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# Teaching Guide for Monopoly and Price Discrimination

Laboratory implementation, theoretical foundations,  
experimental evidence, and variants

Behavioral and Experimental Economics Research Lab  
Department of Economics



Revised edition | October 2026

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

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# How to use this guide

This guide supports the preparation, delivery, and discussion of the monopoly and price discrimination 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 of economics, intermediate microeconomics, industrial organization, regulation, experimental economics, and business strategy.

No previous experience with oTree or classroom experiments is assumed. The document offers three reading routes. The quick guide and lesson plans are sufficient for a first session.

The operational chapters explain access, the participant experience, the private instructor report, and common technical problems. The conceptual chapters develop profit maximization, elasticity, surplus, discrimination, resale, and regulation. Basic and extended activities belong to a single family: common instructions appear once, while each variant explains only the economic environment that changes.

## Author

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### For the instructor

For a first implementation, use the basic one-decision version and ask the class to predict the outcome before results are revealed. Use ten decisions when the purpose is to observe search and learning. Project only the aggregate report. Do not display individual links or connect choices to names, student numbers, or seats in the laboratory.

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# Quick guide and learning outcomes

## 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.

|                                                           |
|-----------------------------------------------------------|
| — precio uniforme, una decisión                           |
| — precio uniforme, 10 decisiones con información completa |
| — 10 decisiones, descubrimiento de demanda                |
| — uniform price, one decision                             |
| — uniform price, 10 decisions with complete information   |
| — 10 decisions, demand discovery                          |
| extendido — referencia uniforme, una decisión             |
| extendido — referencia uniforme, 10 decisiones            |
| extendido — descubrimiento de demanda                     |
| extendido — discriminación de primer grado                |
| extendido — discriminación de segundo grado               |
| extendido — discriminación de tercer grado                |
| extendido — discriminación con reventa                    |
| extendido — precio máximo regulado                        |
| extendido — aumento del costo marginal                    |
| onopoly — uniform benchmark, one decision                 |
| onopoly — uniform benchmark, 10 decisions                 |
| onopoly — demand discovery                                |
| onopoly — first-degree price discrimination               |
| onopoly — second-degree price discrimination              |
| onopoly — third-degree price discrimination               |
| onopoly — price discrimination with resale                |
| onopoly — regulated price cap                             |
| onopoly — higher marginal cost                            |

**Monopolio y discriminación de precios / Monopoly and Price Discrimination — BEER Lab**

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

Figure 1.3: Demo contains only the configurations of this game family, in both languages and editions.

## Rooms

### Current rooms:

|                                                       |
|-------------------------------------------------------|
| [ES] Monopolio y discriminación de precios            |
| [EN] Monopoly and Price Discrimination                |
| [ES] Monopolio y discriminación de precios: extendido |
| [EN] Monopoly and Price Discrimination: extended      |

Figure 1.4: Rooms contains the four rooms for this family: basic and extended editions in Spanish and English.

## Room: [EN] Monopoly and Price Discrimination

### Create a new session

Session Config

[EN] Monopoly — uniform price, one decision



Number of participants

Individual decisions: any positive participant count is allowed.

Create

[Configure session](#) 

### App sequence

**monopoly\_pricing\_game (10 rounds)**

Bilingual monopoly pricing and price-discrimination teaching laboratory.

Figure 1.5: 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.

### Attention

The public routes in this guide are proposed deployment routes for the laboratory. The validated local instance uses port 8038. Demo must display exactly 24 configurations and Rooms exactly four rooms. If games from another family appear, do not start the session; verify that the process was launched with `GAME_FAMILY=monopoly`.

|                          |                                                                                                                                       |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose</b>           | Understand how a firm with market power chooses prices and how profit, quantity, surplus, and deadweight loss respond to that choice. |
| <b>Experimental unit</b> | One person managing a firm that faces computer-simulated consumers.                                                                   |
| <b>Basic edition</b>     | Uniform pricing with complete information for one or ten decisions, plus ten decisions with demand discovery.                         |
| <b>Extended edition</b>  | First-, second-, and third-degree price discrimination; resale; a price cap; and a higher marginal cost.                              |
| <b>Decision</b>          | One or several prices, depending on the mechanism.                                                                                    |
| <b>Outcome</b>           | Quantity, revenue, cost, profit, consumer surplus, total surplus, and deadweight loss, measured in ECU.                               |
| <b>Students</b>          | <a href="https://monopoly.beer-lab.org/room/monopoly_en">https://monopoly.beer-lab.org/room/monopoly_en</a>                           |
| <b>Instructor</b>        | <a href="https://monopoly.beer-lab.org/demo">https://monopoly.beer-lab.org/demo</a>                                                   |
| <b>Local test</b>        | <a href="http://localhost:8038/demo">http://localhost:8038/demo</a> , launched with <code>GAME_FAMILY=monopoly</code> .               |
| <b>Topics</b>            | monopoly; price discrimination; market power; surplus; regulation.                                                                    |
| <b>JEL</b>               | C91; D42; L12.                                                                                                                        |

By the end of a session, a student should be able to distinguish revenue from profit; derive quantity from a demand curve; identify the profit-maximizing uniform price; explain why that price exceeds marginal cost; separate producer surplus, consumer surplus, and deadweight loss; identify the information and enforcement conditions that support price discrimination; distinguish first-, second-, and third-degree discrimination; explain self-selection in a nonlinear tariff; analyze

why resale limits price differences; and assess how a price ceiling or a cost increase changes the result.

The activity also develops empirical reasoning. An average close to the theoretical benchmark does not mean that every participant chose the benchmark. A high average profit can coexist with substantial dispersion. Movement toward the prediction over rounds is compatible with learning, although a single class without a comparison condition does not identify the cause of that movement. The instructor report therefore presents distributions, round-by-round trends, and welfare measures instead of relying on one average.

This family is deliberately individual. Students do not wait for buyers or competitors and the instructor can run it with a small seminar or a large lecture. That feature also clarifies interpretation. Repetition represents repeated opportunities to solve the same pricing problem, rather than reputation, collusion, retaliation, or strategic learning between human players. An instructor who wants to study oligopoly should use a strategic market game instead of interpreting this activity as one.

# Economic foundations and evidence

Each participant manages the only firm supplying a product. Consumers are simulated by the computer, which applies the demand rule associated with the selected treatment. There is no human buyer role. This design keeps the person as the experimental unit, avoids waiting pages, and makes the activity feasible with any number of participants. It also ensures that deviations from a benchmark reflect the participant's pricing decision and understanding rather than an unmatched counterpart.

In the uniform-price reference environment, inverse demand is

$$P(Q) = 120 - Q,$$

so that a price  $P$  between 0 and 120 generates quantity  $Q(P) = 120 - P$ . Marginal cost is constant at 20 ECU and there is no fixed cost. Revenue, cost, and profit are

$$R(P) = P(120 - P), \quad C(P) = 20(120 - P), \quad \pi(P) = (P - 20)(120 - P).$$

The decision screen asks for a price. The computer then calculates all other outcomes. Making price the only control forces the participant to confront the demand tradeoff: raising price increases the margin on every unit that remains sold but reduces the number of units purchased.

The result screen also reports consumer surplus. With linear demand, it is the triangular area between demand and price:

$$CS = \frac{1}{2}(120 - P)Q.$$

Because the model has no fixed cost or other transfer, total surplus is profit plus consumer surplus. The efficient allocation produces until the willingness to pay for the marginal unit equals marginal cost. When  $MC = 20$ , efficient quantity is 100, the competitive reference price is 20, and maximum total surplus is 5,000 ECU. A monopolist restricts output and leaves mutually beneficial trades unrealized; the value of those unrealized trades is deadweight loss.

## Theoretical foundation

ECU is a pedagogical unit of account. The platform does not promise an automatic conversion to money. Before class, the instructor must decide whether ECU are illustrative points or whether an announced incentive rule converts some outcome into payment or course credit. Never introduce a conversion after observing decisions, because doing so changes the meaning of the task and weakens informed participation.

The demand-discovery version uses the same demand and cost but hides the equation before choices are made. After each decision, the participant observes sales and profit and may revise the price. The ten rounds represent search over a stable but initially unknown payoff function. They do

not represent ten negotiations with consumers. The distinction matters: convergence can reflect learning about a technology, but cannot be attributed to changing buyer behavior or reputation.

Extended versions alter information or the feasible tariff. First-degree discrimination gives the firm four known valuations and asks for one price for each consumer. Second-degree discrimination gives the firm a menu of two bundles and lets private types self-select. Third-degree discrimination provides two observable, separated segments. Resale removes effective separation by allowing everyone to access the lowest announced price. A price cap restricts the feasible set, while the high-cost treatment changes the marginal-cost benchmark. These variants share the same visual language and outcome definitions, making comparisons easier without pretending that all mechanisms are identical.

## 2.1 Monopoly theory and benchmark predictions

### 2.1.1 Uniform-price maximization

Uniform-price profit can be expanded as  $\pi(P) = -P^2 + 140P - 2400$ . The first-order condition is  $-2P + 140 = 0$ , yielding  $P^M = 70$ . Quantity is  $Q^M = 50$  and profit equals  $(70 - 20)50 = 2,500$  ECU. The second derivative,  $-2$ , is negative, so this stationary point is a maximum. The same result follows from choosing quantity. Revenue is  $R(Q) = (120 - Q)Q$ , marginal revenue is  $MR = 120 - 2Q$ , and  $MR = MC = 20$  implies  $Q = 50$  and  $P = 70$ .

