



Instructor Guide to the Consumer Choice Activity

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 preparation, delivery, and discussion of the Consumer Choice family developed by the Behavioral and Experimental Economics Research Lab (BEER Lab) in the Department of Economics at Tecnológico de Monterrey. It is written for instructors in principles, microeconomics, public economics, welfare economics, and applied courses that use demand, elasticities, or revealed preference. No prior experience with oTree or experimental economics is assumed.

The guide first explains platform operation, then develops the theory with numerical examples, connects each configuration to a teaching question, and provides a structured method for interpreting results without mistaking a classroom activity for an estimate of students' private preferences. The family contains five basic modes. One decision introduces tangency and expenditure shares.

Ten income changes generate an Engel curve. Ten changes in the price of X generate an own-demand schedule; changes in the price of Y reveal cross-price responses; and combined budgets train students to read intercepts and slopes simultaneously. The extended edition adds Hicks and Slutsky compensation, a programmed preference shift, an income transfer, a per-unit tax, rationing, and a sequence for revealed-preference consistency. The 26 configurations are available in English and Spanish within one isolated family.

Author

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For the instructor

The platform assigns a known Cobb–Douglas score to create a well-defined choice problem. The activity does not claim that this function describes a student's private preferences. Choices reveal understanding and responses inside an induced task; they must not be used to diagnose tastes, ability, or individual welfare.

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Quick implementation guide

1.1 Access through the updated laboratory website

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

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

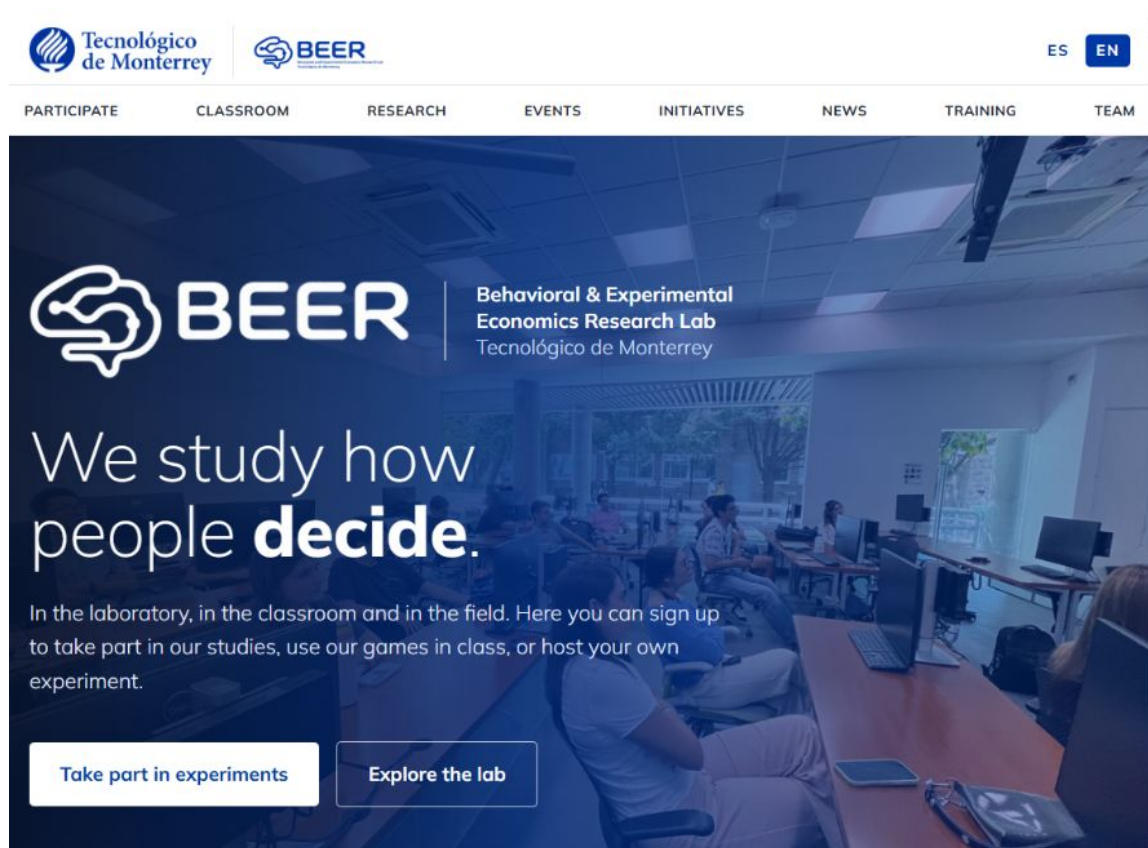


Figure 1.1: Current institutional website. Select **CLASSROOM** in the top navigation menu to open the teaching experiments. Captured on October 7, 2026.

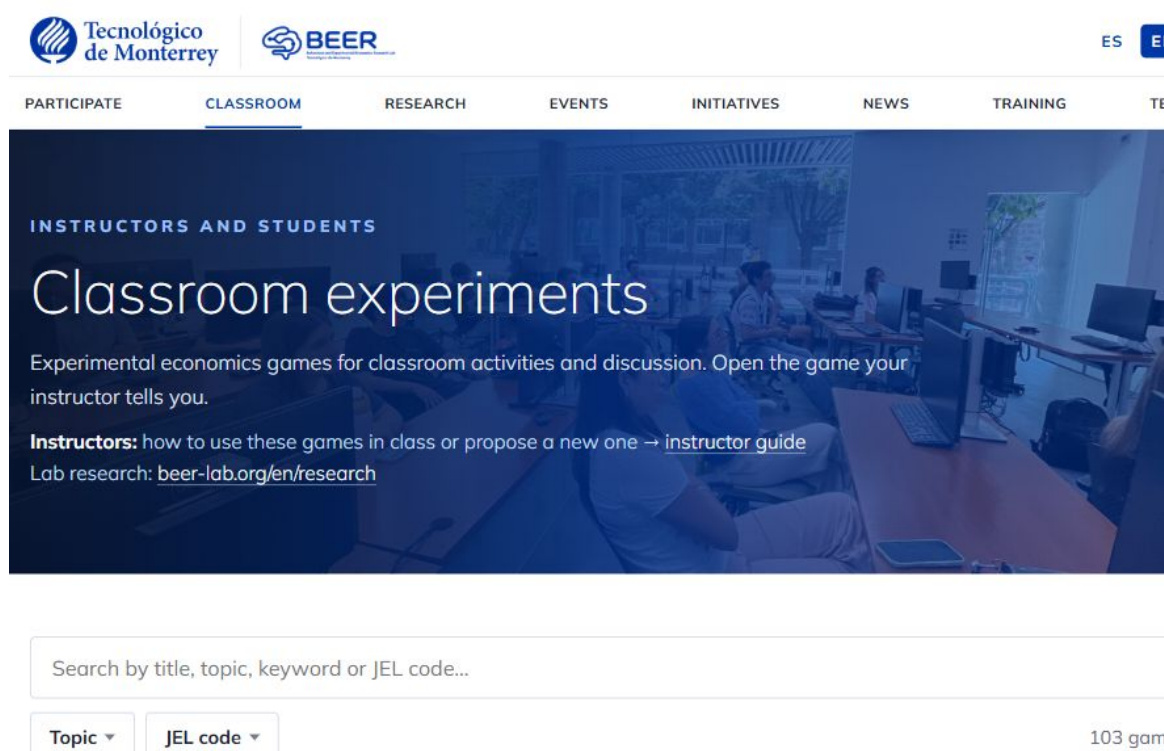


Figure 1.2: Current catalog: search by title, topic, or JEL code. Then locate this family's card and select language and edition. Captured on October 7, 2026.

Checking resources, comprehension, and participant requirements

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

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

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

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

consumidor — una decisión	Elección del consumidor / Consumer
consumidor — cambios de ingreso	
consumidor — una decisión	Elección del consumidor / Consumer Choice — BEER Lab Seleccione una variante de este juego. Select a version of this game.
consumidor — cambios de ingreso	
consumidor — cambios en el precio de X	
consumidor — cambios en el precio de Y	
consumidor — presupuestos combinados	
choice — one decision	
choice — income changes	
choice — changes in the price of X	
choice — changes in the price of Y	
choice — combined budgets	
consumidor extendida — referencia Cobb–Douglas	
consumidor extendida — compensación de Hicks	
consumidor extendida — compensación de Slutsky	
consumidor extendida — cambio de preferencias	
consumidor extendida — transferencia de ingreso	
consumidor extendida — impuesto al bien X	
consumidor extendida — racionamiento de X	
consumidor extendida — preferencia revelada	
Consumer Choice — Cobb–Douglas benchmark	
Consumer Choice — Hicks compensation	
Consumer Choice — Slutsky compensation	
Consumer Choice — preference shift	
Consumer Choice — income transfer	
Consumer Choice — tax on good X	
Consumer Choice — rationing of X	
Consumer Choice — revealed preference	

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

Rooms

Current rooms:

[ES] Elección del consumidor
[EN] Consumer Choice
[ES] Elección del consumidor: extendida
[EN] Consumer Choice: extended

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

Room: [EN] Consumer Choice

Create a new session

Session Config

[EN] Consumer Choice — one decision

Number of participants

Individual decisions: any positive participant count is allowed.

Create

[Configure session](#) 

App sequence

consumer_choice_game (10 rounds)

Consumer choice on linear budgets with Cobb-Douglas preferences.

