



Teacher guide for the reverse reference-price auction game

Lab implementation, theoretical background,
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 lets you prepare, run and discuss the **reverse reference-price auction** game developed for the Behavioral and Experimental Economics Research Lab (BEER Lab) at the Department of Economics, Tecnológico de Monterrey. It is written for instructors of intermediate microeconomics, environmental economics and public economics, with or without prior experience in experimental economics.

The game is a teaching adaptation of Charles Holt’s classroom version (the Veconlab “Reference Price Auctions” program): a computer with a fixed budget buys large and small items from the class and ranks offers by *offer / reference price*. It follows that version’s mechanics; the parameters were set by the game’s maintainer, and the wording of the screens and of this guide is our own.

The **quick-start chapter** gets a session running. The operational chapters explain every screen. The conceptual chapters give the theoretical background and the literature needed to interpret results. Shared rules are explained once; each format and variant lists only what changes relative to the basic game.

Author

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For the instructor

This guide matches the English interface. A separate Spanish version exists. Screenshots in this guide were taken on a local instance of the game with simulated decisions; the numbers shown illustrate the interface and are *not* results from a real class. Project only aggregate results: never link participant codes to names, student IDs, seats or individual decisions.

This game is still being prepared for the lab server. The access steps in Chapter 2 and the screen sequence in Chapter 3 are already final (tested on an identical copy of the game); only the screenshots of YOUR game’s card, login and rooms on teaching-admin.beer-lab.org and teaching.beer-lab.org are still missing — this guide will add them once the game goes live on those sites.

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Quick-start guide

1.1 Fact sheet

Purpose	Show how an agency with a fixed budget (in the field, a payment-for-conservation program) buys “benefit” from sellers: why offers should be ranked by cost per unit of benefit (offer / reference price), why sellers ask for more than their value when they are paid their own offer, and what changes with a uniform cutoff ratio.
Participants	Any number. Fixed auctions of 6, formed at random in round 1; leftover people join the first auctions (31 → one of 7 and four of 6). With fewer than 6, one smaller auction.
Items	Each round, each person has a large item (reference price 100) and a small one (reference 40). Its value (what the person earns by not selling it) is the reference $\times$ a whole-number percentage drawn between 40 and 100: 40–100 ECU for the large item, 16–40 ECU for the small one. New every round; only the owner sees it.
Decision	One whole-number offer per item: 0 = not offered; otherwise 1 to 200 (large) or 1 to 80 (small).
Buyer	The computer, with a budget of 56 ECU per person in the auction (336 with 6; 392 with 7). It ranks offers by offer/reference ratio, lowest first.
Payment	Basic: each seller is paid their offer (discriminatory) or everyone bought is paid reference $\times$ the cutoff ratio (uniform). An unsold item yields its value.
Duration	5–10 minutes for one round; 20–25 minutes for 8 rounds, not counting discussion.
Instructor (you)	teaching-admin.beer-lab.org/en → the game’s card → Open panel . Asks for username and password (section 2.1).
Students	Room link https://referenceauction.beer-lab.org/room/reference_auction_en , its QR code (section 2.5) or teaching.beer-lab.org .
Report	Cost-effective benchmark (the most benefit the budget could buy), efficiency, budget used, share of large items, payment per 100 of benefit, offer/value by size, round-by-round charts, histogram, the “same offers, other rule” table, first versus last rounds, and tables by auction and by round.

Note

There are two different pages. **teaching-admin.beer-lab.org** is yours: from there you enter the game’s panel and download this guide. **teaching.beer-lab.org** is your students’: from there one can only *play*, not create sessions.

1.2 Minimal sequence

Before class

1. Request panel access from lab.economia@servicios.tec.mx, stating the game, course, num-

ber of students and date. You will receive the password for the **admin** user.

2. Open teaching-admin.beer-lab.org/en, find **Reference-price auction** and click **Open panel**. Enter username and password.
3. Rehearse in **Demo**: open a configuration and play it in several tabs to see the screens and the report (section 2.3).

In class

4. Count the students present.
5. In the panel, open **Rooms** and the room **[EN] Reverse Reference-Price Auction** (or the extended one). Choose the configuration (usually the 8-round discriminatory one), type the *exact* number of students under **Number of participants** and click **Create**.
6. Share the room link or project its QR code. Each student clicks **Start**.
7. In the room, click **Monitor the session**: the session page opens, with the **Monitor** (progress) and **Report** tabs. When done, open **Report**, click **Show results** and lead the discussion.

After class

8. In the room, click **Close this room**. It is then ready for the next group; the session's data stay under **Sessions**.

1.3 Checklist

- ☐ Panel password received and tested at referenceauction.beer-lab.org/login.
- ☐ Rehearsal done in **Demo**, with at least one full round and the report.
- ☐ Devices, internet, browser and projector ready.
- ☐ Configuration chosen: discriminatory (one round or 8), uniform (8) or an extended one.
- ☐ Number of participants equal to the number of students present.
- ☐ Room link or QR code at hand (section 2.5); tested from a phone.
- ☐ Students told that ECU are experimental units and there is no cash payment.
- ☐ Monitor and report open; the large/small comparison by ratio (section 5.1) ready for the wrap-up.

Platform access

2.1 Your access: teaching-admin and the game's panel

The instructor page is teaching-admin.beer-lab.org/en. It does not appear in the beer-lab.org menu: type the address directly or bookmark it. It lists every classroom game in the lab; you can search by title, topic or JEL code.

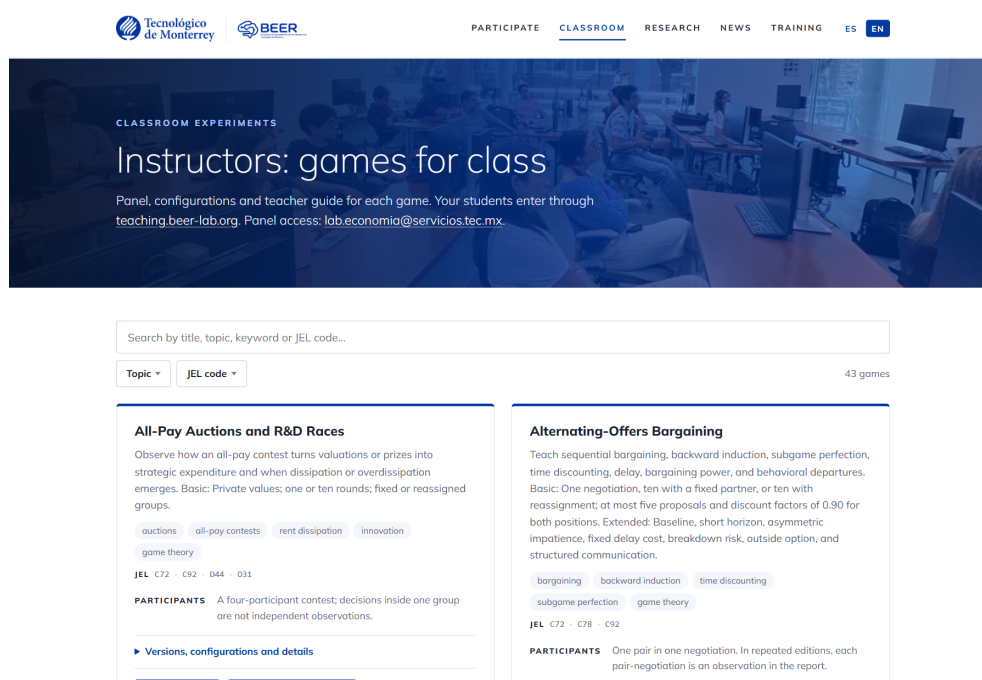


Figure 2.1: Instructor page: teaching-admin.beer-lab.org. Once this game goes live, its card will appear in this same directory (search for **Reference-price auction**).

Each game has a card with its description, number of participants and duration, and two buttons: **Open panel**, which goes to the game's panel, and **Teacher guide (PDF)**, which downloads this guide. Expanding **Versions, configurations and details** lists the rooms, each with its own **open panel** straight to that room's session-creation form. The game's panel (<https://referenceauction.beer-lab.org>) is protected: **Open panel** shows the **Admin Login** screen, where you type **admin** under **Username** and the password the lab gave you under **Password**. If you do not have it, request it at lab.economia@servicios.tec.mx.

Note

This game does not yet have its own card in the directory or an active panel at referenceauction.beer-lab.org: it is still being prepared. The procedure above is identical to every other lab game's (see the Cournot, Bertrand and live market guides); once it goes live, this section will be updated with screenshots specific to **Reference-price auction**.

2.2 The panel: minimal vocabulary

The panel is oTree's own and is in English. These are the only terms you need:

Demo	Practice sessions. Creates a session with fictitious participants that you play yourself across several tabs. Use it to rehearse, never with students.
Rooms	Fixed addresses for class. This game has four: basic and extended, in Spanish and English. Students always enter through a room.
Create / Number of participants	Create the session in the room and declare how many people will play.
Monitor	A table with each participant's round and screen. It does not show decisions.
Advance slowest participants	The Monitor button that moves along whoever has fallen behind (see section 9.2).
Report	The instructor report for projecting aggregate results.
Data	Downloads the data as CSV (and, in the chat variant, the messages).
Sessions	A list of all your sessions, to return to an earlier one.
Close this room	Frees the room when done, for the next group.

In this panel, **Demo** shows only this game's ten configurations and **Rooms** only its four rooms. Inside each room, the session-creation form filters further: the basic English room (**[EN] Reverse Reference-Price Auction**) only offers the three basic English configurations (discriminatory one round, discriminatory 8 rounds and uniform 8 rounds); the extended English room only offers the two extended ones (no reference prices, and with chat). If a different game appears, do not start the session and notify the lab.

oTree Demo Sessions Rooms Data Server Check

Demo

[ES] Subasta inversa con referencias — cada quien cobra su oferta (discriminatoria), una ronda
[ES] Subasta inversa con referencias — cada quien cobra su oferta (discriminatoria), 8 rondas
[ES] Subasta inversa con referencias — razón de corte uniforme, 8 rondas
[EN] Reverse reference-price auction — pay as offered (discriminatory), one round
[EN] Reverse reference-price auction — pay as offered (discriminatory), 8 rounds
[EN] Reverse reference-price auction — uniform cutoff ratio, 8 rounds
[ES] Subasta inversa extendido — orden por monto ofrecido (sin referencias), 8 rondas
[ES] Subasta inversa extendido — discriminatoria con chat, 8 rondas
[EN] Reverse auction extended — ranked by amount offered (no reference prices), 8 rounds
[EN] Reverse auction extended — discriminatory with chat, 8 rounds

Juegos de mercados / Market games — BEER Lab
 Subasta inversa con precios de referencia / Reverse reference-price auction

Figure 2.2: Demo: the game's configurations (six basic and four extended, in Spanish and English).

oTree Demo Sessions Rooms Data Server Check

Rooms

Current rooms:

[ES] Subasta inversa con precios de referencia
[EN] Reverse Reference-Price Auction
[ES] Subasta inversa con precios de referencia — extendido
[EN] Reverse Reference-Price Auction — extended

Figure 2.3: Rooms: the game's four rooms.