A frequent mistake is to choose the price that maximizes revenue. Revenue  $P(120 - P)$  reaches its maximum at  $P = 60$ , where 60 units generate revenue of 3,600. Producing those units costs 1,200, so profit is 2,400. At  $P = 70$ , revenue falls to 3,500 but cost falls to 1,000, and profit rises to 2,500. A firm need not maximize sales or gross receipts. It chooses the action that maximizes the difference between revenue and cost.

Another mistake is to set  $P = MC$ . That equality describes the efficient competitive reference allocation, not the decision of a monopolist that recognizes the slope of demand. To sell one more unit, the monopolist must lower the price, and the lower price applies to inframarginal units as well. Marginal revenue therefore lies below price. The firm expands only until the incremental revenue from another unit equals its incremental cost.

The profit function is also useful for interpreting approximate choices. A participant who charges 69 or 71 earns almost the maximum. A price of 60 or 80 earns 2,400, which is 96 percent of the maximum. Thus an apparently dispersed price distribution can still produce high relative profits. The report includes both prices and the percentage of the treatment-specific maximum so that instructors can distinguish conceptual accuracy from economic performance.

#### Feedback script

Ask first which price received the most choices. Calculate quantity, revenue, cost, and profit for that modal price. Then compare 60, 70, and 80 ECU and ask: “What changes when we maximize profit rather than revenue?” Follow with: “Why is marginal revenue below price?” Close by locating  $P = MC$ ,  $MR = MC$ , and deadweight loss on one demand diagram.

### 2.1.2 Elasticity and the markup

The Lerner rule connects the proportional markup with the price elasticity of demand:

$$\frac{P - MC}{P} = -\frac{1}{\varepsilon(P)}.$$

At the uniform optimum,  $P = 70$  and  $Q = 50$ . The point elasticity for  $Q = 120 - P$  is  $\varepsilon = -P/Q = -1.4$ . The Lerner index is  $(70 - 20)/70 = 0.714$ , equal to  $-1/\varepsilon$ . This rule clarifies why market power does not mean charging an arbitrarily high price. A profit-maximizing monopolist with nonnegative marginal cost will not operate on the inelastic portion of a standard linear demand curve, because a price reduction there raises revenue while also expanding output.

Elasticity also organizes third-degree discrimination. When observable markets can be separated, the firm places a larger proportional markup in the market with less elastic demand, evaluated at the relevant prices. The statement concerns behavioral responses to price, not social labels. A segment with higher income or greater level of demand does not mechanically receive a higher price. The instructor should ask how quantity changes with price in each segment and then connect that response to marginal revenue.

### 2.1.3 Welfare and distribution

At  $P = 70$ , consumer surplus is  $\frac{1}{2}(120 - 70)50 = 1,250$ . Profit is 2,500 and total surplus is 3,750. Since efficient total surplus is 5,000, deadweight loss is 1,250. A lower price transfers some surplus from the firm to consumers and can recover trades. A price that falls below marginal cost, however, can create inefficient production of units whose value is below their cost. Lower price and higher quantity should therefore be evaluated against both willingness to pay and production cost.

The difference between a transfer and a loss is central. Surplus captured from consumers by the firm does not disappear from total surplus; it changes hands. Deadweight loss is value received by neither party because beneficial trades do not occur, or because inefficient trades occur. A regulatory discussion should report profit, consumer surplus, and total surplus. Looking only at profitability omits consumers, while looking only at price omits cost and possible changes in quantity.

Distribution remains a legitimate policy concern even when total surplus is unchanged. First-degree discrimination can implement every efficient trade and transfer nearly all surplus to the firm. Uniform pricing may leave more surplus to high-valuation buyers while excluding some lower valuations. The activity makes this tension visible. It does not resolve the normative question: the instructor must state whether the discussion concerns efficiency, distribution, rights, administrative feasibility, or a combination.

## 2.2 Learning, information, and experimental evidence

Classroom monopoly experiments turn a calculus exercise into a search process. Nelson and Beil (1994) provide cost information while concealing demand; students propose prices and quantities, observe sales, and continue until they approach a profit-maximizing combination. The comparison between trial-and-error and economic reasoning opens a useful discussion: a strategy guided by marginal analysis can use feedback more efficiently than unsystematic price changes.

Oxoby (2001) presents a simple monopoly classroom experiment that links private profit and social contribution. The study highlights the possible roles of information and fairness concerns. The correct lesson for this guide is not that every price below 70 proves a preference for fairness. A low choice may reflect a calculation error, revenue maximization, a desire to sell more, rounding, confusion, or a distributive norm. Choices alone rarely identify motives. A careful debrief names the observations first and treats mechanisms as hypotheses.

Aguiló, Sard, and Tugores (2016) describe a classroom experience in which students set tariffs under first-, second-, and third-degree discrimination and learn through trial and error. The BEER Lab implementation retains the pedagogical comparison while using its own parameters, automated

consumers, and immediate welfare measures. It is an adaptation, not a replication designed to reproduce the published estimates. This distinction lets instructors credit the intellectual source without attributing local design details to the article.

Basuchoudhary and coauthors (2008) compare uniform pricing, group pricing, and group pricing with resale. Their experiment emphasizes that identifying segments is not enough: effective discrimination also requires limits on arbitrage. It further shows why restricting price differences need not have a single welfare implication across environments. The BEER Lab resale treatment makes the mechanism transparent: if two prices are announced, every consumer can access the lower one. This simplification isolates the constraint without asking students to operate a secondary market.

#### For the instructor

One classroom session provides descriptive evidence about that class. A causal claim about information, regulation, or resale requires independent units, assignment to treatments, and enough observations. Compare histograms and trends, but use phrases such as “compatible with learning” or “consistent with greater extraction” when the design cannot distinguish the proposed mechanism from alternatives.

Repetition creates another interpretive challenge. Forty decisions from four people are not forty independent participants. The instructor report labels participant and decision counts because the two answer different questions. The accumulated histogram describes all completed decisions. A round mean describes the average among the people who reached that round. Statistical inference should account for repeated observations within each participant rather than treating every row as independent.

The class can use the activity to practice a compact empirical workflow. State a prediction before opening the report. Describe level, dispersion, and evolution. Compare outcomes with the treatment-specific benchmark. Identify more than one mechanism consistent with deviations. Finally state what additional comparison or information would distinguish those mechanisms. This workflow is valuable well beyond industrial organization.

# Platform implementation

The institutional route begins at <https://beer-lab.org/>. From the teaching section, open <https://teaching.beer-lab.org/> and select the monopoly and price discrimination card. The proposed family domain is <https://monopoly.beer-lab.org/>. Instructors use <https://monopoly.beer-lab.org/demo>; participants enter through a stable room route.

The validated local instance is available at <http://localhost:8038/demo>. Its process must be launched with `GAME_FAMILY=monopoly`. That variable filters session configurations and rooms before oTree builds Demo and Rooms. One bilingual code family exposes four visible entries:

| Room                             | Purpose                       |
|----------------------------------|-------------------------------|
| <code>monopolio_es</code>        | Basic activities in Spanish.  |
| <code>monopoly_en</code>         | Basic activities in English.  |
| <code>monopolio_extendido</code> | Extended variants in Spanish. |
| <code>monopoly_extended</code>   | Extended variants in English. |

Demo contains 24 configurations: three basic and nine extended configurations per language. Rooms contains exactly four rooms. Family isolation prevents a person who enters through this domain from launching a dictator, trust, auction, matching, or other activity. In production, the laboratory should combine catalog filtering with a separate process and database for the family. Filtering controls what the interface knows; separate deployment protects the Sessions and Data areas from mixing records across families.

A session created through Demo generates one link for every participant. Each link represents one participant record and must not be used simultaneously on two computers. If the database is reset or a session is removed, an old link may report that the participant does not exist. The remedy is to create a new session and distribute its current links. Do not invent participant codes or edit the path manually.

Public and instructor routes serve different purposes. The room route gives participants a controlled entry point. Demo lets an instructor create and inspect sessions. The aggregate report belongs to the instructor and should remain on a private screen until the reveal condition is satisfied. Sharing a projector should begin only after every participant has completed the relevant decisions.

## 3.1 Preparation before class

Begin with the teaching question. For a static monopoly introduction, use one complete-information decision. To examine search, use ten demand-discovery decisions and do not reveal the equation

beforehand. To compare institutions, assign independent sections or groups to uniform pricing, discrimination, resale, regulation, or cost treatments. If one class completes several treatments sequentially, describe the comparison as within-class and recognize order, fatigue, and carryover effects.

Decide whether outcomes have material consequences. A no-payment demonstration can be useful, but students should know that ECU are instructional. If an incentive is used, define the conversion, selected round, budget limit, tie rule, and payment process before decisions. A randomly selected paid round reduces wealth effects across rounds while preserving a reason to treat each choice seriously. Any course-credit arrangement should follow institutional policy and provide an appropriate alternative.

Inspect the room before students arrive. Verify the domain, language, edition, treatment, number of participants, and number of decisions. Open one participant link on a separate browser profile. Read the introduction and comprehension item, submit a test decision, and confirm the final screen. Keep a private report tab available but do not project it. A successful technical rehearsal prevents the common error of discovering during class that an old server process is still running.

