



Instructor guide to options and exercise decisions

Laboratory implementation, theoretical foundations,
experimental evidence, and variants

Behavioral and Experimental Economics Research Lab
Department of Economics



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

How to use this guide

This guide supports the preparation, implementation, and classroom discussion of the options and exercise decisions family available through the Behavioral and Experimental Economics Research Lab (BEER Lab) at the Department of Economics of Tecnológico de Monterrey. It is intended for instructors with different levels of familiarity with experimental and behavioral economics.

The document offers three reading paths. The **quick guide** is enough to launch a session. The operational chapters explain each screen used by instructors and students. The conceptual chapters present the theories, predictions, and empirical findings needed to lead the post-game discussion.

Access instructions and common screens are explained once. Each variant then focuses only on what changes relative to the basic game: configuration, group size, decisions, predictions, relevant outcomes, and academic literature.

Author

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For the instructor

This guide follows the English-language interface. Spanish configurations use the same logic. Never project individual codes or connect outcomes to names, student identification numbers, or seats in the room.

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Preparing a class on contingent rights

1.1 The economic question and classroom experience

For the instructor

Ask three questions before interpreting a sale: how much cash it produces now, which right it extinguishes and what its receipts become at expiry. An early sale is distinct from early exercise. Both close the contract, but they can produce different amounts.

An option allows a decision after information arrives, but that right has a price and an expiry date. A claim that can be exercised for twenty units today may sell for more than twenty because future opportunities remain. The activity turns that distinction into a concrete choice: retain a contract, sell it or exercise it. The question is not to predict an actual stock-market rally. It is to identify the right surrendered by closing a position and compare receipts arriving at different dates.

The first objective is to distinguish the underlying quote, strike, premium and settlement. The second is to understand waiting value through a small tree. The third is to separate replication valuation from a forecast of future prices and from a personal preference over risk. The fourth is to reconstruct cash, interest, dividends and final payment without counting one right twice. Extensions examine how those comparisons change when the contract or trading institution changes.

This is an individual activity. No human buyer waits for an offer, classmates do not determine prices, and nobody is matched. An announced program bid allows the participant to realize the right's value. In the hedging conditions, a participant instead accepts a European liability and chooses underlying units to finance it. That counterparty also belongs to the program. Removing social interaction prevents a response to classmates from being mistaken for a consequence of contract terms, probabilities or resources.

Teachers need no previous experimental experience or financial software. Students need to compare quantities, multiply by an interest factor and recognize two possible outcomes. A first lesson can use one contract. With more time, the class can discuss three strikes or contrast American and European rights. Interface language presents resources and actions; theoretical interpretation belongs in the instructor's subsequent feedback. Record responses before explaining which action appears more valuable. This preserves the distinction between an observed choice and a response to advice.

1.2 Family summary and condition selection

Purpose	Relate exercise rights, waiting value and terminal wealth.
Experimental unit	Individual, without matching or waits; hedging against the program.
Participants	Any positive count, including one person.
Basic edition	One contract; three strikes in fixed or individually randomized order.
Extended edition	Baseline and twenty-two contrasts of rights, information, costs, valuation and hedging.
Decision	Retain, sell or exercise when permitted; choose underlying units when hedging.
Payoff	Mean terminal wealth across independent cases.
Topics	call and put options; time value; early exercise; contingent valuation; dividends; delta hedging.
JEL	A22, C91, D81, G13, G32, G41.
Suggested duration	15–25 minutes for the activity; 45–60 with discussion.

The reference uses 100 ECU per case, an initial underlying quote of one hundred, strike one hundred, three transitions, up and down factors of 1.2 and 0.8, and a gross safe factor of 1.02 per transition. ECU means Experimental Currency Units. The announced premium is deducted once and the remainder stays as cash. The horizon counts transitions: ordinary decisions occur at dates zero, one and two; if the claim remains open, date three determines automatic settlement. Explain that calendar before discussing an exercise date.

The basic battery changes strikes to ninety, one hundred and one hundred ten. Each case has separate resources and its order is either fixed or randomized individually. Wealth does not transfer to the next case. Payment is the mean of the three terminal amounts. Thus one hundred ten and ninety in two cases would produce one hundred, not two hundred. Four rooms separate language and edition: each basic room contains three configurations and each extended room twenty-three, including baseline. The 52 configurations constitute one family rather than 52 games.

The authorized endowment parameter accepts cent amounts from one hundred to ten thousand ECU. Instructions use the effective amount. Hold it constant when comparing conditions. Interest, dispersion and dividend parameters are teaching calibrations rather than annualized rates or market estimates. Decisions occur at discrete dates. An American claim permits exercise at every tree decision date, without pretending to be a high-frequency approximation to continuous trading. State that simplification when moving from classroom observations to broader financial reasoning.

1.3 Access and session preparation

Begin at <https://beer-lab.org/> and follow CLASS to <https://teaching.beer-lab.org/>. The family's proposed canonical address is <https://options.beer-lab.org/>. Basic English participants use https://options.beer-lab.org/room/options_en; Spanish participants use https://options.beer-lab.org/room/opciones_es. Extended rooms end in `options_extended` and `opciones_extendida`. The delivery record distinguishes the checked local instance from pending public publication. A completed package does not establish that its public domain has been deployed.

Instructors use `/demo` to select a configuration or `/rooms` to create a session in the appropriate room. This domain should display only its family and exactly four rooms. A basic room initially selects its language's single contract, whereas an extended room initially selects extended baseline. Verify

edition, language, participant count and description before creating. Native oTree administration labels can remain English; participant texts and the report follow the selected session language. This distinguishes normal administrative chrome from a translation defect in the game.

A session supplies individual links and a private report entry. Distribute a separate link to each person and keep instructor windows private. Test the activity on the classroom equipment and network, check the opening case and protect administrative credentials. The local instance <http://localhost:8097/demo> is accessible only from its host computer. Restarting to load current texts does not require deleting the database. An obsolete link should be replaced with its current session link, without inventing a participant or fabricated answers.

Choose the comparison before seeing outcomes. A dividend comparison should hold other terms constant while changing comparable rights. An information-aid comparison should preserve contract, horizon and resources. A private common seed can hold a path comparable, but it does not randomize student assignment. Random order in a battery controls presentation; it does not make contracts with different strikes identical. Allow time for comprehension and discussion. A class ending quickly because many participants sold at the opening date is a feature of its observed flow, not a defect to fill with subsequent artificial choices.

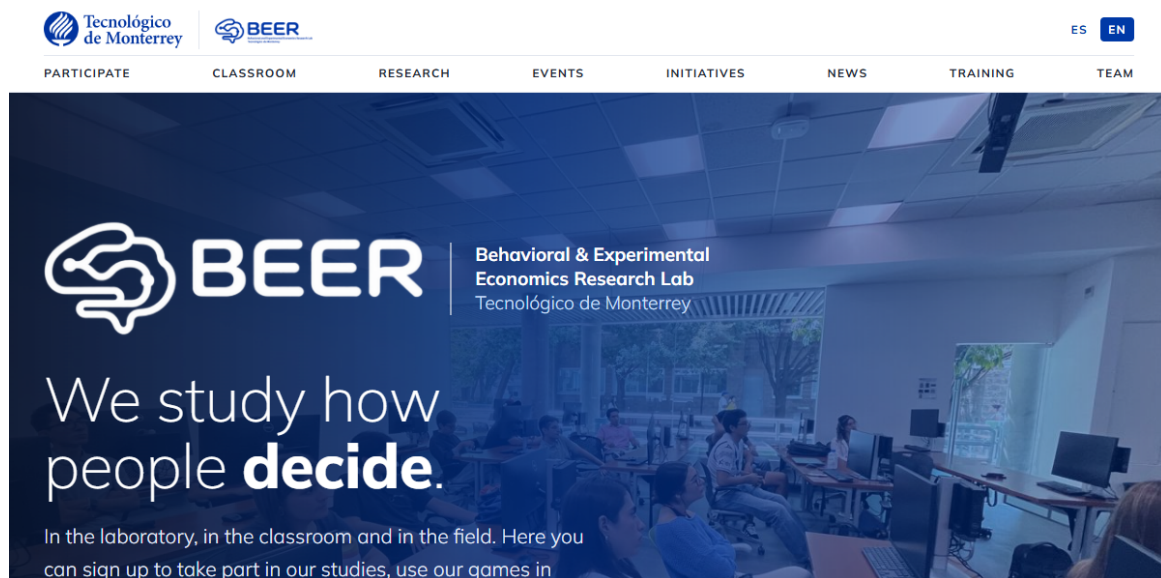


Figure 1.1: The institutional entry links to experimental teaching.