2.3 Rehearsing before class

In **Demo**, click a configuration: a practice session with six participants (one auction) is created and the links page appears. Open each **P1**, **P2**, ... link in a separate tab and play as if you were each student; then open **Report**. A round is resolved once all six have sent their offers. These sessions do not affect your classes.

oTree Demo Sessions Rooms Data Server Check

[EN] Reverse reference-price auction — pay as offered (discriminatory), 8 rounds: session 'yc15n5ec'

Edit Links Monitor Data Payments Report Description

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

Session-wide link

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

<http://localhost:8047/join/musikihi>

Persistent links

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

Single-use links

Below are single-use links.

P1	http://localhost:8047/InitializeParticipant/inr6cxc0
P2	http://localhost:8047/InitializeParticipant/9g8bxdmg
P3	http://localhost:8047/InitializeParticipant/syoimz1a
P4	http://localhost:8047/InitializeParticipant/wd3m6d8e
P5	http://localhost:8047/InitializeParticipant/oxsdbvqr
P6	http://localhost:8047/InitializeParticipant/vgcrmm9
P7	http://localhost:8047/InitializeParticipant/i2dp48e6
P8	http://localhost:8047/InitializeParticipant/65z8sfog
P9	http://localhost:8047/InitializeParticipant/acepqjak
P10	http://localhost:8047/InitializeParticipant/f6qby75q
P11	http://localhost:8047/InitializeParticipant/ivvejq93
P12	http://localhost:8047/InitializeParticipant/cvfbp2uv

Figure 2.4: Links for a session. This guide's screenshots were taken on a local copy, which is why the addresses say `localhost`; on the lab server they show `referenceauction.beer-lab.org` instead.

Note

Do not rehearse with the room link open in several tabs of the same browser: oTree recognizes the browser, and every tab would count as the same person. Use **Demo** to rehearse instead.

oTree Demo Sessions Rooms Data Server Check

[EN] Reverse reference-price auction — pay as offered (discriminatory), 8 rounds: session 'yc15n5ec'

Edit Links Monitor Data Payments Report Description

ID	Code	Label	Progress	App	Round	PageName	Waiting	WaitsFor	Since
P1	inr6cxc0		35/72	reference_auction	4	RoundResult			1m
P2	9g8bxdmg		35/72	reference_auction	4	RoundResult			1m
P3	syoimz1a		35/72	reference_auction	4	RoundResult			1m
P4	wd3m6d8e		35/72	reference_auction	4	RoundResult			1m
P5	oxsdbvqr		35/72	reference_auction	4	RoundResult			1m
P6	vgcrmm9		35/72	reference_auction	4	RoundResult			1m
P7	i2dp48e6		35/72	reference_auction	4	RoundResult			1m
P8	65z8sfog		35/72	reference_auction	4	RoundResult			1m
P9	acepqjak		35/72	reference_auction	4	RoundResult			1m
P10	f6qby75q		35/72	reference_auction	4	RoundResult			1m
P11	ivvejq93		35/72	reference_auction	4	RoundResult			1m
P12	cvfbp2uv		35/72	reference_auction	4	RoundResult			1m

Figure 2.5: Monitor of a session in progress: each participant's round and screen.

2.4 Creating the session in class

Under **Rooms**, open the room for the language you will use. The form offers only that room's configurations. Choose the configuration, type the number of students present under **Number of participants** and click **Create**.

The screenshot shows the oTree web interface. At the top is a dark navigation bar with links: oTree, Demo, Sessions, Rooms, Data, and Server Check. Below this, the page title is "Room: [EN] Reverse Reference-Price Auction". Underneath is the heading "Create a new session". A light blue box contains the text: "English room. Only the configurations of this game, language and edition are shown below." Below this box, there is a "Session Config" section with a dropdown menu showing "[EN] Reverse reference-price auction — pay as offered (discriminatory), one round". Underneath the dropdown is a "Number of participants" input field, which is currently empty. Below the input field, it says "Must be a multiple of 1". At the bottom of this section is a blue "Create" button. Below the "Create" button is a link "Configure session" with a gear icon. At the very bottom, it says "App sequence".

Figure 2.6: Form for the basic English room: only its own three configurations appear.

Note

Declare the exact number, with no spare seats. Auctions are formed at random when the session is created, and each round of an auction is resolved only when all its members have sent offers. If one more student than declared arrives, they will see a “session is full” message (currently shown in Spanish, “La sesión está llena”, on English rooms too); in that case, before starting, click **Close this room**, create another session with the correct number, and ask the class to reopen the link or the QR code. If you declare more people than actually join, the auction with empty seats never finishes its first round.

2.5 How your students join

Students need no account and nothing to install; a phone or computer browser is enough. They have three paths, all leading to the same room:

1. **QR code.** Project the one for the room you are using (below, and full-size in appendix A). They scan it with a phone camera.
2. **Room link.** Share it over the class chat or on Canvas: https://referenceauction.beer-lab.org/room/reference_auction_en.
3. **Catalogue.** At teaching.beer-lab.org they search for **Reference-price auction** and click their language's button (once the game is live).



English, basic

`referenceauction.beer-lab.org/room/reference_auction_en`



English, extended

`referenceauction.beer-lab.org/room/reference_auction_extended`



Español, básica

`referenceauction.beer-lab.org/room/reference_auction_es`



Español, extendida

`referenceauction.beer-lab.org/room/reference_auction_extendido`

What the participant sees

The student opens the room and clicks **Start**. If you have not created the session yet, they see a waiting page and join as soon as you do; so you can share the link or QR code from the start of class. No email or password is needed: they receive an anonymous code.

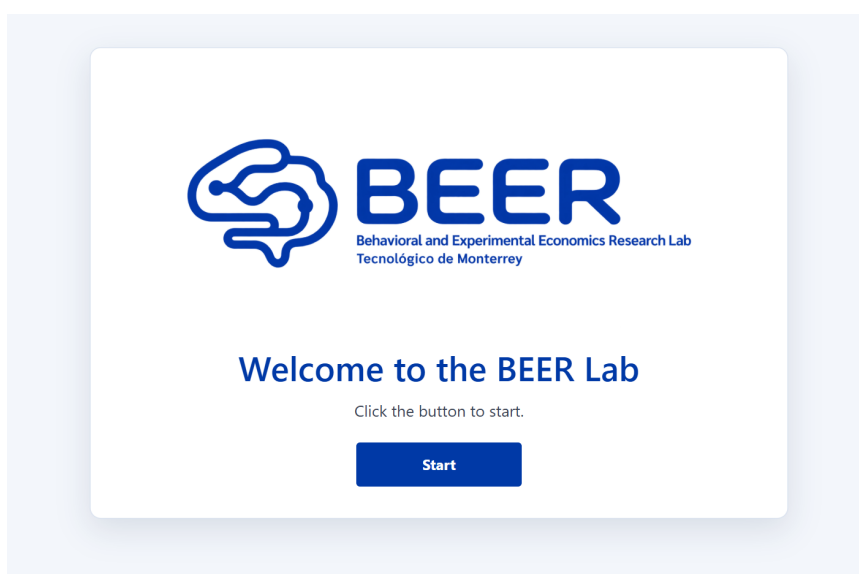


Figure 2.7: Room the student opens.

Language is set per room: a session created in the English room only admits students entering through the English room. If your group is mixed, pick one language for everyone.

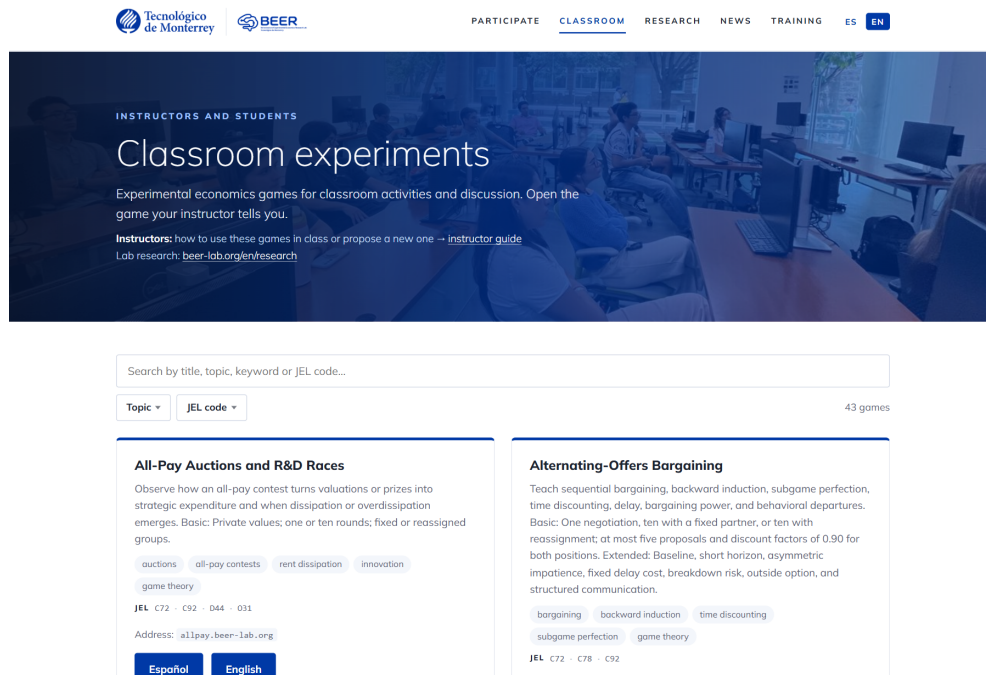


Figure 2.8: Catalogue at teaching.beer-lab.org, the students' page. Once this game goes live, its card will appear here (search for **Reference-price auction**).

