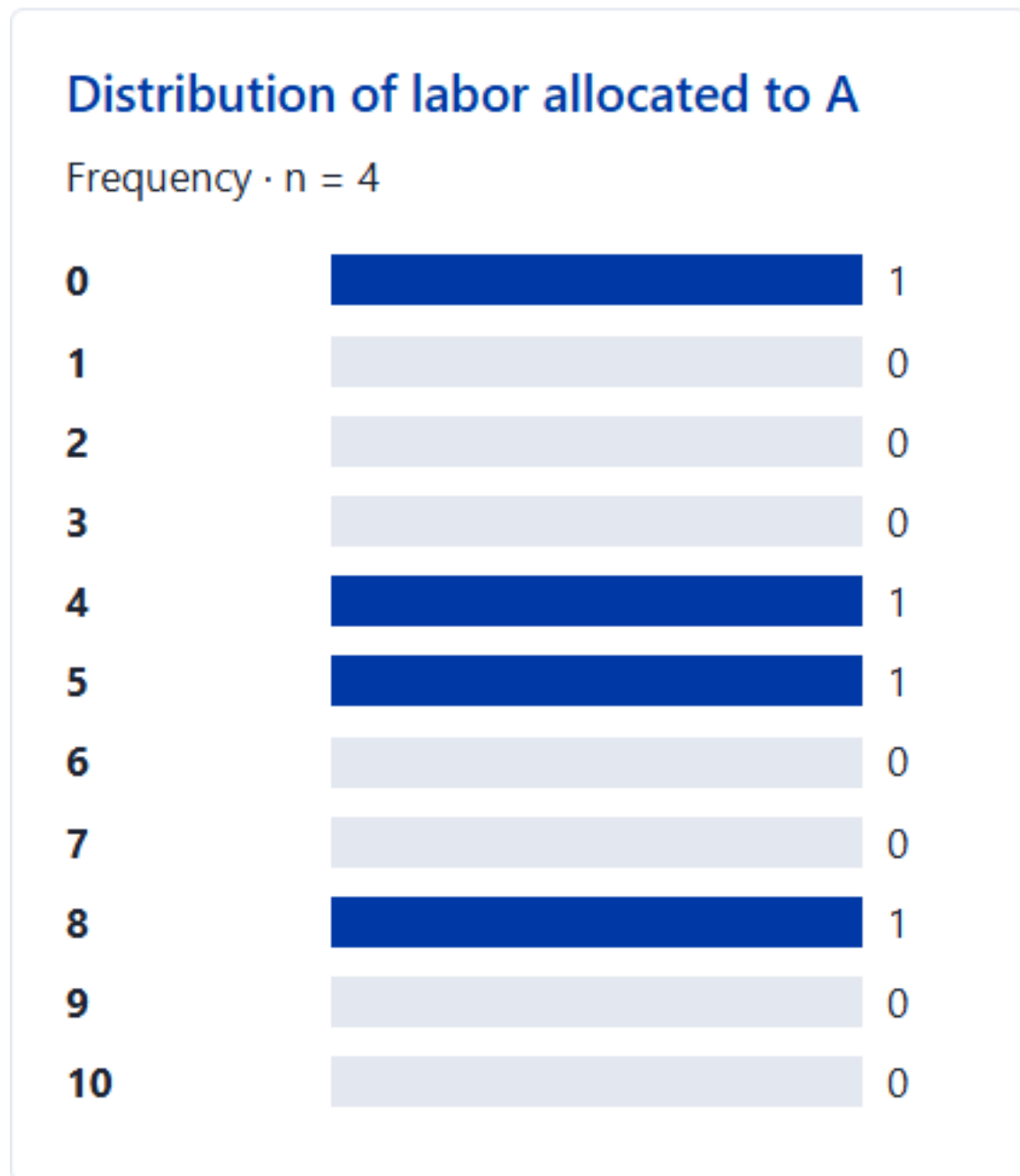


Figure 4.2: Read allocation frequencies with their observation count.

