Mechanics of Options Markets

Lecture 9

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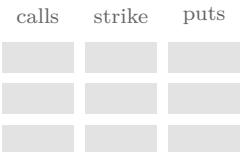

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Outline

1. Reading the option board
2. The life of an option contract
3. The writer's obligation and the clearing machine

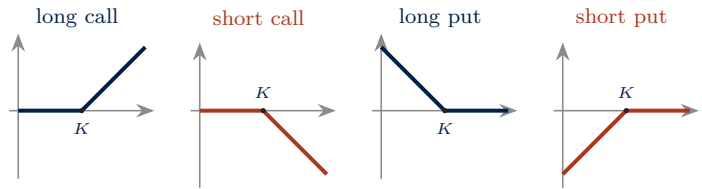
Reading the option board

From symmetric promises to the asymmetric instrument

Lecture 1 introduced the option — the kink, the premium, the right without the obligation — and then eight lectures priced *symmetric* promises: futures, curves, carry, swaps. Part II returns to the asymmetric instrument: this week the market's mechanics; next week the laws option prices must obey; then trees, then the Black–Scholes formula, then the Greeks. The motivating problem: an equity portfolio must be **protected against a fall without being sold**. A futures hedge (Lecture 3) removes the downside, but also the upside. The instrument that keeps the upside is read off the **option chain**.

The four basic positions

Every option strategy is built from four payoffs at expiry, each kinked at the strike K (the premium shifts payoff to profit):



Main point: the buyer (long) has a bounded loss — the premium — and a large gain; the writer (short) has a bounded gain — the premium — and a large loss. That asymmetry organises the whole lecture.

The option board

CSI 300 ETF options, June expiry · ETF at ¥4.000

	calls (last)	strike	puts (last)	IV
	0.240	**3.8**	0.027	?
	0.175	**3.9**	0.062	?
spot sits here - - - - - - - ·	0.120	**4.0**	0.106	?
	0.075	**4.1**	0.161	?
	0.043	**4.2**	0.229	?

An options screen shows this T-layout: calls on the left, strikes down the centre, puts on the right; premiums are per unit. By the end of the lecture every cell will be readable — except the "IV" column, which needs the Black–Scholes formula (Topic 13).

The grammar of one cell

Take the cell "June 4.0 call, 0.120":

- **Class**: all CSI 300 ETF calls, every strike and month.
- **Series**: one strike and one expiry — "the June 4.0 call"; the board is a population of series.
- **Contract unit**: 10,000 ETF units per contract. The quote 0.120 is *per unit*, so one contract costs $0.120 \times 10{,}000 = ¥1{,}200$ and commands ¥40,000 of notional.
- **Sides**: the buyer (holder) of the right, and the **writer** of the obligation — the insurance seller of Lecture 1.

Moneyness: the geography of the board

	calls (last)	strike	puts (last)	
in the money: $S > K$	0.240	**3.8**	0.027	
	0.175	**3.9**	0.062	
	0.120	**4.0**	0.106	
	0.075	**4.1**	0.161	in the money: $K > S$
	0.043	**4.2**	0.229	

at the money on the 4.0 row; everything unshaded is out of the money

Calls are in the money at strikes *below* the spot, puts at strikes *above* it; the shaded corners sit on a diagonal. Exercise pays something in the shade, nothing outside it.

Every premium is intrinsic value plus time value

ium = **intrinsic value** (paid if exercised now) + **time value** (the price of what might still hap

strike	call premium	intrinsic	time value
3.8	0.240	0.200	0.040
3.9	0.175	0.100	0.075
4.0	0.120	0.000	**0.120**
4.1	0.075	0.000	0.075
4.2	0.043	0.000	0.043

Main point: intrinsic value is mechanical; time value is the price of uncertainty — it peaks at the money, and pricing it is the whole task of Topics 12–13 (the dark "IV" column).

