



Instructor's Guide to Leverage and Margin

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 prepares instructors to teach a collateral-financed investment account. It follows the English interface and covers the same economic rules as the Spanish edition. No prior experience running experiments is assumed.

Begin with the summary and worked balance sheet. Then select a contractual contrast from the extended chapter. Classroom plans, data definitions and solved exercises support discussion after choices are recorded.

Common access and accounting are explained once. Screenshots are real local interfaces. Canonical public routes are proposed product routes; local validation and public deployment are distinguished explicitly.

Author

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For the instructor

Use one economic contrast at a time. Record predictions before revealing the private report. Never project personal links or identify participants through their choices.

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Purpose, scope and preparation

Purpose	Distinguish leverage, collateral constraints, liquidation and creditor recovery.
Experimental unit	One person with an automated lender and exogenous prices; no pairing or waits.
Basic edition	One account; three initial-margin cases in fixed or random order.
Extended edition	Thirteen conditions covering funding, collateral, execution and reserve rights.
Decision	Reserve and loan; subsequent debt contribution and voluntary sale.
Payoff	Average terminal own wealth across active cases, in ECU.
Topics	leverage, collateral, margin calls, position liquidation, credit risk, funding constraints
JEL	C91; G11; G23
Participants	Any positive whole number; individual activity.
Suggested duration	15–25 minutes per account including discussion; full class of 75 minutes.

https://leverage.beer-lab.org/room/margin_en

1.1 What this activity contributes to a finance class

A debt-financed position combines two separate choices: which asset to hold and how much of its purchase price to pay with own funds. When the asset price changes, debt does not change in the same proportion. A moderate change in market value can therefore produce a much larger change in equity. This activity makes that distinction observable with a small account, explicit rules and an automated counterparty. Students choose a reserve, request a loan and respond to a subsequent collateral review. The instructor can reconstruct every transfer without inferring hidden balances.

The initial objective is not to make everyone choose high or low borrowing. It is to distinguish assets, obligations and equity, and explain which resources allow a position to remain open when a contract requires an additional contribution. An investment may have positive final value and still be liquidated before that date. A lender may also recover less than the amount due even after an intermediate sale reduced its exposure. Collateral limits risk; it does not automatically remove every source of credit risk.

The experimental unit is one person managing an account. Prices come from an announced tree rather than classmates' offers. There are no pairs, social roles or waiting pages. This classification

prevents a mechanical contractual outcome from being attributed to strategic interaction. A session accepts any positive whole number of participants. In the batteries, cases are independent decisions with new resources. Order may affect learning and attention, but it does not create a lending relationship among students. No participant has to wait for another participant's choice.

The catalogue already includes dividend asset markets, order-book trading, portfolio diversification and credit contracts. This delivery respects those curricular boundaries. It does not rebuild a market or study borrower selection. Its additional channel is the contractual review of collateral after a position has been financed. A discounted sale is an exogenous execution rule, not a price spiral generated by the entire class selling. Studying that second channel would require an aggregate market with a specified price-formation rule and allocation of losses. The distinction should remain explicit throughout discussion.

For the instructor

Before opening a session, write two separate predictions: how equity responds to an asset-price change and how retained quantity responds to a higher collateral requirement. A student may answer the first correctly and misunderstand the second. Use the report to separate those questions rather than label individuals as cautious or reckless.

1.2 Access and selection of the comparison

Start at <https://beer-lab.org/> and follow the teaching-games link. The catalogue is at <https://teaching.beer-lab.org/>. Locate the descriptive family name and select the language. The proposed product domain is <https://leverage.beer-lab.org/>. Including this canonical route in the package does not itself establish that the public server has been updated. The delivery includes a verified local instance at <http://localhost:8104/demo>, accessible from this computer. Public deployment is a subsequent administrator operation.

The family domain's Demo contains only its 32 configurations. Rooms contains four rooms: basic Spanish, basic English, extended Spanish and extended English. The English basic room is https://leverage.beer-lab.org/room/margin_en; its Spanish counterpart is https://leverage.beer-lab.org/room/margen_es. Extended room names end in `margen_extendido` and `margen_extended`. Each room filters its own configurations. A basic room must never start with an extended condition or a configuration from another family. Screenshots below show the final local registry rather than a combined development catalogue.

Instructors enter through the instance's administrative access, create a session with the selected configuration and distribute that session's new participant links. Personal links are not projected or incorporated into teaching materials. Open the session and select Admin report to view the private report. Progress appears before results are revealed; decision tables require the reveal button. Downloads are private and refer to the selected session. A tab belonging to another game does not automatically share participants, permissions or data with this family.

The basic single-account mode uses an initial margin of 50 percent and maintenance margin of 25 percent. Batteries present three accounts with initial margins of 25, 50 and 75 percent. One presents that order; the other randomizes it for each participant. All three retain maintenance margin of 25 percent and the same price tree. Every case starts with new resources; a loss does not reduce the next case's endowment. In comparisons across sessions, preserve parameters, instructions and assignment procedures, and record any comparison seed used.