Wages and resource income: distinct units

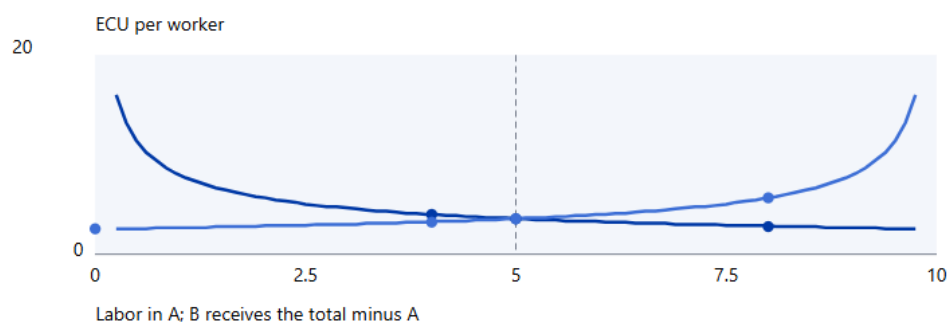
Wages are ECU per worker. Resource incomes are ECU per specific-resource stock. The number of defined wages is reported; empty sectors are excluded from wage means only.

Decision	Wage per worker in A (n)	Wage per worker in B (n)	A wage / basket index	B wage / basket index	Total A specific-resource income	Total B specific-resource income
1 · Two sectors · pA=1 · pB=1 · KA=16 · KB=16 · L=10	3.47 (3)	3.76 (4)	3.47	3.76	14.13	18.52

Figure 4.3: Separate wage units, real returns and total rents.

Graph scenario 1 · Two sectors · pA=1 · pB=1 · KA=16 · L=10

Value marginal products of labor



• Wage per worker in A • Wage per worker in B • Continuous reference: 5

The vertical line marks the continuous reference without moving cost or additional mobility limits. Observed marks are individual allocations, not negotiated wages. The constrained integer optimum appears in the table.

Production possibility frontier



Figure 4.4: Relate observed allocations to marginal products and output possibilities.

Exact benchmarks over permitted options

Benchmarks enumerate all permitted integer options, including ties. With moving costs they condition on that person's chosen previous allocation. They do not retrospectively optimize the entire sequence.

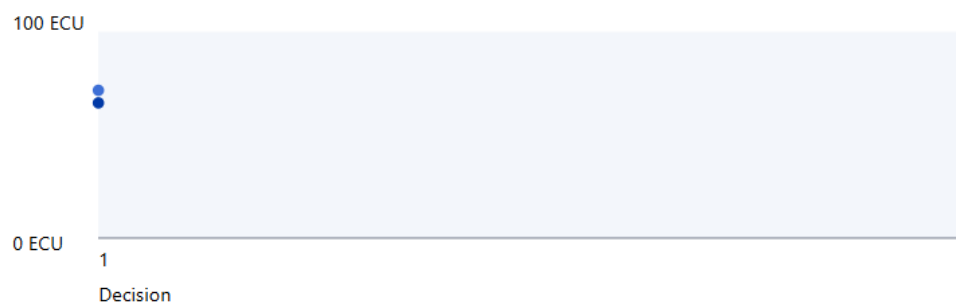
Decision	Maximum private net value	Optimal options	Maximum net value after resource costs
1 • Two sectors • $pA=1$ • $pB=1$ • $KA=16$ • $KB=16$ • $L=10$	71.55	5	71.55

Figure 4.5: Read exact references for permitted integer choices.

parameter change even if choices become less accurate. Compare the reference gap alongside levels rather than reading a trend alone.

Do not infer an empirical effect of trade on unemployment or national welfare from this interface. Employment is fixed by assumption; preferences enter only a diagnostic basket; prices are exogenous; and factor owners are simulated. The results are evidence about student choices under displayed rules. They can illuminate a model and motivate a question for empirical research. A small classroom session does not identify the real-world magnitude of adjustment costs or determine whether compensation would be feasible in an actual economy.

Net value and benchmark by decision



Decision	n	Private net value	Private net benchmark
1	4	65.31	71.55

Figure 4.6: Compare net values and references across active decisions.

Selecting basic modes and extended comparisons

5.1 A common comparison strategy

The extended edition offers independent configurations, not a compulsory sequence of nineteen exercises. Most contain a baseline decision and one change. Read the parameter table rather than relying on the title alone. Stocks, price units and mobility rules are kept identical between languages. When a treatment includes a previous allocation, that actual allocation remains part of its state and appears in the data. An extension can therefore produce different permitted sets for different students even though its announced rule is common.

