

Options III: Trading Strategies

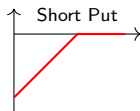
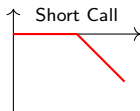
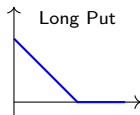
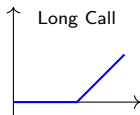
BUSS386. Futures and Options

Prof. Ji-Woong Chung

Lecture Outline

- Options + Underlying Assets
- Spreads: Bull, Bear, Butterfly, Calendar
- Combinations: Straddle and Strangle
- Reading: Chp. 12

Building Blocks — The Four Positions



Plus the underlying (long asset = 45° line, short asset = mirror).

- Every strategy we cover today is a linear combination of these five primitives.
- Parity (Lec 7): long call – long put = long forward. Lets us *synthesize* any one missing piece.

Synthetic Positions — One Identity, Many Uses

From put-call parity for European options (non-dividend):

$$c_0 - p_0 = S_0 - Ke^{-rT}.$$

Rearrange to synthesize any leg:

Want to be	Trade
Long stock	long call + short put + long bond
Short stock	short call + long put + short bond
Long call	long stock + long put - long bond
Long put	long call - long stock + long bond

If shorting a stock is hard (borrow constraints, KRX short-sale rules), synthesize it with options. Conversely, if listed options are illiquid, replicate them dynamically with stock + bond.

Bond + Option #1 — Protected Principal Note

- This is an investment strategy where investors do not lose any of principal (initial investment) and sometimes earn additional profits.
- The portfolio consists of a bond and an option (either call or put).

e.g. A bank offers \$1,000 investment opportunity. If an investor invests \$1,000, the bank guarantees to pay back \$1,000 three years from now and additional profits in some cases. The risk-free interest rate is 6%. Also available is a 3-year call option on a stock index with the strike price of 1,500. The option price is \$160.

- Equity-Linked Bonds (ELB) marketed by Korean banks are this structure on a KOSPI 200 call.

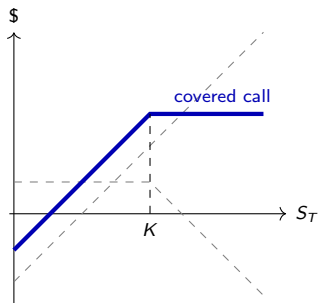
Protected Principal Note

- To construct the strategy, the bank buys ...
 - ① 3-year zero coupon bond with the face value of 1,000.
 - In the bond purchase, the bank pays $1,000e^{-0.06 \times 3} = 835.3$, so $(1,000 - 835.3) = 164.7$ remains.
 - ② Call option on a stock index
 - Use the remaining proceeds to buy the call.
- In year 3, the portfolio value is

$$1000 + \max(S_T - 1500, 0).$$

Stock + Option #2 — Writing a Covered Call

Position. Long 1 share + short 1 call (strike K).



- Profit looks like a *short put* (by parity): same shape.
- Income on a stock you already own and are willing to part with at K .
- Example: **JEPI, QYLD, KODEX KOSPI 200 Covered Call ETF** — \$30B+ global AUM since 2022, sold as “equity yield” products.

Covered Call — Why It Looks Like a Short Put

By put-call parity (European, non-dividend):

$$S_0 - c_0 = Ke^{-rT} - p_0.$$

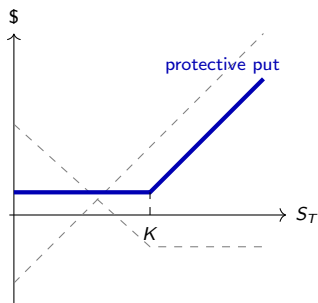
Left side = covered-call portfolio cost today. Right side = short put + cash Ke^{-rT} .

⇒ payoffs identical.

The trader's truth: writing a covered call is selling *volatility*. You collect premium and accept the cap. When realized vol < implied vol, this is profitable. When a tail event hits, the cap doesn't save you on the downside.

Stock + Option #3 — Protective Put

Position. Long 1 share + long 1 put (strike K).



- “Insurance”: downside floored at K – premium; upside preserved.
- Cost: the put premium paid (the “deductible”).
- Example: KOSPI 200 puts as portfolio insurance for institutional accounts; National Pension Service (NPS) reportedly uses index put programs around volatility events.