Attention

Do not recreate a database to update a template or reuse links from a deleted session. Restarting the instance preserves its existing database. A new session produces new links. Before class, check language, case count, initial margin, reserve rights and condition: these differences change the contract students face.

oTree Demo Sessions Rooms Data Server Check Logout

Demo

[ES] Apalancamiento y margen — Una cuenta
[ES] Apalancamiento y margen — Tres márgenes, orden fijo
[ES] Apalancamiento y margen — Tres márgenes, orden aleatorio
[EN] Leverage and margin — One account
[EN] Leverage and margin — Three margins, fixed order
[EN] Leverage and margin — Three margins, random order
[ES] Apalancamiento y margen — Extendido — Cuenta con margen de referencia
[ES] Apalancamiento y margen — Extendido — Compra sin préstamo
[ES] Apalancamiento y margen — Extendido — Margen inicial de 25%
[ES] Apalancamiento y margen — Extendido — Margen inicial de 75%
[ES] Apalancamiento y margen — Extendido — Mantenimiento de 40%
[ES] Apalancamiento y margen — Extendido — Aumento del margen a 50%
[ES] Apalancamiento y margen — Extendido — Interés de 10% sobre la deuda
[ES] Apalancamiento y margen — Extendido — Descuento de garantía de 10%
[ES] Apalancamiento y margen — Extendido — Descuento de venta de 10%
[ES] Apalancamiento y margen — Extendido — Liquidación total si no se subsana
[ES] Apalancamiento y margen — Extendido — Sin venta automática intermedia
[ES] Apalancamiento y margen — Extendido — Precio final igual a 100
[ES] Apalancamiento y margen — Extendido — Reserva también comprometida
[EN] Leverage and margin — Extended — Reference margin account
[EN] Leverage and margin — Extended — Purchase without borrowing

Apalancamiento y margen / Leverage and Margin — BEER Lab
 Seleccione una variante de este juego. Select a version of this game.

Figure 1.1: Demo: opening view of the filtered registry; 32 configurations in total.

Rooms

Current rooms:

[ES] Apalancamiento y margen — Básico
[EN] Leverage and margin — Basic
[ES] Apalancamiento y margen — Extendido
[EN] Leverage and margin — Extended

Figure 1.2: Rooms: the family's four rooms.

oTree
Demo
Sessions
Rooms
Data
Server Check
Logout

Room: [EN] Leverage and margin — Basic

Create a new session

Session Config

[EN] Leverage and margin — One account

Number of participants

Individual decisions: any positive participant count is allowed.

Create

[Configure session](#) ⚙️

App sequence

leverage_margin_game (3 rounds)

0 participants present

Start links

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

Room-wide URL

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

http://127.0.0.1:8104/room/margin_en

Figure 1.3: Basic room form: language and case sequence.

Balance sheets, margin and liquidation: a worked example

2.1 Opening the account without counting a loan as income

Each case has 100 ECU of own funds by default. ECU means Experimental Currency Units and is the accounting unit. The chosen reserve is held outside collateral. A person who reserves 20 ECU and requests an 80 ECU loan invests 80 of own funds and 80 borrowed: an asset purchase of 160 ECU at a price of 100, or 1.60 units. Initial wealth remains 100: reserve of 20 plus invested equity of 80. The loan simultaneously increases assets and liabilities; it does not generate a profit of 80 ECU.

Write E for initial own funds, R for the reserve, D_0 for the loan and $P_0 = 100$ for the initial price. Purchased quantity is $q = (E - R + D_0)/P_0$. Opening requires $(E - R)/(qP_0) \geq m_0$, where m_0 is initial margin. An all-cash account with $q = 0$ and $D_0 = 0$ is also valid; its ratio is not divided by zero. Reserve and loan choices use whole ECU, while units allow hundredths. The server checks both resource limits and the contractual ratio rather than relying only on browser controls.

In the example, invested equity of 80 is half of assets worth 160. It meets initial margin of 50 percent. With that reserve, a loan of 100 would fail because 80 divided by 180 is below one half. A margin of 25 percent would allow a larger financed position with the same invested own funds. This expands the feasible set; it does not require more borrowing. The report must distinguish a looser constraint from the behavioral response to that opportunity. A participant can retain the same loan even when additional credit becomes feasible.

Theoretical foundation

Position leverage is assets divided by invested equity, not debt divided by all own funds including an unpledged reserve. Investing 100 of own funds plus a loan of 100 produces assets of 200 and leverage of two. Before sales, interest and liability limits, a ten-percent asset-price change changes that invested equity by twenty percent. Specify the denominator before comparing leverage across accounts with different reserves.

2.2 Marking collateral after observing the price

The first price is 60 or 140 ECU, with equal probabilities. Except in the terminal-recovery condition, the second price is twenty ECU below or above the first, again with equal probabilities. Four terminal paths result: 60 to 40, 60 to 80, 140 to 120 and 140 to 160. Each has probability one quarter before the account opens. The mean final price is 100. The design does not announce a

positive expected-return premium that automatically justifies borrowing. Under limited liability, the borrower's payoff profile can also differ from total investment value.

Only the first price is revealed after the initial draw. The screen shows quantity, market value, eligible collateral value, debt due, collateral equity and available reserve. Interest, when present, is capitalized once on the original loan before this test. It is not charged again during final settlement. A collateral haircut reduces the value accepted for the test; it does not itself change the price at which units can be sold. This distinction separates a funding constraint from an execution cost. Keep both labels visible when discussing the screen.

Suppose the 1.60-unit example encounters price 60. Market value becomes 96 ECU, debt remains 80 and equity inside collateral becomes 16. The reserve of 20 remains outside. Maintenance margin of 25 percent requires equity of 24, leaving a shortfall of eight. The person has positive total wealth and enough resources to respond. A margin call is therefore not necessarily insolvency: it can occur with positive equity that is small relative to the financed asset. Conversely, a contract can postpone a call even when the eventual loan incurs a loss.

Let h denote the collateral haircut and V_c the accepted value: $V_c = (1 - h)qP_1$, subject to the stated cent rounding. If D includes capitalized interest, collateral equity is $V_c - D$. The requirement is $V_c - D \geq m_1 V_c$. The contribution that removes the shortfall without selling is $\max\{0, D - (1 - m_1)V_c\}$. This is a contractual calculation, not a recommendation about which response maximizes the person's expected value. A feasible response need not be preferred under their objectives, information or tolerance for risk.