The screenshot shows the BEER Lab website interface. At the top, there are logos for 'Tecnológico de Monterrey' and 'BEER'. A navigation bar includes links for PARTICIPATE, CLASSROOM (highlighted), RESEARCH, EVENTS, INITIATIVES, NEWS, TRAINING, and TEAM. Language options 'ES' and 'EN' are in the top right. The main banner for 'CLASSROOM' is titled 'INSTRUCTORS AND STUDENTS Classroom experiments' and describes experimental economics games. Below this, a search bar contains 'G13'. Under the search bar are filters for 'Topic' and 'JEL code'. To the right of the filters, it says '1 of 144 games'. A search result is displayed in a box titled 'Futures Market (Hedging)', with a description: 'Producers and processors hold opposite exposures to an uncertain final price and trade, in a continuous market, promises to buy and sell that are cash-settled at the end of the period (selling short is allowed)'.

Figure 1.2: JEL search locates published financial mechanisms.

oTree
Demo
Sessions
Rooms
Data
Server Check
Logout

Demo

Opciones y decisión de ejercicio · Básica · ES · Un contrato de compra
Opciones y decisión de ejercicio · Básica · ES · Tres contratos en orden fijo
Opciones y decisión de ejercicio · Básica · ES · Tres contratos en orden aleatorio
Options and exercise decisions · Basic · EN · One call contract
Options and exercise decisions · Basic · EN · Three contracts in fixed order
Options and exercise decisions · Basic · EN · Three contracts in random order
Opciones y decisión de ejercicio · Extendida · ES · Un contrato de compra
Opciones y decisión de ejercicio · Extendida · ES · Compra europea
Opciones y decisión de ejercicio · Extendida · ES · Compra americana con dividendo
Opciones y decisión de ejercicio · Extendida · ES · Compra europea con dividendo
Opciones y decisión de ejercicio · Extendida · ES · Venta americana
Opciones y decisión de ejercicio · Extendida · ES · Venta europea
Opciones y decisión de ejercicio · Extendida · ES · Menor dispersión de precios

Opciones y decisión de ejercicio / Options and exercise decisions — BEER Lab
 Seleccione una variante de este juego. Select a version of this game.

Figure 1.3: Demo contains only this family's configurations.

oTree
Demo
Sessions
Rooms
Data
Server Check
Logout

Rooms

Current rooms:

Opciones y decisión de ejercicio · Básica
Options and exercise decisions · Basic
Opciones y decisión de ejercicio · Extendida
Options and exercise decisions · Extended

Figure 1.4: Four rooms separate language and edition.

oTree Demo Sessions Rooms Data Server Check Logout

Room: Options and exercise decisions · Basic

Create a new session

Session Config

Options and exercise decisions · Basic · EN · One call contract

Number of participants

1

Individual decisions: any positive participant count is allowed.

Create

[Configure session](#) ⚙️

App sequence

options_game (15 rounds)

0 participants present

Figure 1.5: The basic room initially selects its language's single contract.

Rights, cash and comparisons across dates

2.1 Four quantities that must remain distinct

What participants will see

Participants observe the current quote, cash, exercise proceeds, a resale bid when available and two contingent next quotes. They do not observe the already drawn future path. An announced possibility in a tree is information about the claim rather than disclosure of the outcome that will occur.

The underlying price, S_t , describes the asset on which the claim is written. Strike K defines the contractual comparison. Premium P_0 is paid to acquire the right. Settlement is a contingent receipt when that right is extinguished. A call's gross intrinsic value is $\max(S_t - K, 0)$; a put's is $\max(K - S_t, 0)$. A premium of seventeen does not mean exercise pays seventeen, and an underlying quote of one hundred twenty does not mean the contract pays one hundred twenty. Name the relevant object before subtracting any amounts.

Exercise is cash settled here. A holder need not finance a stock purchase at the strike or receive stock that subsequently earns dividends. This convention teaches exercise timing without adding a financing constraint on the principal. With an exercise cost, proceeds equal the positive difference less two ECU, floored at zero. The contract does not require an additional outlay when intrinsic value is zero. Distinguish that rule from a fixed commission charged even when an operation produces no receipts. The instrument's specification determines its accounting.

Holder wealth begins with endowment less premium and the acquired right. Cash remains separate from the contract: it grows by R each transition and does not change simply because the right's valuation increases. If the claim is sold or exercised at date t , proceeds join cash and the total is carried to expiry T . The relevant expression is

$$W_T = (B_t + I_t)R^{T-t},$$

where B_t is cash before closing and I_t is closing proceeds. Holding to expiry instead gives $W_T = (W_0 - P_0)R^T + X_T$. An intermediate option quote is not added as another payment. Interest retains internal precision and final payment is rounded once to cents.

Selling and exercising are irreversible in this design. The right disappears and later slots in that case leave the decision set. They are neither missing answers nor repeated retain choices. A battery then opens another independent case with a fresh budget. Earlier wealth does not finance its premium. This sequence separates comparisons across contracts from reinvestment of gains, which

is a different economic question. It also guides data interpretation: distinguish an unused slot from an unfinished journey before constructing any choice denominator.

2.2 A fully worked one-step contract

Consider the one-step condition: $S_0 = K = 100$, $u = 1.2$, $d = 0.8$ and $R = 1.02$. The underlying ends at one hundred twenty or eighty. The call pays twenty in the first state and zero in the second. The probability used to construct its price is $q = (1.02 - 0.8)/(1.2 - 0.8) = 0.55$. Discounting gives $C_0 = (0.55 \times 20 + 0.45 \times 0)/1.02$, approximately 10.784314. Both acquisition premium and monetary resale bid are announced as 10.78 ECU. State the cent convention before comparing very small differences.

The participant has paid that premium and retains 89.22 ECU. Selling for 10.78 restores one hundred at date zero and produces 102 at expiry. Immediate exercise pays zero, leaving cash worth $89.22 \times 1.02 = 91.0044$, paid as 91.00. Retaining produces 111.0044 after an up move or 91.0044 after a down move. Their q -weighted mean is 102.0044. The difference of less than one cent from selling reflects the quoted-price rounding rule rather than a behavioral mechanism. The calculation keeps settlement and portfolio valuation separate.

Opening action	Receipt now	Wealth if up	Wealth if down
Sell	10.78	102.00	102.00
Exercise	0.00	91.00	91.00
Retain	0.00	111.00	91.00

This example explains why the realized path alone cannot evaluate a decision. A holder who retained through a down move receives less than a seller, although both actions had almost the same opening financial value in this calibration. Immediate exercise surrenders a positive right without compensation. That distinction can be examined before learning the random outcome. The report allows a one-cent tolerance when classifying tied actions and retains more precise calculated gaps for technical review. Small quote-rounding differences should not dominate classroom interpretation.

