Options I: Introduction

BUSS386. Futures and Options

Prof. Ji-Woong Chung

Lecture Outline

- Introduction to Options
  - Terminology in option contracts
  - Payoff and profit

Derivatives Review — Where Do Options Fit?

Contract	Buyer's stance	Seller's stance
Forward / Futures	Obligation	Obligation
Swap	Obligation	Obligation
Option	**Right (chooses)**	**Obligation (follows buyer)**

- In futures/forwards/swaps both sides are bound.
- In options, only the **seller** is bound. The buyer pays an upfront *premium* for the right to walk away.
- This asymmetry $\Rightarrow$ option payoffs are *non-linear* (kinked at the strike). Everything that follows comes from this.

What Is an Option?

Def. An **option** is a contract that gives the holder the **right** (but not the obligation) to **buy** (call) or **sell** (put) an underlying asset at a fixed price on or before a fixed date.

- Building blocks:
  - Underlying S_t — stock, index, FX, futures, commodity, crypto
  - Strike price K — the promised trade price
  - Expiration T — last date the right can be used
  - Premium c or p — price paid up front
  - Style: **European** (exercise only at T) vs **American** (anytime up to T)
- Long vs short:
  - **Long** = buy the option (pay premium, hold the right)
  - **Short** = sell/write the option (collect premium, take the obligation)

Why Do Options Exist? — Three Uses

1. **Insurance / Hedging.**
   A long put on a stock you own is portfolio insurance: caps the downside. Cost = premium = the "deductible."

2. **Leverage / Speculation.**
   \$1,000 in MSFT stock at \$500 $\Rightarrow$ 2 shares.
   \$1,000 in MSFT \$510 calls at \$10 $\Rightarrow$ 100 shares of exposure.
   Same dollars in; very different P&L distribution.

3. **Income generation.**
   Covered call writing: sell calls on stock you own to collect premium in exchange for capping upside. Popular with pension and ETF strategies (e.g., JEPI, QYLD).

Example — Long Call on KOSPI 200

Setup. You buy a June 2026 KOSPI 200 European call, strike $K = 360$, premium $c = 4.20$ index points. Multiplier = ₩250,000 per point.

Q1. Index closes at $S_T = 380$ on expiry. Do you exercise? Payoff and profit?

A1. $S_T > K$, so exercise.
Payoff $= \max(380 - 360, 0) = \boxed{20}$ pts $=$ ₩5,000,000.
Profit (ignoring TVM) $= 20 - 4.20 = \boxed{15.80}$ pts $=$ ₩3,950,000.

Q2. Index closes at $S_T = 350$. Do you exercise?

A2. $S_T < K$, do not exercise.
Payoff $= 0$; Profit $= -4.20$ pts $= \boxed{-₩1{,}050{,}000}$.

Example — Long Put on Samsung Electronics

Setup. You buy a 3-month put on 005930.KS, $K = ₩280{,}000$, premium $p = ₩3{,}000$ per share. (KRX single-stock option contract size varies by underlying — check KRX spec; we work per share here.)

Q1. Samsung closes at ₩272,000 on expiry. Exercise? P&L per share?