The basic game and its screens

3.1 Rules, incentives and benchmarks

Auctions and budget. When the session is created, the class is split at random into fixed auctions of 6, kept for every round. If the class does not divide evenly by 6, leftover people join the first auctions one by one (31 $\rightarrow$ one of 7 and four of 6; 35 $\rightarrow$ five of 7). With fewer than 6 participants a single smaller auction is formed (even of one person). In each auction the computer buys, with a budget equal to 40 % of the auction's total reference value: $0.4 \times 140 = 56$ ECU per person, i.e. 336 ECU with 6 people and 392 with 7. The instructions tell each person the actual size of their auction and its budget.

Items and values. Each round, each person has two items: a large one, with reference price $R = 100$, and a small one, with $R = 40$. Reference prices are public (in the field, they summarize the environmental benefit of a tract of land). Each item also has a private *value* $v = R \times r/100$, with r a whole number drawn uniformly between 40 and 100, independently for each item and anew every round: 40–100 ECU for the large item and 16–40 ECU for the small one (rounded to a whole number). It is what the person earns by not selling the item.

Offers and ranking. Each person writes, without seeing the others, a whole-number offer b for each item: 0 means not offering it; otherwise between 1 and $2R$. The computer computes the **ratio** b/R of every positive offer and builds one list with all the auction's offers, of both sizes, from the lowest ratio to the highest (ties at random).

Purchase and payment (discriminatory). The computer goes down the list and buys each item, paying exactly its offer, as long as the offer fits in what is left of the budget; *it stops at the first offer that does not fit*, even if a later, cheaper one would. It is a simple, explainable rule, and the instructions state it as such.

$$\pi = \sum_{\text{items}} \begin{cases} b & \text{if sold} \\ v & \text{if not sold (or not offered)} \end{cases}$$

Selling pays only if the payment exceeds the value. Offering below value is allowed (and then selling loses compared with keeping the item).

For the instructor

Before playing, ask the class: if an agency has a fixed budget and wants to buy as much environmental benefit as possible, should it buy the cheapest tracts first? The question sets up the discussion of why offers are ranked by *cost per unit of benefit* rather than by amount. Skip it if you will later run the no-reference-price variant with the same group, because it gives away what that variant is meant to show.

3.2 Cover, instructions and comprehension check

The cover introduces the BEER Lab and the conduct rules. The instructions describe only the action: the auction's size and budget, the two items and their reference prices, how values are drawn, the earnings rule, how offers are ranked, the purchase and payment rule, and an example with numbers "for illustration only". They do not mention conservation, land, efficiency, markups or the format's name, and they suggest no offer.





Welcome to the BEER Lab

The **Behavioral and Experimental Economics Research Lab** of the Department of Economics at Tecnológico de Monterrey is a space for learning about economic decisions through controlled activities.

Today you will take part in an activity where you sell items. Your earnings depend on your decisions, on other people's decisions and partly on chance.

During the session

- Do not talk or communicate with other people.
- Make your decisions individually.
- Follow the on-screen instructions. Do not refresh or close this page.
- If you need help, raise your hand.

I have read and understood the lab rules.

☐ Yes ☐ No

[Start](#)

Powered by [oTree](#)

Figure 3.1: Cover and lab rules.

Instructions

Round 1 of 8

In each round, you and 5 other people sell items to the computer, which buys with a fixed budget of **336 ECU** per round in your auction. The same people are in your auction in every round.

Your items

In each round you have two items: a **large** one, with a reference price of 100 ECU, and a **small** one, with a reference price of 40 ECU. Everyone has one item of each size, and everyone knows these reference prices.

Each item also has a **value to you**: what you earn if you do not sell it and keep it. That value is a whole-number percentage of its reference price, between 40% and 100%, all equally likely; between 40 and 100 ECU for the large item and between 16 and 40 ECU for the small one (rounded to the nearest whole number). The two percentages are drawn separately and again every round. Only you know your values; other people's values are drawn the same way.

Your earnings in a round add up item by item: if an item is sold, you earn the payment you receive for it; if it is not sold, you keep it and earn its value. So selling pays only if the payment is greater than your value.

How items are sold

Each person writes, without seeing the others, an offer for each of their items: the amount in ECU for which they agree to sell it. It is a whole number between 1 and 200 for the large item and between 1 and 80 for the small one (up to twice its reference price). Write 0 if you do not want to offer that item.

The computer divides each offer by its item's reference price; we call that number the offer's **ratio** (for example, offering the large item at 75 gives a ratio of 0.75; offering the small one at 36 gives 0.90). It then makes a list of all offers in your auction, from everyone and of both sizes, from the lowest ratio to the highest. Ties are ordered at random.

Buying and payment: the computer goes down the list in that order. It buys each item and pays exactly its offer, as long as the offer fits in what is left of the budget. As soon as an offer does not fit, it stops buying: that offer and all the ones after it on the list are not sold.

Example (numbers for illustration only): your large item is worth 63 to you and you offer it at 75 (ratio 0.75); the small one is worth 27 and you offer it at 36 (ratio 0.90). If the large item is bought and the small one is not, you earn 75 for the large item (your offer) + 27 for the small one (your value) = 102 ECU.

- Auctions are formed with 6 people; when the class does not divide exactly, the remaining people join the first auctions. Each auction's budget is 56 ECU for each person in it (336 ECU with 6 people). If there are fewer than 6 participants, a single smaller auction is formed.
- There will be 8 rounds. Your earnings from all rounds are added up.
- Amounts are in ECU (experimental currency units). There is no payment in money.

Continue

Powered by [oTree](#)

Figure 3.2: Instructions in the discriminatory format (auction of 6, budget of 336 ECU).

The example uses a large item with value 63 offered at 75 (ratio 0.75) and a small one with value 27 offered at 36 (ratio 0.90): if the large one is bought and the small one is not, the person earns $75 + 27 = 102$ ECU. The check asks two questions with different numbers: a large item with value 58 offered at 70 and bought (earns 70) and a small item with value 22 offered at 35 and not bought (earns 22). After a mistake, the message restates the rule without giving the answer and lets the person retry. The numbers are fixed, do not come from anyone's draw and are no theoretical benchmark.




Before you start

Round 1 of 8

Answer based on the instructions. The numbers are for illustration only.

Your large item is worth 58 ECU to you. You offer it at 70 and the computer buys it. How much do you earn for that item?

☐ 12 ECU

☐ 58 ECU

☐ 70 ECU

☐ 128 ECU

Your small item is worth 22 ECU to you. You offer it at 35 and the computer does not buy it. How much do you earn for that item?

☐ 0 ECU

☐ 13 ECU

☐ 22 ECU

☐ 35 ECU

Check

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Figure 3.3: Comprehension check.




Before you start

Round 1 of 8

Answer based on the instructions. The numbers are for illustration only.

Your large item is worth 58 ECU to you. You offer it at 70 and the computer buys it. How much do you earn for that item?

☐ 12 ECU

☐ 58 ECU

☐ 70 ECU

☐ 128 ECU

Check: if an item is sold, you earn what you are paid for it, which is your offer.

Your small item is worth 22 ECU to you. You offer it at 35 and the computer does not buy it. How much do you earn for that item?

☐ 0 ECU

☐ 13 ECU

☐ 22 ECU

☐ 35 ECU

Check: if an item is not sold, you keep it and earn its value.

Check

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Figure 3.4: Wrong answers: the messages restate the rule without giving the answer.

3.3 Offers and waiting

The offers screen restates the computer's budget and the number of people in the auction, and shows a table with each item's reference price and value, with one field per offer. The browser does not let anyone send out-of-range or decimal numbers; the server checks again.

Your offers Round 1 of 8

The computer's budget in your auction: **336 ECU**. People in your auction: 6.

Item	Reference price	Your value	Your offer
Large	100	50	95
Small	40	38	74

Large: 0 or 1 to 200. Small: 0 or 1 to 80. 0 = not offered. If an item is not sold, you earn its value.

Send offers

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Figure 3.5: Offers screen (simulated decisions: large item with value 50 offered at 95, small item with value 38 offered at 74).

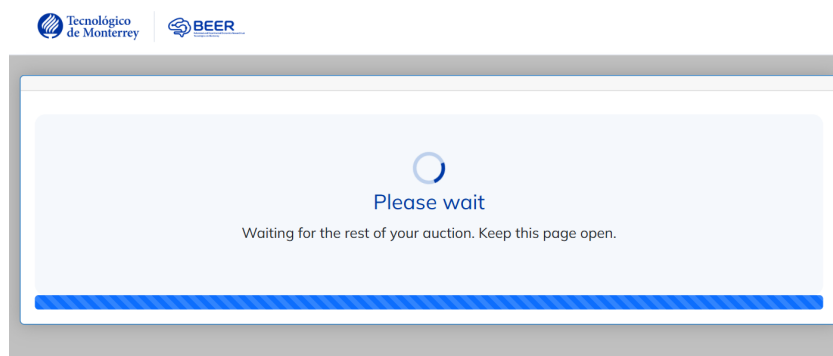


Figure 3.6: Waiting while other people in the auction have not yet sent offers.

What the participant sees

“Please wait” means other people in the same auction have not yet sent their offers. It is not an error. Participants should not close or refresh the page.

3.4 Result and wrap-up

The result shows, for each item, the value, the offer, the ratio, whether it was sold, the payment and the earnings; then the round's and the cumulative earnings, the budget used in the auction (ECU and %), how many items were bought out of those offered, and the list of ratios bought, in order. That list shows where the computer stopped without revealing who offered what.

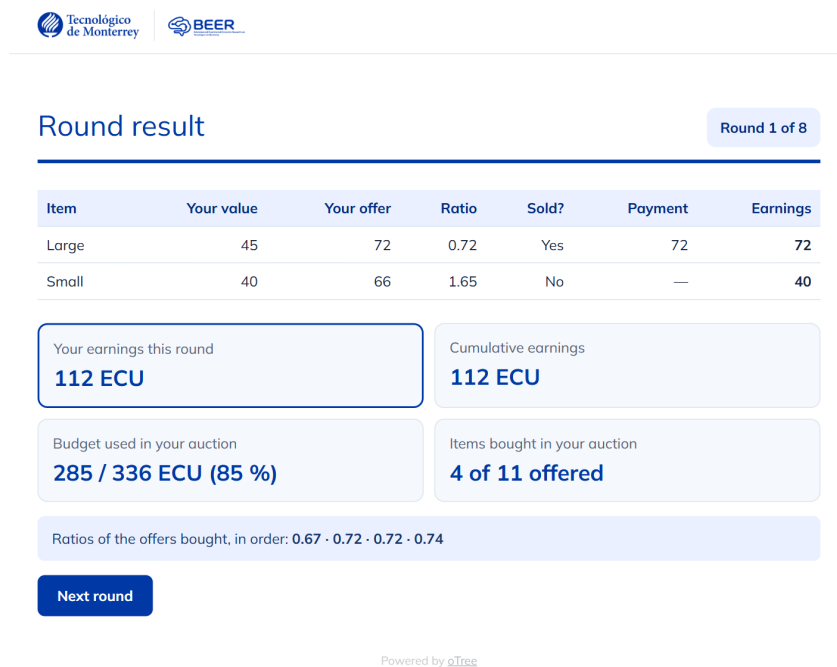


Figure 3.7: Result: the large item sold at its offer, and the small one, offered at a higher ratio, did not (simulated decisions).