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

Downloading a session with several rounds

For the instructor

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

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

1.2 Activity profile

Purpose	Connect budget constraints, preferences, demand, and welfare through observable choices.
Experimental unit	One person; no matching is required.
Goods	Two abstract divisible goods, X and Y.
Resource	Income in Experimental Currency Units (ECU).
Decision	Quantity of X; the platform spends remaining income on Y.
Outcome	$U(X, Y) = 10X^\alpha Y^{1-\alpha}$.
Duration	15–25 minutes for one decision; 40–60 minutes for ten decisions and feedback.
Size	One person is sufficient for testing; at least 12 is preferable for aggregate graphs.
Participants	Proposed basic English room.
Instructor	consumerchoice.beer-lab.org/demo .
Local server	localhost:8056/demo .
Basic edition	one decision; income changes; changes in the price of X; changes in the price of Y; combined budgets.
Extended edition	Cobb–Douglas benchmark; Hicks compensation; Slutsky compensation; preference shift; income transfer; tax on good X; rationing of X; revealed preference.
Topics	consumer choice; budget constraint; preferences; demand; welfare.
JEL	A22; D11; D12.

Attention

The public subdomain is the proposed canonical route and must be activated by the lab. The verified local instance uses port 8056, a separate SQLite database, and `GAME_FAMILY=consumerchoice`. Its **Demo** page contains only 26 Consumer Choice configurations and

Rooms contains only four rooms.

1.3 Learning objectives

After a basic session, students should identify a budget set, calculate intercepts and slope, distinguish affordable from unaffordable bundles, and explain why monotonic preferences imply spending the available income. They should connect the tangency condition to equality between the marginal rate of substitution and the price ratio, derive Cobb–Douglas demands, and recognize that α equals the theoretical expenditure share on X. Repeated modes also teach how to read demand and Engel curves without treating comparisons that change several conditions as causal.

The activity develops a second skill: separating description, prediction, and normative evaluation. The report shows quantities, expenditure shares, score, and efficiency relative to the induced benchmark. Ninety-percent efficiency means the bundle generated 90 percent of the maximum score available on that budget; it does not mean that the person is “90 percent rational.” A WARP violation describes a relation across choices and budgets, but alone cannot distinguish indifference, error, attention, or changing tastes.

1.4 Recommended operating sequence

1. Choose the conceptual question before selecting a configuration. Use income changes for Engel curves, price-X changes for own demand, and the revealed-preference treatment for WARP.
2. Begin at beer-lab.org, continue to teaching.beer-lab.org, and select Consumer Choice.
3. Open one of the four rooms and create a new session. Keep **Monitor** and **Report** in separate tabs.
4. Share the room route or individual links. Require silence and complete reading of instructions.
5. Do not announce the optimal demand before choices. The score formula may be reviewed when the objective is application, but the instructor should not solve the task.
6. Before revealing results, request a written prediction about quantity, expenditure share, or direction of change.
7. Reveal aggregates, state denominators, and then compare them with the Cobb–Douglas prediction.
8. Export data if there will be an assignment. Record configuration, date, class size, prior explanation, and incidents.

Checkpoint

The basic room must offer five configurations and the extended room eight. If Dictator, Trust, auctions, or another family appears, stop before creating the session. Verify the domain and confirm that the service exposes only `consumer_choice_game`.

1.5 Three lesson plans

For a 50-minute class, use one decision. Reserve eight minutes for access, ten for instructions and comprehension, five for choice, five for an individual prediction, fifteen for feedback, and seven for closure. This version works well after preferences and the budget constraint have been introduced. With one observation per person, the efficiency histogram is more useful than a demand curve.

For a 75-minute class, use income or one-price changes. Reserve twenty minutes for ten decisions and thirty for constructing the curve with the class. Ask students first to identify what remains fixed. Show the aggregate graph only after each student draws a prediction. Comparing the prior drawing with observed data turns the report into formative assessment.

For a 100-minute seminar, compare Hicks and Slutsky. Run two sessions or assign conditions across groups. Derive both compensation rules, discuss purchasing power, substitution and income effects, and close with welfare measurement. Do not treat the two series as equivalent: Hicks preserves benchmark utility, whereas Slutsky preserves affordability of the initial bundle.

Access, isolation, and session creation

2.1 Institutional route and catalog

The route begins at beer-lab.org and continues at teaching.beer-lab.org. The Consumer Choice card should lead to a dedicated instance. Its **Demo**, **Rooms**, **Sessions**, and **Data** pages must contain only this family. Isolation prevents a student who received a consumption link from starting Trust, Public Goods, or a market from the same domain, and prevents instructors from mixing exports from unrelated families.

Ten configurations are basic: five modes in each language. Sixteen are extended: eight treatments in each language. Visible names begin with ES or EN. Each configuration specifies language, edition, mode, treatment, and number of decisions. Internal names follow the prefix of their room; family filtering uses the explicitly assigned app rather than fragile matching of display names.

2.2 The four rooms

Room	Options	Content
<code>eleccion_consumidor_es</code>	5	One decision, income, price X, price Y, and combined budgets in Spanish.
<code>consumer_choice_en</code>	5	The same basic modes in English.
<code>eleccion_consumidor_extendida</code>	8	Benchmark, compensation, preferences, transfer, tax, rationing, and WARP in Spanish.
<code>consumer_choice_extended</code>	8	The same extended treatments in English.

The room route is stable and can be embedded in a QR code. A new session generates links tied to the active database. If a participant sees “This user does not exist in the database,” the link belongs to an earlier database or a deleted session. Create a new session; editing the code in the URL does not recover the participant. Do not post old demo links in the LMS as permanent routes.

2.3 Participant count and anonymity

The app is individual and accepts any class size. One participant is enough for a rehearsal, but a distribution requires more observations. With fewer than 12 participants, emphasize points and counts rather than precise-looking percentages. With a large class, inspect pending decisions before reveal. Ten decisions by 30 people produce 300 participant-round observations but only 30 independent people when everyone faces the same sequence.

Individual links should not be publicly associated with names or student IDs. If the exercise counts toward participation, record completion through a separate mechanism. The projected report is aggregate. Exports contain codes and should be stored under institutional rules. Never infer a private preference from a score induced by the instructions.

2.4 Administrative tools

The screenshot shows the oTree web interface for a session titled "[EN] Consumer Choice — combined budgets: session '0hzfx4zs' (demo)". The navigation bar includes links for Demo, Sessions, Rooms, Data, Server Check, and Logout. Below the navigation bar, there are icons for New, Links, Monitor, Data, Payments, Report, and Description. A message states: "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:"

Under "Combined views", there are two buttons: "Split-screen view" (marked "Not available") and "Grid view" (with a "Launch" link).

Under "Session-wide testing link", it says "Open the below link in up to 10 browser tabs." and provides the link: <http://127.0.0.1:8056/join/mobujama>

Under "Single-use links", it says "Open each link in its own browser tab." and lists 10 participant links (P1 to P10):

P1	http://127.0.0.1:8056/initializeParticipant/h1h0bqh1
P2	http://127.0.0.1:8056/initializeParticipant/l34y8s2c
P3	http://127.0.0.1:8056/initializeParticipant/lcbfxg0l
P4	http://127.0.0.1:8056/initializeParticipant/z8n45eb0
P5	http://127.0.0.1:8056/initializeParticipant/0menmzys
P6	http://127.0.0.1:8056/initializeParticipant/cxoagtvr
P7	http://127.0.0.1:8056/initializeParticipant/29uy3lrq
P8	http://127.0.0.1:8056/initializeParticipant/f75s5zuj
P9	http://127.0.0.1:8056/initializeParticipant/9l6wxj24
P10	http://127.0.0.1:8056/initializeParticipant/kc0xnuoo

Figure 2.1: Links and administrative tools for a combined-budget session.

Monitor shows page progress. **Report** contains the feedback indicators and graphs. **Data** exports tabular decisions. **Description** records the configuration. Open Report at the start: while decisions are pending it displays only completion counts and keeps results hidden. This behavior prevents aggregate information from reaching students who are still choosing.

The local server starts with `scripts/start_consumer_choice_local.ps1`. It stores this family in `.local_state/consumerchoice/db.sqlite3` and does not share `db.sqlite3` with other families. Production should use its own PostgreSQL database, secret key, and process behind the hostname. Never run `resetdb` against production or during class.

Participant experience

3.1 Welcome and laboratory rules

The cover displays the Tecnológico de Monterrey and BEER Lab logos, the purpose of the activity, and four rules: silence, individual choice, remaining on the assigned page, and the help protocol. Participants confirm that they read the rules before continuing. The screen separates logistics from the economic instructions.

The instructor can use this stage to clarify that ECU is an internal unit of account. It does not automatically equal pesos or dollars. If a future research version adds real payment, the conversion rate must appear in the instructions and ethical protocol. In the teaching activity, the score compares bundles inside the task.

3.2 Instructions and worked example

Instructions organize the task into four blocks. The choice problem defines income and two goods. The budget rule states that spending on X plus spending on Y cannot exceed income. The Cobb–Douglas function defines the score. The example uses income 100, $p_X = 2$, $p_Y = 1$, and $\alpha = 0.5$: the benchmark is (25, 50) and spends exactly 100 ECU.

The example teaches a method without necessarily revealing the first live choice because configuration parameters can differ. Emphasize units: 25 units of X cost 50 ECU and 50 units of Y cost 50 ECU. Equal quantities are not the rule. With unequal prices, equal expenditure shares generate unequal quantities.

3.3 Comprehension

The check asks which bundles are allowed, how the maximum X changes when its price rises, and what the objective is. Correct answers are bundles within income, a lower X intercept, and maximizing score subject to the budget. An incorrect submission remains on the page and presents a conceptual hint. Attempts are recorded for diagnosis.