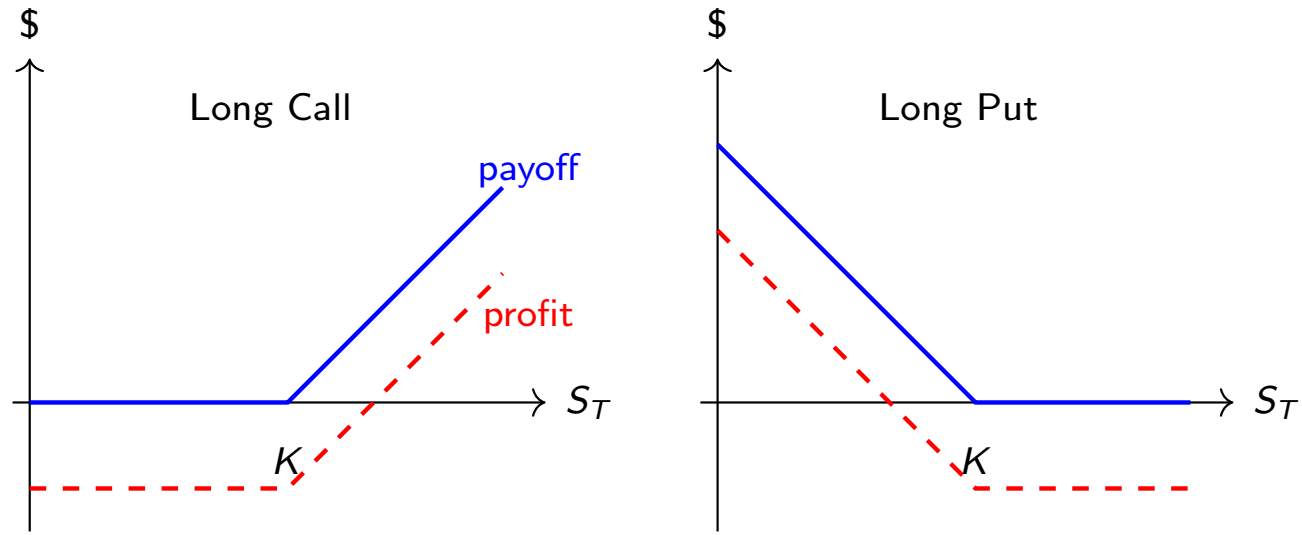
A1. $S_T < K$, so exercise.
Payoff $= \max(280{,}000 - 272{,}000, 0) = ₩8{,}000$.
Profit $= 8{,}000 - 3{,}000 = \boxed{₩5{,}000}$ per share.

Q2. Samsung closes at ₩285,000. Exercise? P&L?

A2. Do not exercise.
Loss = premium paid $= \boxed{-₩3{,}000}$ per share.

General Payoff — Long Call and Long Put

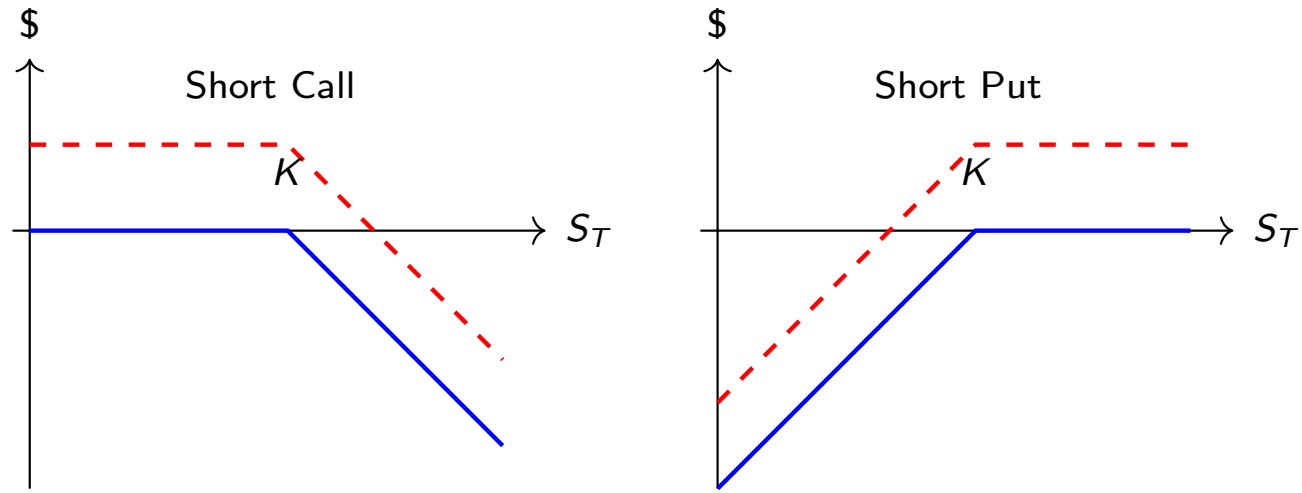
Long call: payoff $= \max(S_T - K, 0)$, profit $=$ payoff $-c$.
Long put: payoff $= \max(K - S_T, 0)$, profit $=$ payoff $-p$.