For demand discovery, prepare a method for recording hypotheses. Ask students to note each chosen price, observed quantity, observed profit, and reason for the next change. The worksheet converts trial-and-error into explicit learning evidence. For discrimination, prepare a table with rows for information, feasible tariff, consumer response, profit, consumer surplus, and total surplus. The common table makes mechanisms comparable without collapsing their distinct constraints.

### Checkpoint

1. Confirm the teaching objective and choose the matching configuration.
2. Verify English language, basic or extended edition, and round count.
3. Confirm that Demo lists 24 configurations and Rooms lists four rooms.
4. Create a new session with the actual number of participants.
5. Test one participant link from welcome through final summary.
6. Keep the instructor report private and check that it is initially hidden.
7. Prepare a board or worksheet for predictions before revealing results.
8. State the ECU incentive rule, or state clearly that ECU are illustrative.
9. Plan how late arrivals and incomplete participants will be handled.
10. Reserve debriefing time equal to or greater than decision time.

Late arrivals should not be inserted casually after others have completed a ten-round activity if their inclusion changes the reveal schedule. The individual design makes a separate session feasible. For a very small class, results remain pedagogically useful, but the histogram should be described as that group's choices rather than evidence about a population. A screenshot of a previous class should never be presented as current live data unless it is explicitly labeled as an illustration.

## 3.2 Participant flow

The welcome page presents the BEER Lab identity, the purpose of controlled classroom work, and laboratory conduct. Participants should work silently, avoid discussing choices, keep their own

link, and raise a hand for technical assistance. These instructions matter even in an individual task because communication can coordinate anchors or reveal the hidden demand in the discovery condition.



## Welcome to the BEER Lab

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

Figure 3. This institutional welcome and general laboratory rules. Continuation 1/2.

The instruction page identifies the decision variable, demand information, marginal cost, and outcome measures. It explains that the participant controls price and that the computer represents consumers. Treatment-specific examples use the actual parameters. In the high-cost treatment, for example, the worked benchmark uses marginal cost 40 rather than repeating the basic case. In the price-cap treatment, the example respects the maximum of 50. This alignment prevents the example from silently teaching the wrong environment.

The comprehension item is a gate rather than a survey. It checks whether the participant understands that a higher price changes quantity and that profit subtracts cost from revenue. Incorrect answers generate explanatory feedback and the participant tries again. The instructor should not supply the answer verbally to one part of the room while others work independently. If a large share fails, pause the whole session and clarify the rule without revealing the maximizing price.

The pricing page highlights the known demand and cost in compact cards, provides one clearly labeled numerical field, and reminds the participant of the admissible range. The visual design separates rules from action. When several prices are needed, each field names the corresponding consumer, bundle, or segment. Values typed in one field never stand for an unannounced unit.

After submission, the result page displays price, quantity, revenue, cost, profit, welfare components, and a treatment-relevant comparison. Feedback should support learning without claiming that one theoretical benchmark is morally correct. In repeated conditions, a Next button leads to the following decision. The page should not reveal classmates' current choices because doing so would contaminate independent search.

The last participant page states explicitly that the activity is complete. It summarizes the participant's decisions and tells the person to wait quietly for the instructor. This page replaces the ambiguous oTree message "No more pages left." It also confirms that data were recorded and

# Welcome to the BEER Lab

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

In this activity, you will manage a firm with market power and decide how to set its prices.

## General laboratory rules

- Remain silent throughout the activity.
- Do not talk or look at other participants' decisions.
- Make your decisions individually and privately.
- Do not refresh, close, or leave this page.
- If you have a problem, raise your hand and contact the staff privately.

I understand and will follow these rules.

- ☐ Sí  
☒ No

Start

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Figure 3.2: Institutional welcome and general laboratory rules. Continuation 2/2.

prevents repeated browser refreshes from being mistaken for an unfinished task.

### 3.3 Instructor flow and aggregate report

From Demo, choose the configuration that matches the plan and enter the number of participants. oTree generates a session code and individual participant links. The link page is operational; do not project it once students are seated, since visible codes can be copied. Distribute links through the laboratory's approved mechanism or the stable room workflow.

The custom report is deliberately hidden while decisions remain incomplete. It displays the number of completed and pending decisions and explains the reveal rule. The protection reduces experimenter cues and prevents early finishers from communicating the emerging distribution. It is a classroom sequence control, not a substitute for database access control.

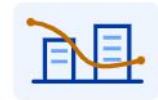
When all required decisions are complete, the report reveals summary cards, the price distribution, the distribution of profit as a percentage of the treatment maximum, welfare measures, treatment-specific tables, and round evolution. The histogram shows bins and counts; it is not a decorative bar chart of averages. Captions state the unit and denominator. For repeated activities, the report distinguishes decisions from people.

Use a stable reveal order. First ask participants for predictions and reasoning while the report remains hidden. Second reveal the price histogram and describe its center and spread. Third reveal profit relative to the benchmark. Fourth connect choices to quantity and welfare. Fifth use treatment-specific panels. This order allows students to revise explanations in response to evidence rather than hearing the instructor's preferred mechanism before seeing the data.

The instructor key and operational notes appear inside bordered callout boxes in the guide and interface. Blue text alone is reserved for headings and links. This distinction is intentional: a



## Instructions



### Resources and unit of account

ECU stands for Experimental Currency Units. It is the unit of account for this activity.  
This session does not convert ECU into real money.

Uniform price with complete information

### Your role

You manage the only firm selling this product. The computer represents consumers through the stated demand rules.

### Objective

Choose the price or tariff that maximizes the firm's profit. All values are expressed in ECU.

**Profit = total revenue – total cost. Revenue depends on the sales generated by your price.**

After deciding, you will see sales, profit, consumer surplus, and deadweight loss. These measures compare private benefit and welfare.

### Uniform price with complete information

Demand is  $Q = 120 - P$  for prices between 0 and 120 ECU. Every unit costs 20 ECU.

### Worked example

If price is 60 ECU, 60 units are sold. With marginal cost of 20 ECU, revenue is 3,600, cost is 1,200, and profit is 2,400 ECU.

This session contains 1 decision(s).

**Continue**

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



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

## Comprehension check

Uniform price with complete information

### What should the firm maximize?

- ☐ Profit
- ☒ Revenue without considering costs
- ☐ Quantity sold

Your answer: Revenue without considering costs. The correct answer is Profit. Review the rules: the firm maximizes profit; a higher price lowers demand; and profit subtracts costs from revenue.

### In the basic demand, what happens to quantity sold when price rises?

- ☒ It falls
- ☐ It rises
- ☐ It does not change

### How is profit calculated?

- ☒ Total revenue minus total cost
- ☐ Price multiplied by cost
- ☐ Consumer surplus plus deadweight loss

Continue

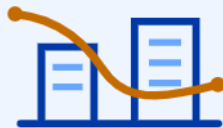
Powered by [oTree](#)

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

## Pricing decision

Decision 1 of 1

Uniform price with complete information



TREATMENT

### Uniform price with complete information

Demand is  $Q = 120 - P$  for prices between 0 and 120 ECU. Every unit costs 20 ECU.

Known demand

Marginal cost: 20 ECU

Uniform price

 ECU**Confirm price(s)**Powered by [oTree](#)

Figure 3.5: Uniform-price decision page.



## Result of your decision

Decision 1 of 1

Uniform price with complete information

|                                        |                                     |                                  |                                    |
|----------------------------------------|-------------------------------------|----------------------------------|------------------------------------|
| Effective price<br><b>70 ECU</b>       | Quantity sold<br><b>50</b>          | Total revenue<br><b>3500 ECU</b> | Total cost<br><b>1000 ECU</b>      |
| Profit<br><b>2500 ECU</b>              | Consumer surplus<br><b>1250 ECU</b> | Total surplus<br><b>3750 ECU</b> | Deadweight loss<br><b>1250 ECU</b> |
| Share of maximum profit<br><b>100%</b> |                                     |                                  |                                    |

### Theoretical benchmark

Maximum profit for this treatment is 2500 ECU, associated with the stated reference price or rule.

Continue

Powered by [oTree](#)

Figure 3.6: Individual result with profit and welfare decomposition.



## Activity completed

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

|                                        |                                                  |                           |
|----------------------------------------|--------------------------------------------------|---------------------------|
| Cumulative profit<br><b>2500,0 ECU</b> | Average share of maximum profit<br><b>100.0%</b> | Best decision<br><b>1</b> |
|----------------------------------------|--------------------------------------------------|---------------------------|

## Decision history

| Round | Effective price | Quantity sold | Profit     | Share of maximum profit |
|-------|-----------------|---------------|------------|-------------------------|
| 1     | 70.0            | 50.0          | 2500,0 ECU | 100.0%                  |

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Figure 3.7: Explicit final screen and personal summary.

oTree
Demo
Sessions
Rooms
Data
Server Check

[EN] Monopoly — uniform price, one decision: session 'ibtpfxn6' (demo)

New
Links
Monitor
Data
Payments
Report
Description

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

Choose one of the following options to play the session:

Split-screen view  
Launch

Grid view  
Launch

**Session-wide testing link**

Open the below link in up to 4 browser tabs.