2.3 Responding with reserve funds or a sale

Contributing eight ECU in the example reduces the reserve from twenty to twelve and debt from eighty to seventy-two. Quantity remains 1.60. Collateral equity becomes 96 minus 72, or 24, exactly one quarter of the asset value. The transfer creates no wealth: before the contribution there was reserve of 20 and equity of 16; afterward there is reserve of 12 and equity of 24. Total wealth is 36 at both moments. The contractual location of resources and the creditor's exposure have changed, not aggregate resources.

A sale has a different effect. It reduces quantity exposed to the terminal price and uses proceeds first to repay debt. Any proceeds exceeding the entire debt return to the reserve. One cannot simultaneously retain the proceeds of a sold unit and the unit itself. The response has two fields: a contribution in whole ECU and voluntary units sold in steps of 0.01. Both accept zero. Server validation prevents contributions exceeding reserve or debt and sales exceeding the available quantity. The rules apply equally when browser restrictions are bypassed.

Separate a chosen sale from an imposed sale. The former is recorded as voluntary quantity. The latter is calculated after the participant's response if collateral still fails the requirement. A person can sell voluntarily even without receiving a call. That choice may reflect reduced exposure, a preference for cash or a valuation of the remaining path; the record alone does not identify the motive. Ask for explanations without presenting an unmeasured belief as data. A positive sale is a quantity outcome, not automatically evidence of panic or a particular bias.

What participants will see

In the comprehension example, 160 ECU are invested, collateral is worth 96 after the decline and its equity is 16. A contribution of eight from the reserve is enough to reach equity of 24. Do not report 36 as equity inside collateral: 36 is total wealth before contributing, including a reserve that was still outside.

2.4 Minimum sales, quantity steps and contractual rules

Consider an account with own funds of 100, no reserve and a loan of 100 to obtain a positive automatic sale without mixing in a contribution. It purchases two units. If the first price falls to 60, assets are worth 120 and collateral equity is 20. Maintenance margin of 25 percent requires equity of thirty. Selling at market value and repaying debt initially preserves those twenty of equity while reducing the denominator. To comply, remaining assets must be worth at most eighty. With unlimited divisibility, two thirds of a unit would have to be sold.

The program allows hundredths and must satisfy the inequality rather than round against the contract. It sells 0.67 units for 40.20 ECU, leaving 1.33 units and debt of 59.80. Remaining assets are worth 79.80 and equity is still 20. Their ratio is slightly above 25 percent. A sale of 0.66 would leave assets of 80.40 and equity of twenty, still failing the requirement. The smallest feasible sale is therefore 0.67. This small difference is quantity discretization, not a behavioral deviation by the participant or evidence of excessive precaution.

With an execution discount, liquidation no longer preserves equity: equity falls by the difference between marked value and execution proceeds. Mechanically applying the no-discount formula and rounding is therefore insufficient. The engine evaluates feasible sales in hundredths and chooses the first that complies under actual accounting. If no quantity complies, it sells the entire position. The full-liquidation condition uses a different rule: if the deficiency persists after the voluntary response, every remaining unit is sold even when a smaller sale would have sufficed. Explain the rule before interpreting retained quantities.

Checkpoint

Check three identities after a sale: initial units minus sales equal retained units; sale proceeds equal debt repayment plus cash returned; total wealth afterward equals prior wealth minus execution loss. When interest applies, also distinguish original principal from debt due. An accounting discrepancy calls for checking records rather than searching for a behavioral explanation.

2.5 Closing the investment and assigning the credit loss

Continue with the 1.33 units and debt of 59.80 from the preceding example. If final price is eighty, units are worth 106.40, the lender collects 59.80 and the person retains 46.60. If final price is forty, assets are worth 53.20; the lender collects that amount, loses 6.60 relative to remaining debt and the person receives zero from the position. No fictitious transfer covers the difference. Loan liability is limited to the collateral defined by the condition's contract. The final screen keeps borrower wealth and lender recovery in separate rows.

An outside reserve is added to final own wealth and, by default, cannot be claimed by the lender. The pledged-reserve variant changes this right at settlement: after collecting from the asset, the lender may collect from remaining reserve up to the unpaid debt. It never receives more than the amount due. A pledged reserve is neither another loan nor an extra endowment. Comparing the rules teaches why total wealth and creditor-recoverable value need not coincide. Rights over existing resources matter even when their physical amount is unchanged.

Write S for intermediate sale proceeds and A_T for retained assets' terminal value. Total investment result is $S + A_T - A_0$, where A_0 is initial purchase value. The person's profit is final wealth less initial own funds. The lender's net result is total recovery less principal advanced. Their sum equals the investment result exactly. Interest transfers value between parties without creating joint wealth. The execution discount does reduce investment results relative to selling at the marked

price. This identity is also a practical audit tool when a record seems surprising.

The battery's experimental payoff is average final wealth, rounded to cents and recorded once after active cases close. Initial reserves, loans and sale proceeds are not added again. A person preserving one hundred ECU in each of three cases receives an average of one hundred, not three hundred. The report also shows per-case means, whose interpretation changes when some people still have pending cases. Individual closure explicitly confirms that choices have been recorded. There is no real-money conversion or repayment obligation beyond the experimental account announced here.

2.6 Theory and evidence supporting the discussion

[Geanakoplos \(2010\)](#) places leverage and collateral at the center of the financial cycle. That perspective motivates comparisons of funding constraints and the ability to retain an asset. Our activity fixes margins contractually and uses exogenous prices. It neither reproduces that equilibrium nor estimates an equilibrium margin. The useful prediction is conditional: with the same position and price, a higher requirement can demand more resources or a larger sale. Initial behavior and subsequent price outcomes must be analyzed separately. An observed final wealth difference alone does not identify the contractual channel.