The check verifies rules rather than solving tangency. If many students miss the price item, draw only the intercepts. If they miss the objective, reread the score function. Avoid saying that half the budget should go to X before they decide: that is an implication of $\alpha = 0.5$ that the activity is designed to discover or apply.

**BEER LAB**

Welcome to the BEER Lab

In this activity, you will make consumption decisions with a limited budget.

Purpose of the activity

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

General laboratory rules

- Remain quiet and do not talk to other participants.
- Make every decision individually.
- Do not open other pages or use your phone during the activity.
- If you have a question, raise your hand and wait for the instructor.

☐ I confirm that I read the rules and will work individually.

Start

Powered by [oTree](#)

Figure 3.1: Institutional welcome and general laboratory rules.



ONE DECISION

Instructions

Cobb–Douglas benchmark · Stable preferences with $\alpha=0.5$ and varied budgets.

Resources and unit of account

Available budget: 100 ECU.

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

This session does not convert ECU into real money.

Your choice problem

You have income in ECU to buy two goods, X and Y.
Choose a bundle that respects the budget constraint and generates the highest possible score.

Budget constraint

Total spending equals price of X $\times$ quantity of X + price of Y $\times$ quantity of Y. The platform allocates all income left after your X choice to Y, so every choice lies on the budget line.

Cobb–Douglas preferences

Your score is $10 \times X^\alpha \times Y^{1-\alpha}$. The parameter α indicates the theoretical expenditure share allocated to good X.

Worked example

With income 100, price of X equal to 2, price of Y equal to 1, and $\alpha=0.5$, the benchmark is $X=25$ and $Y=50$. This bundle spends 100 ECU and balances expenditure shares.

X
25

Y
50

Score
353.55

Sequence

1. Observe income, prices, and preferences.
2. Choose the quantity of X.
3. The platform calculates Y from the remaining income.
4. Compare your bundle with the theoretical benchmark and review aggregate results at the end.

Continue

Con tecnología de oTree

Figure 3.3: Current instructions for the basic edition: initial resources, decision rules, and experimental units. Continuation 2/2.



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



ONE DECISION

Comprehension questions

1. Which bundles are allowed?

- ☐ Bundles that do not exceed available income
- ☒ Any bundle, even if it exceeds income
- ☐ Only bundles with equal quantities

Your answer: Any bundle, even if it exceeds income. The correct answer is Bundles that do not exceed available income. Review the rules: the bundle must be affordable; a higher price lowers the maximum quantity; and the objective is to maximize the score subject to the budget.

2. If the price of X rises while everything else stays fixed, what happens to the maximum affordable X?

- ☒ It decreases
- ☐ It increases
- ☐ It does not change

3. What is the objective of the decision?

- ☒ Maximize the score subject to the budget
- ☐ Spend more than other participants
- ☐ Guess the instructor's bundle

Continue

Con tecnología de oTree

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

3.4 Choice screen

The header shows current decision, mode, and treatment. Four cards display income, prices, and α . Participants use a slider or type X. The platform computes Y from remaining income, spending on X, and an approximate score. The blue point moves on the budget line; the optimum is not shown before confirmation.



DECISION 1 OF 10



Choose your bundle

Combined budgets · Cobb–Douglas benchmark

Available income

100 ECU

Price of X

1 ECU

Price of Y

1 ECU

Weight α on X

0.50

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.

Maximum affordable X: **100**

Resulting quantity of Y

100.00

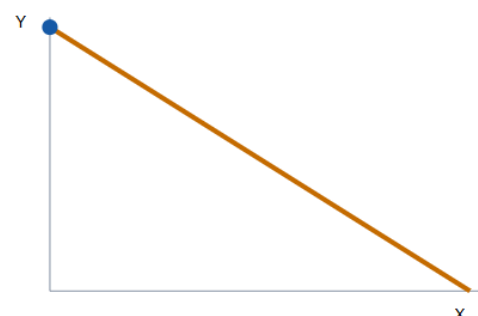
Spending on X

0.00 ECU

Approximate score

0.00

Budget and tentative choice



Budget: $1X + 1Y = 100$

Confirm bundle

Powered by [oTree](#)

Figure 3.5: Choice with synchronized slider, live calculation, and budget line.

The interface reduces two kinds of noise. First, it guarantees budget exhaustion when preferences are monotonic. Second, it avoids requesting two numbers that might be unaffordable. The economic choice remains intact: selecting X determines Y along the frontier. Under rationing, the slider maximum adjusts to the cap. Under tax, the card displays the final price and a callout separates base price from the per-unit tax.

3.5 Result and closure

After confirmation, the result compares the chosen bundle with the benchmark. It reports X, Y, score, share of maximum, and benchmark coordinates. The graph adds the budget line, chosen point, Cobb–Douglas reference, and the indifference curve through the choice. Geometric distance is not a welfare measure; the score ratio is the metric defined by the task.



DECISION 1 OF 10

Result of your decision

Your bundle

X
28

Y
72

Score
449

Share of maximum score
89.80%

Theoretical benchmark

X*
50

Y*
50

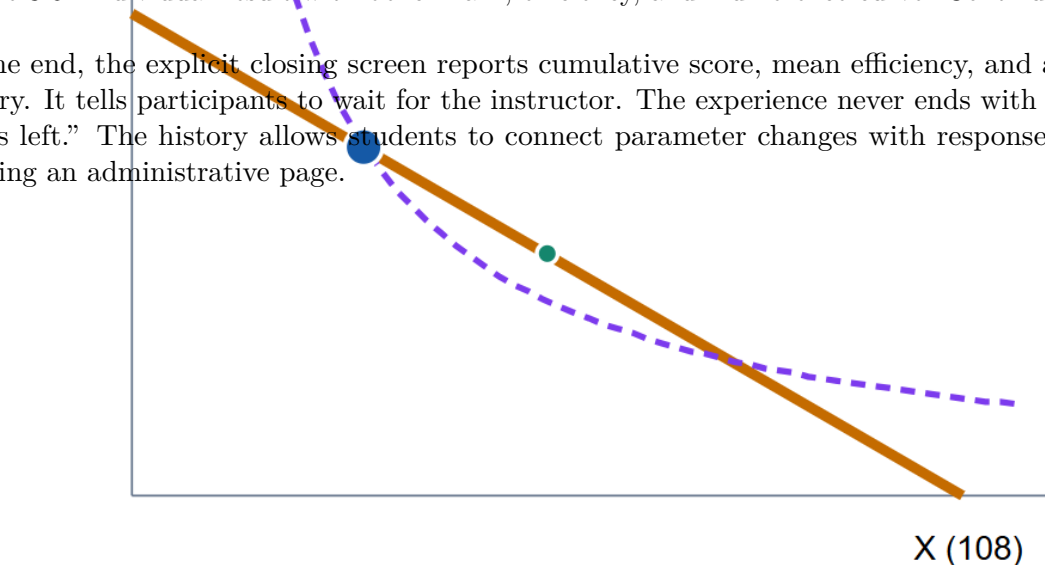
Score
500

Budget, choice, and benchmark

Y (108)

Figure 3.6: Individual result with benchmark, efficiency, and indifference curve. Continuation 1/2.

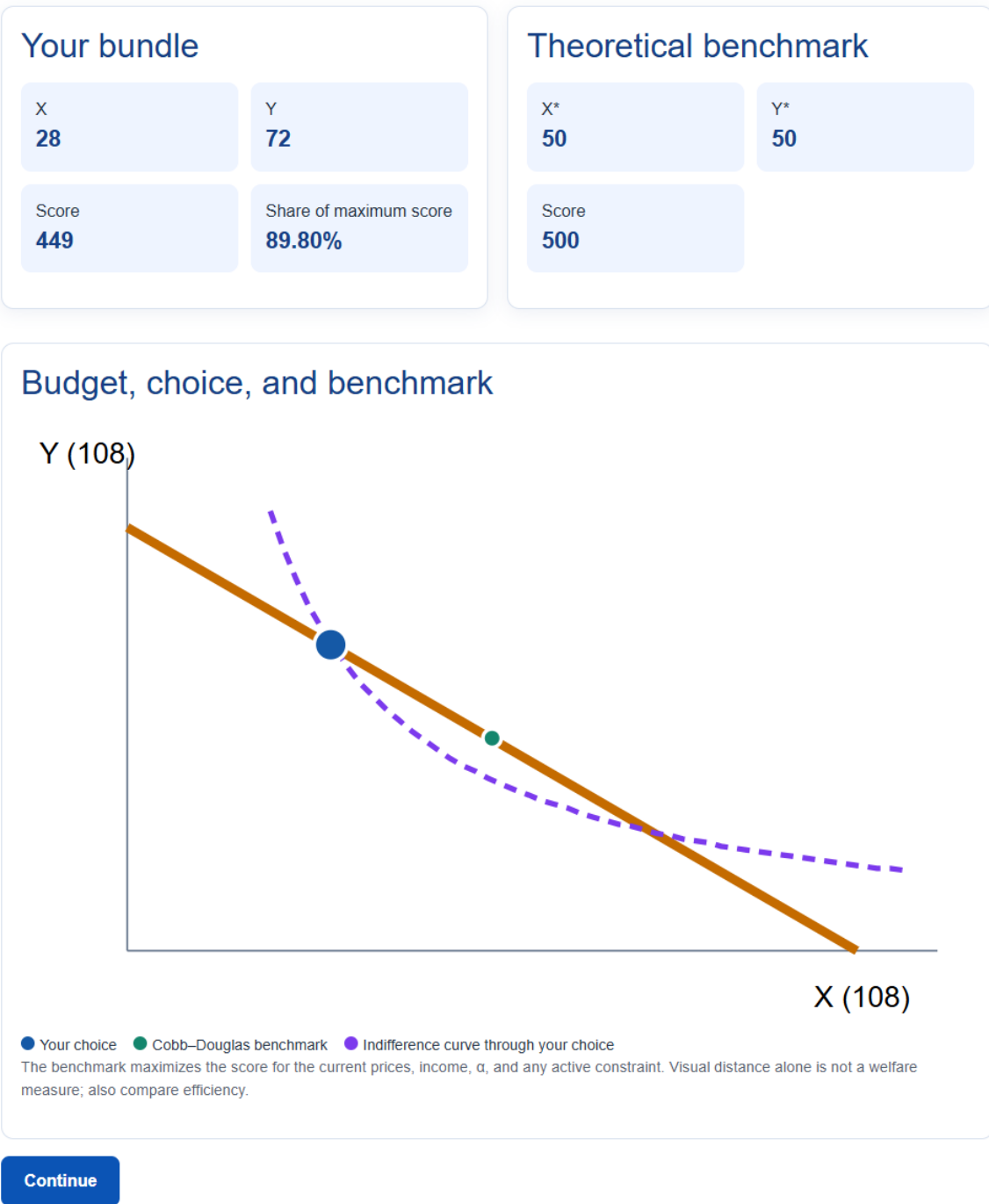
At the end, the explicit closing screen reports cumulative score, mean efficiency, and a decision history. It tells participants to wait for the instructor. The experience never ends with “No more pages left.” The history allows students to connect parameter changes with responses without opening an administrative page.