A case in moneyness: the 192-times contract

On 25 February 2019 the mainland market jumped: the SSE 50 ETF rose more than seven percent in a session.

- On the board sat the **2.80 call, two days from expiry**, so far out of the money it traded at ¥0.0003 per unit — a whole contract cost about ¥3.
- The surge carried the ETF toward the strike, and the contract closed near ¥0.058 — roughly **192 times** its morning price.

Nothing exotic happened: a premium that was almost entirely faint time value suddenly acquired real chance of finishing in the money, and percentage arithmetic on a tiny base did the rest.

The other half of that case

Two days later the contract expired, settling far below its peak. Whoever bought near the top lost most of it within 48 hours.

- Deep out of the money near expiry, a premium is time value on a stopwatch: it must convert to intrinsic value quickly or decay to zero (the clock is called theta — Topic 14).
- Leverage works both ways, as in Lecture 1, here magnified.
- The far wings of the board are priced like lottery tickets because that is what they are.

Leverage at market prices

Deploy ¥10,000 today:

	2,500 ETF units	8 at-the-money calls
outlay	¥10,000	¥9,600
notional commanded	¥10,000	¥320,000
ETF +10% (to 4.40)	+¥1,000	+¥22,400
ETF −10% (to 3.60)	−¥1,000	−¥9,600 (all of it)

Lecture 1's leverage example with real premiums: the call buyer pays ¥9,600 for protection against everything below the strike and 32 times the notional exposure above it. The exact price of that asymmetry is the premium — the subject of Topics 12–13.

The other side of the board

Someone sold those eight contracts:

- **Writers**: the insurance sellers of Lecture 1 — known income against an uncertain loss. *Covered* if they hold the units behind each call; *naked* if they do not.
- **Market makers**: obliged to quote both sides all day; they earn the bid–ask spread and hedge the residual exposure (with what, exactly, is Topic 14).

The buyer's risk ends when the premium is paid; the writer's continues until expiry — and Lecture 2's clearing machine has firm views on open-ended risk (Block C).

The venue map, and two exercise styles

- **ETF options**: SSE 50 (Feb 2015, the mainland's first), CSI 300 (Dec 2019), CSI 500 (2022), STAR 50 (2023) — delivered in units.
- **Index options** (CFFEX): CSI 300 (Dec 2019), CSI 1000 (2022) — cash-settled.
- **Commodity options** (DCE, CZCE, SHFE, INE): written on futures (soybean meal, sugar, copper, crude, and others).

China lists no options on individual stocks — only on ETFs, indices, and commodity futures (the US has listed single-stock options since 1973). Two exercise styles: **European** — exercisable only at expiry (the local ETF and index options); **American** — exercisable any trading day (US equity options, most local commodity options). Is the extra freedom of American exercise worth anything? Next week proves when it is worth exactly nothing.

Volume and open interest

The same two measures as for futures (Lectures 1–2):

- **volume**: contracts traded today; **open interest**: contracts still outstanding tonight, per series.
- Liquidity concentrates *at the money* and in the near months — where time value (frame 8) lives; the far wings trade thin.
- Heavy volume with falling open interest means positions closing, not opening (Lecture 2).

Who may trade: the suitability regime

Mainland options are not open-access retail products. An investor must pass a suitability test:

- about **¥500,000** in securities assets, a knowledge examination, and a simulated-trading record;
- **tiered permissions**: the first tier allows covered calls and protective puts only; higher tiers add buying, then naked writing.

The design follows directly from this lecture: leverage (frame 11) plus open-ended writer risk (frame 12) leads to gated access, with the tiers ordered by exactly the asymmetry of the two sides.

Where we are

the board, after Block A

layout, class, series, contract unit	✓
moneyness; intrinsic + time value, the hump	✓
volume, open interest, the suitability gate	✓
who lists the strikes? what is contract “3.846A”?	Block B
the writer’s margin	Block C
the “IV” column	Topic 13

Block B follows a contract’s life: how a series is born, adjusted, and ends in one of three ways.