Covered Call and Hedging

- This practice of writing a covered call is considered one of the contributors to the recent price surge of US tech stocks.
- A WSJ article
 - Small investors bought call options with roughly \$500 billion of notional value in August . . . five times the previous monthly high . . .
 - Option buying is important partly because it forces Wall Street banks, which sell options to investors, to hedge their positions, potentially accelerating trends in either direction.
 - When brokers sell call option to investors, they will buy shares and derivatives to protect themselves if the market soars. That act itself can drive up shares.

Insure (Put) vs Hedge (Forward) — Trade-off

Setup. Fund manager long a stock S , worried about a drawdown.

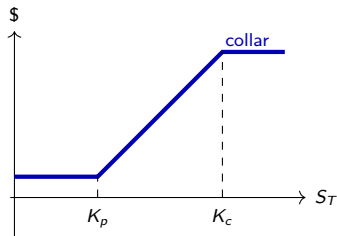
	Short forward at K	Long put at K
Upfront cost	zero	premium paid
Locked-in price	K (no choice)	floor at K , upside open
Profile	flat at K	one-sided protection (kinked)

Takeaway. Forward = symmetric, free, but *kills upside*. Put = asymmetric, costs premium, *preserves upside*.

Real choice. Treasurers and CFOs choose between the two based on how much they value the optionality vs how much they want to pay up front.

Stock + Option #4 — Collar (Zero-Cost Collar)

Position. Long 1 share + long put (strike $K_p < S_0$) + short call (strike $K_c > S_0$).



- “Costless” if call premium received = put premium paid (**zero-cost collar**).
- Used by executives to hedge concentrated/appreciated stock positions (e.g., founder collars for tax-efficient diversification).
- Used by ETFs (**JHEQX, JPMorgan Hedged Equity**) — rolling zero-cost collar over SPX.
- Trade-off: protection at K_p , ceiling at K_c , both upside and downside extreme outcomes are sacrificed.

Spreads — Definition

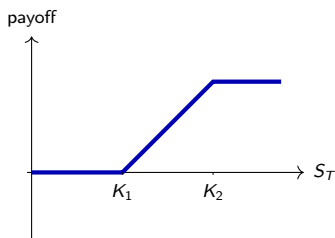
Spread = two or more options of the *same type* (all calls or all puts), on the same underlying, with different strikes *and/or* different expiries.

- Strikes differ → *vertical* spread (bull, bear, butterfly).
- Expiries differ → *horizontal* spread (calendar).
- Both differ → *diagonal*.

Spreads have a **defined max gain and max loss**, so margin is the spread width minus credit received — much less capital-intensive than naked options. This is why they dominate retail 0DTE trading.

Bull Spread (with calls)

Position. Long call at K_1 + short call at K_2 , $K_1 < K_2$.



Action	$S_T < K_1$	$K_1 \leq S_T < K_2$	$S_T \geq K_2$
Long K_1 call	0	$S_T - K_1$	$S_T - K_1$
Short K_2 call	0	0	$-(S_T - K_2)$
Payoff	0	$S_T - K_1$	$K_2 - K_1$
Profit (net of net premium π)	$-\pi$	$S_T - K_1 - \pi$	$K_2 - K_1 - \pi$

View: moderately bullish. Net premium $\pi > 0$ (long lower-strike call costs more).

Bear Spread

Position. Long put at K_2 + short put at K_1 , $K_1 < K_2$. View: moderately bearish.

Q. On SPX (5,800 today), 1-year call quotes: $K = 5,700$ at \$200, $K = 5,900$ at \$120. Build a bear spread *with calls* and compute the profit at $S_T \in \{5,600, 5,750, 5,900, 6,000\}$.

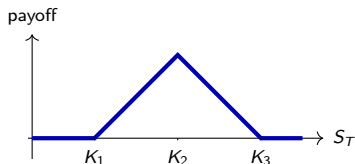
A. Bear with calls: sell low-strike, buy high-strike (asymmetric to the put version).
Net premium received = $200 - 120 = +\$80$.

S_T	Short $K = 5700$ call	Long $K = 5900$ call	Net payoff	Profit
5,600	0	0	0	+80
5,750	-50	0	-50	+30
5,900	-200	0	-200	-120
6,000	-300	100	-200	-120

Max profit = \$80 (the credit). Max loss = \$120 (= 200 - credit). Breakeven $S_T = 5,780$.