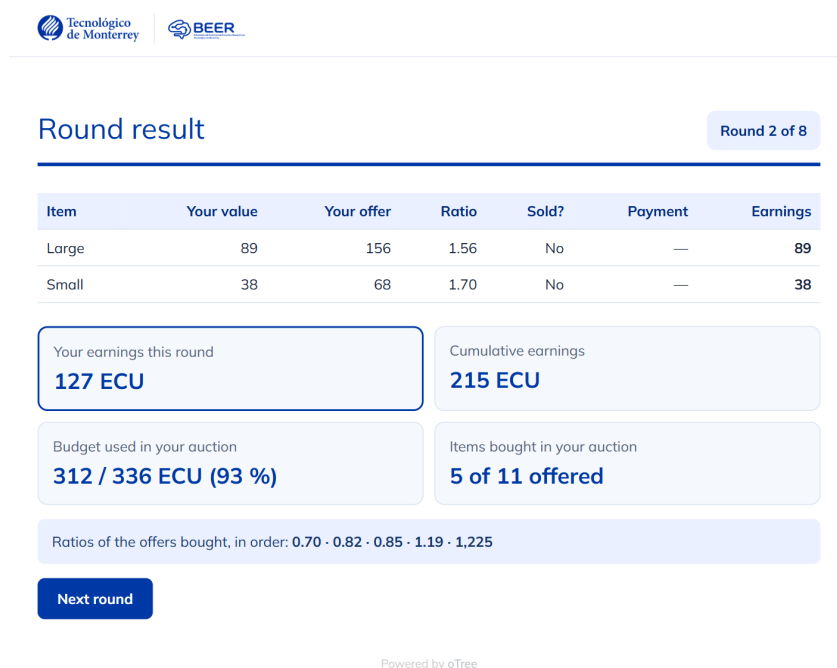


Figure 3.8: Result with no sale: both offers were beyond where the computer stopped, and the person earns both values (simulated decisions).

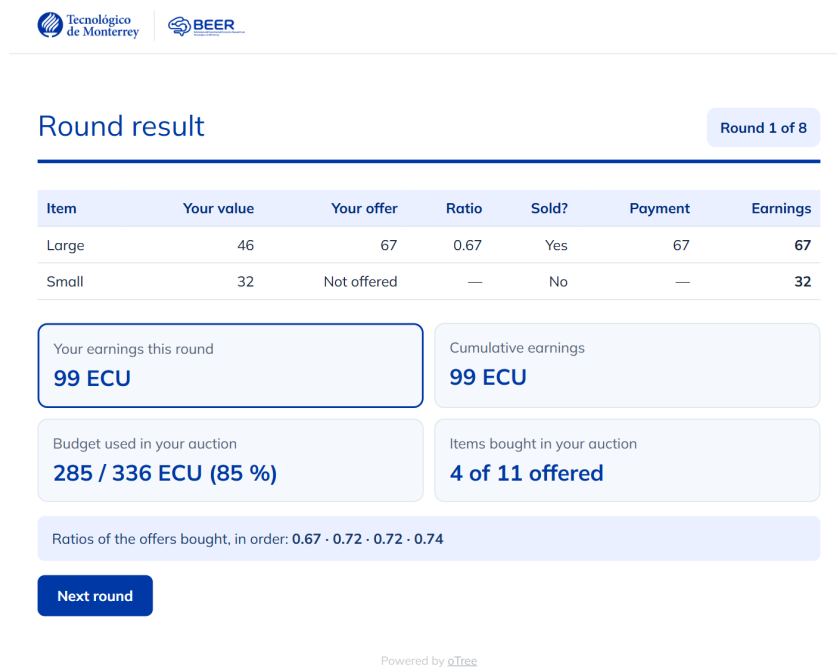


Figure 3.9: Result for someone who did not offer the small item (offer 0): they earn its value (simulated decisions).

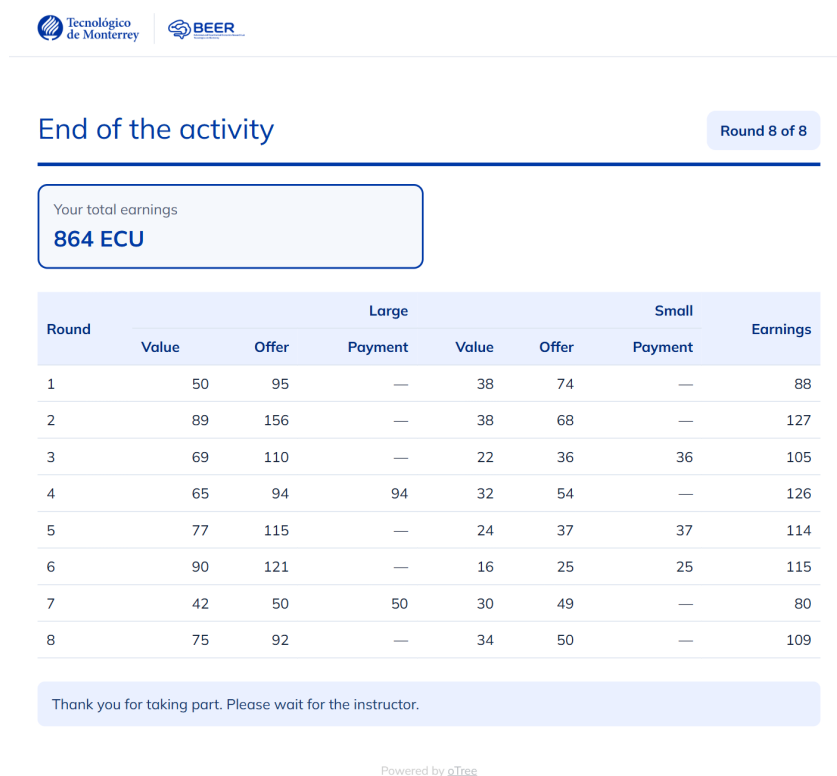


Figure 3.10: Wrap-up: total earnings, round history and a note to wait for the instructor (simulated decisions).

Instructor report and debrief

4.1 When to reveal

Report is a tab of the session page: reach it from the room via **Monitor the session**, or from **Sessions** once the session has ended. It opens with results hidden. At the top it shows participants, number and size of auctions, budget per auction and completed rounds, so you can project it from the start without giving anything away. Click **Show results** when the current round ends; **Refresh** adds new rounds and **Hide results** covers them again.

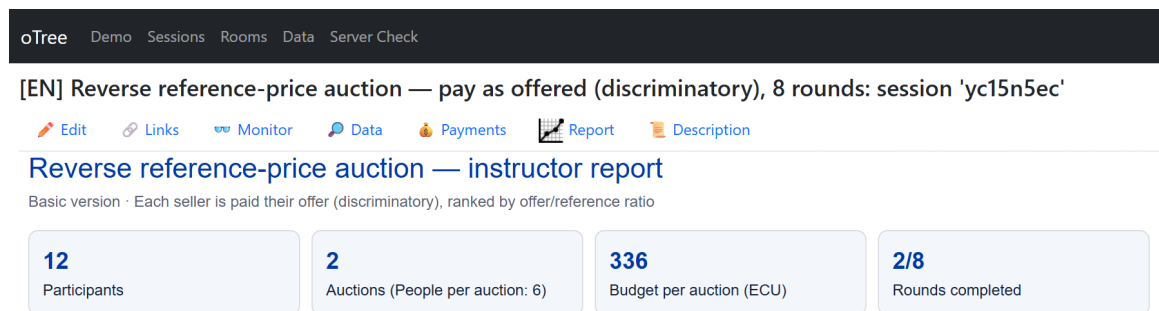


Figure 4.1: Report with results hidden.