[Brunnermeier and Pedersen \(2009\)](#) study the relation between market liquidity and funding liquidity. The activity preserves a teaching distinction: an execution discount changes money received on a sale, while a collateral haircut changes what is accepted to secure debt. Contrasting them separates the channels. Prices do not respond to other students' sales, so a large liquidation does not demonstrate an endogenous spiral. The exercise illustrates a contractual part of those mechanisms under announced assumptions. It should not be described as a calibrated reproduction of the paper's full model.

[Adrian and Shin \(2010\)](#) provide evidence on marked-to-market balance sheets and intermediaries' leverage behavior. Its classroom contribution is to take equity accounting seriously when prices change and balance-sheet size adjusts. Activity data are not a sample of professional intermediaries and cannot establish crisis magnitudes. When comparing evidence with the simulation, identify what follows from an accounting identity, what changes through a contract and what requires an adjustment decision. These explanations answer different questions. The distinction helps students use an experiment as an analytical illustration while recognizing the evidence needed for an empirical claim.

Choose your response

Case 1 / 1

Margin after the change: 25,0%

Collateral meets the current rules.

Observed price per unit	140.00
Units in the account	1.60
Market value of units	224.00
Eligible collateral value	224.00
Debt due including interest	80.00
Equity inside collateral	144.00
Reserve outside collateral (whole ECU)	20.00
Contribution required without selling	0.00

Figure 2.1: Actual account after the first price: balance, collateral and reserve.

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.

Comprehension example: own funds 100 ECU, reserve 20, loan 80, initial price 100. The price then becomes 60 and required margin is 25%, with no interest or discounts. This example illustrates the calculation even if your case uses different parameters.

How many ECU are initially invested in units?

Your answer: 159. The correct answer is 160. The investment is $100 - 20 + 80 = 160$ ECU: 1.60 units.

What is equity inside the collateral after the price changes to 60 ECU?

Your answer: 15. The correct answer is 16. Collateral is worth $1.60 \times 60 = 96$ ECU. Its equity is $96 - 80 = 16$ ECU. The reserve of 20 is outside.

How many ECU of reserve suffice to repay debt and meet margin without selling?

Your answer: 7. The correct answer is 8. Required equity is $25\% \times 96 = 24$ ECU. Repaying 8 reduces debt from 80 to 72 and raises equity from 16 to 24.

Continue

Figure 2.2: Question-specific corrections with answers retained.

Extended comparisons and teaching questions

3.1 Reference: separate funding, response and settlement

The reference condition retains own funds of one hundred, initial margin of 50 percent, maintenance margin of 25 percent and a general loan cap of three hundred ECU. That general cap does not make three hundred feasible with every reserve: the opening inequality may impose a much smaller maximum. There is no interest or discount, and the reserve is unpledged. The reference also appears in extended menus to support comparisons within the same menu. It is the basic account's mechanism rather than an additional economic institution.

Establish common terms here: invested own funds, purchased assets, debt due and outside reserve. The report identifies accounts without debt, margin deficiencies and positive automatic sales. These categories are not equivalent. Before comparing another rule, reconstruct one account and confirm that students understand why borrowing increases assets and liabilities together. Subsequent contrasts are interpretable only if those quantities retain the same meaning. Always check the initial position before comparing outcomes generated by different contracts.

3.2 Purchase without borrowing: a balance sheet without outside funding

This condition sets permitted borrowing to zero. The person still chooses how much to reserve and invest from own funds and may sell after the first price. Margin does not impose a sale because there is no debt to secure. The condition teaches asset exposure without the credit component. It is not a safe investment: purchased units can still finish at forty, eighty, one hundred twenty or one hundred sixty ECU. Holding cash removes that exposure; purchasing units retains it. A zero loan is imposed here rather than an unrestricted choice of zero debt.

Compare with the reference under the same price distribution and own resources. Examine final wealth and initial quantity as well as debt, which is zero by construction. A wealth difference cannot be interpreted solely as a borrowing cost when people also change investment. To isolate the accounting identity, calculate another example with the same feasible quantity. To study behavior, treat quantity changes as choices rather than software errors. This separation prevents attributing every difference between portfolios to leverage and clarifies what the contract actually restricts.

3.3 Initial margin of 25 percent: expanding purchasing capacity

Invested own funds must cover at least one quarter of purchased assets, while maintenance remains one quarter. With no reserve and own funds of one hundred, the contract permits a loan of three hundred and a purchase of four units. If the first price is sixty, assets are worth two hundred forty and debt is three hundred. Even selling everything cannot repay debt. The program sells all four units; the lender recovers two hundred forty and loses sixty. The person receives zero from the position and has no additional liability beyond the stated collateral contract.

The mechanical prediction is an expanded feasible debt frontier. Predicting chosen debt also requires preferences and interpretations of risk. Limited liability changes who bears the negative tail, so higher demand for borrowing cannot be called irrational without specifying the decision maker's objective. Compare high-loan frequencies, lender loss and own wealth. The example does not estimate fairly priced credit: the program offers the announced contract rather than adjusting its rate endogenously for every borrower. The same price draw can have different distributional consequences under different liability and collateral rules.

3.4 Initial margin of 75 percent: restricting feasible positions

Three quarters of assets must now be financed by invested own funds. With one hundred of own funds and no reserve, the largest whole-ECU loan is thirty-three: thirty-four would violate the requirement. The account purchases 1.33 units. At a first price of sixty, assets are worth 79.80, debt is thirty-three and equity is 46.80. Maintenance margin of one quarter is satisfied without an automatic sale. The initial restriction prevented a very large position; it did not guarantee a final profit or eliminate the possibility of losing own funds.