● Your choice ● Cobb–Douglas benchmark ● Indifference curve through your choice

The benchmark maximizes the score for the current prices, income, α , and any active constraint. Visual distance alone is not a welfare measure; also compare efficiency.

Continue



Powered by [oTree](#)

Figure 3.7: Individual result with benchmark, efficiency, and indifference curve. Continuation 2/2.



BEER LAB



Activity completed

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

Cumulative score
4883.62

Mean efficiency
89.80%

Decision history

Round	Available income	Price of X	Price of Y	X	Y	Score	Share of maximum score
1	100	1	1	28	72	449	89.80%
2	120	1	1	33.60	86.40	538.80	89.80%
3	80	1	1	22.40	57.60	359.20	89.80%
4	120	2	1	16.80	86.40	381	89.80%
5	120	0.50	1	67.20	86.40	761.98	89.80%
6	120	1	2	33.60	43.20	381	89.80%
7	120	1	0.50	33.60	172.80	761.98	89.80%
8	150	2	1	21	108	476.24	89.80%
9	90	1.50	1	16.80	64.80	329.95	89.80%
10	140	1	2	39.20	50.40	444.49	89.80%

Wait for the instructor's directions.

Powered by [oTree](#)

Figure 3.8: Explicit closure and individual history for ten decisions.

Economic model and predictions

4.1 Budget set

Let $m > 0$ denote income and let $p_X > 0$ and $p_Y > 0$ be prices. The affordable set is

$$B(p, m) = \{(X, Y) \in \mathbb{R}_+^2 : p_X X + p_Y Y \leq m\}.$$

The intercepts are m/p_X and m/p_Y and the frontier slope is $-p_X/p_Y$. Higher income shifts the line outward in parallel. A higher p_X rotates it inward around the Y intercept. A higher p_Y rotates it around the X intercept. These changes link the numerical cards to the graph.

With locally nonsatiated preferences, a bundle inside the set with unspent income cannot be optimal because a nearby bundle contains more of at least one good. The interface therefore applies the equality and computes

$$Y = \frac{m - p_X X}{p_Y}.$$

Reducing the task to one dimension does not impose the solution; it removes choices dominated through unspent income. The equality would require reconsideration in applications with saving, satiation, or indivisibilities.

4.2 Cobb–Douglas preferences

The induced score is

$$U(X, Y) = 10X^\alpha Y^{1-\alpha}, \quad 0 < \alpha < 1.$$

The factor 10 scales points without changing choice. Indifference curves are downward sloping and convex. The marginal rate of substitution is

$$MRS_{XY} = \frac{MU_X}{MU_Y} = \frac{\alpha}{1-\alpha} \frac{Y}{X}.$$

At an interior optimum, $MRS_{XY} = p_X/p_Y$. Combining tangency with the budget gives Marshallian demands

$$X^* = \frac{\alpha m}{p_X}, \quad Y^* = \frac{(1-\alpha)m}{p_Y}.$$

The most visible prediction is the expenditure-share rule: $p_X X^*/m = \alpha$ and $p_Y Y^*/m = 1 - \alpha$. When $\alpha = 0.5$, expenditures are equal, not quantities. If X costs twice as much as Y, optimal X is half of Y. This distinction should guide feedback whenever students search for the 45-degree line.

4.3 Demand, Engel curves, and elasticities

For X , income elasticity is one: doubling m doubles X^* . The Engel curve passes through the origin with slope α/p_X . Own-price elasticity is minus one: doubling p_X halves X . Marshallian demand for X does not contain p_Y , so its cross-price elasticity is zero under this functional form. That does not mean the goods are unrelated in preferences; Y absorbs the adjustment needed to preserve its expenditure share.

Aggregate graphs can depart from these predictions because students round, learn, or choose away from the benchmark. A downward-sloping cloud is compatible with demand, but ten points from a classroom sequence do not estimate a population elasticity. Arc elasticity should state its denominator. Point elasticity is known theoretically to be minus one.

4.4 Score and efficiency

The app computes the score of the chosen bundle and the maximum under the current prices, income, α , tax, and cap. Reported efficiency is

$$E = 100 \times \frac{U(X, Y)}{U(X^*, Y^*)}.$$

A feasible choice should not exceed 100 except for negligible rounding. Normalization permits descriptive comparisons across budgets. It is not a monetary loss measure; the same percentage gap can correspond to different quantities at different scales.

Theoretical foundation

The score function belongs to the mechanism. Demand analysis tests whether choices respond to induced incentives and constraints. Studying real preferences would require valued goods, suitable incentives, an ethical protocol, and a design that makes the chosen option consequential.

Price changes, compensation, and welfare

5.1 Slutsky decomposition

When p_X changes, the Marshallian response combines substitution and income effects. In differential form,

$$\frac{\partial X(p, m)}{\partial p_X} = \frac{\partial h_X(p, u)}{\partial p_X} - X(p, m) \frac{\partial X(p, m)}{\partial m}.$$

The first term holds utility constant; the second reflects purchasing power. Since X is normal under Cobb–Douglas, both effects lower X when its own price rises. A class need not use calculus to see the logic: compare an uncompensated price sequence with a compensated one.

5.2 Hicks compensation

Let u_0 be initial utility measured without the factor 10. The expenditure function is

$$e(p_X, p_Y, u_0) = u_0 \left(\frac{p_X}{\alpha} \right)^\alpha \left(\frac{p_Y}{1 - \alpha} \right)^{1 - \alpha}.$$

The Hicks configuration adjusts income at each price to preserve initial utility. The initial bundle need not remain chosen, but the benchmark stays on the same indifference curve. Movement traces compensated demand.

With $m_0 = 100$, unit prices, and $\alpha = 0.5$, the initial bundle is (50, 50). If p_X rises to two, Hicks income is approximately 141.42 and the reference is (35.36, 70.71). X falls through substitution and Y rises. The compensation is 41.42, less than the amount needed to purchase the original bundle exactly.

5.3 Slutsky compensation

Slutsky compensation supplies enough income to keep the initial bundle affordable:

$$m^S = m_0 + (p'_X - p_X)X_0 + (p'_Y - p_Y)Y_0.$$

In the example, $m^S = 150$. Bundle (50, 50) can still be purchased, but it is not optimal at the new slope. The Cobb–Douglas benchmark becomes (37.5, 75). Because Slutsky income exceeds Hicks income, final utility can exceed u_0 . The difference shows why an inflation compensation rule requires a defined index.

5.4 Compensating and equivalent variation

Compensating variation asks how much income after a change restores initial utility. Equivalent variation asks how much income at initial prices would reproduce the utility change. For a harmful price increase, both are monetary welfare measures but generally differ. The Hicks session connects directly to compensation; it does not estimate participants' willingness to pay because utility is assigned by the task.

Feedback script

Draw the initial line, the new uncompensated line, and a compensated line. Ask what is held constant in each comparison before naming substitution effect, income effect, Hicks, and Slutsky. This order keeps geometric intuition ahead of terminology.

Basic modes

6.1 One decision

The configuration uses $m = 100$, unit prices, and $\alpha = 0.5$, so the benchmark is $(50, 50)$. It is appropriate for an introduction or diagnostic. Ask students to draw the line before playing, then inspect the efficiency distribution. If nearly everyone chooses 50, ask whether the reasoning used tangency, shares, or symmetry. The same answer can arise from different methods.

One decision cannot test stable preferences or construct a demand curve. Its advantage is transparency. Ask what would change if α were 0.7: the expenditure share on X would become 70 percent. This counterfactual prepares the preference-shift treatment.

6.2 Income changes

Prices stay at one and income rises from 60 to 240. With $\alpha = 0.5$, $X^* = Y^* = m/2$. The prediction is a linear Engel curve. Request a graph of X against income before reveal. If the mean grows less than proportionally, check for early learning or focal-number choices.

The sequence does not measure an Engel curve for actual goods. It illustrates an induced preference. Use it to discuss normal goods, unit income elasticity, and homotheticity. Quantities rise while the expenditure share remains near 50 percent.