The life of an option contract

A series has a life cycle

The board is a managed population. Each series is **born** by exchange rule, **lives** through corporate events that may rewrite its terms, and **ends** in one of three ways: exercise, offset, or worthless expiry. Block B follows one life cycle: who decides which strikes exist, why an odd contract like "3.846A" appears on real boards, and why the standing rule is to sell an option rather than exercise it — with one exception.

Birth: the exchange lists the series

- **Expiries**: several trade at once — typically the near two months plus the next two quarterly months.
- **Strikes**: an at-the-money rung plus several above and below, at fixed spacing; as the ETF moves, new strikes are listed on the advancing side, so the ladder grows toward the price.
- The exchange lists the series; the market prices them. A strike or tenor the board lacks is available only on the OTC market (frame 24).

Ending by exercise, worked

A European option is exercised only at expiry; in-the-money positions are auto-exercised. ETF options settle in units, CFFEX index options in cash. The June 3.9 call, ETF finishing at ¥4.05:

pay ¥39,000, receive units worth ¥40,500	payoff +¥1,500
premium paid when the trade was opened	−¥1,750
net result on the trade	**−¥250**

Main point: at expiry the only comparison is exercise value versus zero — exercise the ¥1,500, even though the trade as a whole lost: payoff and profit are different things.

Ending by assignment: the writer's side

For every exercised contract, a writer is **assigned** — selected by the clearing house among the open short positions.

- The assigned writer of that 3.9 call must deliver 10,000 units at 3.90 — from inventory if covered, bought at market if naked.
- There is no negotiation, no timing choice, and no appeal; the premium collected earlier was the fee for precisely this obligation.

The buyer holds a decision; the writer holds an obligation that may be called.

American exercise

In some markets — US equity options, most local commodity options — the holder may exercise on any trading day.

- More freedom can never be worth less, so an American option is worth at least its European counterpart.
- How much more? For one large class of options the answer is exactly nothing, proved next week from no-arbitrage alone, with no model and no statistics.

Until that proof, the offset rule of frame 27 is the safe practical guide. *Main point: more freedom can never be worth less, so an American option is worth at least its European twin — a no-arbitrage fact, before any pricing model.*

Life events: stock splits

Suppose the ETF splits two-for-one. Holders of the June 4.0 call now hold the June **2.0** call on **20,000** units.

- The strike halves and the contract unit doubles, so the claim's economics are identical before and after.
- The principle: adjustments neutralise **corporate arithmetic** — relabellings of the same value — and never compensate for market moves.

Life events: dividends, and the non-standard contract

A cash distribution lowers the price on the ex-dividend day. Adjust the option?

- **The classic US stock-option convention: no.** The call holder absorbs the predictable ex-day drop, so the dividend is a silent cost to the call holder (next week's pricing charges for it explicitly).
- **The local ETF-option convention: yes.** A distribution triggers a recalculated strike and unit, and the adjusted series remains on the board as a **non-standard contract**, flagged "A", with an odd strike such as 3.846.

Main point: two markets, two defensible conventions — read your own market's adjustment rule before pricing anything.

Beyond the board: the OTC market

Any size, tenor, underlying, or payoff can be written over the counter by a dealer, under Lecture 7's master-agreement and collateral arrangements.

- In early 2024, "snowball" structures — autocallable notes embedding short put-like exposure to mid- and small-cap indices — hit their knock-in levels together during a small-cap decline, and many retail buyers met the downside terms for the first time.

The discipline is Lecture 1's: read the payoff diagram before the brochure. Anything that cannot be diagrammed cannot be assessed.

Position and exercise limits

Position limits and exercise limits cap what one account, or one group acting in concert, may hold on a side.

- The reason is Lecture 2's squeeze lesson: rights concentrated in one hand near expiry are a corner waiting to happen.
- When option positions grow large relative to the underlying's float, the option can move the underlying — a mechanism named in Topic 14 (gamma); the GameStop episode of January 2021 is one example.