For a clean classroom comparison, state the question before selecting the extension: does a price change reallocate labor, does a resource increase change rents per unit, or does support change private adjustment? Hold unrelated features fixed. Compare equivalent scenarios, retain the order and acknowledge learning. It is appropriate to show a theoretical counterfactual for the same allocation, but distinguish it from a participant's second observed choice. Otherwise, a change attributed to price may also reflect learning or an earlier corner decision.

The three basic modes differ in horizon and order. One allocation is suitable for introducing opportunity cost. Five fixed prices use 1, 0.75, 1.25, 1.5, 2 for A, with B fixed at one. The integer references are respectively 5, 4, 6, 7, 8. Random order presents that same set once per person and preserves the order in the export. It does not draw prices from an unknown distribution or change incentives through risk. Use it to discuss order and carryover, not as a risk-preference elicitation.

5.2 Prices and production conditions

5.2.1 Higher relative price of A

The two-decision comparison changes A's price from one to 1.5 while B's stays one. Specific stocks and total labor remain fixed. The mechanism raises A's value marginal product at any given labor allocation. The frictionless reference draws labor into A; its specific-resource income rises and B's falls. Ask students to compare wages in units of each good before using a basket. A higher nominal wage does not settle the worker's real-income question. This is a given-price illustration of a trade-related incentive, not a simulated trade liberalization with endogenous imports and tariff revenue.

5.2.2 Lower relative price of A

A's price changes to 0.75 in decision two. The continuous A allocation becomes 3.6, with integer reference four. Labor moves toward B, reversing the direction of the preceding comparison. Use the condition to check whether students reason through the mechanism rather than memorize that A always receives more labor. Labels A and B have no intrinsic ranking. The direction of an income effect follows prices, stocks and movement, not the color of a sector or the order in which it was introduced.

5.2.3 Proportional increase in both prices

Both prices increase to 1.5. Relative prices and the optimizing allocation remain unchanged. At a fixed allocation, nominal wages and rents rise by fifty percent, and the normalized basket index rises by the same factor. Real wages are unchanged. Production quantities do not change. The classroom endowment remains one hundred nominal ECU, so its purchasing power would change if it were treated as a household asset; the app does not count it as a factor return. Ask students to identify which quantities are nominal, physical and real before interpreting the higher score.

5.2.4 More specific resources in A or B

Separate configurations increase one stock from sixteen to thirty-six. The other stock, prices and labor remain unchanged. Additional A resources raise the continuous A allocation to approximately 6.92; additional B resources reverse the allocation. Distinguish a productivity shift from a movement of the original stock: the sector receives more resources, but the other sector does not lose them. Total rent of the enlarged stock can rise while rent per unit falls. Ask whether the owner acquired additional units at a cost, which this configuration does not model, before claiming an investment return.

5.2.5 Larger or smaller labor supply

The labor-inflow condition increases total labor from ten to fourteen; outflow reduces it to six. With symmetric sectors, equal division remains optimal: seven each after inflow and three each after outflow. More labor increases total production while lowering wages per worker with fixed specific resources. Outflow reverses this pattern. All available labor is allocated, so these conditions do not introduce unemployment. Nor do they identify migrants' nationality. They are changes in one economy's supply; use the dedicated migration conditions when country-of-origin accounting is the teaching objective.

5.2.6 Higher productivity in A

Productivity z_A rises to 1.5. At initial prices, its allocation incentives match those from multiplying A's price by 1.5, but the physical production and price-index implications differ. This is a useful test of whether students distinguish output units from output value. Equal-looking wage curves do not establish that the shocks are economically identical. Compare the production frontier and basket index across the two treatments. Keep B's productivity and both specific stocks fixed; otherwise a resource change would be mixed with the intended technology comparison.

5.3 Immobility, costly adjustment and support

5.3.1 Fixed allocation after a price change

Decision one permits any baseline allocation; decision two raises A's price and locks the earlier choice. Students confirm that same number. This simulates an immediate horizon in which labor cannot yet move, rather than sector-specific capital becoming mobile. Wages can diverge because adjustment is prohibited. Compare the fixed point with a frictionless reference for the same parameters. A student who originally chose an unusual allocation may face an unusual locked outcome. That is a recorded starting condition, not a reason to replace it secretly with an efficient initial allocation.