The comparison does not determine which lottery a person prefers. Selling converts risk into a certain amount and can be consistent with different preferences. By contrast, receiving more from sale than exercise at the same date, with identical subsequent consequences, directly compares receipts. Ask students to identify which argument supports each response. Avoid labeling a preference for certainty a financial error merely because another action has a slightly higher draw-weighted mean. Contract valuation and preference elicitation answer different questions even when they use the same observed choice.

Checkpoint

Before comparing outcomes, verify that all three amounts have been carried to the same expiry date. Then compare the rights left by each action. Positive final wealth does not establish that no waiting value was surrendered.

2.3 Several steps, dividends and puts

For the three-step American call without dividends, the reference premium is 17.26. After a first up move the underlying is worth one hundred twenty and accumulated cash is $82.74 \times 1.02 = 84.3948$. Exercise pays twenty now; resale pays 28.40. Both receipts are carried over two transitions to the

same expiry. Terminal wealth is approximately 108.61 with exercise and 117.35 with sale. The former exceeding the opening endowment does not eliminate the difference of 8.74 between actions available at that date.

A dividend changes future comparisons rather than granting another payment to the option holder. In the dividend condition, the underlying distributes fifteen percent of its total price during the transition to date two. From one hundred twenty, the up branch produces a total price of one hundred forty-four, dividend 21.60 and subsequent quote 122.40. The down branch produces ninety-six, dividend 14.40 and quote 81.60. Adding dividend and quote reconstructs the total underlying price in each branch. Keep those components visible when explaining ownership.

At that node an American call can be exercised for twenty while its financial continuation is approximately 13.63. The bid without a resale cost is also twenty: sale and exercise tie in receipts, while retaining has lower financial value in this tree. This does not imply that every call should be exercised before every dividend. Distribution size, strike and remaining horizon matter. The calibration supplies a contrast visible through straightforward arithmetic rather than a universal rule for market practice. Different opening premiums also prevent raw terminal wealth differences from isolating exercise rights by themselves.

A put reverses the contractual comparison. In the reference tree, two down moves leave the underlying at sixty-four. Exercising an American put pays thirty-six, whereas retaining over its last step is worth approximately 34.04. After only one down move, however, the quote is eighty and continuation is approximately 21.40 against twenty from exercise. Identifying an in-the-money contract is therefore insufficient. Locate the node and remaining rights before applying an exercise rule. This is the transition from memorizing a slogan to solving a contingent decision.

2.4 Hedging requires a different ledger

The hedging extension assigns one hundred ECU of collateral and credits a European call premium for an obligation the participant must pay at expiry. It does not simultaneously grant a long option. If the underlying ends at one hundred twenty with strike one hundred, the obligation is twenty. The participant can hold from zero to one underlying units, in increments of 0.001, keeping the rest as cash. Buying uses cash and reducing holdings releases it. Borrowing is unavailable and there are no human counterparties or margin calls.

The one-step example credits a premium of 10.78. Half an underlying unit costs fifty, leaving 60.78 as cash. At expiry that cash becomes 61.9956. With an up move the units are worth sixty and the liability is twenty. With a down move they are worth forty and the liability is zero. Wealth is 101.9956 in either branch, paid as 102.00. Equality comes from financing a contingent obligation with another asset combination, not from adding an artificial hedging gain to payment.

Over several dates, the ledger records cash before adjustment, previous units, the adjustment cost, subsequent interest and credited dividends. Half a unit carried through a dividend of 21.60 receives 10.80. The option alone did not receive that amount. At expiry underlying units are liquidated and the obligation is deducted once. Submitted units have three decimals, so a theoretical delta with additional decimals can leave a small, legitimate hedging residual. Distinguish a constraint on submitted precision from a failure to follow an accounting identity.

The terminal reference also incorporates the rounded credited premium: $(W_0 + P_0 - V_0)R^T$. A portfolio financed by the exact theoretical premium would deliver W_0R^T , but the cent quote can differ slightly. The report separates unit error from terminal wealth error. A position close to delta need not generate identical tracking error on every path. This extension asks how exposure reduction is financed without turning the activity into a leverage or margin market. Its limited action set and short horizons are part of the teaching design.

Valuation, predictions and evidence

3.1 Solving the tree backward from expiry

Backward induction starts where no future decision remains. At expiry the right pays its net contractual settlement, X_T . At the preceding node, compute both branch values and discount them. With replication probability q and safe factor R , continuation is $C_t = [qV_{t+1}^\uparrow + (1 - q)V_{t+1}^\downarrow]/R$. A European option has that value before expiry. An American option is worth $\max(X_t, C_t)$ when exercise is permitted. A Bermudan claim compares exercise only at its allowed dates. Work through terminal payoffs before introducing an exercise boundary.

Probability q does not come from asking how many students expect an up move. It equates the underlying's total return to the safe factor. If $S^\uparrow$ and $S^\downarrow$ are post-dividend quotes and $D^\uparrow$ and $D^\downarrow$ their distributions, then

$$q = \frac{RS_t - (S^\downarrow + D^\downarrow)}{(S^\uparrow + D^\uparrow) - (S^\downarrow + D^\downarrow)}.$$

Without rounding or dividends this reduces to $(R - d)/(u - d)$. The engine uses cent quotes and actual dividends to preserve the total-return identity. It requires probabilities strictly between zero and one. Rounding can prevent a price tree from recombining perfectly, so each relevant branch remains explicit.

Replication explains why that probability is useful. A combination of Δ underlying units and a safe balance reproduces the right's two next values. The required position is

$$\Delta_t = \frac{V_{t+1}^\uparrow - V_{t+1}^\downarrow}{(S^\uparrow + D^\uparrow) - (S^\downarrow + D^\downarrow)}.$$

A safe balance completes one branch and, by construction, the other. Valuing the combination today produces continuation value. This does not require every individual to be risk indifferent. It requires the financing and trading opportunities assumed by the theoretical reference. The hedging extension teaches a bounded version of that construction with an actual cash ledger.

Distinguish contractual value from the policy available in the activity. The resale bid is rounded to cents and can carry a cost. To measure the best action within those rules, the program also works backward including permitted future sales, exercise and retention. The support table's retention value includes subsequent opportunities. It does not compare a real cent bid with a policy that artificially prohibits selling at the next date. Small rounding differences remain recorded, with an explicit one-cent tolerance when classifying ties. That convention avoids turning numerical precision into a behavioral explanation.

Theoretical foundation

The financial reference compares contingent strategies under announced rights and opportunities. Replication probabilities construct a price; draw probabilities describe state frequencies. They can coincide by calibration but are distinct objects. Neither is estimated from the fraction of students who sell.

3.2 What the reference predicts and cannot identify

For an American call without dividends, positive interest and no relevant frictions, retaining can preserve value destroyed by exercise. If a bid allows sale at that value, a person wanting cash can close through resale. The useful prediction is not that everyone must wait. Sale and retention can share financial value while producing different exposures. Early exercise paying less than a contemporaneous sale does surrender an amount available with the same subsequent closing consequences. Compare actions rather than attaching a verdict to an early date alone.

A dividend can reduce future quotes without paying its distribution to the option holder. A put can benefit from realizing a fixed amount earlier and earning interest. A rule learned for a non-dividend call therefore does not apply to every instrument. Maturity, dispersion and interest change values and exercise regions. Resale restrictions change the available actions; a resale cost does not by itself change the underlying distribution. The premium already paid affects wealth but not the same claim's future opportunities. State which dimension changes before predicting behavior.