Use the three-margin battery to study these opportunities within one person. Distinguish order effects: someone observing a loss may choose less debt in the next case even under an unchanged rule. The randomized battery changes order, not the available margins or price probabilities. Interpret the margin table by contractual percentage rather than first, second or third screen. Position results describe learning but do not replace this economic grouping. Comparing cases by position alone can combine different constraints and produce a misleading apparent trend.

3.5 Maintenance margin of 40 percent: a stronger subsequent requirement

Initial margin remains one half, but the later test requires forty percent. This difference is announced before choosing. With two units, debt of one hundred and price sixty, marked equity is twenty. With no execution discount, remaining assets must be worth at most fifty for twenty to represent forty percent. The smallest sale in hundredths is 1.17 units: 0.83 remain, assets are worth 49.80 and debt is 29.80. The reference sale of 0.67 would be insufficient under this contract. The later requirement changes liquidation even when the opening position is held constant.

Compare sold and retained quantities without confusing a conditional contractual effect with a comparison of people choosing different loans. Higher maintenance can induce less initial borrowing, more reserve or a subsequent contribution. Any of these responses may reduce observed automatic sales. A lower sale rate therefore does not show that the requirement became looser. Examine rules, initial position and response together. An unambiguous prediction about the minimum sale requires holding these earlier variables fixed. Behavioral adjustment and the mechanical effect of a constraint should be reported separately.

3.6 Margin increases to 50 percent: an announced rule change

Opening requires fifty percent, and the contract specifies that the post-price test will also use fifty rather than twenty-five. This is a programmed, known increase, not an unannounced surprise. With two units, debt one hundred and first price sixty, the minimum sale is 1.34 units. The account retains 0.66, assets of 39.60 and debt of 19.60; equity of twenty exceeds half the remaining assets. The example illustrates how requirements can change while prices and original principal remain identical. It does not require a new interpretation of asset ownership.

Compare this condition with forty-percent maintenance and the reference. Describe differences as requirements at the same contractual moment. Do not attribute behavior to policy uncertainty when instructions announced the change. Studying an unexpected announcement would require a different specification of prior information, probabilities and experimental procedures. This delivery maintains a transparent, reproducible rule. The report records the effective percentage so that each requirement can be reconstructed. Ask students to distinguish knowing a future requirement from possessing enough liquid resources to meet it after an adverse price realization.

3.7 Interest of 10 percent: principal versus debt due

Interest is charged once on the original loan before the first test. Principal of one hundred becomes debt of one hundred ten. It is not interest compounded over an unspecified number of rounds. With two units at price sixty, collateral equity is ten instead of twenty and the contribution needed without selling becomes twenty. A reserve adequate in the reference may become insufficient. Funding cost affects both terminal balances and the ability to retain units during the episode. The screen labels debt including interest so that students can distinguish an opening choice from the resulting contractual obligation.

For the joint result, add own profit and the lender's net result relative to principal. Interest paid transfers value between these parties rather than destroying resources. Interest due but unrecovered cannot be reported as collected income. Compare actual recovery with debt due and principal. This condition does not calculate an equilibrium interest rate or an optimal competitive contract. It teaches how a specified funding cost changes balances and the intermediate restriction even with the same price path. Different recovery outcomes should not be hidden inside an average promised rate.

3.8 Collateral haircut of 10 percent: contractual valuation

Eligible collateral value is ninety percent of market value after the first change. This rule does not reduce the execution price. In the two-unit account at price sixty, market value is one hundred twenty but accepted collateral is one hundred eight. With debt one hundred, contractual equity is eight and the quarter-margin requirement is twenty-seven. The shortfall is nineteen. This calculation does not mean nineteen ECU disappeared from market wealth: the contract values the backing conservatively. A difference between market value and eligible value is a contractual restriction, not automatically a realized loss.

Selling at sixty repays debt with market proceeds even though remaining assets remain subject to the collateral haircut. The minimum sale differs from both the reference and an execution discount. Show both valuation columns before discussing welfare. A person may comply by contributing reserve without changing the asset price. Funding liquidity depends on what the creditor accepts as backing as well as how many assets exist. The condition does not establish that a haircut observed in an actual market has the same value, cause or empirical effect as this teaching parameter.

3.9 Sale discount of 10 percent: execution consumes equity

The test now uses full market value, but every intermediate sale receives ninety percent of the first price. At a marked price of sixty, execution occurs at fifty-four. A sale loses equity because it removes an asset marked at sixty and produces only fifty-four for repayment. The program evaluates feasible quantities with actual proceeds rather than assuming liquidation preserves equity. Retained units' final settlement uses the terminal price without this intermediate discount. Distinguish that final valuation from the price received for units already sold.

Compare with the collateral haircut while holding position, margin and path fixed. Both can increase liquidation but do so through different accounting channels. The haircut reduces value accepted as debt backing; the execution discount reduces proceeds actually received. Lender results and own wealth can respond differently. Ask which transfer or loss appears in the joint identity and which price belongs at each step. A fixed discount is not evidence of endogenous market impact or a decline caused by classmates' sales. Such claims would require an additional market mechanism and corresponding data.

3.10 Full liquidation: a discrete automatic response

The person can still contribute reserve and sell voluntarily. If that response leaves a deficiency, the program sells every remaining unit. The comparison is with selling only enough to comply. With two units, debt one hundred, first price sixty and no voluntary response, two units sell for one hundred twenty. The lender receives one hundred and the reserve receives twenty. The final price no longer affects this account because no units remain. Wealth of twenty may be higher or lower than the alternative depending on the terminal path. Eliminating exposure changes both upside and downside.

Do not describe full liquidation as universally better for either creditor or borrower without specifying later prices and rights. It may reduce future exposure while removing a favorable recovery. Compare retained units, recovery and wealth under the same states. A voluntary response that cures the deficiency prevents full liquidation, so not every account in this condition closes all units. A positive automatic sale in the report does not itself reveal whether the entire position was sold. Use quantities in the case-level file to distinguish partial liquidation from total closure.