5.3.2 Half-ECU and two-ECU moving costs

Two distinct configurations charge 0.5 or two ECU per unit that changes sector after A's price rises. No movement cost is charged in the initial decision. The number moved is the absolute difference from the initial A allocation, not the second allocation itself. With an initial five, the low-cost optimum is six and the high-cost optimum is five. Both can be correct despite differing wage gaps. These conditions adapt the general adjustment-cost mechanism discussed by [Artuç et al. \(2010\)](#); they do not reproduce that study's dynamic estimates or household decision process.

5.3.3 Movement of at most two units

The second decision permits allocations within two units of the first, subject to the total resource constraint. With an initial four, the upper feasible allocation is six, below the unconstrained integer reference of seven. With an initial five, seven is available and the limit need not bind. This contrast is valuable: a restriction's existence does not demonstrate that it changes an outcome. Ask students to report their actual feasible range before comparing values. A pooled constrained-versus-free mean can mix people for whom the same rule binds with people for whom it does not.

5.3.4 Moving with 1.5-ECU support

The resource cost is two per moved unit and support is 1.5, leaving a private cost of 0.5. Support is paid only for units that actually change sectors. It is not a grant added to the initial one-hundred-ECU endowment. From an initial five, private optimization chooses six while the resource-net optimum remains five. Compare private value, resource-net value and support expenditure explicitly. The exercise shows the accounting and incentive effect of a transfer under the stated model. It does not include financing distortions, insurance, external benefits or longer-term skill acquisition.

5.4 Purchasing power and international mobility

5.4.1 Baskets intensive in A or B

These configurations raise A's price to 1.5 and use A weights of 0.75 or 0.25 in the normalized basket index. Production incentives and the participant's monetary score do not depend on that weight. The same nominal wage can imply a real decline in the A-intensive basket and a real increase in the B-intensive basket. This is a diagnostic comparison with specified weights, not a measure of participants' consumption choices. Use continuous references for the clean theoretical example and observed allocations for discussing how imperfect adjustment changes the conclusion.

Price of good A	1.5 ECU per unit of good
Price of good B	1 ECU per unit of good
A productivity	1
B productivity	1
Resource cost per moved unit	0
Support per moved unit	0
Private cost per moved unit	0 ECU

Previous A allocation: 5

This decision must retain your previous allocation.

To express wages in a basket, the index uses a 50% weight on good A. This measure does not change your score.

Permitted options: 5

Labor units in A

----- ▾

Confirm decision

Figure 5.1: Confirm the only permitted allocation in the immobile condition.

Price of good A	1.5 ECU per unit of good
Price of good B	1 ECU per unit of good
A productivity	1
B productivity	1
Resource cost per moved unit	2
Support per moved unit	1.5
Private cost per moved unit	0.5 ECU

Previous A allocation: 5

The private cost is charged for each unit switching sectors relative to your previous allocation. Keeping the allocation incurs no moving cost.

To express wages in a basket, the index uses a 50% weight on good A. This measure does not change your score.

Permitted options: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Labor units in A

Confirm decision

Figure 5.2: Distinguish resource cost, support and private moving cost.

5.4.2 Mobility between two economies

The initial populations are ten each, with specific stocks thirty-six in A and four in B. Students choose movers from B to A, with no resource cost and a maximum of nine. The exact reference is eight. Ask for world output, destination and origin wages, specific-resource income and nationality-based totals separately. Do not count a migrant's destination wage as income of an A native. This original numerical illustration follows the complementarity and distribution questions in [Borjas \(1995\)](#); it does not model heterogeneous skills, entry selection, public services or migrant preferences.

5.4.3 Costly or limited migration

The costly configuration charges one ECU per mover. Its exact private reference is six, rather than the no-cost eight. At six, wages are three in A and two in B: their difference matches the continuous marginal cost condition. The limited configuration permits at most two movers without a cost. Its constrained maximum is two, with a larger residual wage difference. A remaining wage gap may therefore indicate a constraint or a cost rather than an irrational failure to migrate. The report retains separate world and nationality accounts so aggregate gains cannot hide distributional losses.