In the seventy-percent physical up-probability condition, the replication quote keeps its financial construction while the actual draw changes. A person maximizing expected money may prefer retaining exposure because that distribution differs from the probability implicit in the bid. The report separately calculates the financial criterion and expected value under the actual draw probability. Disagreement between them does not establish misunderstanding. The objective being maximized has changed, and recognizing that difference is itself part of the lesson. Preference over risk can create another distinction beyond both monetary criteria.

This design does not identify a utility function, subjective belief or unique psychological cause. Sale may reflect risk aversion; exercise may reflect confusion between premium and settlement, a wish to close or a simplified rule. Comprehension answers help diagnose procedural problems but do not transform a verbal account into a preference measure. To attribute change to a mechanism, assign conditions transparently and hold other relevant dimensions fixed. A difference among a few students also does not establish a population regularity. Use the classroom evidence to ask a disciplined question rather than claim a diagnosis.

Attention

Do not classify an action by its name. Check contract, date, bid, costs and denominator. An action tied within one cent is not a strict error, and a realized loss after retention does not show that retention had lower value when chosen.

3.3 Literature supporting the discussion

The tree and replicating combination follow the approach of Cox, Ross and Rubinstein ([Cox et al., 1979](#)). General arguments about rights, valuation and exercise relate to Merton ([Merton, 1973](#)). This implementation adapts those ideas to a few states, cent quotes and cash settlement. It neither reproduces continuous trading nor uses an estimated-volatility formula. An instructor can

connect each assumption to an identity that students can verify directly. The distinction between theoretical mechanism and teaching calibration should remain explicit throughout the discussion.

Poteszman and Serbin ([Poteszman and Serbin, 2003](#)) examine early exercises in traded-option records. Their analysis motivates distinguishing closures that surrender value from other early actions. Jensen and Pedersen ([Jensen and Pedersen, 2016](#)) show why frictions can change conclusions from a costless reference. Their observational data are not results from this activity. Nor does the implementation reproduce their full financing, short-sale and institutional environment: resale cost is a limited teaching contrast. Use those studies to qualify a rule rather than promise that the classroom reproduces their estimates.

Rockenbach ([Rockenbach, 2004](#)) uses an option-valuation experiment to examine connections across investment opportunities and mental accounts. That contribution motivates asking whether students integrate premium, underlying and safe balance. It does not justify labeling every tree deviation mental accounting. Murphy, Andrzejewicz and Knaus ([Murphy et al., 2016](#)) examine sequential real-option decisions in laboratory settings. The connection is adaptation value; their real investment decisions and incentives are distinct from this family's financial claim. A related mechanism is useful context without being an exact replication.

Prior purchase adapts the mechanism of Becker, DeGroot and Marschak ([Becker et al., 1964](#)). An independent price determines payment while the stated maximum determines acceptance. The upper bound of forty limits elicitation: a response at that boundary can be censored. Understanding the draw and the consequences of buying matters for interpretation. These sources support mechanisms and questions rather than preset classroom effect sizes. All numerical comparisons in this guide come from the implemented calibration. Teachers should present theoretical calculations and observed class responses as separate forms of evidence.

Modes and teaching contrasts

4.1 Three basic modes

The single-contract mode uses an American call without dividends over three transitions. Available actions are retain, sell and exercise. It introduces a contingent right without changing strikes within the same activity and serves as extended-room baseline. A participant can close at the opening date or reach expiry. Those journeys differ in length without becoming different games. The report retains the actual set exposed to a decision at each date rather than treating every possible date as an observed choice.

The fixed battery presents three independent cases with strikes ninety, one hundred and one hundred ten, in that order. Initial underlying quote, transitions, interest and horizon remain fixed. Opening intrinsic value and the corresponding premium change. The teaching question is whether students compare remaining opportunities or follow a rule based solely on being in the money. Do not compare sale counts across contracts without considering the opportunities each person actually reached. Independent case resources prevent a preceding gain from financing another acquisition.

The randomized battery keeps those three contracts and draws their order individually. It supports discussion of presentation and learning without transferring resources between cases. Each strike has a common within-session path regardless of its position. Comparing a battery against one contract does not isolate order: experience also changes. Keep moneyness and sequence identifiable in the reconstructed data. A common path by strike controls one source of variation while leaving the participant's observed stopping opportunities endogenous to their actions.

The following extensions use one contract unless a hedging role is specified. Each changes an identified dimension of baseline. Numerical values are teaching calibrations related to theory rather than literal replications of an article's parameters. Select a contrast for class and explain rights before assignment. Many available configurations do not require one class to play them all, nor justify automatically combining factors that have not been controlled. The purpose is to support a precise comparison that students can reconstruct.

4.2 Call, put and exercise-date rights

The European call removes exercise before expiry while retaining resale. A person wishing to close can sell the right; resale does not make the claim American. Without dividends and relevant costs, theory allows American and European call values to coincide despite different menus. Comparing outcomes asks when extra flexibility has value and when it merely adds actions that need not be used. The distinction prevents a larger action set from being mistaken for a strictly larger attainable financial payoff.

The American put reverses settlement: it pays the positive difference between strike and underlying quote. An early exercise region can exist, as in the sixty-four node of the worked example. The European put keeps that payoff but reserves exercise for expiry. Both allow resale. This contrast follows contingent-claim valuation and the role of interest. It should not be presented as evidence that put exercisers are more impatient: the contractual consequences have changed. Compare the same date and underlying state before assigning a behavioral interpretation.

Exercise on specified dates permits exercise at zero and two, and at expiry. At date one that action disappears, although retention and sale remain available. It approximates a discrete Bermudan claim. Its value lies between comparable European and American rights, but the inequality can be weak. In this non-dividend call calibration, removing exercise dates need not reduce value. The prediction concerns the right and tree rather than the number of buttons or radio options displayed. A missing exercise action at a restricted date is therefore an intended contract feature.

4.3 Dividends, dispersion, horizon and probabilities

The American call with a dividend distributes fifteen percent of total underlying price during the transition to date two, keeping other parameters unchanged. The European dividend call uses the same distribution while removing early exercise. This pair examines flexibility where it can matter. Holders receive no underlying dividend; the quote adjusts after distribution. To explain differing opening values, reconstruct the tree instead of mechanically adding a dividend to option payment. The comparison is between rights over the same underlying cash-flow process.

Lower and higher dispersion use factors 1.1 and 0.9, or 1.35 and 0.65, respectively. Horizon, interest and strike remain unchanged. Convex call payoffs make the price distribution relevant beyond its mean. Replication probabilities are recalculated for effective branches; they should not remain 0.55 by habit after factors change. More selling under greater dispersion can reflect both the offered bid and the risk retained. Observed behavior therefore requires the monetary opportunity set as well as a treatment label.

Short and long maturities use one and five transitions, against three at baseline. Decision dates always precede expiry. These contrasts change adaptation time and safe cash growth. Comparing raw wealth across horizons does not isolate waiting value because accumulated interest on the endowment also changes. Use same-node values or discounted amounts when discussing decisions. A one-step session must end on an explicit final page rather than show nonexistent dates as pending. Longer trees remain finite teaching environments, not calibrated annual market trajectories.

Zero interest uses $R = 1$ and higher interest $R = 1.08$. Price factors stay at 1.2 and 0.8 and satisfy the tree restrictions. Interest affects both discounting and the benefit of holding cash released by closure. These are not recommendations about prevailing rates. For a non-dividend call, deferring the strike comparison contributes to value; a put can have a different exercise comparison. The implemented interest contrast keeps contract type fixed so the conceptual distinction remains interpretable. Explain the rate per transition before discussing its cumulative effect.

The seventy-percent physical up-probability condition keeps replication quotes while changing the state draw. Both probabilities are displayed. The expected-money reference uses the actual draw; the financial reference uses the quote-construction probability. It demonstrates why a valuation probability need not be a physical frequency. Beliefs are not elicited, and the choice does not reveal a uniquely implied subjective probability. The report's separate criteria help students recognize that different benchmarks can disagree without a software or accounting inconsistency.