Reading a full quote row

The June 4.1 call as a screen shows it (figures illustrative):

last	bid	ask	volume	open int.	settle
0.075	0.074	0.076	12,431	28,907	0.075

- **last** is history; **bid/ask** is the market maker's living and the immediate cost of trading;
- **settle** is the price tonight's margin marks use (Lecture 2's settlement-price logic, for options);
- volume and open interest are as on frame 14, per series.

Sell, do not exercise — the standing rule

Touching the board costs the spread (here 0.002, about 2.7% of this premium), fees, and — if exercised — full-notional settlement plus any time value still alive, forfeited. Near expiry, holding the 3.9 call with the ETF at 4.05 and a bid of 0.155:

offset: sell at the bid	+¥1,550
exercise: intrinsic value only	+¥1,500

Selling beats exercising by the ¥50 of time value the market still pays; exercise only if the underlying itself is wanted. *Main point: an option is worth more sold than exercised whenever time value is positive — the intuition behind next week's early-exercise theorem.*

Where we are

the board, after Block B

birth: expiries, the growing strike ladder	✓
three endings: exercise (−¥250), assignment, expiry	✓
adjustments: splits yes, cash dividends by convention	✓
OTC market, limits, row literacy, the offset rule	✓
the writer's margin	Block C, now
the "IV" column	Topic 13

Block C: the writer's obligation, the margin it requires, and the clearing machine beneath the board.

The writer's obligation and the clearing machine

The asymmetry, and its consequences

Two sides of every cell have entirely different risk shapes:

- the **buyer's** worst case is the premium — paid in full on day one, with nothing more ever demanded;
- the **writer's** worst case has no fixed ceiling — and Lecture 2 showed what the clearing machine does with open-ended promises: it collateralises them daily.

Main point: the buyer pre-pays risk and the writer pre-sells it; every option-market feature — no buyer margin, writer margin, the tiered gate, covered exemptions, central clearing — is that one asymmetry, administered.

Why buyers post nothing

- The premium leaves the account at purchase, and the clearing house then has no further claim on the buyer: a bought option can hurt the buyer only once.
- Options cannot be bought on credit here; premiums are paid in full, because the leverage is already inside the instrument (frame 11) — 32 times notional needs no loan added on top.

Contrast Lecture 2: a futures position is an open promise needing daily margin; a bought option is a promise already paid for.

The writer's margin, computed

A local margin formula (per unit, for a written call):

$$\text{margin} = \text{settlement premium} + \max(12\% \times S - \text{out-of-money amount},\ 7\% \times S).$$

Write one June 4.1 call (out-of-money amount $= 0.10$):

$12\% \times 4.00 - 0.10$ versus $7\% \times 4.00$	0.38 versus 0.28
margin $= (0.075 + 0.38) \times 10{,}000$	**¥4,550**
premium received	¥750

Six times the income, posted as cover. The formula reads as: the marked debt, plus a buffer scaled to the underlying, less an allowance for being far out of the money, floored. The US rule (20%/10%) has the same structure.

The margin moves with the market

Overnight the ETF firms to 4.05 and the call's settlement marks up to 0.105:

yesterday	¥4,550
today: $(0.105 + \max(0.436,\ 0.2835)) \times 10{,}000$	¥5,410
to post by morning	+¥860

Main point: both legs moved against the writer at once — the marked debt rose and the out-of-money allowance shrank — so margin accelerates as danger nears; this is Lecture 2's credit-to-liquidity conversion, in options.

Covered writing needs no cash margin

Hold the 10,000 units and write the call against them:

- no cash margin is required — the units are locked as cover, so the obligation is pre-funded in kind, and delivery on assignment is a transfer rather than a purchase;
- this is why the suitability gate's lowest tier (frame 15) already permits covered writing: the open-ended tail is removed.