5.5 Ten-decision learning

Learning repeats the symmetric baseline ten times with renewed monetary endowments, unchanged physical resources and own-result feedback. There are no partners to hold fixed or reassign. A previous allocation does not impose a moving cost in this condition. Examine whether choices approach five and whether reference gaps shrink. Use per-decision net values, not cumulative outcomes, when comparing learning to one allocation. Repetition can generate exploration or memorization; neither automatically identifies a particular behavioral bias. A causal test of feedback would require another appropriately designed comparison, which this catalog does not claim to provide.

BEER LAB · DECISION 1 OF 1

Move workers

Initial endowment per decision

100 ECU

Total labor units

20

A specific resource

36

B specific resource

4

You receive 100 initial ECU in EACH decision. ECU stands for Experimental Currency Units. Your outcome is a classroom score; it is not converted into real money. Labor and specific-resource units are physical model inputs, not ECU.

Each economy, A and B, initially has ten workers. Choose how many to move from B to A. A then has 10 plus the movers and B has 10 minus the movers. Movement from A to B is not allowed. Specific resources remain in their economy.

Outcome = 100 + the output value of A and B – private moving cost. The endowment is renewed in each decision; the cumulative outcome adds your decisions. Do not add wages and resource income again: they are already included in output value.

Price of good A	1 ECU per unit of good
Price of good B	1 ECU per unit of good
A productivity	1
B productivity	1
Resource cost per moved unit	1
Support per moved unit	0
Private cost per moved unit	1 ECU

The cost is charged for each worker moved from B to A.

To express wages in a basket, the index uses a 50% weight on good A. This measure does not change your score.

Permitted options: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

Workers moved from B to A

Figure 5.3: Choose movers while specific resources stay in each economy.



Activity completed

You have completed every decision. Keep this screen open and wait for the instructor's directions.

Cumulative ECU outcome

206

Decision history

Decision	Workers moved from B to A	Private net value	ECU outcome
1	6	106	206

Figure 5.4: Read the migration result and explicit closure.

Running the lesson and assessing understanding

6.1 A fifty-minute introductory lesson

Begin with five minutes explaining a concrete short-run production problem: workers can change tasks, but installed equipment cannot instantly change sectors. Introduce the ten labor units, the two stocks of sixteen, and the separate one-hundred-ECU account. Ask a student to explain what happens to B if A receives one more unit. Do not initially display the equilibrium calculation. That question reveals whether the resource constraint is understood before the class attempts calculus or reads a wage graph.

Reserve ten minutes for access, instructions, comprehension and one allocation. Walk through the laboratory to resolve access problems without watching or commenting on choices. Each person progresses independently, so an early finisher remains on the closing page while others work. There is no market-wide wait to diagnose. If the report remains locked, use the participant monitor to locate unfinished pages. Do not complete a student's missing choice on their behalf to make the display available.

Use ten minutes to reveal the allocation histogram and reconstruct a submitted interior example. Ask why one sector's product can rise while the other's falls. Draw the wage diagram's two curves and explain why B's curve uses the remaining labor. Then introduce the exact integer reference and compare it with the continuous condition. An efficient-looking corner is a productive-use observation, not necessarily a value-maximizing decision. Let students explain the supporting role of prices before showing a numerical solution.

Use a further ten minutes for the higher-relative-price extension and ten for its distributional discussion. Keep comparisons on a per-decision basis. Finish with five minutes of individual writing: one statement about allocation, one about specific-resource income and one about worker purchasing power. Require each statement to identify a unit and a parameter. This short task gives evidence of understanding even if the session produced nearly identical choices and a narrow histogram.

Feedback script

Start with "What moved, and what stayed fixed?" Continue with "Why does B's curve rise when the horizontal axis shows A's labor?" Then ask "Who receives the production value, and have we counted it twice?" Finish with "A nominal wage rose; what can that worker buy now?" Use a student's explanation to choose the next figure, rather than revealing every table at once.

6.2 An advanced comparison

For a seventy-five-minute class, allow twenty minutes for the baseline and price change, fifteen for costs and support, fifteen for migration, and twenty-five for discussion and a written exercise. Distribute distinct links when assigning different treatments. No complete markets are needed, but specify whether comparisons are within a person or between people.

Discuss support by showing private net value, resource-net value and government expenditure together. Ask why a privately optimal choice can move away from the resource-net maximum. Have students identify a learning externality, insurance function or financing cost omitted from this model that could change the policy conclusion.