- Payoff curves are **kinked at** K — the source of non-linearity.
- Profit = payoff shifted down by the premium (no TVM adjustment by convention).

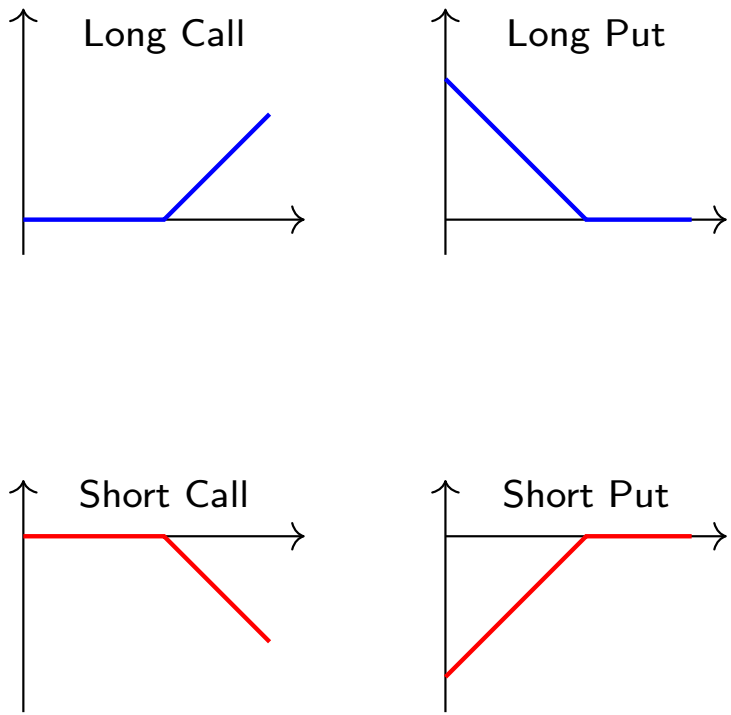
Short Positions — Mirror Images

Short call: payoff $= -\max(S_T - K, 0)$
Short put: payoff $= -\max(K - S_T, 0)$



- Seller's max gain = premium collected; max loss = (large or unbounded).
- Short call has **unlimited** downside if $S_T \to \infty$.
- Short put loss bounded by $K - 0 = K$ (stock can't go below zero).

The Four Fundamental Positions — One Picture



- Every option position — and every option *strategy* (spreads, collars, straddles) — is a linear combination of these four.
- Lecture 7 will build strategies by stacking these.

Moneyness

	Call	Put
$S_t > K$	in-the-money (ITM)	out-of-the-money (OTM)
$S_t = K$	at-the-money (ATM)	at-the-money (ATM)
$S_t < K$	out-of-the-money	in-the-money

- "In-the-money" means *would pay something if exercised right now.*
- ATM options have the most uncertainty about whether they will end ITM — they trade with the highest *time value* (next slide).
- Quote convention: "KOSPI 200 360 call" usually means $K = 360$ on the nearest standard expiry.

Intrinsic Value + Time Value

Decomposition:

$$\underbrace{\text{Option price}}_{\text{quoted}} = \underbrace{\text{Intrinsic value}}_{\max(S_t - K, 0) \text{ for call}} + \underbrace{\text{Time value}}_{\geq 0}$$

- Intrinsic value: payoff if exercised *now*.
- Time value: extra premium for the chance the option moves further ITM before expiry.
- Time value $\to 0$ as $t \to T$ ("theta decay").
- Example: MSFT at \$500, June \$490 call quoted \$15. Intrinsic $= 10$, time value $= 5$.