6.3 Changes in the price of X

Income is 120, $p_Y = 1$, and p_X ranges from 0.5 to 5. The benchmark $X^* = 60/p_X$ is hyperbolic; spending on X remains 60 ECU. In levels the demand curve is convex to the origin. In logs its slope is minus one. Benchmark Y remains 60.

The screen shows that “downward sloping” does not mean linear. It also distinguishes movement along demand from a shift: only X price changes while income, Y price, and preferences remain fixed. Pooling cohorts or treatments would weaken this interpretation.

6.4 Changes in the price of Y

Income is 120 and $p_X = 1$. Under Cobb–Douglas, $X^* = 60$ for every p_Y , whereas $Y^* = 60/p_Y$. This surprising result illustrates exact cancellation of substitution and income effects on X in the Marshallian demand. Do not generalize zero cross-price elasticity to all preferences.



DECISION 1 OF 1



Choose your bundle

One decision · Cobb–Douglas benchmark

Available income

100 ECU

Price of X

1 ECU

Price of Y

1 ECUWeight α on X**0.50**

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.

Maximum affordable X: **100**

Resulting quantity of Y

100.00

Spending on X

0.00 ECU

Approximate score

0.00**Confirm bundle**

Budget and tentative choice

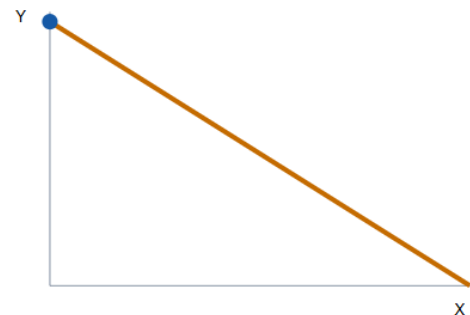
Budget: $1X + 1Y = 100$ Powered by [oTree](#)

Figure 6.1: Basic one-decision mode.



DECISION 1 OF 10



Choose your bundle

Income changes · Cobb–Douglas benchmark

Available income

60 ECU

Price of X

1 ECU

Price of Y

1 ECUWeight α on X**0.50**

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.

Maximum affordable X: **60**

Resulting quantity of Y

60.00

Spending on X

0.00 ECU

Approximate score

0.00**Confirm bundle**

Budget and tentative choice

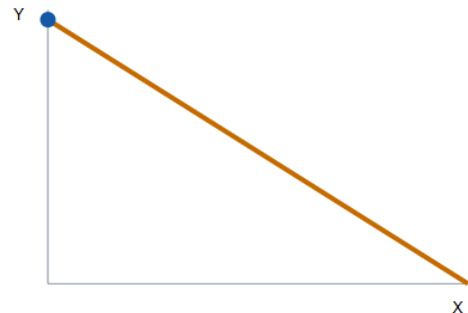
Budget: $1X + 1Y = 60$ Powered by [oTree](#)

Figure 6.2: First decision in the income sequence.



DECISION 1 OF 10



Choose your bundle

Changes in the price of X · Cobb–Douglas benchmark

Available income

120 ECU

Price of X

0.50 ECU

Price of Y

1 ECUWeight α on X**0.50**

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.



Maximum affordable X: **240**

Resulting quantity of Y

120.00

Spending on X

0.00 ECU

Approximate score

0.00
Confirm bundle

Budget and tentative choice

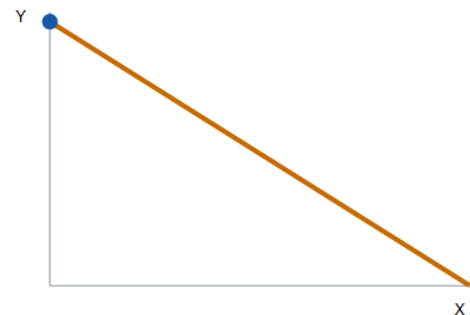
Budget: $0.50X + 1Y = 120$ Powered by [oTree](#)

Figure 6.3: Own-price sequence for X.



DECISION 1 OF 10



Choose your bundle

Changes in the price of Y · Cobb–Douglas benchmark

Available income

120 ECU

Price of X

1 ECU

Price of Y

0.50 ECUWeight α on X**0.50**

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.



Maximum affordable X: **120**

Resulting quantity of Y

240.00

Spending on X

0.00 ECU

Approximate score

0.00
Confirm bundle

Budget and tentative choice

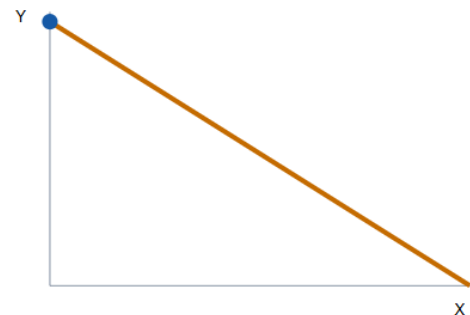
Budget: $1X + 0.50Y = 120$ Powered by [oTree](#)

Figure 6.4: Y-price sequence for studying cross responses.

Ask for a prediction before play. Many students expect X to rise when Y becomes more expensive. That can occur under other preferences. The classroom result is a functional-form implication, not a universal correction.

6.5 Combined budgets

Income and prices change jointly across ten decisions. This mode trains calculation, slope comparison, and normalization. Its scatter cannot identify a simple demand curve because several variables change. It can still assess efficiency and stability of expenditure shares.



DECISION 1 OF 10

Choose your bundle
Combined budgets · Cobb–Douglas benchmark

Available income 100 ECU	Price of X 1 ECU	Price of Y 1 ECU	Weight α on X 0.50
------------------------------------	----------------------------	----------------------------	-------------------------------------

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.

Maximum affordable X: **100**

Resulting quantity of Y
100.00

Spending on X
0.00 ECU

Approximate score
0.00

Confirm bundle

Budget and tentative choice

Budget: $1X + 1Y = 100$

Powered by [oTree](#)

Figure 6.5: Combined budgets for integrated practice.

This mode best demonstrates the full instructor report: it generates variation for price and income plots, the round table, and WARP indicators. It may be demanding for beginners. Use it after one simple decision or provide a worksheet with income, prices, intercepts, and shares.

Extended treatments

7.1 Cobb–Douglas benchmark

The benchmark uses ten combined budgets with stable preferences. It is the comparison condition for the other extensions. The prediction is an X share near 50 percent and high efficiency. Comparing it with tax or rationing requires independent sessions or assignment across students; a before-after class comparison also contains learning.

7.2 Hicks and Slutsky compensation

Both treatments use the same sequence of X prices. Hicks changes income to preserve initial utility; Slutsky preserves the ability to buy the initial bundle. The cards make clear that income is not fixed. Avoid calling both “constant real income” without specifying the index.

Compare price, compensated income, X, Y, and score. Under Hicks, benchmark score is constant. Under Slutsky, the original bundle remains affordable but chosen score changes. This comparison prepares cost-of-living indices.

7.3 Preference shift

The parameter α equals 0.5 for five decisions and 0.7 from decision six. With unit prices and income 100, the benchmark jumps from (50, 50) to (70, 30). The header displays the new weight. The report correctly states that WARP across phases is not a valid test of stable preferences.

The treatment shows that demand can shift when prices and income do not change. It does not explain why real preferences change; the shift is programmed. Use it to discuss identification: observing more X does not establish a taste change if information, quality, or expectations also changed.

7.4 Income transfer

Income equals 70 for five decisions and 130 thereafter, with unit prices. The benchmark changes from (35, 35) to (65, 65). The transfer has no repayment or fiscal cost inside the game. It isolates an income effect and illustrates normal goods and homotheticity.

For public economics, distinguish utility, quantities, and shares. The score increases while efficiency can remain high in both phases. If discussing policy, remind students that financing taxes, targeting,



DECISION 1 OF 10



Choose your bundle

Combined budgets · Cobb–Douglas benchmark

Available income

100 ECU

Price of X

1 ECU

Price of Y

1 ECUWeight α on X**0.50**

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.



Maximum affordable X: **100**

Resulting quantity of Y

100.00

Spending on X

0.00 ECU

Approximate score

0.00
Confirm bundle

Budget and tentative choice

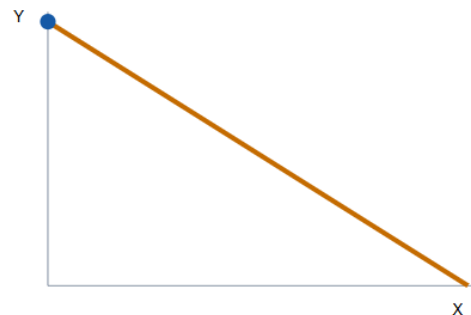
Budget: $1X + 1Y = 100$ Powered by [oTree](#)

Figure 7.1: Extended benchmark with stable preferences.



DECISION 1 OF 10



Choose your bundle

Changes in the price of X · Hicks compensation

Available income

70.71 ECU

Price of X

0.50 ECU

Price of Y

1 ECUWeight α on X**0.50**

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.

Maximum affordable X: **141.42**

Resulting quantity of Y

70.71

Spending on X

0.00 ECU

Approximate score

0.00**Confirm bundle**

Budget and tentative choice

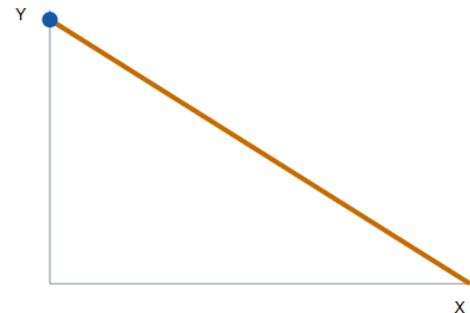
Budget: $0.50X + 1Y = 70.71$ Powered by [oTree](#)

Figure 7.2: The rules generate different incomes and benchmark bundles. Hicks compensation.