4.4 Resale, information and prior acquisition

Resale cost subtracts two ECU from the valuation bid, floored at zero. No resale removes that action. These are distinct interventions: one keeps a less favorable bid and the other removes early monetization through sale. The relevant comparison includes retention and exercise, not merely two quoted prices. Exercise cost subtracts two from the positive difference, floored at zero, and applies at expiry as well. Changing that payoff formula changes the contract's opening valuation rather than merely relabeling an otherwise identical decision.

The contingent-value table displays a comparison of actions at the same date. Values use the announced tree and permitted future opportunities without revealing the drawn path. Consequences and resources are unchanged. The question is whether easier comparison changes actions that otherwise require several calculations. A response closer to the reference can reflect computational support; it does not by itself establish changed preferences. Both groups retain the same tolerance and gap definition in the report. Keeping the opportunity set fixed makes the information contrast interpretable.

The higher acquisition premium is twice theoretical value before cent rounding. Baseline therefore produces 34.53 against an ordinary premium of 17.26. Subsequent opportunities of the right are identical; remaining cash and wealth differ. This contrast discusses sunk costs without pretending both participants have the same balance. A changed action can involve wealth or presentation effects. It should not automatically be attributed to a sunk-cost fallacy. Ask students to identify which term has changed in final wealth and which terms have not changed in a current action comparison.

Valuation and prior purchase requests a maximum from zero to forty ECU and draws an independent uniform price from the 4,001 cent amounts. A maximum reaching that price buys at the drawn price. Otherwise the participant retains the endowment and closes without exercise decisions. Resale remains available after purchase. The object valued is therefore a tradable right rather than a lottery that must be held to expiry. The upper bound can censor valuations and buyer selection changes subsequent decision denominators. Prior offers remain separate from retain actions in the report, preserving the distinction between declining acquisition and retaining an owned claim.

4.5 Three conditions with actual hedging

One-step hedging assigns a European call liability and permits one position before the only draw. Dynamic hedging keeps that obligation over three transitions with adjustments at each date. Dividend hedging adds the fifteen-percent distribution during the transition to date two. All three credit premium, retain personal collateral and account for purchases, sales, interest, dividends and settlement. They do not let a participant exercise somebody else's right or treat a short liability as a freely endowed long option. Role language and cash flows change together.

Positions range from zero to one unit in steps of 0.001, subject to available cash. Replication delta appears after the choice with the transition result; it is not imposed as the participant's answer. An exact delta can contain additional decimals, leaving residual exposure in a feasible submitted position. The report uses one mean unit-error observation per person, a separate distribution and terminal error against funded replication. These quantities are not pooled with holders' exercise rates. Identifying the unit of analysis prevents superficially similar charts from answering different questions.

Contingent-claim theory supports comparing portfolios that deliver the same state payoffs. The implemented version is small, with no underlying shorting or borrowing and sufficient collateral for permitted calibrations. It does not represent every constraint faced by a real intermediary. Its

value is that a class can reconstruct which resources finance the obligation and why receiving a premium does not create a gain without responsibility. The dividend condition additionally checks that underlying ownership and option ownership carry different cash-flow rights.



The activity has ended

Wait for your instructor's directions. The table summarizes closed cases and the mean payment.

Your payment in points: **106.12 ECU**

Case	Strike price	Date	Chosen action	This case's terminal wealth
1	110	0	Sell to the program	106.12
2	90	0	Sell to the program	106.12
3	100	0	Sell to the program	106.12

Figure 4.1: Independent cases close with a mean payment.



Your decision at this date

Case 1 of 1; date 0 of 3

Underlying quote: **100.00 ECU**
Available cash: **82.74 ECU**

Net intrinsic value; exercise unavailable at this date	0.00 ECU
Sale bid now	17.26 ECU
Next quote if up	120.00 ECU
Next quote if down	80.00 ECU
Draw up probability	55.0000%
Quote up probability	55.0000%

Choose an available action

- ☐ Retain until the next date
☐ Sell to the program

Continue

► Observed quotes

Figure 4.2: The European claim does not offer early exercise.



This case's contract

Case 1 of 1; date 0 of 3

Contract type	Call
Strike price	100 ECU
Expiry date	3
Safe factor per transition	1.02
Endowment per case	100.00 ECU
Acquisition premium	17.26 ECU

This call settles the positive difference between underlying price and strike in cash. You do not purchase the underlying or pay the strike principal.

You may exercise at dates 0 and 2, and at expiry. At other dates this action is unavailable.

The initial premium is deducted once. All receipts are compared at the common expiry date.

Continue

Figure 4.3: The contract announces its specified exercise dates.



Your decision at this date

Case 1 of 1; date 0 of 3

Underlying quote: **100.00 ECU**

Available cash: **88.12 ECU**

Net exercise settlement now	0.00 ECU
Sale bid now	11.88 ECU
Next quote if up	120.00 ECU
Next quote if down	80.00 ECU
Draw up probability	55.0000%
Quote up probability	55.0000%

Choose an available action

- ☐ Retain until the next date
- ☐ Exercise and settle in cash
- ☐ Sell to the program

Continue

► Observed quotes

Figure 4.4: The put reverses the contractual comparison.



Your decision at this date

Case 1 of 1; date 1 of 3

Underlying quote: **80.00 ECU**

Available cash: **91.00 ECU**

Net exercise settlement now	0.00 ECU
Sale bid now	0.00 ECU
Next quote if up	81.60 ECU
Next quote if down	54.40 ECU
Draw up probability	55.0000%
Quote up probability	55.0000%

Choose an available action

- ☐ Retain until the next date
- ☐ Exercise and settle in cash
- ☐ Sell to the program

Continue

► Observed quotes

Figure 4.5: Next quotes reflect the announced distribution.



Your decision at this date

Case 1 of 1; date 0 of 3

Underlying quote: **100.00 ECU**

Available cash: **82.74 ECU**

Net exercise settlement now	0.00 ECU
Sale bid now	17.26 ECU
Next quote if up	120.00 ECU
Next quote if down	80.00 ECU
Draw up probability	55.0000%
Quote up probability	55.0000%

Comparison at the same date

These values use the tree and the quote-construction probability; they are not newly drawn outcomes. Retaining includes permitted future choices.

Choose an available action	Value at this date (ECU)
Retain until the next date	17.26
Exercise and settle in cash	0.00
Sell to the program	17.26

Choose an available action

- ☐ Retain until the next date
☐ Exercise and settle in cash
☐ Sell to the program

Continue

► Observed quotes

Figure 4.6: The table compares contingent values at the same date.



Your purchase maximum

Before acquiring the contract, state a maximum from 0 to 40 ECU. A cent price from 0 to 40 is drawn independently, all equally likely. If your maximum is at least that price, you buy at the drawn price; otherwise you retain your budget.

Strike price	100 ECU
Expiry date	3
Safe factor per transition	1.02

Purchase maximum, from 0 to 40 ECU

Continue

Figure 4.7: The stated maximum determines purchase against an independent price.



Your decision at this date

Case 1 of 1; date 0 of 3

Underlying quote: **100.00 ECU**
Available cash: **72.61 ECU**

Contract acquired: Yes; Drawn price: 27.39 ECU

Net exercise settlement now	0.00 ECU
Sale bid now	17.26 ECU
Next quote if up	120.00 ECU
Next quote if down	80.00 ECU
Draw up probability	55.0000%
Quote up probability	55.0000%

Choose an available action

- ☐ Retain until the next date
- ☐ Exercise and settle in cash
- ☐ Sell to the program

Continue

► Observed quotes

Figure 4.8: The actual purchase price accompanies the later choice.