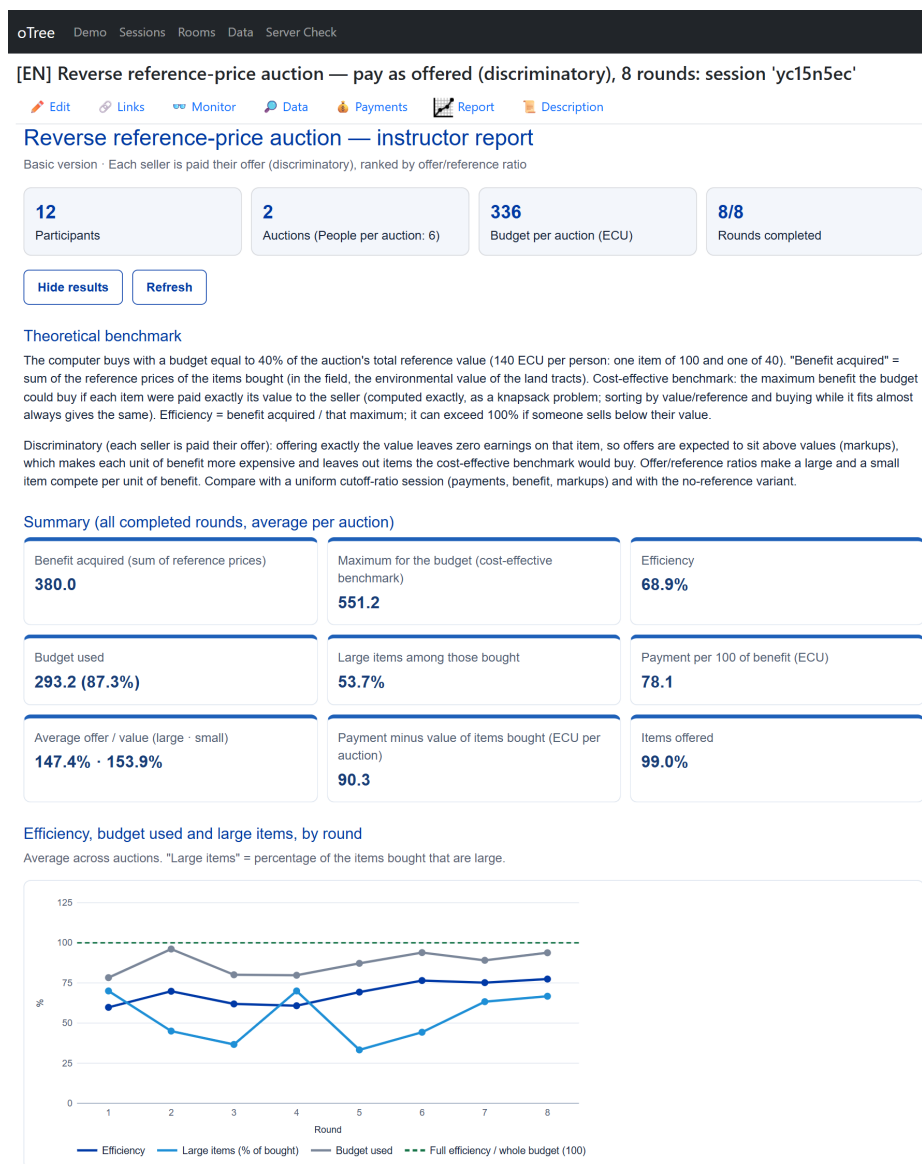
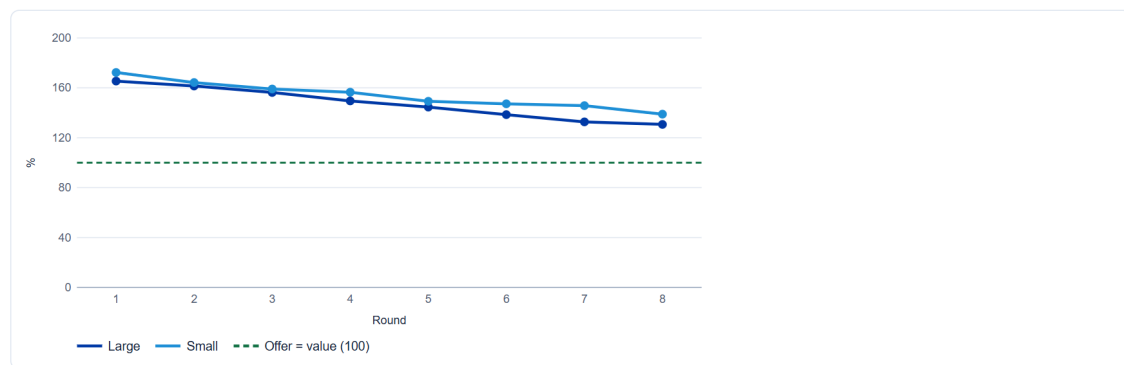


Figure 4.2: Revealed report: theoretical benchmark, summary and round-by-round chart (session of 12 participants, two auctions, 8 rounds, simulated decisions).

Offer as % of value, by size and round

Average of offer/value $\times 100$ over the items offered (items not offered do not count). 100% = offering exactly the value.



Distribution of offer/value (last completed round)

All positive offers in the last completed round, as % of the item's value (300% or more in the last bar).

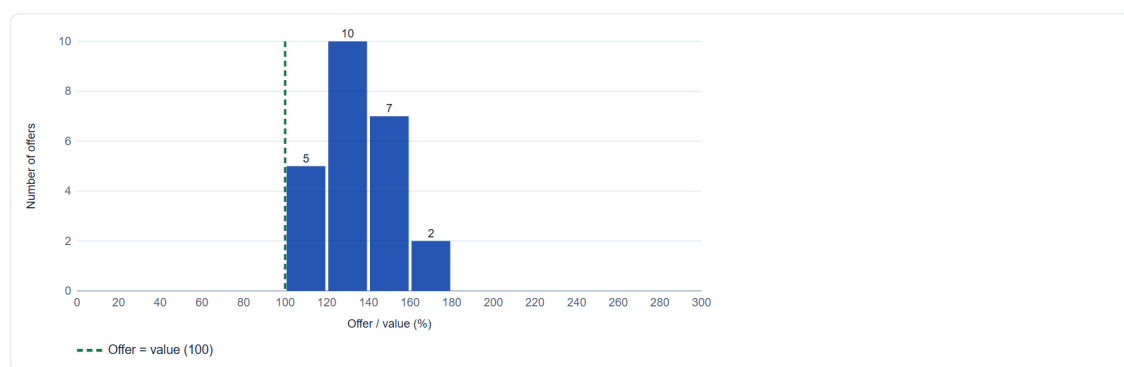


Figure 4.3: Revealed report: offer as % of value by size and round, and histogram of the last round (simulated decisions).

Same offers, other rule (mechanical comparison)

Average per auction if this session's offers were ranked and paid under each rule. It does not predict what would happen under another rule: people would offer differently. The marked row is this session's rule.

Rule	Benefit	Paid	Large
Ratio, each paid their offer (this session)	380.0	293.2	53.7%
Ratio, uniform cutoff ratio	303.8	272.4	52.7%
Amount, each paid their offer	320.0	306.1	12.8%

First rounds versus last rounds

	Benefit	Efficiency	Paid	Large	Offer/value large	Offer/value small
Rounds 1–4	345.0	63.1%	280.8	55.4%	158.2%	162.8%
Rounds 5–8	415.0	74.6%	305.8	51.9%	136.6%	145.3%

Auctions in the last completed round (Round 8)

Auction	People	Budget	Offered	Bought	Paid	Benefit	Maximum	Efficiency	Large
1	6	336	12	6	311.0	480	620	77.4%	66.7%
2	6	336	12	6	319.0	480	620	77.4%	66.7%

Results by round

Round	Auctions	Benefit	Maximum	Efficiency	Paid	Budget used	Large	Offer/value large	Offer/value small
1	2	360.0	600.0	59.8%	263.0	78.3%	70.0%	165.4%	172.3%
2	2	370.0	530.0	69.8%	323.0	96.1%	45.0%	161.5%	164.3%
3	2	340.0	550.0	61.9%	269.0	80.1%	36.7%	156.3%	159.1%
4	2	310.0	510.0	60.8%	268.0	79.8%	70.0%	149.5%	156.5%
5	2	360.0	520.0	69.3%	293.0	87.2%	33.3%	144.6%	149.2%
6	2	390.0	510.0	76.5%	315.5	93.9%	44.3%	138.5%	147.2%
7	2	430.0	570.0	75.2%	299.5	89.1%	63.3%	132.7%	145.7%
8	2	480.0	620.0	77.4%	315.0	93.8%	66.7%	130.7%	138.9%

Individual data: Data → Custom export (reference_auction). Design: Holt (Veconlab, "Reference Price Auctions").

Figure 4.4: Revealed report: “same offers, other rule”, first versus last rounds, auctions in the last round and table by round (simulated decisions).

4.2 How to read the report

1. The **theoretical benchmark** defines the *benefit acquired* (sum of the reference prices of what was bought) and the *cost-effective benchmark*: the most benefit the budget would buy if every item were paid exactly its value. *Efficiency* = benefit acquired / that maximum. Below it is a paragraph specific to the session's format.
2. The **summary** averages over auctions and completed rounds: benefit and maximum, efficiency, budget used, share of large items among those bought, payment per 100 of benefit, average offer/value by size (offered items only), payment minus value of what was bought (the sellers' rent) and share of items offered (in the uniform format, the average cutoff ratio).
3. The **efficiency chart** shows efficiency, budget used and share of large items by round; the **offer as % of value** chart shows the markup by size (100 % = offering exactly the value); the **histogram** distributes the last round's offers by offer/value.

4. **Same offers, other rule** takes the session's actual offers and runs them, mechanically, through the three rules (ratio and pay-as-offered; ratio and uniform cutoff ratio; amount and pay-as-offered), with the same tie-break. *It is a recomputation, not a prediction:* under another rule people would have offered differently. It shows what each rule does with given offers, for instance how many large items are lost when ranking by amount.
5. **First versus last rounds** compares rounds 1–4 with 5–8; the **tables** give each auction in the last round and each round, without identifying anyone.

Note

With auctions of different sizes (say, one of 7 and four of 6), benefit, payment and rent per auction are averages over auctions with different budgets. Efficiency, budget used in % and offer/value are comparable across sizes; prefer them in discussion.

For the instructor

In the simulated session in the figures (12 participants, two auctions of 6, 8 rounds; *scripted* decisions for illustration, not results from a class), average efficiency was 68.9 %, 87.3 % of the budget was used, 53.7 % of the items bought were large, and the average offer was 147.4 % of value for large items and 153.9 % for small ones. From rounds 1–4 to rounds 5–8, offer/value for large items fell from 158.2 % to 136.6 % and efficiency rose from 63.1 % to 74.6 %. The script had each person start by asking 1.45 to 1.9 times their value, lower that multiple after each item offered and not sold, and raise it a little after each sale; values were drawn by the game. Your class's numbers will differ.

Debrief script

Ask first: how far above your value did you ask, and why? What did you learn from the rounds in which you did not sell? Then reveal the offer-as-%-of-value chart and the efficiency chart. Ask which item gives more benefit per ECU: a large one offered at 70 or a small one offered at 36. Lead the class to two key sentences: *the agency buys benefit, not items, so it compares cost per unit of benefit*; and *when everyone is paid their own offer, asking your value earns nothing, so everyone asks more and the same budget buys less*. Finish with the “same offers, other rule” table, making clear it is a mechanical recomputation.

Theoretical background and evidence

5.1 Theoretical benchmark

Theoretical background

Ranking by ratio. The agency wants the most benefit $\sum R_i$ with spending $\sum b_i \leq B$. If it paid exactly the offers and could buy fractions, the optimum would be to buy in increasing order of b_i/R_i (cost per unit of benefit) until the budget runs out. Example: a large item offered at 70 costs 0.70 ECU per unit of benefit; a small one offered at 36 costs 0.90. Ranking by amount would put the small one first ($36 < 70$) even though it gives less benefit per ECU.

Cost-effective benchmark. The report computes, with the actual values, the most benefit that could be bought if every item were paid its value v_i : the 0/1 knapsack problem $\max \sum R_i x_i$ subject to $\sum v_i x_i \leq B$, $x_i \in \{0, 1\}$, solved exactly. Ranking by v/R and buying while it fits almost always gives the same answer, but not always (a cheap small item can block a large one). It is only a yardstick: a real agency does not know the values.