DECISION 1 OF 10



Choose your bundle

Changes in the price of X · Slutsky compensation

Available income

75 ECU

Price of X

0.50 ECU

Price of Y

1 ECUWeight α on X**0.50**

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.

Maximum affordable X: **150**

Resulting quantity of Y

75.00

Spending on X

0.00 ECU

Approximate score

0.00**Confirm bundle**

Budget and tentative choice

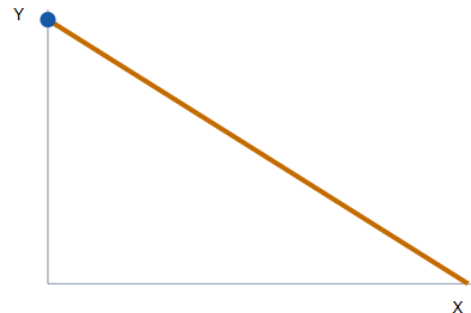
Budget: $0.50X + 1Y = 75$ Powered by [oTree](#)

Figure 7.3: Slutsky compensation.

DECISION 6 OF 10



Choose your bundle

Combined budgets · Preference shift

Available income

100 ECU

Price of X

1 ECU

Price of Y

1 ECUWeight α on X**0.70**

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.

Maximum affordable X: **100**

Resulting quantity of Y

100.00

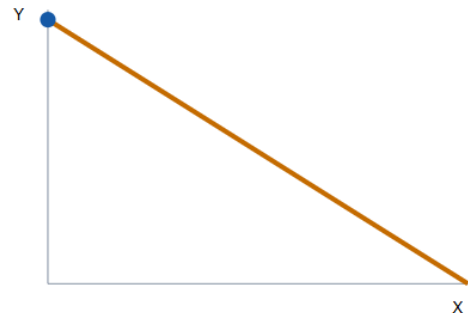
Spending on X

0.00 ECU

Approximate score

0.00**Confirm bundle**

Budget and tentative choice

Budget: $1X + 1Y = 100$ Powered by [oTree](#)Figure 7.4: Decision six after the shift in α .



DECISION 6 OF 10



Choose your bundle

Income changes · Income transfer

Available income

130 ECU

Price of X

1 ECU

Price of Y

1 ECUWeight α on X**0.50**

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.

Maximum affordable X: **130**

Resulting quantity of Y

130.00

Spending on X

0.00 ECU

Approximate score

0.00**Confirm bundle**

Budget and tentative choice

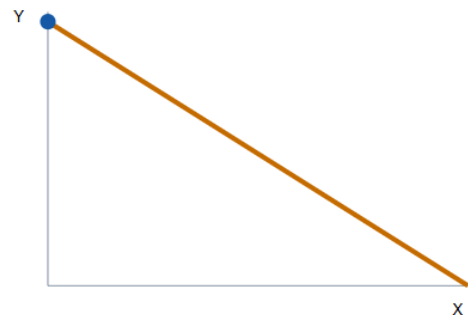
Budget: $1X + 1Y = 130$ Powered by [oTree](#)

Figure 7.5: Second phase after the income transfer.

and equilibrium price changes are outside this mechanism.

7.5 Tax on good X

The final price is the base price plus a per-unit tax. The screen displays both. Revenue is not rebated. The prediction is lower X, unchanged benchmark Y under nominal income and Cobb–Douglas, and total X expenditure remaining at its assigned share even though each unit costs more.



DECISION 4 OF 10

Choose your bundle

Changes in the price of X · Tax on good X

Available income
120 ECU

Price of X
1.50 ECU

Price of Y
1 ECU

Weight α on X
0.50

The final price of X includes a tax of 0.50 ECU per unit. Base price of X: 1 ECU.

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.



Maximum affordable X: **80**

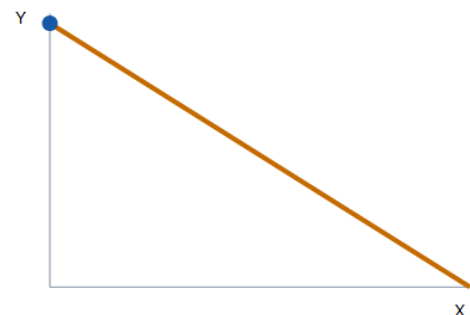
Resulting quantity of Y
120.00

Spending on X
0.00 ECU

Approximate score
0.00

Confirm bundle

Budget and tentative choice



Budget: $1.50X + 1Y = 120$

Powered by [oTree](#)

Figure 7.6: Per-unit tax separated from the base price.

The configuration can introduce tax wedges, revenue, and welfare but contains no supply or market equilibrium. The tax is a consumer-facing price wedge. Do not calculate net social cost without specifying the use of revenue. A simple extension computes tX and the compensation needed to

restore utility.

7.6 Rationing

The cap on X becomes progressively tighter. A cap above unconstrained X^* does not bind. A lower cap yields $X = \bar{X}$ and Y absorbs remaining income. The warning callout and slider maximum make the constraint visible.



DECISION 3 OF 10

Choose your bundle

Combined budgets · Rationing of X

Available income
100 ECU

Price of X
1 ECU

Price of Y
1 ECU

Weight α on X
0.50

A maximum of 45 units of X applies.

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.



Maximum affordable X: **45**

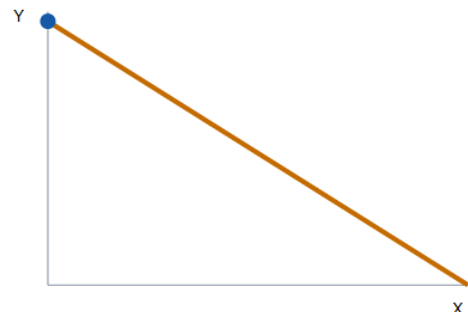
Resulting quantity of Y
100.00

Spending on X
0.00 ECU

Approximate score
0.00

Confirm bundle

Budget and tentative choice



Budget: $1X + 1Y = 100$

Powered by [oTree](#)

Figure 7.7: An active quantitative cap on X .

Rationing permits comparison of price and quantity instruments. A consumer may want more X at the posted price but cannot purchase it. The budget slope is unchanged; the feasible set is cut vertically. That geometry differs from a tax even if observed X happens to match.

7.7 Revealed preference

Ten intersecting budgets permit choice comparisons. WARP requires that if A is selected while B was affordable, B cannot be selected strictly when A is also affordable. The report calculates comparable pairs, violations, violation rate, and participants with at least one violation.



DECISION 1 OF 10



Choose your bundle

Combined budgets · Revealed preference

Available income
100 ECU

Price of X
1 ECU

Price of Y
1 ECU

Weight α on X
0.50

Quantity of X

Use the slider or type the quantity of X. The graph and calculations update before you confirm.

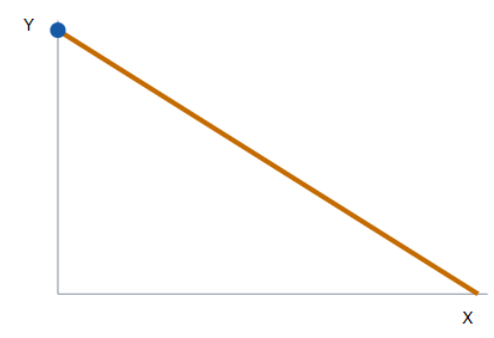
Maximum affordable X: **100**

Resulting quantity of Y
100.00

Spending on X
0.00 ECU

Approximate score
0.00

Budget and tentative choice



Budget: $1X + 1Y = 100$

Confirm bundle

Powered by [oTree](#)

Figure 7.8: First choice in the revealed-preference sequence.

Zero violations are compatible with stable maximization but do not prove Cobb–Douglas or exhaust rationality. WARP is pairwise; GARP includes chains. Rounding and near indifference matter. The platform applies small numerical tolerances. Advanced assignments can export choices and implement Afriat inequalities or a critical-cost efficiency index.

Reading the instructor report

8.1 Hidden results and completion

Before completion, the report shows participants, decisions per person, completed decisions, and pending decisions. Reveal remains disabled. Once pending reaches zero, the instructor controls the reveal. Do not project another tab that contains individual links.

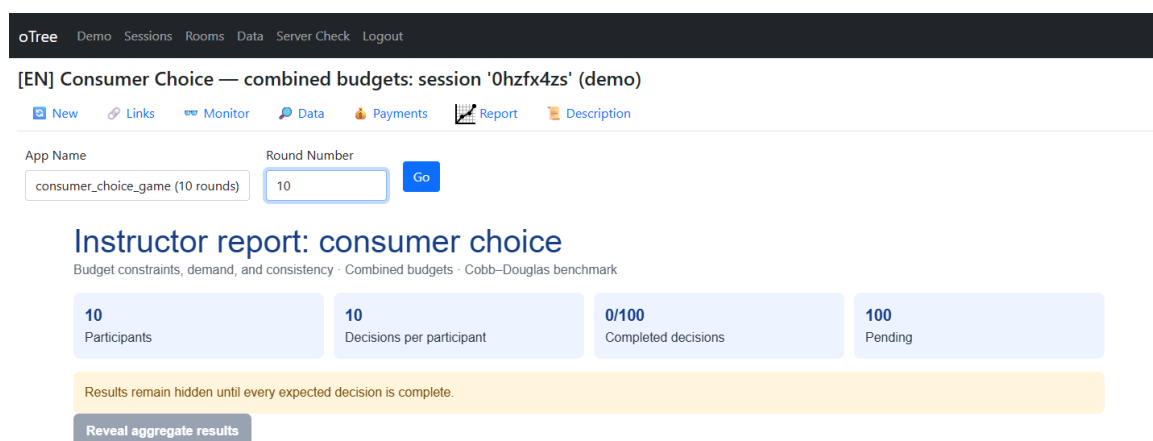


Figure 8.1: Aggregates appear only after the session is complete. Report while decisions are pending.