Date summary

Case 1 of 1; date 0 of 3

Prior purchase result

Drawn price	13.53 ECU
Your purchase maximum	0.00 ECU
Contract acquired	No
Available cash	100.00
Prior purchase result	No purchase
This case's terminal wealth	106.12

This case is closed; it will not settle again.

Cash includes only actual flows and interest. Value comparisons are not added to payment.

Continue

Figure 4.9: Declining retains the endowment without generating exercise choices.



Choose the hedge position

Case 1 of 1; date 0 of 3

Underlying quote: **100.00 ECU**

Available cash: **117.26 ECU**

Underlying units	0.000
Remaining obligation value	17.26 ECU
Next quote if up	120.00 ECU
Next quote if down	80.00 ECU
Draw up probability	55.0000%
Quote up probability	55.0000%

Before each transition choose from 0 to 1 underlying units, in steps of 0.001. Buying reduces cash and selling increases it. Borrowing is unavailable. Cash earns interest and dividends on your units are credited. At expiry units are sold and the obligation is paid once. You cannot sell or exercise its holder's right.

Units to hold over the transition (0 to 1; steps of 0.001)

Continue

Figure 4.10: Hedging requests an actual position subject to cash.



Date summary

Case 1 of 1; date 1 of 3

Available cash	66.87
Underlying units	0.500
Cash after hedge adjustment	58.50
Dividend received on your units	7.20
Next-step replication units	0.0000
Remaining obligation value	0.00

Underlying quote: 81.60 ECU

The contract remains open. The next quote has been applied to the relevant cash and position.

Cash includes only actual flows and interest. Value comparisons are not added to payment.

Continue

Figure 4.11: Underlying units receive the dividend.

Instructor report: Options and exercise decisions

Private aggregate results. No individual identifiers are displayed.

Dynamic hedging

Participants: 4 Potential slots: 12 Recorded decisions: 12 Pending decisions: 0

Participants finished: 4; Closed or inapplicable slots: 0

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[Hide aggregates](#)

Mean terminal wealth per participant	112.65
People included in the histogram	4 / 4
Mean absolute unit error relative to delta	0.4455
Mean terminal error relative to funded replication	6.5241

Each person contributes one mean absolute unit-error observation. Terminal error compares wealth with funded replication, including premium rounding. Hedge choices are not counted as exercise or sale of an owned option.

Distribution of the individual measure

One observation per person with a defined measure. Cases without decisions are excluded from that distribution, with their count shown.

Mean absolute unit error relative to delta	Number of people	%
[0,0.01]	0	0%
(0.01,0.1]	0	0%
(0.1,0.5]	2	 50%
(0.5,1]	2	 50%

Figure 4.12: Hedging uses its own measures and distribution.

Journey, report and data

5.1 From welcome to contract closure

Welcome introduces the laboratory, its rules and the beginning of the journey. Instructions separate case resources, experimental currency, price formation and settlement. The resource box uses the effective configuration and distinguishes a holder paying premium from someone receiving premium for a liability. Check that distinction when preparing a hedge session. A credited amount should not be described as a gain without an obligation, and a case's cash is not renewed within its decision dates. Later quotes update opportunities rather than generate another budget.

Comprehension uses procedural examples. One hundred less a ten-unit premium leaves ninety; sale removes the right to collect later exercise; dividends belong to underlying units; one hundred ten and ninety average one hundred. An incorrect response explains its correction next to the relevant field while preserving other answers. Corrections do not reduce points. If an error persists, revisit the concept and example without recommending an action in the actual contract. The check supports procedural understanding rather than training a preferred strategy.

The contract page presents instrument, strike, expiry, safe factor and premium when already determined. In prior valuation the premium is not imposed before the maximum is submitted: opening prospects are shown and the drawn price follows. A nonbuyer proceeds to a closing review while retaining the interest-bearing endowment. They do not answer artificial questions about an option never acquired. A buyer observes the amount paid and decides over the contract actually available. That sequence distinguishes acquisition from subsequent management of a right.

The decision page displays quote and cash, plus exercise proceeds and a bid when relevant. Its menu respects contract dates. Hedging uses a different form for underlying units subject to precision and cash limits. A review then displays applied flows and, upon closure, wealth at expiry. Acknowledging the last review completes the journey. Final summary shows closed cases and mean payment without another decision. Early closure skips remaining dates but preserves that final acknowledgement. An unfinished review therefore differs from an unobserved future choice.

5.2 Revealing and interpreting aggregates

The report starts with participants, potential slots, recorded choices, unresolved slots and closures. Slots after sale, exercise or purchase rejection cease to be pending. Progress can complete with fewer decisions than the potential maximum. Aggregates become available after everyone closes their cases and acknowledges reviews. The instructor must then reveal them explicitly. They can be hidden again, and reloading restores the hidden presentation. Private session downloads remain available before revelation. This separates classroom display control from the instructor's access to their session records.

Mean wealth uses one average payment per participant while respecting independent cases. For holders, the report compares each action with the largest financial value available at that node, including closures and later opportunities. An action within one cent meets the criterion; several actions can qualify. The expected-money criterion instead uses the actual draw probability. Both rates are presented separately so a physical frequency is not confused with price construction. Neither rate estimates utility or the strength of a psychological preference.

An individual's gap discounts date-specific differences from observed actions to the start and averages cases. The histogram contains one observation per person with a defined measure, not one per slot or potential state. A nonbuyer can have well-defined wealth but no subsequent decision for that distribution. The report states the included count. This gap measures monetary opportunities under the tree. It is not a realized loss against the hindsight path that would have been most favorable. Maintaining that distinction prevents luck from being treated as decision quality.

The date graph includes only decisions reaching that date, with risk-set size in its table. Closed cases do not reappear as retain choices, and a date without a denominator has neither percentage nor point. A later exercise rate can change because earlier sellers left the set, even without changed personal rules. Discuss that selection before describing a trend as learning or growing impatience. In a battery, dates are pooled across cases while strike and order remain available for a more detailed reconstruction.

Hedging uses mean absolute unit error per person and terminal error against funded replication. Those units are not mixed with exercise rates. In prior valuation, mean and distribution of maxima include all offers; mean price paid includes buyers only. With no buyers the latter is undefined while a stated maximum of zero remains legitimate. The two histograms describe different objects: acquisition and subsequent management. Comparisons across conditions use identified sessions and documented parameters rather than automatically converting group differences into causal effects.

For the instructor

Before projecting a graph, describe who can enter its denominator. After early closures, its last point concerns those still making choices. For an experimental comparison, retain the assignment unit and distinguish individual observations from price shocks shared within a session.

5.3 Downloads, pending records and privacy

The report offers a slot-level file and a wide format, both scoped to the selected session. The first contains several rows per person; the second places dates in columns within an individual row. Keeping all slots helps distinguish pending records, closures and inapplicable periods. It does not make every slot an observed choice. A technical final-settlement record can contain average payment without containing another contract action. Interpret economic dates rather than treating the raw row count as the sample size.

The slot file retains case, date, assigned strike, individual order, language, condition, status and results. A result record reconstructs cash before and after choice, closure, receipts and comparisons. Hedge records additionally retain units, dividends, liability and error. Saved design snapshots also preserve assigned order so a randomized battery can be reconstructed in wide data. Do not infer the instrument from premium alone: retain the effective strike and link each decision to its case. This is essential when order differs across people.

Blank fields in a pending session must not become zeros. A zero purchase maximum is a response; an absent response is a different state. The same distinction applies to wealth not yet settled and dates inapplicable after closure. Select actually observed actions, verify units and retain exclusion

rules before calculating statistics. Design fingerprints support record integrity rather than identify preferences or replace parameter documentation. Raw files should permit another instructor to reproduce a denominator without guessing what missing values meant.