<http://127.0.0.1:8038/join/tevuzuta>

**Single-use links**

Open each link in its own browser tab.

|    |                                                                                                                         |
|----|-------------------------------------------------------------------------------------------------------------------------|
| P1 | <a href="http://127.0.0.1:8038/initializeParticipant/zuwawx59">http://127.0.0.1:8038/initializeParticipant/zuwawx59</a> |
| P2 | <a href="http://127.0.0.1:8038/initializeParticipant/4kuvj68g">http://127.0.0.1:8038/initializeParticipant/4kuvj68g</a> |
| P3 | <a href="http://127.0.0.1:8038/initializeParticipant/wagiltfr">http://127.0.0.1:8038/initializeParticipant/wagiltfr</a> |
| P4 | <a href="http://127.0.0.1:8038/initializeParticipant/47zvm9n0">http://127.0.0.1:8038/initializeParticipant/47zvm9n0</a> |

Figure 3.8: Session page with one participant link per place.

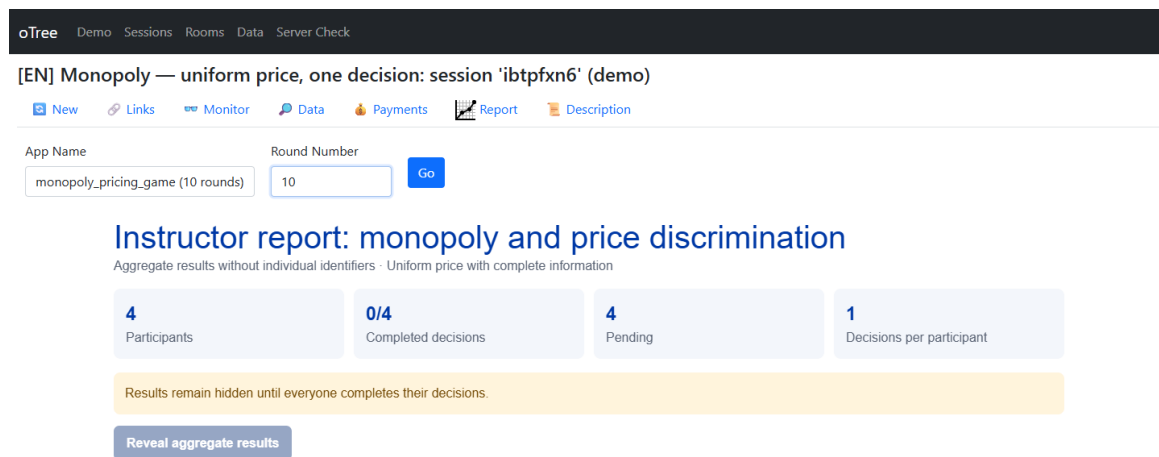


Figure 3.9: Private report while decisions are still pending.

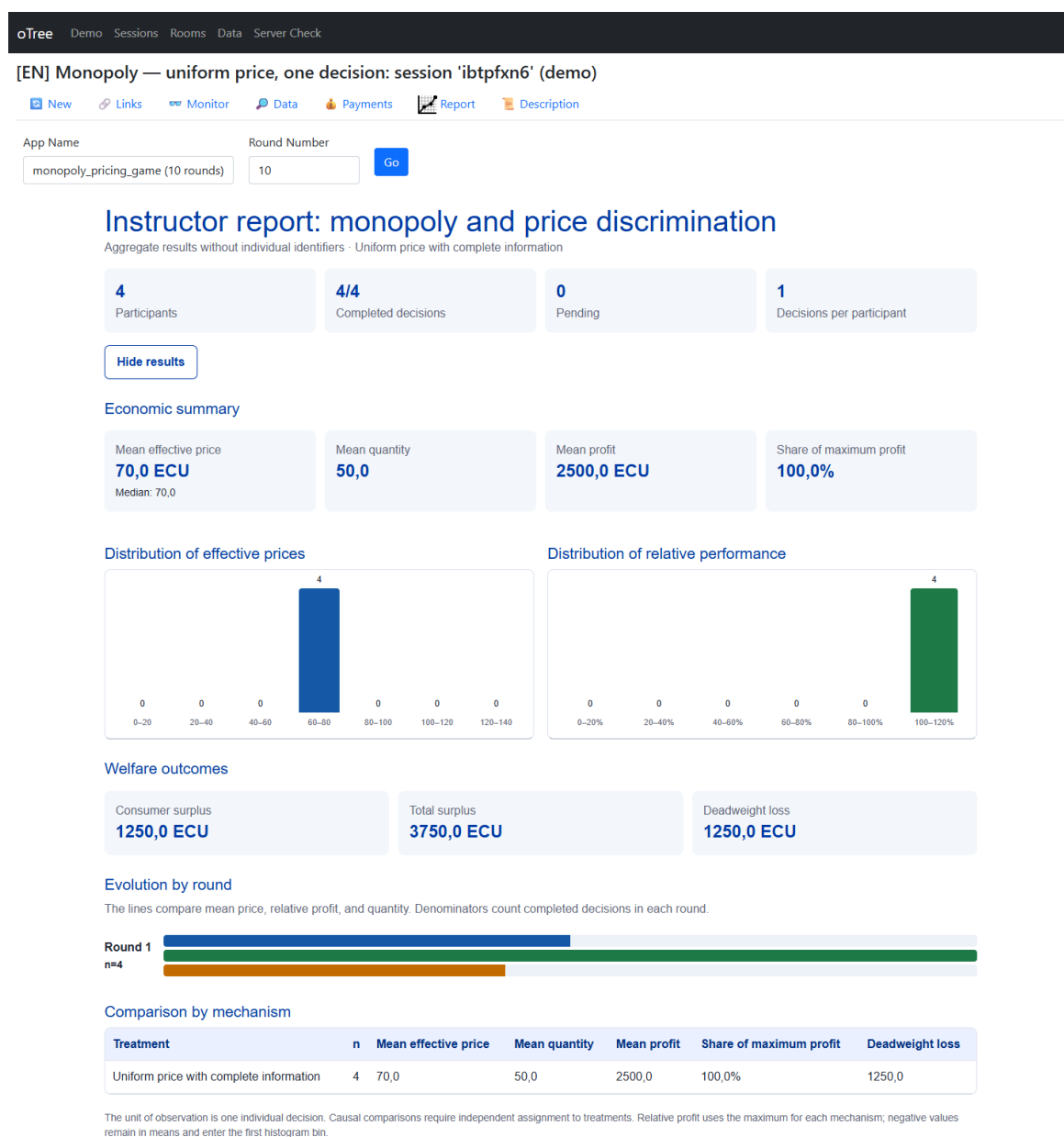


Figure 3.10: Aggregate teaching report after the reveal condition is met.

box marks material that requires action or special attention, while color provides hierarchy. If an updated screenshot displays a key as an unboxed blue paragraph, the visual component has regressed and should be corrected before deployment.

# Basic configurations

## 4.1 One decision with complete information

The one-decision version is the cleanest introduction. Participants see  $Q = 120 - P$  and  $MC = 20$ , choose once, and receive feedback. The theoretical prediction is  $P = 70$ ,  $Q = 50$ , and profit 2,500. Because the equation is available, deviation can reflect imperfect application, alternative objectives, or ordinary input mistakes. It should not be called failure to discover demand.

Before reveal, ask every student to write a predicted modal price for the class and one sentence of reasoning. Common predictions include marginal-cost pricing at 20, revenue maximization at 60, the monopoly price at 70, and a very high price based on the idea that a monopolist charges as much as possible. The histogram turns these competing models into visible empirical categories.

This version works well in principles courses because it separates accounting identities from optimization. Start with one observed price, calculate quantity, multiply for revenue, subtract cost, and then compare another price. Only after students understand the table should the class derive marginal revenue. The formal solution becomes an explanation of a pattern they have already generated.

## 4.2 Ten decisions with complete information

The repeated complete-information version keeps demand and cost visible for ten decisions. It measures whether participants improve after direct payoff feedback. The benchmark remains 70 in every round. There is no changing state and no strategic opponent. A participant who changes price is experimenting with the payoff function, correcting a calculation, or pursuing another goal.

Use the round chart to ask whether convergence means exact equality at 70, declining dispersion, rising relative profit, or all three. Because the profit function is smooth near its maximum, profit may converge faster than price. A class can therefore become economically successful without every decision matching the integer benchmark. This is an opportunity to distinguish loss functions and tolerances from a binary correct/incorrect score.

Repeated complete information can also reveal persistence. Some participants may continue selecting 60 because the result page shows high revenue; others may select 20 because they use the competitive rule; others may alternate around 70. Ask for anonymous written explanations before attributing clusters to particular reasoning. The distribution suggests hypotheses, while the explanations provide additional evidence.

### 4.3 Demand discovery

The discovery version hides  $Q = 120 - P$  before choices. Participants know marginal cost and learn from realized quantity and profit. A systematic strategy might vary price in large steps to locate a profitable region and then refine. An unsystematic strategy may jump without using previous outcomes. The class can compare exploration, exploitation, and the opportunity cost of experimentation.

Do not reveal the demand equation or optimum during the activity. If one participant asks for the equation, remind the room that demand must be learned from feedback. Communication between participants is especially consequential because one person can share a discovered price. Laboratory silence is therefore part of the economic treatment, not merely etiquette.