For migration, draw both locations and retain origin labels. Distinguish destination wages, local output and original-resident income. Migrant earnings enter destination production and origin-nationality accounts without being counted twice. Ask whether winners could compensate losers; this activity does not implement compensation.

6.3 Exercises with answer guidance

6.3.1 A monetary amount is not a productive input

A student says that assigning eight labor units costs eight ECU and leaves ninety-two for production. Ask the class to identify the error. Labor units are inputs already available; allocating them does not spend the initial endowment. With ten labor units, assigning eight to A leaves two in B, while the initial monetary account remains one hundred. A cost arises only under an explicit moving rule and depends on movement from an anchor or across economies. The correction should identify units, not simply replace the student's number.

6.3.2 Technological feasibility versus value efficiency

In the baseline, consider zero, five and ten labor units in A. All use the full ten-unit stock and lie on the frontier. The two corners each yield approximately 50.60 total output value and the equal split 71.55. Ask whether the corners are inefficient because labor is idle. They are not: none is idle. The loss comes from foregone productive opportunities due to diminishing marginal products. A resource-feasible frontier point must still be evaluated at product prices to identify the maximizing allocation.

6.3.3 A constant relative price

Raise both prices from one to two while holding an allocation fixed. Output quantities and the optimizing allocation do not change; wages and rents double. The basket index doubles, so wage purchasing power is unchanged. The participant score is one hundred plus the doubled production value, not twice the old score: the endowment does not double. Ask students to explain this distinction algebraically. It tests whether they understand both nominal neutrality in the production model and the artificial classroom monetary account.

6.3.4 Gross values across different prices

Suppose one observed allocation is unchanged but A's product price rises. Total value increases even if neither output quantity changes. Does the higher value prove a real welfare gain? No:

the valuation changed. A welfare claim needs a purchasing-power or consumption criterion and a stated population. Comparing alternative allocations at the same prices is useful for efficiency; comparing levels across prices needs more care. Have students calculate what changed in the quantities and the index before describing a higher ECU value as a benefit.

6.3.5 Total rent and rent per unit

Compare the baseline continuous reference with thirty-six resources in A. A's total rent rises from about 17.89 to 31.57, while its rent per resource unit falls from about 1.12 to 0.88. Both statements can hold because the stock is larger. A student calling this an investment profit must specify acquisition cost and ownership of the new stock, neither of which the condition supplies. An appropriate answer describes a comparative-static resource change without importing an unmodeled financing decision.

6.3.6 Whether a movement cap binds

In the two-unit-cap treatment, compare initial A choices four and five. The second feasible ranges are two through six and three through seven, respectively. The unconstrained integer reference after the price rise is seven. Thus the first student's cap binds and the second's does not. A lower constrained mean alone does not identify an identical policy effect for everybody. Ask for the counterfactual reference and feasible set separately. This exercise helps students distinguish a rule, its application and its realized consequence.

6.3.7 Support and accounting

From an initial five, moving to six generates 90.79 gross value. A resource cost of two and support of 1.5 leave a private cost of 0.5. Private net value is 90.29, resource-net value 88.79 and support expenditure 1.50. The identity is private net minus support equals resource-net value. Keeping five would generate 89.44 without costs. A privately sensible move can therefore reduce the resource-net quantity under these assumptions. Require the account before asking for a policy interpretation.

6.3.8 Migration and population totals

Moving six workers from B to A leaves sixteen in A and four in B, not six and fourteen. With one ECU per mover, total cost is six, not sixteen. At these stocks, wages are three and two and output values ninety-six and sixteen. Private net world value is 106. A-native income is 78 and B-native income 28, including migrants in their native group and subtracting their cost. These numbers sum to 106. A clear answer must specify populations, production locations and nationality income distinctly.

6.4 A rubric based on explanations

Assess four criteria: resources, accounting, diagrams and inference limits. A correct answer identifies total labor and fixed stocks; subtracts costs once without duplicating factor income; names axes and distinguishes continuous and integer references; and separates a classroom result from a real empirical claim. Award partial credit for coherent reasoning and zero for an explanation inconsistent with the resource constraint. Do not grade only proximity to the optimum, which may reflect imitation. Ask students to explain their choices, permit revisions and retain initial answers to document learning. Discuss anonymous examples.