Private downloads contain identifiers linking one person's rows. They should not be projected or circulated with names, student numbers or seating information. Use aggregates for feedback and share only tables that preserve anonymity. Common price paths do not create independent shock observations. Keep test data, teaching sessions and assignment records distinct. These recordkeeping decisions matter for a well-documented activity even when classroom results are not intended for a research article. They allow a teacher to explain what happened without exposing an individual participant.



Welcome to Contract Decisions

The Behavioral and Experimental Economics Research Lab (BEER Lab), in the Department of Economics at Tecnológico de Monterrey, is a place to learn about economic decisions through controlled activities.

General rules

- Remain silent and do not communicate with others.
- Decide individually and privately.
- Follow the instructions; do not close or refresh the page.
- Raise your hand or contact the instructor privately if there is a problem.
- Wait for the instructor's directions after finishing.

I have read the rules and am ready to start.

- ☐ Yes
☐ No

Start

Figure 5.1: Welcome and private choices.



Resources and contract rules

Resources and unit of account

Each case has a fresh 100.00 ECU. Cases are independent. Activity payment is the mean of their terminal wealth, not the sum of budgets.

You control an option acquired for 17.26 ECU; initial remaining cash is 82.74 ECU. Cash grows by the factor 1.02 at each transition.

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

This session does not convert ECU into real money.

ECU means Experimental Currency Units. It is this activity's unit of account.

The underlying starts at 100 ECU. At each transition its total price rises by 1.2 or falls by .8, rounded to cents. The current up probability is shown at each date. Your decisions do not change prices.

This call settles the positive difference between underlying price and strike in cash. You do not purchase the underlying or pay the strike principal.

You may exercise at any decision date.

The underlying pays no dividends.

Quotes, premiums and proceeds are announced in cents. The ledger retains interest and replication with rational precision; final payment is rounded once to cents.

Selling or exercising extinguishes the contract once. Proceeds join cash and grow to the same expiry date. Retaining at the last decision leads to automatic settlement at the next price. Intermediate valuations are not added.

The sale bid is the contract value in the announced tree, minus 0.00 ECU, floored at zero and rounded to cents. It is an automatic program quote.

Exercise settlement deducts 0.00 ECU from the positive difference; proceeds never fall below zero.

The price-draw probability and the probability used to construct the quote are displayed separately. The latter equates the underlying's total return to the safe factor.

Continue

Figure 5.2: Instructions distinguish resources, rights and settlement.



Check the rules

Resources and unit of account

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

This session does not convert ECU into real money.

Answer questions about the procedure. You may correct mistakes without losing points.

In an example with 100 ECU and a 10 ECU premium, how much cash remains after buying one option?

Your answer: 89. The correct answer is 90. $100 - 10 = 90$ ECU. This question uses that example; your actual case premium is shown separately.

If you sell the contract, may you also collect its later exercise?

☐ Yes

☒ No

Who receives an underlying dividend?

☒ The holder of underlying units

☐ Every option holder, even without underlying units

If two independent cases end at 110 and 90 ECU, what is their mean payment?

Continue

Figure 5.3: The correction explains the rule and preserves other answers.



This case's contract

Case 1 of 1; date 0 of 3

Contract type	Call
Strike price	100 ECU
Expiry date	3
Safe factor per transition	1.02
Endowment per case	100.00 ECU
Acquisition premium	17.26 ECU

This call settles the positive difference between underlying price and strike in cash. You do not purchase the underlying or pay the strike principal.

You may exercise at any decision date.

The initial premium is deducted once. All receipts are compared at the common expiry date.

Continue

Figure 5.4: The case announces strike, expiry and premium.



Your decision at this date

Case 1 of 1; date 0 of 3

Underlying quote: **100.00 ECU**

Available cash: **82.74 ECU**

Net exercise settlement now	0.00 ECU
Sale bid now	17.26 ECU
Next quote if up	120.00 ECU
Next quote if down	80.00 ECU
Draw up probability	55.0000%
Quote up probability	55.0000%

Choose an available action

- ☐ Retain until the next date
- ☐ Exercise and settle in cash
- ☐ Sell to the program

Continue

► Observed quotes

Figure 5.5: Choice uses current quote and cash.



Date summary

Case 1 of 1; date 2 of 3

Available cash	87.80
Chosen action	Retain until the next date
Settlement or sale proceeds	0.00
This case's terminal wealth	87.80

Underlying quote: 76.80 ECU

This case is closed; it will not settle again.

Cash includes only actual flows and interest. Value comparisons are not added to payment.

Continue

Figure 5.6: Review separates flows from wealth at expiry.



The activity has ended

Wait for your instructor's directions. The table summarizes closed cases and the mean payment.

Your payment in points: **87.80 ECU**

Case	Strike price	Date	Chosen action	This case's terminal wealth
1	100	3	Expiry settlement	87.80

Figure 5.7: Closure displays cases and payment without another choice.

Instructor report: Options and exercise decisions

Private aggregate results. No individual identifiers are displayed.

One call contract

Participants: 4 Potential slots: 12 Recorded decisions: 5 Pending decisions: 3

Participants finished: 3; Closed or inapplicable slots: 4

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Aggregates become available when everyone completes their cases and acknowledges the last summary.
Slots after closure are not abandonment.

Figure 5.8: Pending progress keeps aggregates unavailable.

Instructor report: Options and exercise decisions

Private aggregate results. No individual identifiers are displayed.

One call contract

Participants: 4 Potential slots: 12 Recorded decisions: 8 Pending decisions: 0

Participants finished: 4; Closed or inapplicable slots: 4

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[Reveal aggregates for discussion](#)

Figure 5.9: Session completion does not replace deliberate revelation.

Mean terminal wealth per participant	92.38
People included in the histogram	4 / 4
Mean per-person value gap, discounted to start	4.3173
Decisions within 0.01 ECU of the tree's largest value	87.50%
Decisions within 0.01 ECU of the draw's largest expected value	87.50%

Figure 5.10: Measures state their unit and criterion.

Distribution of the individual measure

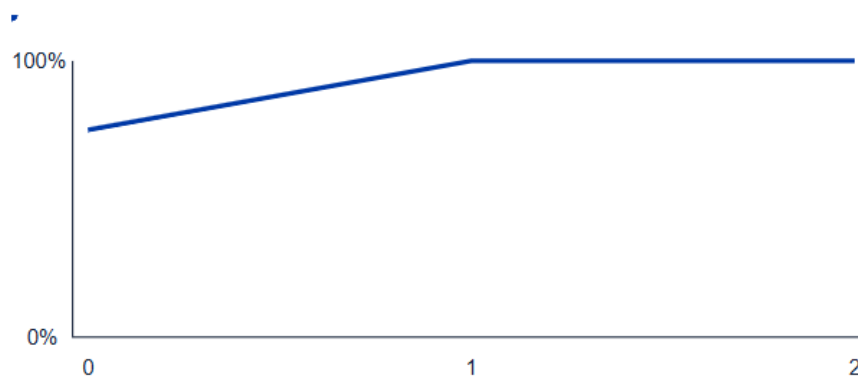
One observation per person with a defined measure. Cases without decisions are excluded from that distribution, with their count shown.

Value gap	Number of people	%
[0,0.01]	3	75%
(0.01,1]	0	0%
(1,5]	0	0%
(5,∞]	1	25%

Figure 5.11: The histogram uses one defined observation per person.

Choices by date and risk set

No denominator: no percentage or point is shown. Closed cases do not reenter the risk set.