Discriminatory. If an item with value v is offered at b and bought with probability $P(b)$ (decreasing), the item's expected earnings are $v + P(b)(b - v)$. Offering $b = v$ yields exactly v , the same as not offering; any b somewhat above v with $P(b) > 0$ yields more. Hence a markup ($b/v > 1$) is expected: each seller trades probability of selling for margin. The markup makes each unit of benefit more expensive and, with a fixed budget, leaves out items the benchmark would buy.

Uniform cutoff ratio. The first k items in the list are bought and each is paid $R_i \cdot c$, where c is the ratio of the first rejected offer (2.00 if every offer is bought); k is the largest number such that $c \sum_{i \leq k} R_i \leq B$. If your offer is bought, the payment does not depend on it (another offer sets it), and you are paid at least what you asked. Your offer matters only when it decides whether you are in or out, or when it is the cutoff offer. That is why the incentive to ask above value is weaker than in the discriminatory format. It is not exact dominance: with a fixed budget, the cutoff offer also decides how many items fit. Offering below value is not safe either: if the cutoff ratio falls below v/R , you sell at a loss.

Which format buys more benefit. Under the discriminatory rule each seller is paid their own, higher offer; under the uniform rule offers are closer to value but everyone bought is paid the cutoff ratio. Which buys more benefit with the same budget is an empirical question; the class can see it by comparing separate sessions, not within one.

The game's numbers. Values average 70% of the reference and the budget is 40% of total reference value: even paying exactly the values, the budget cannot buy everything, so competition between offers is real. The cost-effective benchmark picks first the items with a low value relative to their reference; in this guide's simulated sessions it bought, on average, between 551 and 555 of

the 840 ECU of reference value in an auction of 6.

Risk. Risk aversion pushes against the markup in the discriminatory format: someone afraid of not selling asks less. It does not change the conclusion that asking exactly one's value does not pay.

5.2 Related literature

The classroom version this game follows is that of [Holt \(2019\)](#) and its “Reference Price Auctions” program on Veconlab (<https://veconlab.com>). The literature below is cited by topic; this guide does not attribute specific numerical results to it.

- [Latacz-Lohmann and Van der Hamsvoort \(1997\)](#): bidding theory in auctions of conservation contracts.
- [Cason et al. \(2003\)](#): laboratory reverse auctions for reducing non-point source pollution.
- [Cason and Gangadharan \(2004\)](#): auction design for voluntary conservation programs.
- [Cason and Gangadharan \(2005\)](#): a laboratory comparison of uniform and discriminative price reverse auctions for environmental programs; the basis for this game's discriminatory versus uniform comparison.
- [Schilizzi and Latacz-Lohmann \(2007\)](#): an experimental assessment of the performance of conservation auctions.
- [Messer et al. \(2017\)](#): what information to make public in reverse auctions for ecosystem services (complementary reading; not used to set parameters).

Note

No published article by Holt and co-authors specifically on reverse reference-price auctions could be found: **not verified**. A Crossref search found none, so none is cited. The Holt and Shobe papers that do appear are about emission-permit auctions (see the permit auction guide), not this format.

5.3 Patterns worth discussing

The following are expectations from the model in section 5.1, not guaranteed results; check them in your own session's report.

- In the discriminatory format, offer/value should sit above 100 %, with more markup early on; rejections teach how far down the list goes.
- In the uniform format, offer/value should be closer to 100 % than in a discriminatory session; payment per 100 of benefit may be higher or lower.
- Without reference prices, small items should make up most of what is bought: the share of large items and efficiency should fall relative to a session with reference prices.
- With chat, sellers may try to raise their offers together; whether they succeed depends on whether each keeps their word, because shading one's own offer a little secures the sale.

Note

Results from one class are descriptive. The difference between first and last rounds mixes learning with the luck of the value draws. With one or two auctions and 8 rounds, the same person's offers are not independent observations; comparisons across formats require separate sessions, and with different groups the people differ too.

Basic formats

The three basic formats share one room (basic, in each language); the panel allows only one active session per room at a time.

6.1 Discriminatory, one round

`reference_auction_en_discriminatory_1_round`: a single round. Useful as a short demonstration or to collect “first-instinct” offers before explaining the model. The report has no trend chart and no first-versus-last comparison.

6.2 Discriminatory, 8 rounds

`reference_auction_en_discriminatory_8_rounds`: the reference configuration, described in Chapter 3. It shows whether the markup falls with experience.

6.3 Uniform cutoff ratio, 8 rounds

`reference_auction_en_uniform_8_rounds`: the same ranking by ratio, but the computer buys the first items in the list and pays each its reference price $\times$ the **cutoff ratio**, the ratio of the first offer it does not buy. The instructions explain it with the same example (cutoff ratio 0.80: the large item is paid $100 \times 0.80 = 80$ and the small one, unsold, yields 27; total 107). The first comprehension question adapts: a large item offered at 70, bought, with a cutoff ratio of 0.85 (earns 85). Payments may have one decimal ($40 \times 0.84 = 33.6$).

Instructions

Round 1 of 8

In each round, you and 5 other people sell items to the computer, which buys with a fixed budget of **336 ECU** per round in your auction. The same people are in your auction in every round.

Your items

In each round you have two items: a **large** one, with a reference price of 100 ECU, and a **small** one, with a reference price of 40 ECU. Everyone has one item of each size, and everyone knows these reference prices.

Each item also has a **value to you**: what you earn if you do not sell it and keep it. That value is a whole-number percentage of its reference price, between 40% and 100%, all equally likely; between 40 and 100 ECU for the large item and between 16 and 40 ECU for the small one (rounded to the nearest whole number). The two percentages are drawn separately and again every round. Only you know your values; other people's values are drawn the same way.

Your earnings in a round add up item by item: if an item is sold, you earn the payment you receive for it; if it is not sold, you keep it and earn its value. So selling pays only if the payment is greater than your value.

How items are sold

Each person writes, without seeing the others, an offer for each of their items: the amount in ECU for which they agree to sell it. It is a whole number between 1 and 200 for the large item and between 1 and 80 for the small one (up to twice its reference price). Write 0 if you do not want to offer that item.

The computer divides each offer by its item's reference price; we call that number the offer's **ratio** (for example, offering the large item at 75 gives a ratio of 0.75; offering the small one at 36 gives 0.90). It then makes a list of all offers in your auction, from everyone and of both sizes, from the lowest ratio to the highest. Ties are ordered at random.

Buying and payment: the computer buys the first items on the list. For each item it buys, it pays the item's reference price $\times$ the **cutoff ratio**, which is the ratio of the first offer on the list that it does not buy. It buys as many items as it can, provided the sum of those payments fits in the budget. If it buys every offer, the cutoff ratio is 2.00 (the maximum allowed).

Example (numbers for illustration only): your large item is worth 63 to you and you offer it at 75 (ratio 0.75); the small one is worth 27 and you offer it at 36 (ratio 0.90). If the cutoff ratio is 0.80, the large item is bought and receives $100 \times 0.80 = 80$ ECU; the small one is not bought and you earn its value, 27. In total you earn $80 + 27 = 107$ ECU.

- Auctions are formed with 6 people; when the class does not divide exactly, the remaining people join the first auctions. Each auction's budget is 56 ECU for each person in it (336 ECU with 6 people). If there are fewer than 6 participants, a single smaller auction is formed.
- There will be 8 rounds. Your earnings from all rounds are added up.
- Amounts are in ECU (experimental currency units). There is no payment in money.

Continue

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Figure 6.1: Instructions in the uniform format.




Before you start

Round 1 of 8

Answer based on the instructions. The numbers are for illustration only.

Your large item is worth 58 ECU to you. You offer it at 70, the computer buys it and the cutoff ratio is 0.85.
How much do you earn for that item?

☐ 12 ECU
 ☐ 58 ECU
 ☐ 70 ECU
 ☐ 85 ECU

Your small item is worth 22 ECU to you. You offer it at 35 and the computer does not buy it. How much do you earn for that item?

☐ 0 ECU
 ☐ 13 ECU
 ☐ 22 ECU
 ☐ 35 ECU

Check

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Figure 6.2: Comprehension check in the uniform format.




Round result

Round 1 of 8

Item	Your value	Your offer	Ratio	Sold?	Payment	Earnings
Large	61	79	0.79	Yes	80	80
Small	31	42	1.05	No	—	31

Your earnings this round
111 ECU

Budget used in your auction
304 / 336 ECU (90 %)

Cutoff ratio
0.80

Cumulative earnings
111 ECU

Items bought in your auction
5 of 12 offered

Next round

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Figure 6.3: Result in the uniform format: the large item is bought and paid $100 \times 0.80 = 80$, above its offer of 79; the small one, at a ratio above the cutoff, is kept (simulated decisions).

Summary (all completed rounds, average per auction)

Benefit acquired (sum of reference prices) 362.5	Maximum for the budget (cost-effective benchmark) 555.0	Efficiency 65.3%
Budget used 295.6 (88.0%)	Large items among those bought 54.0%	Payment per 100 of benefit (ECU) 81.9
Average offer / value (large · small) 117.4% · 119.5%	Payment minus value of items bought (ECU per auction) 100.1	Average cutoff ratio 0.819

Efficiency, budget used and large items, by round

Average across auctions. "Large items" = percentage of the items bought that are large.

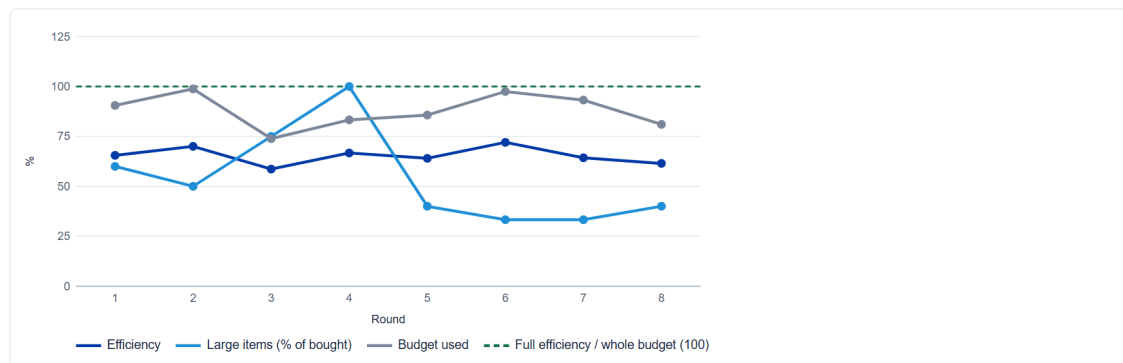


Figure 6.4: Report summary and chart for a uniform demonstration session (6 participants, 8 rounds, simulated decisions).