The main unit is participant-round. Ten people making ten choices yield 100 observations but only ten independent people. The table reports n by round. If someone leaves, the report does not silently change the denominator. Recover the link through Monitor or document the exclusion.

8.2 Overview indicators

Mean score combines budget scale and choice quality, so its level should not be compared across rounds with different incomes. Mean efficiency normalizes by the benchmark. Mean X expenditure share can be compared with 100α percent. The share of decisions above 90-percent efficiency states both threshold and denominator.

The mean can hide tails. The histogram uses bins below 60, 60–69, 70–79, 80–89, 90–94, 95–99, and 100. The last category requires numerical proximity to the maximum. Do not call low observations irrational. First consider comprehension, rounding, exploration, fatigue, and interface difficulty.

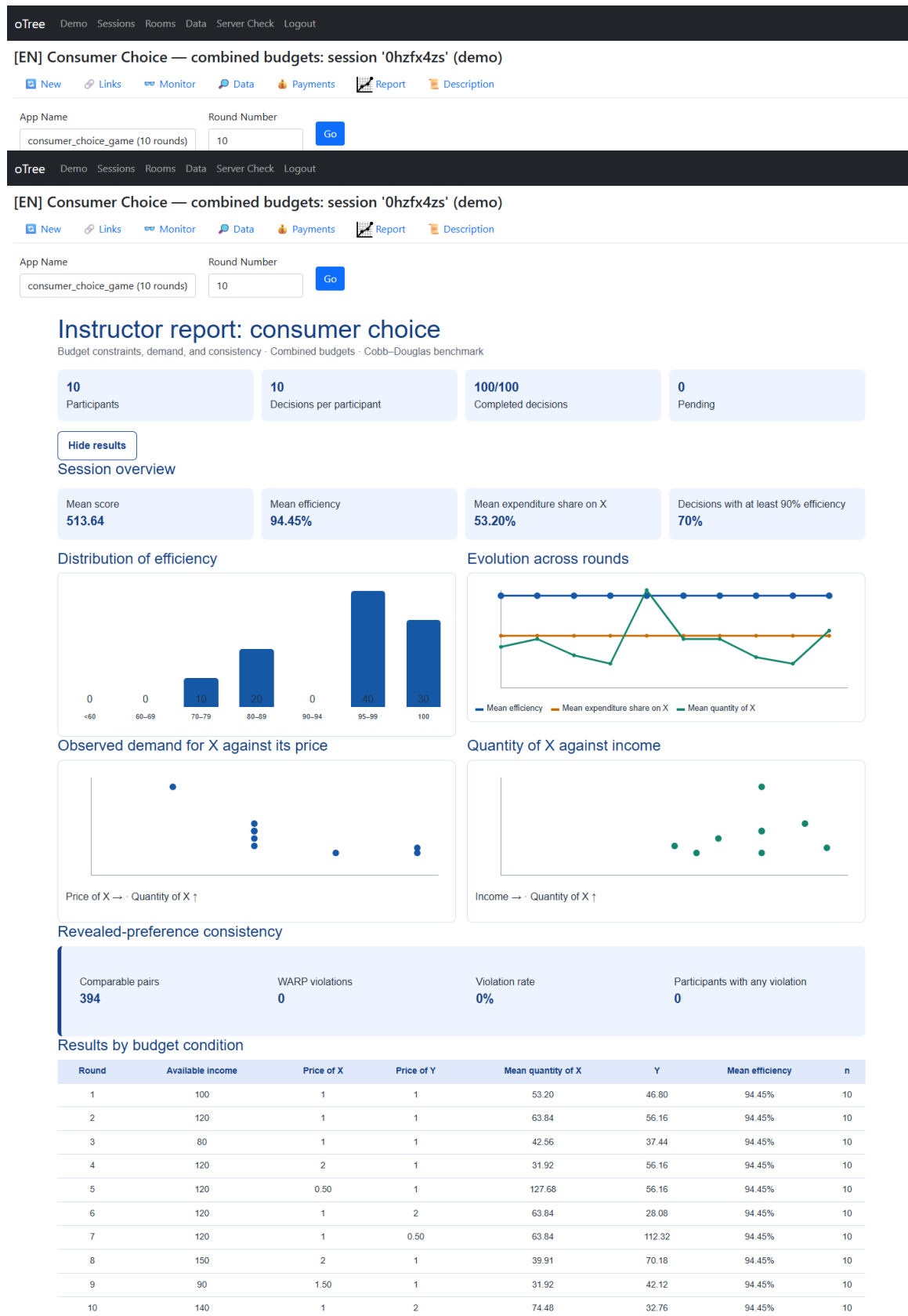


Figure 8.3: Complete report with graphs and round table. Continuation 2/2.

8.3 Evolution, demand, and Engel plots

The evolution graph overlays mean efficiency, X share, and X quantity. Efficiency and share use a 0–100 scale; quantity is visually normalized to its own maximum, so compare direction rather than height across colors. The table preserves actual units. A price sequence should lower X, an income sequence should raise it, and the preference treatment should shift the share.

The demand scatter places X price horizontally and quantity vertically. The Engel scatter uses income and X. They are round means, not fitted regressions. Under combined budgets, other variables move and the points do not identify a *ceteris paribus* curve. Select the correct mode for a simple causal interpretation.

8.4 Revealed-preference consistency

The WARP block reports comparable pairs and violations. Its denominator is not all possible pairs when neither alternative was affordable under the other budget. “Participants with any violation” counts people, whereas “violations” counts pairs. The rate uses comparable pairs.

Under the preference shift, the report states that cross-phase comparisons are invalid. Under income and price sequences with stable α , WARP is meaningful, but the app already assigns a known utility function: violations measure departures from the task rather than discovering unknown tastes. Research use would need a prespecified tolerance and rounding rule.

8.5 Round table

The table displays round, income, prices, mean quantities, efficiency, and n . It anchors interpretation when plots lack detailed axis labels. Ask students to select two rows, calculate intercepts and demand, and then compare with the mean. If n changes, explain the missing observations first.

Feedback script

A robust order is: verify completion; name the variable that changed; describe quantities; compare the X share with α ; assess efficiency; inspect dispersion; interpret WARP; and close with one limitation. This order separates facts, theory, and scope.

Revealed preference and experimental evidence

9.1 From Samuelson to Afriat

[Samuelson \(1938\)](#) develops choice theory from observed behavior without relying on introspective utility. Weak revealed preference links a selected bundle to alternatives that were affordable. [Houthakker \(1950\)](#) strengthens the approach and clarifies conditions for consistency with a utility representation.

[Afriat \(1967\)](#) shows that a finite set of choices satisfies GARP if and only if it can be rationalized by a well-behaved utility function under the theorem's conditions. The result is constructive: Afriat inequalities recover utility numbers and multipliers. [Varian \(1982\)](#) makes this logic a nonparametric approach to demand analysis.

The platform's WARP treatment is an introduction rather than a full Afriat implementation. It uses pairwise comparisons and tolerance. Advanced courses can use the export to build an affordability matrix, calculate transitive closure, and find a critical efficiency index. Ask how much budgets must be contracted to remove violations.

9.2 Consumer choice in the laboratory

[Sippel \(1997\)](#) studies choices from budgets involving actual consumer goods and reports violations for a substantial share of participants. The design reminds us that a demanding test requires multiple budgets, incentives, and goods that matter to subjects. Our teaching activity assigns points and prioritizes comprehension, so its violation rate should not be compared directly with that study.

[Mattei \(2000\)](#) examines large-scale real tests of consumer behavior. [Harbaugh et al. \(2001\)](#) apply GARP to children and adults and study development of consistency. These papers motivate questions about learning, complexity, and noise. A class can compare early and late rounds, but a fixed sequence confounds experience with order.

Graphical budget tasks also study heterogeneity and consistency under risk, including [Choi et al. \(2007\)](#). There the axes represent state-contingent payments rather than ordinary goods. Visual similarity does not imply the same economic interpretation. This distinction helps connect consumer theory to choice under uncertainty.

9.3 What a class can support

Expenditure shares near the prediction are consistent with understanding of Cobb–Douglas. Lower X at higher p_X is compatible with the demand prediction. Improving efficiency suggests learning. None of these statements identifies a stable population trait without prespecified sampling, incentives, assignment, and analysis.

Order, rounding, practice, feedback, and task demand can shape choices. Use conditional language: “in this session,” “under the assigned score,” and “the pattern is compatible with.” Such precision strengthens the lesson by teaching how models meet evidence.

Feedback script

10.1 Stage one: describe without theory

Ask students to write three facts from the histogram and graphs. A valid statement names a variable, direction, and denominator. Delay explanations. Then consult the table and identify what changed. If two rounds share a price but not income, they do not isolate a price effect. This stage trains disciplined reading.

10.2 Stage two: derive the benchmark

Write

$$\mathcal{L} = 10X^\alpha Y^{1-\alpha} + \lambda(m - p_X X - p_Y Y).$$

Divide first-order conditions to obtain MRS equal to the price ratio and derive demands. Calculate one live row and compare the observed share with α . Convert a score gap into efficiency before discussing its size.