After the final decision, reconstruct demand from two or more price-quantity observations. Since slope is constant, two accurate points identify the line. Then derive the optimum and compare it with actual paths. Ask whether an early high-profit result led to premature stopping and whether a participant tested prices on both sides of the candidate maximum. This connects experimental search to firm demand estimation.

# Extended discrimination variants

## 5.1 First-degree discrimination

Four consumers have known valuations of 100, 80, 60, and 40 ECU for one unit. Marginal cost is 20 per unit. The firm sets one price for each person. A consumer buys if the assigned price does not exceed valuation. Charging exactly each valuation sells all four units, produces revenue 280, cost 80, and profit 200. Consumer surplus is zero and all positive gains from trade accrue to the firm.

The efficient quantity is four because every valuation exceeds marginal cost. A price above valuation excludes a profitable trade and creates deadweight loss equal to valuation minus cost. A price below valuation preserves the trade but transfers surplus to the consumer. This clean decomposition allows students to see that extraction and efficiency are different concepts.

The theoretical result rests on demanding assumptions: the firm knows each person's maximum willingness to pay, can condition price on identity, prevents resale, and can enforce the tariff at low cost. Real-world personalization uses imperfect predictions and may create privacy, fairness, and legal concerns. The class should list which assumption fails in examples such as tuition aid, negotiated medical bills, personalized digital offers, or vehicle sales.

Do not describe the four price fields as four unrelated products. Every consumer values the same unit and has the same production cost. The variation comes from willingness to pay and information. If students instead imagine quality differences, the activity no longer isolates first-degree discrimination.

## 5.2 Second-degree discrimination and self-selection

The firm cannot observe type directly. It offers a small package with two units and a large package with four units. The low type values the packages at 100 and 120 ECU; the high type values them at 140 and 260. Production costs 20 per unit. Each type chooses the option that gives the highest nonnegative surplus. If alternatives tie, the programmed tie rule is stated in the instructions so that the prediction is reproducible.

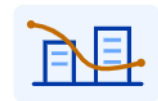
Consider a small-package price of 100 and a large-package price of 220. The low type obtains zero from the small package and  $120 - 220 = -100$  from the large package, so the small package is selected. The high type obtains  $140 - 100 = 40$  from the small package and  $260 - 220 = 40$  from the large package; under the stated tie rule, the high type chooses the large package. Total revenue is 320, six units cost 120, and profit is 200. The high type retains an information rent of 40.

Why not charge 260 for the large package? At that price the high type receives zero from large and 40 from small, so the high type downgrades. The small package is an internal outside option.



## Instructions

First-degree price discrimination



### Your role

You manage the only firm selling this product. The computer represents consumers through the stated demand rules.

### Objective

Choose the price or tariff that maximizes the firm's profit. All values are expressed in ECU.

**Profit = total revenue – total cost. Revenue depends on the sales generated by your price.**

After deciding, you will see sales, profit, consumer surplus, and deadweight loss. These measures compare private benefit and welfare.

### First-degree price discrimination

There are four consumers with values of 100, 80, 60, and 40 ECU. You may offer an individual price to each one. Each purchase costs 20 ECU to produce. A consumer buys if value is at least the offered price.

This session contains 5 decision(s).

**Continue**

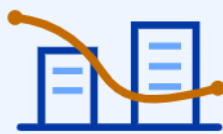
Powered by oTree

Figure 5.1: Known individual valuations in the first-degree treatment.

## Pricing decision

Decision 1 of 5

First-degree price discrimination



### TREATMENT

## First-degree price discrimination

There are four consumers with values of 100, 80, 60, and 40 ECU. You may offer an individual price to each one. Each purchase costs 20 ECU to produce. A consumer buys if value is at least the offered price.

Known demand

Marginal cost: 20 ECU

Price for  
consumer 1(100  
ECU)

ECU

Price for  
consumer 2(80  
ECU)

ECU

Price for  
consumer 3(60  
ECU)

ECU

Price for  
consumer 4(40  
ECU)

ECU

**Confirm price(s)**Powered by [oTree](#)

Figure 5.2: One price field for each simulated consumer.



## Instructions

Second-degree price discrimination



### Your role

You manage the only firm selling this product. The computer represents consumers through the stated demand rules.

### Objective

Choose the price or tariff that maximizes the firm's profit. All values are expressed in ECU.

**Profit = total revenue – total cost. Revenue depends on the sales generated by your price.**

After deciding, you will see sales, profit, consumer surplus, and deadweight loss. These measures compare private benefit and welfare.

### Second-degree price discrimination

There is one low type and one high type consumer. For the low type, the 2-unit package is worth 100 ECU and the 4-unit package 120 ECU. For the high type, they are worth 140 and 260 ECU. You set each package's total price; each consumer chooses the one yielding the greatest surplus, or does not buy. Each unit costs 20 ECU.

This session contains 5 decision(s).

Continue

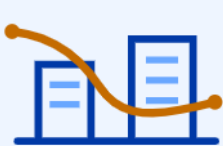
Powered by [oTree](#)

Figure 5.3: Bundle values, cost, and self-selection rule.

## Pricing decision

Decision 1 of 5

Second-degree price discrimination



**TREATMENT**

### Second-degree price discrimination

There is one low type and one high type consumer. For the low type, the 2-unit package is worth 100 ECU and the 4-unit package 120 ECU. For the high type, they are worth 140 and 260 ECU. You set each package's total price; each consumer chooses the one yielding the greatest surplus, or does not buy. Each unit costs 20 ECU.

Known demand    Marginal cost: 20 ECU

Small package: 2 units

ECU

Large package: 4 units

ECU

Confirm price(s)

Powered by [oTree](#)

Figure 5.4: Two package prices define the menu.

The menu must satisfy participation constraints and incentive-compatibility constraints. A tariff can extract more from a high type only while preserving the intended ranking of options.

Second-degree discrimination is often confused with first degree because buyers pay different totals. The defining feature is how the difference is implemented. The firm posts a menu and consumers reveal information through their choice. Quantity discounts, product versions, service tiers, and nonlinear electricity tariffs may use this logic. The instructor should still ask whether observed costs or quality differences also explain the menu.

When discussing the report, do not rely only on average price per unit. Two menus can have the same average yet induce different selections. Examine package prices, the option selected by each type, consumer rents, profit, and total surplus. A menu that appears expensive may fail because both types choose small or neither buys.

### 5.3 Third-degree discrimination

The firm observes two segments and can keep them separate. Segment A has demand  $Q_A = (140 - P_A)/2$  and segment B has demand  $Q_B = 100 - P_B$ . Marginal cost is 20 in both. Separate marginal-revenue conditions produce  $P_A = 80$ ,  $Q_A = 30$ ,  $P_B = 60$ , and  $Q_B = 40$ . Profits are 1,800 and 1,600, for total profit 3,400.

The relevant comparison is not simply which segment has a higher intercept. At the optimal prices, segment A receives a higher markup because its demand response supports it. Ask students to calculate elasticity or marginal revenue in each segment. Then compare the discriminating outcome with the best single price applied to the pooled market.

The welfare effect of third-degree discrimination is not signed by the label alone. A change in price structure can expand output in one market and contract it in another. Whether total output rises, and which marginal valuations are served, matters. Distribution across groups also changes. The report therefore separates quantities and surplus by segment rather than displaying only total profit.

Observable segmentation raises classification questions. Student discounts, geographic prices, peak/off-peak pricing, and age-based tariffs differ in costs, elasticities, legal treatment, and policy objectives. The activity supplies a mechanism, not a verdict about any specific practice. A strong debrief asks what information is used, whether consumers can switch category, and whether service costs differ.

### 5.4 Resale and arbitrage

The resale treatment begins with the same two announced segment prices, but consumers can access the lower price. The effective price is therefore  $\min\{P_A, P_B\}$  for both segments. If the firm announces 80 and 60, both segments buy at 60. Segment A demands 40 and segment B demands 40; profit is  $(60 - 20)80 = 3,200$ . The announced high price does not bind.

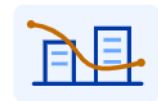
This treatment illustrates why separation is an economic condition rather than a label in a data set. If participants bring the two announced prices closer together, the pattern is consistent with the arbitrage constraint. If a large announced gap persists, inspect effective price and profit: the higher announcement may simply be irrelevant under the programmed rule.

Real markets contain transaction costs, shipping, warranties, contracts, capacity limits, and product differentiation. These frictions can limit resale without eliminating it. The simplified treatment intentionally sets such frictions to zero. After students understand the benchmark, ask



## Instructions

Third-degree price discrimination



### Your role

You manage the only firm selling this product. The computer represents consumers through the stated demand rules.

### Objective

Choose the price or tariff that maximizes the firm's profit. All values are expressed in ECU.

**Profit = total revenue – total cost. Revenue depends on the sales generated by your price.**

After deciding, you will see sales, profit, consumer surplus, and deadweight loss. These measures compare private benefit and welfare.

### Third-degree price discrimination

There are two separated segments. In A,  $Q_A = (140 - P_A)/2$ ; in B,  $Q_B = 100 - P_B$ . Marginal cost is 20 ECU. You may set one price per segment.

This session contains 5 decision(s).

**Continue**

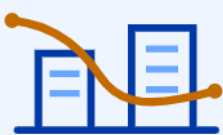
Powered by [oTree](#)

Figure 5.5: Two observable and separated demand segments.