Same offers, other rule (mechanical comparison)

Average per auction if this session's offers were ranked and paid under each rule. It does not predict what would happen under another rule: people would offer differently. The marked row is this session's rule.

Rule	Benefit	Paid	Large
Ratio, each paid their offer	455.0	299.5	50.0%
Ratio, uniform cutoff ratio (this session)	362.5	295.6	54.0%
Amount, each paid their offer	415.0	298.5	22.3%

Figure 6.5: "Same offers, other rule" in the uniform session: a mechanical recomputation, not a prediction (simulated decisions).

For the instructor

In the simulated uniform session (6 participants, one auction; scripted multiples of 1.0 to 1.35 of value that fall only slightly), average offer/value was 117.4 % (large) and 119.5 % (small), the average cutoff ratio was 0.819 and efficiency 65.3 %. The "same offers, other rule" table says these same offers, paid as offered, would have bought more benefit. Do not conclude that the discriminatory format is better: under that rule the same people would have asked more (as in the main session, where they asked about 150 % of value). That is why the behavioral comparison requires separate sessions.

Debrief script

If you ran both formats with different groups, put offer/value, efficiency and payment per 100 of benefit side by side. Ask: in the uniform format, does your payment change if you raise your offer and are still bought? When does your offer matter?

Extended variants

Variant	What changes	What it is for
No reference prices	The list is ranked by amount offered; each seller is paid their offer.	Show that buying “the cheapest” is not buying the most benefit: small items crowd out large ones.
With chat	Discriminatory with 60 seconds of chat within the auction before each round.	Discuss coordination among sellers and its fragility.

Both live in the extended room ([EN] **Reverse Reference-Price Auction — extended**) and have 8 rounds.

7.1 No reference prices (ranking by amount)

`reference_auction_extended_no_reference_8_rounds`: like the discriminatory format, but the computer ranks by amount in ECU, regardless of size. Reference prices still appear on the screens (they define the ranges of values and offers) but are not used for ranking. The instructions’ example is reversed to respect ranking by amount: the small item (36) is bought and the large one is not, total $36 + 63 = 99$. The result shows no ratios and lists the amounts bought.

Instructions

Round 1 of 8

In each round, you and 5 other people sell items to the computer, which buys with a fixed budget of **336 ECU** per round in your auction. The same people are in your auction in every round.

Your items

In each round you have two items: a **large** one, with a reference price of 100 ECU, and a **small** one, with a reference price of 40 ECU. Everyone has one item of each size, and everyone knows these reference prices.

Each item also has a **value to you**: what you earn if you do not sell it and keep it. That value is a whole-number percentage of its reference price, between 40% and 100%, all equally likely: between 40 and 100 ECU for the large item and between 16 and 40 ECU for the small one (rounded to the nearest whole number). The two percentages are drawn separately and again every round. Only you know your values; other people's values are drawn the same way.

Your earnings in a round add up item by item: if an item is sold, you earn the payment you receive for it; if it is not sold, you keep it and earn its value. So selling pays only if the payment is greater than your value.

How items are sold

Each person writes, without seeing the others, an offer for each of their items: the amount in ECU for which they agree to sell it. It is a whole number between 1 and 200 for the large item and between 1 and 80 for the small one (up to twice its reference price). Write 0 if you do not want to offer that item.

The computer makes a list of all offers in your auction, from everyone and of both sizes, from the lowest amount in ECU to the highest, regardless of the item's size. Ties are ordered at random.

Buying and payment: the computer goes down the list in that order. It buys each item and pays exactly its offer, as long as the offer fits in what is left of the budget. As soon as an offer does not fit, it stops buying; that offer and all the ones after it on the list are not sold.

Example (numbers for illustration only): your large item is worth 63 to you and you offer it at 75; the small one is worth 27 and you offer it at 36. If the small item is bought and the large one is not, you earn 36 for the small item (your offer) + 63 for the large one (your value) = 99 ECU.

- Auctions are formed with 6 people; when the class does not divide exactly, the remaining people join the first auctions. Each auction's budget is 56 ECU for each person in it (336 ECU with 6 people). If there are fewer than 6 participants, a single smaller auction is formed.
- There will be 8 rounds. Your earnings from all rounds are added up.
- Amounts are in ECU (experimental currency units). There is no payment in money.

Continue

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Figure 7.1: Instructions for the no-reference-price variant.




Your offers

Round 1 of 8

The computer's budget in your auction: **336 ECU**. People in your auction: 6.

Item	Reference price	Your value	Your offer
Large	100	78	113
Small	40	22	33

Large: 0 or 1 to 200. Small: 0 or 1 to 80. 0 = not offered. If an item is not sold, you earn its value.

Send offers

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Figure 7.2: Offers screen without reference prices (simulated decisions).




Round result

Round 1 of 8

Item	Your value	Your offer	Sold?	Payment	Earnings
Large	78	113	No	—	78
Small	22	33	Yes	33	33

Your earnings this round

111 ECU

Cumulative earnings

111 ECU

Budget used in your auction

287 / 336 ECU (85 %)

Items bought in your auction

7 of 12 offered

Offers bought, in order (ECU): 22 · 28 · 33 · 41 · 47 · 50 · 66

Next round

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Figure 7.3: Result without reference prices: list of amounts bought, in order (simulated decisions).

Summary (all completed rounds, average per auction)

Benefit acquired (sum of reference prices) 357.5	Maximum for the budget (cost-effective benchmark) 552.5	Efficiency 64.5%
Budget used 298.8 (88.9%)	Large items among those bought 19.6%	Payment per 100 of benefit (ECU) 85.9
Average offer / value (large · small) 119.6% · 153.4%	Payment minus value of items bought (ECU per auction) 85.4	Items offered 100.0%

Efficiency, budget used and large items, by round

Average across auctions. "Large items" = percentage of the items bought that are large.

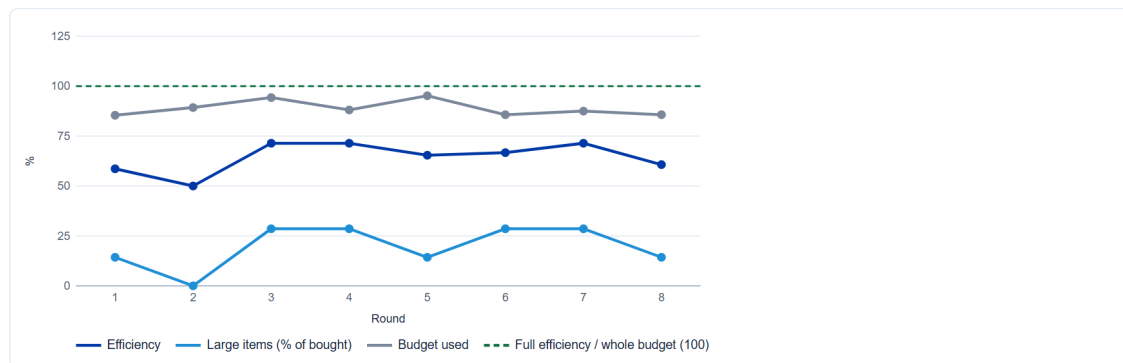


Figure 7.4: Report summary and chart without reference prices (6 participants, 8 rounds, simulated decisions).

Same offers, other rule (mechanical comparison)

Average per auction if this session's offers were ranked and paid under each rule. It does not predict what would happen under another rule: people would offer differently. The marked row is this session's rule.

Rule	Benefit	Paid	Large
Ratio, each paid their offer	442.5	302.1	67.1%
Ratio, uniform cutoff ratio	360.0	303.6	68.8%
Amount, each paid their offer (this session)	357.5	298.8	19.6%

Figure 7.5: "Same offers, other rule" without reference prices: the actual offers, re-ranked by ratio, buy more large items. A mechanical recomputation, not a prediction (simulated decisions).

For the instructor

In the simulated session without reference prices (6 participants, 8 rounds), only 19.6% of the items bought were large and efficiency was 64.5%. The same offers, re-ranked by ratio and paid as offered, would have bought 442.5 of benefit per round with 67.1% large items, versus 357.5 with 19.6%. The script used moderate multiples that fell after each rejection and rose after each sale; since small items almost always sold, their offer/value rose round after round. Your class's numbers will differ.

Debrief script

Ask: if you were the agency, would you rather buy six small items or three large ones with the same money? What information is missing for someone who ranks by amount? What did the owners of small items ask, knowing they came first in the list?

7.2 Discriminatory with chat

`reference_auction_extended_discriminatory_chat_8_rounds`: the discriminatory format, with 60 seconds of chat among the people in the same auction before each round. Nothing written is binding. The cover's rules say so ("except in the chat"), the instructions explain it and the chat asks people not to write names or personal data. Each person can move on to the offers before the minute ends with **Go to the offers**; when time runs out, the page advances on its own.




Instructions

Round 1 of 8

In each round, you and 5 other people sell items to the computer, which buys with a fixed budget of **336 ECU** per round in your auction. The same people are in your auction in every round.

Your items

In each round you have two items: a **large** one, with a reference price of 100 ECU, and a **small** one, with a reference price of 40 ECU. Everyone has one item of each size, and everyone knows these reference prices.

Each item also has a **value to you**: what you earn if you do not sell it and keep it. That value is a whole-number percentage of its reference price, between 40% and 100%, all equally likely: between 40 and 100 ECU for the large item and between 16 and 40 ECU for the small one (rounded to the nearest whole number). The two percentages are drawn separately and again every round. Only you know your values; other people's values are drawn the same way.

Your earnings in a round add up item by item: if an item is sold, you earn the payment you receive for it; if it is not sold, you keep it and earn its value. So selling pays only if the payment is greater than your value.

How items are sold

Each person writes, without seeing the others, an offer for each of their items: the amount in ECU for which they agree to sell it. It is a whole number between 1 and 200 for the large item and between 1 and 80 for the small one (up to twice its reference price). Write 0 if you do not want to offer that item.

The computer divides each offer by its item's reference price; we call that number the offer's **ratio** (for example, offering the large item at 75 gives a ratio of 0.75; offering the small one at 36 gives 0.90). It then makes a list of all offers in your auction, from everyone and of both sizes, from the lowest ratio to the highest. Ties are ordered at random.