3.11 No intermediate automatic sale: retaining exposure until settlement

This condition retains the opening constraint but disables the intermediate test that would impose a sale. The person can still repay or sell voluntarily. With two units, debt one hundred, no reserve and no response, two units remain until settlement. At final price forty, assets are worth eighty, own wealth is zero and the lender loses twenty. At final price eighty, assets are worth one hundred sixty and own wealth is sixty. The same contract has different outcomes across terminal states; postponing adjustment is not a guarantee of recovery.

Avoiding an imposed sale preserves potential gains and exposure to losses. It neither eliminates debt nor guarantees solvency. The reference may sell during a temporary decline and forgo a recovery; it can also reduce a later, larger loss. Examine the outcome distribution and lender loss alongside mean own wealth. If people change their responses when informed that sales will not be imposed, record that as behavior. Do not confuse it with the mechanical outcome of preserving

the same position without adjustment. The rule is an explicit contract comparison, not a claim that margin requirements have a uniform welfare effect.

3.12 Final price equals one hundred: known recovery and intermediate liquidity

The first price remains sixty or one hundred forty, but the terminal price is one hundred in either state. Recovery is announced before opening and recalled on the response screen. This isolates an intermediate restriction when terminal price is known. With two units and debt one hundred, retaining the position without adjustment would yield equity of one hundred at settlement. Without reserve to cure the decline to sixty, the reference sells 0.67 units. It ends with 1.33 units at one hundred less debt of 59.80, or wealth of 73.20.

The difference of 26.80 reflects selling part of the position before recovery. It is neither a terminal surprise nor an incorrect belief about a price announced in advance. The participant can anticipate the requirement when choosing debt and reserve. Ask why an investment with sufficient terminal value may require intermediate funding. Keep final value separate from the ability to comply today. The numerical magnitude is not a prediction for actual assets, where recovery is rarely guaranteed by design. It is a transparent consequence of this particular contract and path.

3.13 Pledged reserve: recovery rights at settlement

Reserve is not automatically used to cure the intermediate test: the person chooses the contribution. The change occurs at settlement, when the creditor may collect from remaining cash if assets cannot repay debt. With reserve forty, loan sixty and initial quantity 1.20, a decline to sixty followed by no response causes a minimum sale of 0.40 units. The account retains 0.80 units and debt of thirty-six. At final price forty, assets pay thirty-two and four remain unpaid. The pledged rule collects those four from the reserve rather than leaving them protected.

Own wealth becomes thirty-six and the creditor loses nothing. Under protected reserve, the person would keep forty and the creditor would lose four. Total endowment and asset price are unchanged; rights over existing resources changed. Compare opening reserve, voluntary contributions and additional recovery. This condition does not impose unlimited personal liability or permit collections beyond debt due. It includes no wage, other property or guarantee absent from the account. Its teaching purpose is to distinguish the existence of cash from the creditor's legal or contractual access to that cash.



Decide tu respuesta

Caso 1 / 1

Margen después del cambio: 25,0%

La garantía es insuficiente con las reglas vigentes.

Precio observado por unidad	60.00
Unidades en la cuenta	1.20
Valor de mercado de las unidades	72.00
Valor admitido como garantía	64.80
Deuda exigible con interés	60.00
Patrimonio dentro de la garantía	4.80
Reserva fuera de la garantía (ECU enteros)	40.00
Aportación necesaria sin vender	11.40

Figure 3.1: Actual collateral-haircut test (Spanish interface).

Classroom use, data interpretation and exercises

4.1 A teaching sequence with observable questions

Use the activity after introducing an investment balance sheet or before formalizing funding constraints. For the first approach, ask students to calculate equity and leverage before receiving a link. For the second, first collect a plain-language explanation of what happens when an investment loses value while its loan remains outstanding. Both approaches reach the same balance sheet from different levels of prior knowledge. Students do not need general-equilibrium models to interpret a margin call, but they do need a clear distinction between a stock of debt and a change in wealth.

A short class can use one account and concentrate on the numerical reconstruction in the next chapter. A longer class can compare the reference with a margin increase, an execution discount or a pledged reserve. Change one contractual element per contrast. Running every condition in sequence can illustrate a curriculum, but it confounds treatment with learning and selection into continued participation. Such a sequence is not an isolated causal estimate of every rule. The report describes choices under specified contracts, not a randomized design that the instructor did not implement.

Before revealing aggregates, ask students to record three objects: chosen debt, the possibility of an automatic sale and expected final wealth. The first is a decision; the second also depends on the draw and contract; the third is an expectation about future outcomes. The program records choices and realizations, not a measure of expectations unless the instructor collects one separately. This distinction avoids retrospectively assigning a belief that would make an observed choice appear optimal. Explanations can be discussed without being treated as measured beliefs.

4.2 Preparing and running a seventy-five-minute session

Use the first ten minutes to construct a balance sheet on the board. Write own funds, loan, purchased assets and reserve without presenting a behavioral prediction yet. Ask how much the person owns and owes. Spend another ten minutes explaining the initial-margin inequality and reviewing the comprehension example. Incorrect quiz answers do not reduce payoffs: each receives a question-specific correction while other answers are retained. The purpose is to ensure subsequent choices follow an understood procedure, not to select students by arithmetic speed or induce a particular investment strategy.

Allow fifteen minutes to open and close the first account. After choosing a position, ask students to observe the price and note whether collateral complies before entering a response. Do not tell

them which loan or contribution to choose. Finished participants remain on the final page awaiting instructions; they should not restart a link to obtain another draw. Instructors can inspect progress without revealing aggregates. If some people are still pending, wait or explicitly explain that an initial discussion includes closed cases only. Do not fill missing responses with instructor-generated choices or treat them as decisions made by students.