## Pricing decision

Decision 1 of 5

Third-degree price discrimination



**TREATMENT**

### Third-degree price discrimination

There are two separated segments. In A,  $Q_A = (140 - P_A)/2$ ; in B,  $Q_B = 100 - P_B$ . Marginal cost is 20 ECU. You may set one price per segment.

Known demand    Marginal cost: 20 ECU

Price for segment A     ECU    Price for segment B     ECU

Confirm price(s)

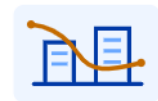
Powered by [oTree](#)

Figure 5.6: One price for each segment.



## Instructions

Price discrimination with resale



### Your role

You manage the only firm selling this product. The computer represents consumers through the stated demand rules.

### Objective

Choose the price or tariff that maximizes the firm's profit. All values are expressed in ECU.

**Profit = total revenue – total cost. Revenue depends on the sales generated by your price.**

After deciding, you will see sales, profit, consumer surplus, and deadweight loss. These measures compare private benefit and welfare.

### Price discrimination with resale

Segments can resell. If prices differ, everyone can access the lower price. Both segments' demand is calculated using that effective price.

This session contains 5 decision(s).

**Continue**

Powered by [oTree](#)

Figure 5.7: The lowest announced price becomes accessible to both segments.

## Pricing decision

Decision 1 of 5

Price discrimination with resale



### TREATMENT

## Price discrimination with resale

Segments can resell. If prices differ, everyone can access the lower price. Both segments' demand is calculated using that effective price.

Known demand

Marginal cost: 20 ECU

Price for segment A

ECU

Price for segment B

ECU

[Confirm price\(s\)](#)Powered by [oTree](#)

Figure 5.8: Two announced prices under the resale constraint.

which friction would be sufficient to sustain a gap and what empirical evidence would reveal its importance.

The comparison also disciplines policy reasoning. Preventing resale can increase the firm's ability to extract surplus, but it can sometimes support service to a market that would otherwise be excluded. Allowing resale can equalize effective prices while changing output. The class should calculate the local parameterization before making a general welfare claim.

# Regulation and cost variants

## 6.1 Binding price cap

The regulation treatment sets a maximum price of 50 ECU. Since the unconstrained monopoly price is 70, the cap binds. Within the feasible set the firm chooses 50, sells 70 units, receives revenue 3,500, pays cost 1,400, and earns profit 2,100. Consumer surplus rises to  $\frac{1}{2}(120 - 50)70 = 2,450$  and total surplus rises to 4,550. Deadweight loss falls to 450.

Under these parameters, the cap lowers profit, raises quantity, and increases total surplus relative to unregulated monopoly. Do not generalize that every ceiling improves welfare. A cap below marginal cost can generate losses, exit, rationing, reduced quality, or lower investment. Those supply responses are absent from the current activity. The comparison demonstrates the direct static effect for a firm that continues to serve computer-calculated demand.

The constrained benchmark matters when reading relative profit. A participant who chooses 50 earns 100 percent of the maximum available under the cap, even though 2,100 is below the unregulated maximum of 2,500. The report uses the treatment-specific feasible maximum. This prevents a regulated decision from being classified as privately suboptimal merely because the unconstrained action is prohibited.

## 6.2 Higher marginal cost

The cost treatment raises marginal cost from 20 to 40 while leaving demand unchanged. The condition  $120 - 2Q = 40$  gives  $Q = 40$  and  $P = 80$ . Profit is  $(80 - 40)40 = 1,600$ . Price rises by 10 when marginal cost rises by 20, a one-half pass-through rate in this linear benchmark. Quantity falls from 50 to 40. The efficient reference becomes  $P = 40$ ,  $Q = 80$ .

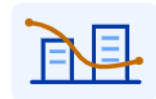
This version separates a cost-driven price increase from an increase attributed to greater market power. If participants retain the old price of 70, quantity remains 50 but the margin falls; profit is 1,500, below the new maximum of 1,600. The optimal response does not add the entire cost increase mechanically to the old price. The firm solves the margin-quantity tradeoff again.

The variant also introduces pass-through. In a linear demand with constant marginal cost, a unit cost increase raises the monopoly price by one half unit. Other demand curvature, taxes, capacity constraints, or competition can produce different pass-through. The classroom benchmark gives a concrete starting point for asking why incidence is an empirical question.



## Instructions

Regulated price cap



### Your role

You manage the only firm selling this product. The computer represents consumers through the stated demand rules.

### Objective

Choose the price or tariff that maximizes the firm's profit. All values are expressed in ECU.

**Profit = total revenue – total cost. Revenue depends on the sales generated by your price.**

After deciding, you will see sales, profit, consumer surplus, and deadweight loss. These measures compare private benefit and welfare.

### Regulated price cap

Demand is  $Q = 120 - P$ , marginal cost is 20 ECU, and regulation prevents a price above 50 ECU.

### Worked example

At the maximum permitted price of 50 ECU, 70 units are sold. Revenue is 3,500, cost is 1,400, and profit is 2,100 ECU.

This session contains 5 decision(s).

Continue

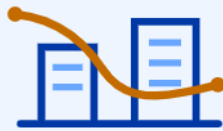
Powered by [oTree](#)

Figure 6.1: Rule and worked example for the binding price cap.

## Pricing decision

Decision 1 of 5

Regulated price cap



### TREATMENT

## Regulated price cap

Demand is  $Q = 120 - P$ , marginal cost is 20 ECU, and regulation prevents a price above 50 ECU.

Known demand

Marginal cost: 20 ECU

Maximum permitted price: 50 ECU

Uniform price

ECU

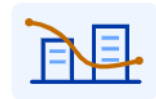
**Confirm price(s)**Powered by [oTree](#)

Figure 6.2: The input field does not allow a price above 50 ECU.



## Instructions

Higher marginal cost



### Your role

You manage the only firm selling this product. The computer represents consumers through the stated demand rules.

### Objective

Choose the price or tariff that maximizes the firm's profit. All values are expressed in ECU.

**Profit = total revenue – total cost. Revenue depends on the sales generated by your price.**

After deciding, you will see sales, profit, consumer surplus, and deadweight loss. These measures compare private benefit and welfare.

### Higher marginal cost

Demand is  $Q = 120 - P$  and marginal cost rises to 40 ECU.

### Worked example

If price is 80 ECU, 40 units are sold. With marginal cost of 40 ECU, revenue is 3,200, cost is 1,600, and profit is 1,600 ECU.

This session contains 5 decision(s).

**Continue**

Powered by [oTree](#)

Figure 6.3: Stable demand and a marginal cost of 40 ECU.

## Pricing decision

Decision 1 of 5

Higher marginal cost



TREATMENT

### Higher marginal cost

Demand is  $Q = 120 - P$  and marginal cost rises to 40 ECU.

Known demand

Marginal cost: 40 ECU

Uniform price

ECU

**Confirm price(s)**Powered by [oTree](#)

Figure 6.4: Pricing decision under higher marginal cost.

## How to read the results

Start with the number of participants and completed decisions. A session with four people and ten rounds contains up to forty decisions, but only four individual trajectories. For a mean in each round, the denominator is four if everyone completes. For the pooled histogram, it is forty. The report shows both denominators to prevent observations from being mistaken for independent experimental units.

The price histogram answers whether choices concentrate around the benchmark and whether modes correspond to competing rules. The histogram of percent of maximum profit summarizes private losses from suboptimal choices. A narrow distribution near 100 percent indicates strong economic performance, but says little by itself about social welfare. Under first degree, maximum profit can coexist with zero consumer surplus. Under a price cap, the constrained maximum can be lower than unregulated profit and yield higher total surplus.

Round evolution displays price, relative profit, and quantity by period. Inspect direction, dispersion, and stabilization. If price moves toward 70 while relative profit rises, the pattern supports learning toward the uniform optimum. If price oscillates while profit remains high, remember that the payoff function is fairly flat near its maximum. Small price differences can produce almost identical profits.

For third degree, compare  $P_A$  with 80 and  $P_B$  with 60, and compare quantities 30 and 40. A weighted average price can hide errors in opposite directions. For resale, distinguish announced prices from effective price. For second degree, inspect which package each type selects; average revenue per unit cannot reveal whether the menu screens as intended. For first degree, count served consumers and retained consumer rents.

Do not use a chart as a causal estimate. A downward mean over rounds is an observation. Learning from feedback is a plausible mechanism. Claiming that feedback caused the decline requires a counterfactual, such as a comparison condition without the same information. Likewise, a price below 70 may be consistent with fairness, but also with revenue maximization or misunderstanding. Good feedback separates what the graph displays from what the instructor infers.

### Theoretical foundation

Keep observation, mechanism, and inference distinct. “The class mean declined over rounds” is an observation. “Participants learned from payoff feedback” is a compatible mechanism. “Feedback caused the decline” requires an identifying comparison. This discipline strengthens the debrief and prepares students to evaluate experimental evidence.

A useful report narrative has four layers. Describe where the distribution is centered. Report spread and any secondary modes. Connect economically meaningful clusters to calculations. Then compare welfare. Avoid reading every decimal or ranking individuals. The purpose is to explain the market institution and the class’s reasoning, not to evaluate a named participant.