Data, troubleshooting and continuity

7.1 Downloading the intended class

Use *Download this session's CSV* in the report for one class. It exports one row per participant and active decision, including unanswered rows. Four participants in ten-decision learning generate forty data rows: if one finishes and three have not started, ten are complete and thirty pending. Missing outcomes stay blank. A recorded choice of zero is a valid corner or no-migration choice and must not be treated as missing. Session and participant identifiers allow checking coverage but should not be projected in classroom feedback.

The native Data page also offers wide, app-specific and custom exports, which can include multiple sessions in this instance. Native app files can contain inactive technical rounds; the custom export filters active decisions. Preserve the original file, filter the session when appropriate and retain one participant-decision key. Because this is individual, there is no repeated group outcome to deduplicate. Repeated decisions by a person still require acknowledging within-person dependence if the data are used for statistical inference.

The custom file contains language, edition, treatment, completion, comprehension attempts, individual order, prices, stocks, productivity, basket share, cost, support, limits and previous allocation. It also contains the chosen allocation, production, wage and rent diagnostics, private and resource-net values and exact references. Migration records add nationality totals and migrant income. An unfinished row can have known parameters but no result. Do not replace absent wages at zero employment with zero or fill incomplete production outcomes from an optimizing reference.

Attention

Blank is not zero. An unfinished decision has no realized account. An empty sector has a defined zero production but an undefined wage. Preserve both distinctions in spreadsheets and summaries. Do not automatically substitute reference allocations for participants who did not submit.

7.2 Common problems and safe recovery

If a room is empty, the instructor may not yet have created a session. If a participant link says the person does not exist, it may identify a session from an old or recreated database. Use the current session's links rather than repeatedly refreshing an obsolete code. Updating code does not require resetting a database. Coordinate laboratory changes outside teaching sessions and preserve existing data. A local preview and a Git commit do not establish that a public server has been updated.

If the selector has one option, inspect the treatment and anchor before reporting an error: immobility deliberately locks the second choice. If an allocation is absent, check the total-labor stock and movement cap. If the report shows several rows for one round, inspect order and anchor rather than assuming duplicate participants. If a wage is blank, inspect employment. If the score differs from a hand calculation, retain unrounded output during arithmetic and round only the final displayed account.

7.3 Preserving a reusable teaching package

Retain configuration, code version, participant count, order, date and the original export. Store one complete guide per language for the family, with the editable source and referenced images. The repository keeps one shared figure folder; Dropbox copies are self-contained by language. Record operational difficulties separately from economic results. A comprehension correction, a misunderstood unit or a late entrant can inform future teaching without being labeled evidence of an economic bias.

After class, note which figure resolved confusion and which question generated a useful disagreement. Distinguish an observed allocation error, a prediction conditional on equilibrium and an omitted real-world mechanism. Choose the next extension to answer that specific uncertainty. This makes the family a progressive teaching resource rather than a sequence of unrelated clicks. Keep the basic and extended interfaces together so colleagues can choose a short activity without losing access to the theoretical and operational support.

Checkpoint

Before closing, confirm the explicit participant ending, all-active-decision export, completion counts and backed-up parameters. Check that every claim names its unit and population. Keep proposed public routes distinct from locally verified access, and preserve the session data when updating the software.

Bibliography

- Lin, Y.-H. (2021). A classroom experiment on the specific factors model. *International Review of Economics Education*, 37, 100214. <https://doi.org/10.1016/j.iree.2021.100214>. Accessible earlier working paper: https://mpra.ub.uni-muenchen.de/89013/1/MPRA_paper_89013.pdf.
- Neary, J. P. (1978). Short-Run Capital Specificity and the Pure Theory of International Trade. *The Economic Journal*, 88(351), 488–510. <https://doi.org/10.2307/2232049>.
- Artuç, E., Chaudhuri, S., and McLaren, J. (2010). Trade Shocks and Labor Adjustment: A Structural Empirical Approach. *American Economic Review*, 100(3), 1008–1045. <https://doi.org/10.1257/aer.100.3.1008>.
- Borjas, G. J. (1995). The Economic Benefits from Immigration. *Journal of Economic Perspectives*, 9(2), 3–22. <https://doi.org/10.1257/jep.9.2.3>. Earlier working paper: <https://www.nber.org/papers/w4955>.
- American Economic Association. JEL Classification System. Classification consulted in 2026. <https://www.aeaweb.org/econlit/jelCodes.php?view=jel>.