Use the next fifteen minutes to reconstruct an anonymous account and reveal the report. Compare the chosen loan, imposed sale and lender loss. These are separate objects: an initial decision, a contractual adjustment and a consequence of the path. Introduce one contrasting condition during the following fifteen minutes. For a demonstration without a causal claim, calculate the same path under another rule. To compare behavior, use an explicit assignment procedure and create separate sessions before distributing links. Reserve the final ten minutes for exercises and a written explanation connecting the balance sheet to the rule.

In an introductory course, select the reference and purchase without borrowing or high initial margin. In intermediate finance, contrast maintenance, collateral haircut and execution cost. For contract discussions, use protected versus pledged reserve. Known terminal recovery is particularly useful for separating eventual solvency from the ability to finance a position during its path. Select the concept students still need to understand rather than attempt to complete every menu item. Running thirteen conditions in one class leaves little time to reconstruct accounts and may bury the mechanism beneath successive outcomes.

4.3 Turning the report into an informed discussion

The report shows participants, closed cases, pending cases and people who finished. Active cases are the progress denominator. A three-case battery with ten people contains thirty planned cases, although it has only ten participants. Inactive technical rounds of a single account are not pending decisions. Aggregates remain hidden until the instructor reveals them and can be hidden again. Revealing results neither completes an unfinished case nor changes a choice. Tables show no names, personal codes or rows designed to associate an account with an identity in the classroom.

Mean loans use closed cases and include zero borrowing. The deficiency rate counts cases failing collateral before the voluntary response. The automatic-sale rate counts positive imposed quantities after that response. The credit-loss rate counts positive lender losses at settlement. All use closed cases as denominator, and the summary displays numerators and totals. These rates need not coincide: a contribution can cure a call, a sale can reduce later risk and a retained position can lose value in the second draw. Always distinguish the timing of a measurement before comparing percentages that describe different stages.

The histogram groups loans into zero, up to fifty, above fifty through one hundred, above one hundred through two hundred, and above two hundred. Upper endpoints are included; zero has its own bar. Frequencies sum to closed cases. The position table shows the first, second and third decisions of a battery. The margin table regroups by the economic restriction even when its order was randomized. A single account produces one row in both tables. Missing values appear as a dash rather than an observed zero. Compare frequencies as well as percentages when sample sizes differ or a session remains incomplete.

Feedback script

Start with: "How many cases are closed, and what is this number's denominator?" Continue with: "Was this sale chosen or imposed by the contract?" Then ask: "What changed in the numerator and denominator of margin?" Finish with: "Who bears the unrecovered amount, and which resources could the lender claim?"

Case result

Case 1 / 1

Units voluntarily sold	0.00
Units automatically sold	0.00
Units retained until settlement	1.60
Final price per unit	160.00
Final own wealth	196.00
Change from initial own funds	96.00
Total lender recovery	80.00
Lender loss	0.00
Lender collection from reserve	0.00

Amounts are rounded to cents, with halves rounded up. Loans are not income, and intermediate payments are not added again at settlement.

Continue

Powered by [gTree](#)

Figure 4.1: Individual settlement: own wealth and lender recovery.

Instructor report: investment account

Private aggregates for this session. No individual identifiers are shown. Incomplete decisions are not imputed as zero.

Reference margin account

Participants: 1 Closed cases: 1 Pending cases: 0 Participants finished: 1

Download this session by case (CSV)

Download this session in wide format

Aggregates include only closed cases; the session may be incomplete.

Hide aggregates

Aggregate results for closed cases

Mean opening loan (ECU)	80.00
Mean final wealth per case (ECU)	196.00
Cases with initial collateral deficiency	0.0% (0/1)
Cases with positive automatic sale	0.0% (0/1)
Cases with positive lender loss	0.0% (0/1)
Mean lender loss per case (ECU)	0.00

Figure 4.2: Revealed private report: aggregate summary and denominators.

4.4 Downloading and reconstructing records

The case-level button delivers a CSV restricted to the selected session. It includes each participant's three technical rounds even when only one case is active. Status distinguishes pending, position open, completed and inactive. An open position contains initial choices but no completed response. Missing fields retain their absence; they do not mean zero contribution or zero wealth. File identifiers allow the team to link rounds and must remain outside a public projection. The aggregate report omits these identifiers by design. Access to an administrative file is different from permission to associate a classroom choice with a person.

Language, edition, condition, order and initial-margin columns reconstruct assignment. Loan, reserve, contribution and voluntary sale use visible ECU or asset units. Opening and result objects store internal cash in cents and quantities in hundredths of a unit. Divide by one hundred to recover visible units. The opening object preserves effective parameters, their fingerprint and the drawn path for private audit. The instructor's ability to download the full path does not mean a participant knew the second price when responding. Information available at a choice must be distinguished from information later available for reconstruction.

To reconstruct an account, first verify purchased quantity and the opening identity. Calculate interest and eligible collateral next. Review contribution, voluntary sale and imposed sale in that order. Every sale event contains quantity, price, proceeds, repayment and returned excess cash. At settlement, check terminal assets, recovery from assets, recovery from reserve where applicable, credit loss and own wealth. The joint-result identity in the accounting chapter must close to cents. Do not add terminal recovery to debt already repaid as though they were new obligations. Collections over the entire episode and the final remaining debt are different quantities.

Native wide format has one row per participant with rounds in columns. It helps join a person's choices; the case-level file facilitates longitudinal calculations. Both download through links that include the session code. A correct download must not incorporate people from other sessions of the same family. Preserve original files and document subsequent filtering. When comparing sessions, add assignment information rather than assume identical configuration names guarantee identical parameters, seeds or classroom procedures. A saved configuration is part of the evidence; the actual instructions, realized paths and assignment method remain necessary to interpret a comparison.