## 7.1 Lesson plans

### 7.1.1 A 50-minute session: basic monopoly

Allocate five minutes to revenue, cost, and laboratory rules; five to comprehension; five to one private decision; ten to predictions before reveal; fifteen to deriving  $MR = MC$  and calculating welfare; and ten to discussion. Do not display the solution before the choice. On reveal, locate the mode and ask about prices 20, 60, 70, and 120. Close with the distinction between a transfer and deadweight loss.

The instructor can begin with a concrete prompt: “If you raise price by one ECU, what happens to the margin and to sales?” Collect answers without announcing the correct balance. After choices, build a small table for prices 60, 70, and 80. Students see that equal profits can appear on either side of the optimum and that revenue and profit peaks differ.

For an introductory audience, draw demand and marginal cost first, then construct marginal revenue. For an intermediate class, derive both quantity and price formulations. For an industrial-organization class, add the Lerner condition and discuss identification of demand. The same activity supports different technical depth without changing participant instructions.

### 7.1.2 A 75-minute session: demand discovery

Use ten rounds without revealing demand. Reserve about fifteen minutes for decisions and ask each participant to record the rule used to choose the next price. Show aggregate trajectories, never individual names. Reveal  $Q = 120 - P$  after the final round, derive the optimum, and compare systematic search with erratic variation. Discuss why a real firm estimates demand from data and why a stable deterministic curve is a simplification.

At the midpoint, do not tell students whether they are close to the optimum. A neutral reminder can say: “Use the information already produced by your own decisions.” Early coaching changes the information treatment. If some participants finish far earlier than others, ask them to remain silent on the final screen.

The debrief can classify search strategies: monotonic adjustment, bracketing, local comparison, random experimentation, or repetition after a satisfactory outcome. These categories should come from written explanations rather than from prices alone. Connect the exercise to exploration and exploitation, pricing experiments, and the risk that historical data cover only a narrow range.

### 7.1.3 A 90-minute session: discrimination

Assign independent groups to uniform price, first degree, second degree, third degree, and resale. With too few students, run treatments sequentially and present comparisons as descriptive because order and carryover are uncontrolled. Allocate twenty minutes to decisions, twenty to calculations, twenty to surplus, twenty to institutional conditions, and ten to applications.

Build a comparison table with columns for information about consumers, tariff instrument, buyer response, enforcement requirement, profit, consumer surplus, and quantity. Ask each group to explain its mechanism without using the degree label. The rest of the class should infer whether discrimination is based on identity, self-selection, or observable group.

Finish with a resale counterfactual. A tariff that works under separation may fail once consumers can access the low price. Ask which real-world barriers restore separation and whether those barriers themselves use resources. This step prevents students from treating price discrimination as a matter of simply typing different prices.

### 7.1.4 A regulation session

Compare unregulated monopoly, a cap of 50, and marginal cost 40. Before revealing outcomes, request predictions for price, quantity, profit, consumer surplus, and total surplus. Use one common table. Emphasize that the report's maximum profit is specific to each feasible environment.

After calculations, introduce missing margins: rationing, quality, entry, investment, and political objectives. Ask which missing response would weaken the static welfare result and which data would be required to measure it. Students should leave able to explain both the local finding and why it is not a universal conclusion about price controls.

#### For the instructor

An effective classroom sequence has five steps: private prediction, decision, description of results, theoretical derivation, and institutional evaluation. If theory is shown first, the activity mostly measures application of a formula. If derivation is omitted afterward, the class sees a pattern without learning why it emerges.

# Solved exercises for classroom feedback

## 8.1 Uniform pricing

**Question.** Calculate quantity, revenue, cost, profit, consumer surplus, and deadweight loss when  $P = 80$ . **Solution.**  $Q = 40$ , revenue is 3,200, cost is 800, and profit is 2,400. Consumer surplus is  $\frac{1}{2}(40)(40) = 800$ . Total surplus is 3,200 and, relative to the efficient maximum of 5,000, deadweight loss is 1,800. Profit is only 100 below the maximum even though price is 10 above the optimum.

**Question.** Why does  $P = 60$  fail to maximize profit? **Solution.** It maximizes revenue:  $R = 3,600$ . Cost for 60 units is 1,200, giving profit 2,400. At  $P = 70$ , revenue falls to 3,500 and cost falls to 1,000, so profit rises to 2,500.

**Question.** What happens at  $P = 20$ ? **Solution.** Quantity is 100 and the allocation is efficient, but the firm's per-unit margin is zero, so profit is zero. Consumer surplus is 5,000. This result helps distinguish the competitive welfare benchmark from the monopolist's private optimum.

**Question.** What happens at  $P = 120$ ? **Solution.** Demand is zero, so revenue, cost, and profit are all zero. "Charge the highest possible price" is not a valid monopoly rule because demand responds to price.

## 8.2 First-degree discrimination

**Question.** If the firm charges 90, 80, 60, and 40 to consumers valued at 100, 80, 60, and 40, what occurs? **Solution.** All four buy. Revenue is 270, cost is 80, and profit is 190. The first consumer retains 10 of surplus and the others retain zero. No efficient trade is lost. Raising the first price to 100 would increase profit to 200.

**Question.** If the first consumer is charged 110, is the effect merely a transfer? **Solution.** No. That consumer declines to buy. A trade worth  $100 - 20 = 80$  is lost, creating deadweight loss of 80 and lowering profit. A price above willingness to pay does not extract more; it eliminates the transaction.

**Question.** If every consumer is charged 20, is the outcome first-degree discrimination? **Solution.** The platform permits four fields, but equal marginal-cost prices produce the efficient competitive allocation and no discriminatory extraction. The mechanism allows personalization; the participant's actual tariff determines whether prices differ.

### 8.3 Second-degree discrimination

**Question.** Evaluate a small-package price of 100 and large-package price of 220. **Solution.** The low type obtains zero from small and  $-100$  from large, choosing small under the participation and tie rules. The high type obtains 40 from both and chooses large under the stated tie rule. Revenue is 320, six units cost 120, and profit is 200. The high type retains an information rent of 40.

**Question.** Why not charge 260 for the large package? **Solution.** The high type would receive zero from large and 40 from small, so would choose small. The small package is an internal outside option. Incentive compatibility limits extraction from the large bundle.

**Question.** What does it mean if both types choose the small package? **Solution.** The menu does not separate types. It may still generate profit, but the intended screening mechanism failed. Compare utilities under both options before diagnosing whether the large price is too high or the small option too attractive.

### 8.4 Third degree and resale

**Question.** Verify prices 80 and 60 under separated markets. **Solution.** In A,  $Q_A = 30$  and margin is 60, producing profit 1,800. In B,  $Q_B = 40$  and margin is 40, producing profit 1,600. Total profit is 3,400. Consumer surpluses are 900 and 800.

**Question.** What if prices 80 and 60 are announced when resale is possible? **Solution.** Both markets access the effective price 60. Segment A demands 40 and segment B demands 40. Profit is  $(60 - 20)80 = 3,200$ . The announcement of 80 is not enforceable and has no effect on transactions.

**Question.** Does the lower resale profit prove that banning resale is socially desirable? **Solution.** No. Profit is one component. Compare consumer surplus, total output, total surplus, and any real resources needed to prevent resale. The activity isolates a pricing constraint and does not encode all enforcement costs or distributional judgments.

### 8.5 Regulation and costs

**Question.** Compare the cap at 50 with unregulated monopoly at 70. **Solution.** Quantity rises from 50 to 70; profit falls from 2,500 to 2,100; consumer surplus rises from 1,250 to 2,450; and deadweight loss falls from 1,250 to 450. Total surplus improves by 800, while distribution moves against the firm.

**Question.** With marginal cost 40, why not charge 90? **Solution.** At 90, quantity is 30 and profit is  $50(30) = 1,500$ . At 80, quantity is 40 and profit is  $40(40) = 1,600$ . The larger margin at 90 does not compensate for the reduced quantity.

**Question.** Why does a 20-unit cost increase raise optimal price by only 10? **Solution.** The firm rebalances margin and quantity. Solving  $MR = MC$  under linear demand gives  $P = (120 + MC)/2$ , so pass-through is one half. It is a property of these functional forms, not a universal law.

# Interpretive errors and discussion questions

Saying “a monopolist charges the most possible” is imprecise: at 120 the firm sells nothing and earns zero. Saying “price discrimination always lowers welfare” is also incorrect: discrimination can change quantity and permit trades absent under a uniform price. Saying “first degree is inefficient” confuses allocation and distribution: under the activity’s assumptions it serves every valuation above cost. Saying “a price ceiling always helps” omits supply, quality, investment, and rationing responses.

Useful questions include: What information is required for each degree of discrimination? What distinguishes observable segmentation from a self-selected menu? Which institution prevents resale? Is a membership program second-degree discrimination or identity-based pricing? Which part of higher profit is a transfer and which part comes from additional trades? Which measure in the report answers each question, and what additional evidence would be needed?

For real applications, require a unit and a counterfactual. A student discount may reflect lower willingness to pay, lower acquisition cost, a distributional goal, or a subsidy. Airfares may vary because of ticket restrictions, timing, inventory risk, and segmentation. A personalized online price may be a prediction of valuation, a response to cost, or an experiment. Economic concepts organize questions; they do not replace evidence about the particular market.