Why this matters: Greeks (delta, gamma, theta, vega) describe how each piece moves with S, t, and σ. Set up here, computed in Lec 9.

Six Determinants of an Option's Price

Factor (increase ↑)	European Call c	European Put p
Spot price S_0	↑	↓
Strike price K	↓	↑
Time to expiry T	↑ (usu.)	↑ (usu.)
Volatility σ	↑	↑
Risk-free rate r	↑	↓
Dividends D (or q)	↓	↑

- Volatility is the *only* factor not directly observable. It must be implied from market prices — "implied volatility."
- Higher σ helps *both* calls and puts: more upside without more downside (because of the kink).
- For European options on dividend-paying stocks, longer T is not always monotone — the table marks "usually."

Contract Specifications — US vs Korea

	US listed options	KRX
Equity option multiplier	Generally 100 shares	10 shares
Index option (main)	SPX ($100×index)	KOSPI 200 (₩250,000×pt)
Expiry cycle	Monthly (3rd Fri), weeklies, quarterlies; SPX has weekday expirations/0DTE	Monthly (2nd Thu), weeklies; quarterly months also listed
Settlement (equity)	Physical delivery	Cash settlement
Settlement (index)	Cash settlement (e.g., SPX)	Cash settlement (KOSPI 200)
Margin	Longs pay premium; uncovered shorts margin	Required under KRX margin rules
Tick size	Equity: penny/non-penny class dependent; SPX: $0.05 / $0.10	KOSPI 200: 0.01 / 0.05 pts depending on premium level

- Long option position: loss is limited to premium paid; account-level deposit or eligibility rules may still apply.
- Short option position: must post margin because losses can be large, and for uncovered calls theoretically unbounded.
- KOSPI 200 option multiplier history: ₩100k → ₩500k in 2012 → ₩250k on 27 Mar 2017. Currently ₩250k.

Common Underlyings for Listed Options

- **Single stocks**: ∼4,000+ US names (CBOE, NYSE American, Nasdaq, PHLX); Samsung 005930, SK Hynix 000660, and other KRX names.
- **Equity indices**: SPX, NDX, RUT (US); **KOSPI 200** (KRX); Nikkei 225; Euro Stoxx 50; HSCEI.
- **Volatility**: **VIX options** (CBOE) — options on expected vol itself.
- **Short-dated**: **0DTE** options on SPX trade ∼50% of SPX option volume since 2023.
- **FX**: PHLX listed FX; most FX option volume is OTC.
- **Futures options**: oil, gold, ag, US Treasury, KTB, SOFR (traded on same exchange as the futures).
- **Crypto**: BTC and ETH options on CME and Deribit.

Other Things That Are Really Options

- **Employee stock options (ESOs)**. Long-dated calls on the employer's stock, granted as compensation. Illiquid, vesting, early-exercise common. Dilutive when exercised.
- **Warrants**. Like ESOs but tradeable; issued by the company (dilutive).
- **Convertible bonds**. Bond + embedded equity call. Huge Korean issuance market.
- **ELS / DLS** (Korea, Japan). Structured notes embedding short puts + autocall calls. The 2024 HSCEI losses.
- **Real options**. Corporate decisions to expand, delay, or abandon a project = call/put on project NPV. Used in valuation and capital budgeting.

Exotic Options — Preview (Lecture 12)

- **Asian**: payoff depends on *average* price over a window. Used for FX hedging, oil swaps. Smoother than vanilla.
- **Barrier**: knocks in or out if the underlying crosses a level. Cheaper than vanilla; key building block of ELS.
- **Lookback**: payoff depends on max/min over the life.
- **Digital / Binary**: fixed payoff if a condition is met. Building block for autocallables.
- **Quanto**: payoff in a currency different from the underlying. Common in Korean-issued products linked to US indices.