An alternative maximizes $\ln U = \ln 10 + \alpha \ln X + (1 - \alpha) \ln Y$. The conditions equalize marginal utility per ECU. This route is convenient in calculus-based courses and shows why the factor 10 disappears.

10.3 Stage three: generate mechanisms

Require two explanations for each deviation. One may be calculation error and another focal values. A response of X to p_Y may reflect a general intuition about substitutes even though Cobb–Douglas predicts zero. A choice at a rationing cap reflects a constraint, not proof of intense preference.

Classify mechanisms as comprehension, attention, learning, rounding, or induced change. Ask what evidence would distinguish them. Comprehension attempts, trajectory, response time, and independent treatment assignment answer different questions. Do not invent motives from one choice.

10.4 Stage four: welfare and policy

For the tax, separate utility loss, revenue, and use of revenue. For the transfer, separate individual demand from general equilibrium. For rationing, compare feasible sets. For compensation, ask what “keeping the consumer whole” means. These questions connect consumer theory to policy.

Feedback script

Suggested closing: “The budget constraint tells us what can be chosen; the induced preference orders those options; demand describes the solution as parameters change; and the report shows how close our choices were to that benchmark. A deviation starts a question; it is not a label for a person.”

10.5 Course-specific sequences

10.6 Principles

Use one decision and the X-price sequence. Avoid the full derivation. Teach intercepts, monetary opportunity cost, and the law of demand. Ask why the line rotates. A follow-up assignment can calculate the 50-percent spending rule under unequal prices.

10.7 Intermediate microeconomics

Combine income, X price, Hicks, and Slutsky. Derive Marshallian and Hicksian demands and the indirect utility or expenditure function. Compare compensated series. Add WARP and have students reproduce the affordability matrix from exported data.

10.8 Public economics

Use transfer, tax, and rationing. Request predictions about quantity, revenue, and utility. Discuss compensating variation. State that the mechanism omits supply, avoidance, and redistribution. A useful extension rebates tax revenue as a lump sum and compares it with a quantity cap that produces the same X.

10.9 Methods and econometrics

Use the sequences to discuss panel data, observation units, and order effects. Regress $\ln X$ on $\ln p_X$ in the own-price mode, treating zeros carefully. The benchmark coefficient is minus one. Within-person errors are dependent; 300 rows do not create 300 subjects.

For income, estimate elasticity and compare with one. Add round controls to explore learning. The parameters are assigned and the activity is not designed for population inference. Its advantage is that the theoretical truth is known and estimator behavior can be inspected.

Data, assessment, and practice

11.1 Data structure

Each participant-round row contains income, base price, tax, final X price, Y price, α , cap, X, Y, expenditures, score, benchmark, and efficiency. Session fields identify language, edition, mode, and treatment. Anonymous code links rounds. Preserve session ID when merging exports.

Demand analysis uses the final price. Revenue is tax times X. Under rationing, test whether the cap binds by comparing it with unconstrained demand. Under preference shift, define a post-six indicator. Document missing and incomplete choices before analysis.

11.2 Formative assessment

A ten-point rubric can assign two points each to the budget, benchmark, comparative prediction, report reading, and limitation. Do not grade the choice by proximity to the optimum; that encourages copying and penalizes exploration. Grade the explanation after the activity.

Useful short questions include: what stays fixed; what is a shift versus a movement; why equal spending does not imply equal quantities; and what denominator appears in the WARP rate. Each diagnoses a distinct misconception.

11.3 Comparing classes

If two sections use different treatments, differences need not be treatment effects. Time, major, prior teaching, and class size can vary. Causal comparison needs simultaneous assignment or a planned design. For teaching, report distributions and context and avoid significance tests with few independent people.

Research use requires an ethical protocol, data-security plan, and analysis plan. The activity is a starting mechanism, not a substitute for those steps. Do not select a hypothesis after viewing the same outcomes that will be used to test it.

11.4 Privacy

Project aggregates. Do not ask who selected an extreme bundle. Do not publish participant codes. Store exports in an authorized location. At closure, state what will be retained and why. Delete unnecessary copies according to laboratory policy.

Troubleshooting

12.1 A participant sees “Please wait”

Confirm that the session was created and that the link belongs to the active database. This individual task has no matching wait page. A persistent message usually means incomplete session creation, a stopped server, or an old link. Check Monitor and create a new session if the database changed.

12.2 Room Not Found

Use one of the four exact room names; underscores matter. Verify `GAME_FAMILY=consumerchoice`. Locally, use the family script and wait for the ready message. A participant URL is not a room URL.

12.3 Report does not enable reveal

Inspect pending decisions. In ten rounds, everyone must confirm the final result and reach closure. Reopen a closed tab with the same link. If the class continues without someone, document the exclusion rather than presenting the original denominator as complete.

12.4 The benchmark seems wrong

Check final price, α , and constraints. Tax changes final p_X . A binding cap changes the constrained optimum. Hicks and Slutsky change income. Recalculate shares using displayed parameters. Preserve configuration, round, and screenshot if a discrepancy remains.

12.5 Another game appears

Stop the session. The hostname must map to a separate instance and database. Hiding links in a template is insufficient because Sessions and Data also require isolation. In production, inspect process, `GAME_FAMILY`, `DATABASE_URL`, and proxy routing. Locally, use port 8056 and the database under `.local_state/consumerchoice`.

Exercises with solutions

13.1 Budget and benchmark

Exercise 1. With $m = 180$, $p_X = 3$, $p_Y = 2$, and $\alpha = 0.4$, calculate intercepts, slope, and benchmark. **Solution.** Intercepts are 60 and 90 and slope is $-3/2$. Spending on X is 72 and on Y is 108, yielding $X^* = 24$ and $Y^* = 54$.

Exercise 2. A student chooses $X = 30$. Find Y. **Solution.** X costs 90, leaving 90 for 45 units of Y. The bundle is feasible and exhausts income. Its efficiency compares its score with $(24, 54)$.

13.2 Demand and elasticity

Exercise 3. With $m = 120$ and $\alpha = 0.5$, p_X rises from one to two. **Solution.** X falls from 60 to 30; Y remains 60 if $p_Y = 1$. Point elasticity is minus one. A midpoint arc elasticity differs for this large change.

Exercise 4. p_Y doubles with other variables fixed. **Solution.** X stays at 60 and Y falls from 60 to 30. X's Marshallian cross elasticity is zero, but the goods remain jointly valued.

13.3 Compensation

Exercise 5. Starting from $(50, 50)$ at unit prices, p_X rises to two. Find Slutsky income. **Solution.** The old bundle costs 150, so compensation is 50. The new benchmark is $(37.5, 75)$.

Exercise 6. Compare Hicks. **Solution.** Hicks income is $100\sqrt{2} \approx 141.42$, producing approximately $(35.36, 70.71)$ and preserving initial utility. Hicks compensation is smaller here.

13.4 Tax and rationing

Exercise 7. With $m = 120$, base X price one, tax 0.5, and $p_Y = 1$, find demand and revenue. **Solution.** Final X price is 1.5, so $X^* = 40$, $Y^* = 60$, and revenue is 20 ECU. The model does not specify how revenue is used.

Exercise 8. With $m = 100$, unit prices, and $\bar{X} = 20$, find the constrained optimum. **Solution.** Unconstrained demand is 50, so the cap binds and the benchmark is $(20, 80)$. MRS need not equal prices at the quantity constraint.

13.5 Revealed preference

Exercise 9. Bundle a is chosen when b is strictly affordable; later b is chosen when a is affordable.

Solution. The pair violates WARP when at least one affordability relation is strict. The two choices cannot be generated by one stable complete preference that maximizes on both budgets.

Exercise 10. Does zero WARP violations prove Cobb–Douglas? **Solution.** No. Many preferences rationalize consistent choices. WARP checks part of consistency; Cobb–Douglas adds expenditure-share and comparative-static restrictions.

13.6 Reflection prompts

1. Why does the platform compute Y instead of asking for both quantities? Discuss monotonicity and error reduction.
2. What changes with indivisible goods? Tangency may fail and the optimum can be a corner or nearest feasible point.
3. How could tax revenue be returned without changing marginal incentives? Use a lump-sum transfer while keeping the price wedge.
4. Why is WARP invalid across the change in α ? The maintained hypothesis of stable preferences fails.
5. What evidence separates error from indifference? Nearby repetitions, response time, incentives, and a prespecified tolerance.

Implementation checklist

14.1 Before class

Confirm hostname, four rooms, and counts; rehearse the chosen configuration; complete one participant link through closure; open Monitor and Report; prepare QR and backup plan; define the prediction prompt; verify that slides match parameters; and decide what data will be retained.

14.2 During class

Enforce silence and comprehension; do not reveal the benchmark; monitor pending links; record incidents; request a prediction before reveal; state denominators; compare model and data; protect anonymity; and reserve time for limitations.

14.3 After class

Export only if needed; document session and treatment; store data in an authorized location; record common questions; avoid person-level labels; close administrative tabs; and report any software issue with configuration, round, and screenshot.

Glossary

Bundle: quantities of X and Y. **ECU:** experimental unit of account. **Efficiency:** observed score divided by induced maximum. **Engel curve:** relation between income and demand. **GARP:** Generalized Axiom of Revealed Preference. **Hicksian demand:** least-cost bundle for a utility target. **Marshallian demand:** optimal bundle at prices and income. **MRS:** marginal willingness to substitute Y for X. **Rationing:** direct quantity limit. **WARP:** Weak Axiom of Revealed Preference.

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