Buying and payment: the computer goes down the list in that order. It buys each item and pays exactly its offer, as long as the offer fits in what is left of the budget. As soon as an offer does not fit, it stops buying: that offer and all the ones after it on the list are not sold.

Example (numbers for illustration only): your large item is worth 63 to you and you offer it at 75 (ratio 0.75); the small one is worth 27 and you offer it at 36 (ratio 0.90). If the large item is bought and the small one is not, you earn 75 for the large item (your offer) + 27 for the small one (your value) = 102 ECU.

- Auctions are formed with 6 people; when the class does not divide exactly, the remaining people join the first auctions. Each auction's budget is 56 ECU for each person in it (336 ECU with 6 people). If there are fewer than 6 participants, a single smaller auction is formed.
- Before each round you can write messages to the people in your auction for 60 seconds. Nothing written there is binding.
- There will be 8 rounds. Your earnings from all rounds are added up.
- Amounts are in ECU (experimental currency units). There is no payment in money.

Continue

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Figure 7.6: Instructions for the chat variant.

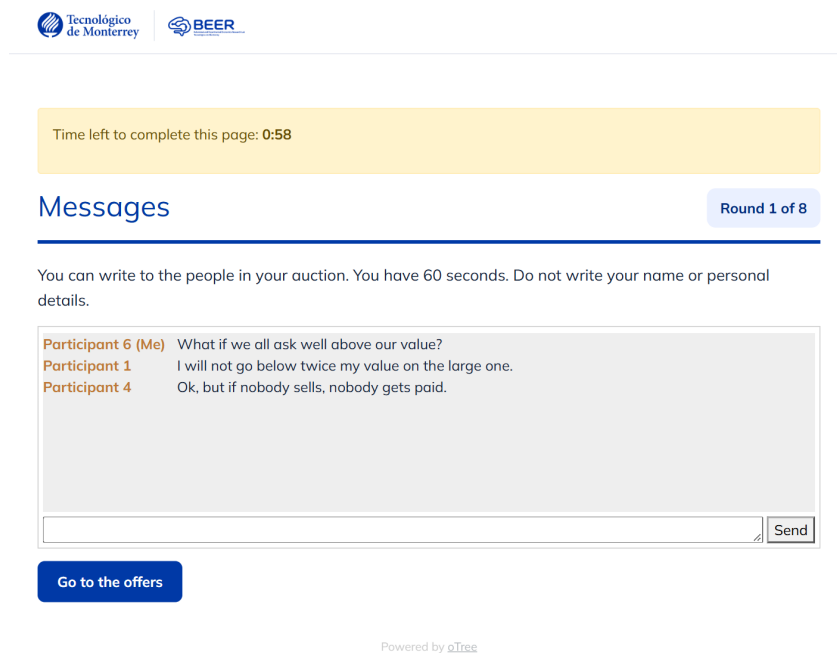


Figure 7.7: Chat before a round (simulated messages).

Messages are downloaded under **Data** → **Chat**. If you project them, do so without identifying anyone.

Debrief script

Compare offer/value and payment per 100 of benefit with and without chat (in separate sessions): did offers rise? Were agreements kept? What temptation did someone who had promised to ask a lot face? Connect with the risk of collusion in real procurement-by-auction programs.

Class plan and reading the results

8.1 Suggested 50-minute session

0–5 min	Create the session (room [EN] Reverse Reference-Price Auction , configuration <code>reference_auction_en_discriminatory_8_rounds</code>). Students join via QR code or link.
5–12 min	Cover, instructions and comprehension check. Clear up questions about the ratio and about where the computer stops, without suggesting offers.
12–30 min	8 rounds of offers (about two minutes per round). Follow progress in the Monitor.
30–35 min	Open the hidden report; ask for predictions: how far above their values did the class ask? What share of the possible maximum did the computer buy?
35–45 min	Reveal the results. Show the summary, the offer-as-%-of-value chart, the efficiency chart and the “same offers, other rule” table (as a recomputation, not a prediction). Discuss.
45–50 min	Wrap-up: cost per unit of benefit, the margin–probability trade-off in the discriminatory format and the logic of the cutoff ratio; connect with payment-for-conservation programs.

8.2 Questions to guide the discussion

- Why does the computer divide the offer by the reference price? What would it buy if it did not?
- Why did almost no one offer exactly their value? What would they gain by doing so?
- What did you learn from the rounds in which you did not sell? Did your offer change?
- With the uniform cutoff ratio, when does your offer matter and when does it not?
- The cost-effective benchmark uses the actual values. Could a real agency reach it? What would it need to know?
- What would happen if sellers could reach an agreement? Would the agreement be stable?
- Where do reverse auctions with a fixed budget appear outside the classroom? Conservation programs, public procurement, renewable-energy subsidies.

8.3 Common misreadings

Misreading	Clarification
“The agency should buy the cheapest offers.”	It should buy the cheapest benefit: the offer per unit of reference price, not the amount.
“Asking more than one’s value is abuse.”	It is the expected response when everyone is paid their own offer: asking one’s value earns nothing.
“In the uniform format everyone is paid what they asked.”	Everyone bought is paid their reference $\times$ the cutoff ratio, which is at least their own ratio and usually more.
“The ‘same offers, other rule’ table shows which rule is better.”	It is a mechanical recomputation with this session’s offers; under another rule people would have offered differently.
“100 % efficiency means everything was bought.”	It means as much benefit was bought as the budget would buy paying exactly the values; it can exceed 100 % if someone sells below value.
“If budget was left over, the computer made a mistake.”	In the discriminatory format it stops at the first offer that does not fit; what is left over is not spent.

Operations, privacy and troubleshooting

9.1 Privacy and conduct

Participant codes are anonymous: never ask for or display names, student IDs or seats alongside individual decisions. Project only aggregate results (averages, charts, histograms). The session's data remain available to you under **Data**; do not share them outside teaching use or research authorized by the lab.

9.2 If someone disconnects: Advance slowest participants

Each round of an auction is resolved only when all its members have sent offers. If someone disconnects, ask them to reopen the room in the same browser: they resume where they were. If they cannot, use **Advance slowest participants** in the Monitor. This is what the game records in that case:

- **Someone who did not send offers** is left with both items **not offered** (empty fields count as 0): they earn both values. Their items do not enter the list, so the auction has less competition that round. In the report the “items offered” share drops; offer/value does not change (it only counts offered items), and the cost-effective benchmark does include their items (at their value), so that auction's efficiency may fall.
- **In the chat**, advancing someone only cuts their minute short; the chat moves on by itself when time runs out.
- On the cover, the instructions and the comprehension check, advancing someone only moves them to the next screen.

9.3 Common problems

Situation	What to do
Someone sees “session is full” (“La sesión está llena”).	You declared fewer participants than arrived. Close the room and create another session with the correct number.
The round keeps waiting.	Someone in that auction has not sent offers. Ask them to reopen the room in the same browser, or use Advance slowest participants (section 9.2).
Someone cannot send their offer.	It is out of range or has decimals: 0 or 1 to 200 (large), 0 or 1 to 80 (small), whole numbers.
Someone asks why they were not bought although their offer was low.	The computer ranks by ratio (offer/reference), not by amount, and stops at the first offer that does not fit.
Someone was paid more than their offer.	It is the uniform format: they are paid $\text{reference} \times \text{cutoff ratio}$.
Payments with decimals.	In the uniform format, payment is $\text{reference} \times \text{cutoff ratio}$ (e.g. $40 \times 0.84 = 33.6$).
A different game appears in Demo or Rooms.	The panel does not belong to this game. Do not start the session; notify the lab.
You need to repeat the activity with the same group.	Create a new session in the same room; the earlier session’s data stay under Sessions .

9.4 Data for later analysis

Data → **Custom export (reference_auction)** gives one row per participant and round: session, anonymous code, round, language, edition, treatment, auction and its size, budget, the drawn percentage and value of each item, offers, whether each item sold and its payment, earnings, the auction’s spending, items offered, bought and large items bought, benefit, maximum, efficiency, cutoff ratio (uniform) and attempts on the comprehension check. It contains no personal identifiers. In the chat variant, **Data** → **Chat** downloads the messages. Note that the English report, like the Spanish one, uses decimal points throughout.

Annotated bibliography

- [Holt \(2019\)](#): the classroom version and its Veconlab program (“Reference Price Auctions”).
- [Latacz-Lohmann and Van der Hamsvoort \(1997\)](#): bidding theory in auctions of conservation contracts.
- [Cason et al. \(2003\)](#): laboratory reverse auctions for reducing non-point source pollution.
- [Cason and Gangadharan \(2004\)](#): auction design for voluntary conservation programs.
- [Cason and Gangadharan \(2005\)](#): uniform versus discriminative price in environmental reverse auctions, in the laboratory.
- [Schilizzi and Latacz-Lohmann \(2007\)](#): an experimental assessment of the performance of conservation auctions.
- [Messer et al. \(2017\)](#): public information in reverse auctions for ecosystem services.

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- Cason, T. N. and Gangadharan, L. (2004). Auction design for voluntary conservation programs. *American Journal of Agricultural Economics*, 86(5), 1211–1217. doi:10.1111/j.0002-9092.2004.00666.x.
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- Holt, C. A. (2019). *Markets, Games, and Strategic Behavior: An Introduction to Experimental Economics* (2nd ed.). Princeton University Press. No DOI. “Reference Price Auctions” program on Veconlab: <https://veconlab.com>.
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- Schilizzi, S. and Latacz-Lohmann, U. (2007). Assessing the performance of conservation auctions: An experimental study. *Land Economics*, 83(4), 497–515. doi:10.3368/le.83.4.497.
- A published article by Holt and co-authors (e.g. with W. Shobe) specifically on reverse reference-price auctions: **not verified**; not cited.

Room QR codes

Project or print the page for the room you will use. Students scan it with their phone camera and click **Start**.

Reference-price auction

English room



`referenceauction.beer-lab.org/room/reference_auction_en`

Scan the code and press **Start**.

Reference-price auction

English room, extended version



`referenceauction.beer-lab.org/room/reference_auction_extended`

Scan the code and press **Start**.

Reference-price auction

Sala en español



`referenceauction.beer-lab.org/room/reference_auction_es`

Escanee el código y pulse **Comenzar**.

Reference-price auction

Sala en español, versión extendida



referenceauction.beer-lab.org/room/reference_auction_extendido

Escanee el código y pulse **Comenzar**.