What covered writing is *for* — income, exit discipline, and its real costs — is strategy, and strategy is Topic 11.

The clearing machine, under options

Behind every cell stands the clearing house — novation, a default waterfall, daily marks: Lecture 2's machine, now under **options** as well as futures and swaps.

- the buyer, premium paid, faces no further demand and no counterparty search; exercise is routed through the machine;
- the writer faces the machine daily (frames 31–32);
- assignment (frame 20) is the machine allocating the obligation.

In the US, listed options clear through the Options Clearing Corporation; in China, ETF options clear through the securities depository's arm and CFFEX clears its index options — the same architecture.

The protective put, priced off the board

The task from frame 3: protect a **¥60 million** equity portfolio without selling it. The board quotes that protection directly:

portfolio ÷ contract notional: 60M/(4.0 × 10,000)	1,500 contracts
June 3.8 puts at 0.027: 1,500 × ¥270	¥405,000
cost of a two-month floor, 5% below the market	**0.675% of the portfolio**

The downside is capped at the floor, the upside is intact, and the worst case is known to the yuan — against Lecture 3's futures hedge, which is free but symmetric. Which to choose is a strategy question (Topic 11). *Main point: an option buys shaped protection — downside capped, upside kept — at a price the board quotes directly.*

Related instruments

The same kink, different issuers:

- **warrants**: options written and sold by an institution or by the company itself;
- **employee stock options**: calls granted as pay, vesting over years;
- **convertibles**: a bond with an embedded call on the issuer's shares.

One structural difference: when a *company* writes calls on itself, exercise creates **new shares** (dilution), whereas exchange options merely transfer existing ones. China's 2005–08 warrants episode — option-like instruments traded far above any rational value in a speculative bubble — is a caution that an option-like payoff plus retail speculation can detach price from value.

The board, fully read

calls	strike	puts	IV
0.240	**3.8**	0.027	?
0.175	**3.9**	0.062	?
0.120	**4.0**	0.106	?
0.075	**4.1**	0.161	?
0.043	**4.2**	0.229	?

one column still dark: **Topic 13**

Every cell now reads: moneyness, intrinsic and time value, the life cycle, both sides' obligations, and the clearing machine beneath. One column remains — a premium re-expressed as a volatility, which only the Black–Scholes formula can perform.

Summary

- Lecture 1: transfer. Lecture 2: concentrate. Lecture 3: exchange. Lectures 4–7: price symmetric promises. Lecture 8: correlation collects pooled risk back.
- Lecture 9: **choice is bought; obligation is collateralised.**

The buyer converts an uncertain loss into one known premium, paid once; the writer accepts an uncertain loss for known income, and the clearing machine prices that acceptance every night. A premium is intrinsic value plus time value — and time value is what the rest of Part II will learn to price.

A desk note

board literacy	read moneyness, intrinsic and time value on sight; settlement prices drive the marks
the floor	June 3.8 puts price the portfolio's protection at 0.675% per two months, upside intact; decision held for the strategy review (Topic 11)
writing policy	covered only for now; any short option carries a margin line sized to the breathing formula before the order is placed
the wings	no deep out-of-the-money, near-expiry positions on firm accounts — the 192× contract is a story, not a strategy
OTC paper	the payoff diagram before the brochure; anything that cannot be diagrammed is not held

In-class problems

A. Decompose the June 4.1 *put* (premium 0.161) into intrinsic and time value, and explain why its time value is smaller than the 4.0 put's.

B. You hold the June 3.9 call at expiry; the ETF prints 4.05 and the bid is 0.155. Rank exercise, offset, and abandon, and state the overall profit on the trade in the best case.

C. Compute the opening margin for writing one June 4.2 call, and say what is special about the two legs of the max.

Every cell on the board can now be read.

Next: the laws those prices must obey — bounds from pure logic, and an identity already hiding on tonight's board.

Topic 10: properties of stock options — upper and lower bounds, put–call parity, and the early-exercise theorem.