4.5 Exercises with answer guidance

First exercise: a person keeps no reserve and borrows one hundred under initial margin of one half. How much is purchased and what is initial equity? The answer is two units, assets of two hundred, debt of one hundred and equity of one hundred. Borrowing does not increase initial wealth. If the asset rises ten percent with nothing else changing, its value becomes two hundred twenty and equity becomes one hundred twenty. Equity return is twenty percent, twice the asset return. State that this relation precedes interest, sales and limited-liability boundaries; it is not a universal formula after every contractual adjustment.

Second exercise: that account faces price sixty and maintenance of one quarter. Is selling 0.66 units enough? No. Remaining assets are worth 80.40 and equity of twenty is less than one quarter. Selling 0.67 leaves assets of 79.80 and debt of 59.80, satisfying the rule. A student answering exactly two thirds has recognized the continuous formula but still must apply the hundredth-unit step. Explain the difference as a quantity constraint, not an additional execution loss. This is a useful check that students understand both the inequality and the interface's feasible choices.

Third exercise: with reserve twenty, loan eighty and quantity 1.60, what changes when eight are

contributed after price falls to sixty? Debt becomes seventy-two and reserve twelve; units do not change. Collateral equity rises from sixteen to twenty-four, and total wealth remains thirty-six. The contribution changes the contractual location of cash. If an answer claims eight ECU were gained, ask where that money came from and correct the total. This example distinguishes a transfer across compartments from a change in aggregate wealth, a distinction needed for interpreting both collateral contributions and debt repayments.

Fourth exercise: after the minimum sale of 0.67, compare final prices forty and eighty. In the first state, assets and recovery are 53.20, lender loss is 6.60 and own wealth is zero. In the second, assets are 106.40, recovery is 59.80, lender loss is zero and own wealth is 46.60. A margin sale did not eliminate all credit risk. The test used an earlier price, while the second draw could still reduce retained value. Both states belong in an explanation of risk even if only one occurred in the session. Ex ante possibilities and the ex post realization answer different questions.

Fifth exercise: how does accepting ninety percent as collateral differ from selling at ninety percent of price? The former changes contractual value in the inequality; the latter changes execution proceeds and therefore equity. With two units at price sixty, accepted collateral is one hundred eight under the haircut. Execution price is fifty-four under the sale discount. Do not interchange these numbers across columns. Both mechanisms can induce larger sales without becoming the same mechanism. Ask which price determines marked wealth, which value determines compliance and which proceeds actually repay the loan.

Sixth exercise: after sales, an account has reserve forty, 0.80 units and debt thirty-six. Final price is forty. Who loses four? With protected reserve, the lender collects thirty-two and loses four while the person keeps forty. With pledged reserve, four more are collected from cash and the person ends with thirty-six. The joint result is unchanged. The new recovery right reallocates a loss rather than creates four ECU. An adequate answer identifies both the resource and the contractual right, not just the numerical difference in borrower wealth.

Seventh exercise: final wealth across three cases is eighty, one hundred and one hundred twenty. What is the battery outcome and which observation is independent? Average wealth is one hundred ECU. The three accounts belong to one person and must not automatically be treated as three independent individuals for inference. Case-level analysis can describe decisions but must recognize participant clustering. If assignment occurred at session level, consider that level as well. Software provides records; it does not choose the appropriate estimation design. Distinguish a convenient unit for a table from the unit that received experimental assignment.

4.6 Incidents, limitations and closure

If a loan is rejected, first reconstruct initial margin using the chosen reserve. The general cap of three hundred does not replace that inequality. If a response is rejected, check that the contribution is whole ECU and does not exceed reserve or debt, and that sales respect hundredth-unit steps. A field error preserves other responses for correction. If someone loses a link, retrieve the current session link rather than reset the database. This individual activity does not depend on another person's response: an unfinished participant creates a pending case, not a waiting barrier blocking everyone else.

Own funds and the general loan cap can be changed through technical configuration, subject to engine validation. An adaptation must update examples and identify the changed parameter rather than assume every number in this guide describes it. Short sales, stock borrowing, recall rights and human creditors are not implemented. Those contracts require additional rules and cannot be obtained by reversing the sign of a long position. Strategic trading and credit reputation already have their own families; adding them without an additional question would duplicate coverage.

Exogenous liquidation discounts also do not create an aggregate market feedback mechanism.

Close by requesting a brief explanation linking a balance-sheet identity, a contractual rule and a choice. A complete answer might say that the price decline reduced equity, maintenance required a particular ratio, and holding a reserve allowed repayment without selling. None of these elements substitutes for another. Preserve anonymous evidence, distinguish illustration from causal inference and archive incomplete choices as incomplete. The expected learning outcome is an ability to reconstruct the funding channel with clear accounts rather than memorize a variant name or rank classmates by their realized wealth.

Bibliography

- Adrian, T., and Shin, H. S. (2010). Liquidity and leverage. *Journal of Financial Intermediation*, 19(3), 418–437. https://www.newyorkfed.org/research/staff_reports/sr328.html.
- Brunnermeier, M. K., and Pedersen, L. H. (2009). Market liquidity and funding liquidity. *Review of Financial Studies*, 22(6), 2201–2238. <https://www.nber.org/papers/w12939>.
- Geanakoplos, J. (2010). The leverage cycle. *NBER Macroeconomics Annual*, 24, 1–66. <https://doi.org/10.1086/648285>.
- oTree. Pages; administering an experiment; data export. Official documentation. <https://otree.readthedocs.io/en/master/>. Accessed October 17, 2026.