Another error is to treat the class average as an equilibrium generated by interaction. Participants do not share a market and do not compete. The average is a summary of individual solutions to equivalent computer-generated problems. It can reveal common anchors or mistakes, but it is not a market-clearing price.

Do not rank participants by profit on the projector. A public leaderboard can introduce status incentives unrelated to the learning objective and can discourage questions. Use anonymous distributions. If course assessment requires individual credit, base it on a separately announced rubric that rewards reasoning rather than simply proximity to one parameter-specific optimum.

## Feedback script

Use three columns on the board: “we observe,” “could explain it,” and “cannot conclude.” Put prices, quantities, and dispersion in the first; learning, error, or fairness in the second; and individual intentions or unsupported causal effects in the third. This routine prevents every deviation from becoming an unidentified behavioral story.

Ask students to design one additional treatment. To distinguish fairness from calculation error, they might provide a profit table to one group. To measure the role of demand uncertainty, they might compare known and hidden demand. To examine arbitrage costs, they might introduce

a fixed cost of accessing the low market. The proposal should name the comparison, unit of assignment, outcome, and prediction. This exercise converts a classroom demonstration into training in experimental design.

## 9.1 Data, privacy, and export

The custom export records a technical participant code, round, language, edition, treatment, mode, price fields, effective price, quantities, revenue, cost, profit, surplus, deadweight loss, and relative profit. The code links a person's rounds inside oTree but should not be joined to a name or student number in a projected analysis. Aggregates are sufficient for classroom feedback.

Incomplete decisions do not enter economic summaries. The report header states how many decisions remain pending. Do not replace missing values with zero: zero can be a valid price and has a distinct economic meaning. For later analysis, document inclusion criteria, treatment, round, and aggregation level. If all rounds are pooled, acknowledge within-person dependence.

The report stays hidden until the session is complete. This rule protects the sequence but does not make the database anonymous. Administrative access, backups, and exports remain subject to laboratory practice. Do not project the Data page or individual URLs. Retain exported files only for an authorized teaching or research purpose and remove temporary copies according to institutional policy.

For a research use, the classroom implementation is not automatically an approved study. Research questions involving publication, systematic analysis, or identifiable educational records may require ethics review, consent, preanalysis decisions, and data governance beyond this guide. The instructor should consult the relevant institutional process before collecting data for such a purpose.

When comparing sections, record configuration, date, course, instruction timing, incentive rule, and any interruption. These metadata often explain variation that the decision table cannot. They should be stored separately from direct identifiers. Never infer a participant's motives solely from an exported price.

## 9.2 Troubleshooting

**Another game appears in Demo.** Do not start the session. The instance is not filtered correctly. Verify `GAME_FAMILY=monopoly`, the running process, and the separate production deployment. The family domain must display only its 24 configurations.

**Rooms shows more or fewer than four rooms.** Confirm that the deployed code contains the four canonical names and restart the correct instance. A basic room should default to a basic configuration in its language and exclude extended configurations.

**A participant is reported as nonexistent.** The link belongs to an old session or database. Create a new session and distribute current links. Never run `resetdb` against the production database during a class.

**The report does not reveal.** Check the pending count. In a ten-round session, every participant must complete all ten decisions. A closed or abandoned browser can leave required decisions pending. Do not fabricate records to unlock the display; address the participant session or create a documented replacement session.

**A response looks economically impossible.** Verify treatment and unit. Under first degree, effective price is an average across sales; under second degree, it is revenue per unit; under resale, it is the lower announced price. Inspect original export fields before declaring a calculation error.

**Spanish and English are mixed.** Confirm that the selected configuration is labeled [EN] and that participants received `monopoly_en` or `monopoly_extended`. Language belongs to the session configuration, not to a browser translation button.

**The local link waits indefinitely.** Confirm that the development server is still running on port 8038 and that the URL uses the current host. A participant link from an earlier server process may be stale even when Demo opens. Create a fresh local session after restart.

**A chart contains duplicated labels or blue text below black text.** The screenshot or report template may contain overlapping elements. Stop using that image in the guide, correct the template, recapture the real screen, and compile again. Do not hide the defect by cropping away relevant content.

**The page shows Debug info.** The student interface should not expose debug details in the validated experience. Check production settings and the page template. Debug controls are for development and must not be part of a deployed classroom screen.

# Configuration catalog

The basic edition offers, in each language, one uniform decision, ten uniform decisions with complete information, and ten demand-discovery decisions. The extended edition repeats the one- and ten-decision reference cases, retains demand discovery, and adds six mechanisms. Stable configuration names allow the laboratory to build routes, tests, and documentation without depending on translated display text.

| English configuration                                   | Content                                   |
|---------------------------------------------------------|-------------------------------------------|
| <code>monopoly_en_1_round</code>                        | Uniform price, one decision.              |
| <code>monopoly_en_10_rounds_complete_information</code> | Uniform price, ten decisions.             |
| <code>monopoly_en_10_rounds_demand_discovery</code>     | Search with hidden demand.                |
| <code>monopoly_extended_reference_1_round</code>        | Extended reference, one decision.         |
| <code>monopoly_extended_reference_10_rounds</code>      | Extended reference, ten decisions.        |
| <code>monopoly_extended_demand_discovery</code>         | Demand discovery in the extended edition. |
| <code>monopoly_extended_first_degree</code>             | Individualized prices.                    |
| <code>monopoly_extended_second_degree</code>            | Two-bundle menu.                          |
| <code>monopoly_extended_third_degree</code>             | Two separated segments.                   |
| <code>monopoly_extended_resale</code>                   | Two announcements with arbitrage.         |
| <code>monopoly_extended_price_cap</code>                | Binding cap of 50 ECU.                    |
| <code>monopoly_extended_high_cost</code>                | Marginal cost of 40 ECU.                  |

The Spanish configurations follow the same order and mechanisms. The English room never displays the Spanish list, yet both languages use the same tested application code and payoff functions.

When adding a configuration, assign it explicitly to the monopoly family, select language and edition through configuration fields, add a bot test, and update the catalog and guide only after the screen has been captured from a real session. Do not filter families by translated display-name prefixes. Stable internal metadata provides a safer boundary than visible labels.

## 10.1 Conceptual glossary

**Arbitrage.** Purchasing in a low-price market and reselling or accessing the good in a high-price market, which limits sustainable price differences.

**Average revenue.** Revenue divided by quantity; under a single uniform price it equals price, but under bundles or personalized prices it may be a constructed summary.

**Consumer surplus.** The aggregate difference between willingness to pay and actual payment for purchased units.

**Deadweight loss.** Gains from trade that no party receives because efficient transactions fail to occur, or because inefficient transactions occur.

**Demand discovery.** Learning about an initially hidden demand relationship from the consequences of pricing decisions.

**First-degree price discrimination.** Individual pricing based on known willingness to pay, subject to participation and enforcement.

**Incentive compatibility.** A condition under which every private type prefers the option designed for that type to other options in the menu.

**Information rent.** Surplus that a type retains because the tariff must induce truthful self-selection when information is private.

**Inverse demand.** The maximum price associated with each aggregate quantity.

**Lerner index.** The proportional markup  $(P - MC)/P$ , connected to elasticity at an interior monopoly optimum.

**Marginal cost.** The additional cost of producing one more unit.

**Marginal revenue.** The change in total revenue from selling an additional unit, including the effect of any required price reduction on earlier units.

**Participation constraint.** A condition ensuring that a buyer weakly prefers purchasing an option to the outside alternative.

**Price cap.** A legal or institutional upper limit on the tariff the firm may charge.

**Profit.** Revenue minus economic cost. It is not synonymous with revenue, sales, or producer receipts before cost.

**Resale.** Transfer or access that allows consumers intended for a high-price market to obtain the lower-price offer.

**Second-degree price discrimination.** A menu of quantities or qualities designed so that privately informed consumers select different options.

**Self-selection.** A consumer's choice from a menu, which indirectly reveals information relevant to the firm.

**Third-degree price discrimination.** Different prices for observable, separated groups with distinct demands.

**Total surplus.** Profit plus consumer surplus in this activity; the measure abstracts from unmodeled externalities and administrative costs.

**Transfer.** A change in who receives surplus without necessarily destroying total value.

**Uniform price.** One price available to all buyers for the same unit under the same terms.

## 10.2 Final operational checklist

### Checkpoint

1. Define the learning objective, duration, language, treatment, and incentive.
2. Enter through <https://beer-lab.org/> and <https://teaching.beer-lab.org/>.
3. Confirm the dedicated domain <https://monopoly.beer-lab.org/>.
4. Verify exactly 24 configurations and four rooms.
5. Create a fresh session and distribute one link per participant.
6. Keep the aggregate report on a private screen until reveal.
7. Do not disclose demand or the solution before a discovery activity ends.
8. Wait until the pending count reaches zero.
9. Collect predictions before showing aggregate results.
10. Discuss distribution, evolution, profit, and welfare with clear denominators.
11. Export data only for a defined and authorized purpose.
12. Close with limits of inference and the institutional conditions behind each mechanism.

Before ending class, return to the learning outcomes. Ask one student to distinguish revenue and profit, another to explain  $MR = MC$ , another to identify the information required for discrimination, and another to describe why resale matters. A final minute paper can request one observed result, one theoretical explanation, and one conclusion the class cannot draw. These responses reveal whether the experiment produced conceptual understanding rather than only an entertaining sequence of screens.

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