Date	Observed decisions	Within the financial criterion	Exercise	Sale	Retain
0	4	75.00%	25.00%	25.00%	50.00%
1	2	100.00%	0.00%	0.00%	100.00%
2	2	100.00%	0.00%	0.00%	100.00%

Figure 5.12: The trajectory reports the risk set at each date.

Instructor report: Options and exercise decisions

Private aggregate results. No individual identifiers are displayed.

Valuation and prior purchase

Participants: 3 Potential slots: 9 Recorded decisions: 0 Pending decisions: 0

Participants finished: 3; Closed or inapplicable slots: 9

Download this session's records (CSV)

Download this session's wide data

Hide aggregates

Mean terminal wealth per participant	106.12
People included in the histogram	0 / 3
Mean per-person value gap, discounted to start	—
Decisions within 0.01 ECU of the tree's largest value	—
Decisions within 0.01 ECU of the draw's largest expected value	—
Accepted purchases / prior offers	0 / 3
Mean purchase maximum, all offers	0.00
Mean price paid, buyers only	—

Figure 5.13: Without buyers, wealth and offers remain defined while later-choice rates do not.

Distribution of prior purchase maxima

One offer per person, including nonbuyers. The 40 ECU upper bound can censor a higher valuation.

ECU	Number of people	%
[0,10]	3	100%
(10,20]	0	0%
(20,30]	0	0%
(30,40]	0	0%

Figure 5.14: The maximum-bid distribution includes nonbuyers.

Class plan and worked exercises

6.1 A fifty-minute lesson

Allow five minutes to introduce the contract and distinguish its four quantities. Use ten for instructions, comprehension and choices, allowing some participants to close sooner. Spend another ten solving the one-step example and reconstructing cash at expiry. In the next ten, contrast one relevant condition: dividends, European rights or calculation support. Give ten to the report and interpretation questions and five to close discussion and preserve files. This is a teaching schedule, not a rigid timing rule. A class needing an interest review should receive it before adding variants.

During choices, do not project an individual's page or advise selling or waiting. Ask early finishers to wait without discussing their actions. A participant may finish sooner after exercise, sale or purchase rejection. That variation should not publicly reveal who chose what. In a small class, use worked examples to extend discussion rather than pretend that few observations deliver a precise estimate. The classroom result need not reproduce the prediction for the activity to teach something. Reconstructing an unexpected denominator can be as valuable as recognizing an anticipated pattern.

After revelation, describe observed actions and denominators first. Then identify a monetary comparison, a risk comparison and an inference limit. This sequence moves from facts to explanation without conflating them. A useful closing question asks which additional condition would distinguish two accounts consistent with the same data. A complete answer identifies what stays constant and how the contrast would be assigned rather than merely requesting more students. Keep that answer separate from an unsupported diagnosis of why a particular classmate acted as they did.

Feedback script

"Reconstruct the right available, the cash obtainable and its date. Did sale and exercise pay the same amount? Did retention change exposure? Now check who reached each date and what comparison the report supports. An explanation should name the rule and denominator before attributing a preference."

6.2 Eight problems with solutions

Premium and settlement

A participant paid 17.26 for the option and can now exercise for twenty. Should 17.26 be deducted again from exercise proceeds? No: opening cash already reflects acquisition. Reconstruct wealth by adding twenty to available cash rather than a net gain that deducts premium twice. Assess

exercise by comparing current actions for the same right. Past cost belongs in the acquisition record and wealth account but is not charged again when the claim closes. Distinguishing those tasks prevents a common arithmetic error.

Comparing dates

At the one-hundred-twenty node, sale pays 28.40 and exercise twenty. Two transitions remain with factor 1.02. Their terminal difference is $(28.40 - 20)1.02^2 = 8.73936$, approximately 8.74. Comparing receipts without carrying them to a common date hides the cash opportunity. No subsequent up or down outcome is needed to obtain that difference because both actions close the claim and reinvest proceeds in the same way. This comparison evaluates an available alternative rather than reconstructing luck after the fact.

Two probabilities

In the one-step example, change only the draw up probability to 0.70. Retention produces expected terminal receipts of fourteen and present value $14/1.02 = 13.72549$. The replication bid stays at 10.78. Expected-money comparison favors retention more strongly; the financial probability is not replaced with seventy percent when constructing the quote. A participant can additionally prefer certainty, something this mean calculation does not determine. State which probability and objective support an answer before interpreting a changed choice as understanding or misunderstanding.

Dividend and put rights

Half an underlying unit passes through a distribution of 21.60 per unit. It receives 10.80 cash and retains units quoted after adjustment. An option holder without units receives none of that dividend. In another case, an American put with $S = 64$ and $K = 100$ pays thirty-six on exercise, exceeding continuation of 34.04. These apply different contractual rights. Neither permits indiscriminate use of a non-dividend call rule. Ask students to identify the owner of each receipt before adding it to a ledger.

Higher acquisition premium

Compare premiums 17.26 and 34.53 for the same future tree. Opening cash amounts are 82.74 and 65.47. Bids, settlements and future opportunities of the right are identical at corresponding nodes. Comparing exercise with resale therefore does not require first recovering the higher premium. Wealth and exposure relative to total resources nevertheless differ. A behavioral discussion of sunk costs should retain that wealth effect as an alternative explanation rather than assume it away. The contractual comparison and the interpretation of changed behavior are separate steps.

Prior offer and absent decisions

A stated maximum of fifteen with a drawn price of twelve buys at twelve and leaves eighty-eight. A maximum of eleven with the same price declines purchase: the hundred-unit endowment grows to $100 \times 1.02^3 = 106.1208$. There is no retain choice in the latter case. If everyone declines, the exercise rate has no denominator while mean stated maximum and wealth remain defined. A zero response and a nonexistent rate therefore require different statistical treatment. The prior-offer table preserves observations that the later-action histogram appropriately excludes.

Observation weights

One person makes one choice outside the financial criterion and another makes three choices within it. The decision-weighted proportion is three of four, or seventy-five percent. Their mean individual proportions instead equal fifty percent. Both answers use different weights. The report labels its decision-based rates and constructs the histogram from one measure per person. Any additional analysis should state its weighting rule, especially when early closure creates journeys of unequal length. An apparent disagreement between two summaries can arise from weighting without any coding mistake.

Mean wealth and hedge quality

In the one-step liability case, hold 0.25 units rather than 0.5. With a credited premium of 10.78, cash is 85.78 and grows to 87.4956. After paying the relevant liability, terminal wealth is 97.4956 if up and 107.4956 if down. Its 0.55-weighted mean is 101.9956, the same as the half-unit replication. Outcomes are no longer constant across states, however. Comparing mean wealth alone does not measure hedge quality: residual exposure also matters. The unit-error and tracking-error records reveal a distinction that an average payoff conceals.

6.3 Troubleshooting without losing records

Attention

Do not erase the database to repair a link or fill absent responses with zeros. Identify session, case, contract status and review acknowledgement. An inapplicable slot follows from the flow rather than being a decision that must be fabricated.

If exercise is absent, check European rights or a restricted date. If no further decision follows sale, the right has closed. A rejected purchase leaves cash as announced. For hedging, inspect precision, permitted units and cash before attributing form rejection to a malfunction. A post-dividend quote is accompanied by dividend receipts only when underlying units were actually held. These checks start with the instrument and ledger rather than a guess about participant intentions or software behavior.

If aggregates remain unavailable after apparent completion, a review may still require acknowledgement. Check progress without inventing closure. If a graph lacks a point, inspect its denominator before substituting zero. For a payment question, reconstruct premium, flows, interest and settlement, then average independent cases. Preserve source, PDF and figures together so later revisions retain both explanations and the screens of the version used. A useful troubleshooting record names the relevant rule and observed state without exposing an individual's identity to classmates.

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