Butterfly Spread

Position. Long K_1 call + long K_3 call - 2 short K_2 calls, with $K_2 = \frac{K_1 + K_3}{2}$.



- Max payoff $K_2 - K_1$ at $S_T = K_2$; zero at the wings.
- View: stock will end near K_2 . Equivalent to *betting on low volatility*.
- A positive-payoff butterfly must have a positive cost (otherwise: free lunch). The cost reflects the market's implied probability that S_T lands in the middle bucket.

Butterfly Spreads — Payoff

- Payoff at expiration (assuming that $K_2 = 0.5(K_1 + K_3)$)

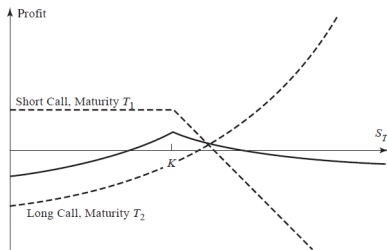
Action	Payoff at time T			
	$S_T \geq K_3$	$K_3 > S_T \geq K_2$	$K_2 > S_T \geq K_1$	$K_1 > S_T$
long call with K_1	$S_T - K_1$	$S_T - K_1$	$S_T - K_1$	0
long call with K_3	$S_T - K_3$	0	0	0
short 2 calls with K_2	$-2(S_T - K_2)$	$-2(S_T - K_2)$	0	0
net payoff	$\underbrace{2K_2 - K_1 - K_3}_{=0}$	$\underbrace{-S_T + 2K_2 - K_1}_{=-S_T + K_3}$	$S_T - K_1$	0

- The butterfly spreads can also be created using puts (buying a put with K_1 , buying a put with K_3 and selling two puts with K_2 .)

Calendar Spread (Horizontal)

- Calendar spreads consist of European options with the same strike price K and different expiration dates.
- To create, we sell a European call with maturity T_1 and buy a European call with maturity $T_2(> T_1)$.

Figure 11.8 Profit from calendar spread created using two call options, calculated at the time when the short-maturity call option expires.



Calendar Spreads

- We start off with $c_0(T_1) - c_0(T_2)$ at $t=0$.
- At T_1 , T_1 -call is expired. The resulting payoff at T_1 is

$$- \max(S_{T_1} - K, 0) + c_{T_1}(T_2)$$

where $c_{T_1}(T_2)$ is the price of T_2 -call at T_1 .

- Usually, a longer-maturity call option has a higher price, so this strategy requires an initial investment.
- The investor makes profit when stock price is close to K . This pattern is similar to the butterfly spreads.

Calendar Spreads — Example

- An investor started a calendar spread in October 2019 with a short position in 1-year European call and a long position in 2-year European call. Both calls are on the same non-dividend-paying stock and have the strike price of \$120. At that time, the price of 1-year call was \$5 and the price of 2-year call was \$8. One year has passed, and the investor is now about to close all of the positions. The current stock price is \$150 and the risk-free interest rate is 3% per annum. What is smallest and largest possible profit from this calendar spread?

Calendar Spreads — Example

- The cash flow in October 2020 is

$$- \max(150 - 120, 0) + c_t(\text{Oct 2021})$$

where the first is payoff for the short position in the 2020-call and $c_t(\text{Oct 2021})$ is the price of the 2021-call in October 2020. As the 2021-call will expire one year later, its price should be

$$\underbrace{\max(150 - 120e^{-0.03 \times 1}, 0)}_{=33.547} \leq c_t(\text{Oct 2021}) \leq 150$$

using the lower/upper bound for the call price. Including initial cash flows, the profit is $-30 + c_t(\text{Oct 2021}) + 5 - 8$. Thus, the profit should be

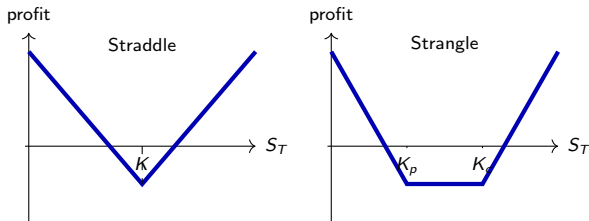
$$0.547 \leq \underbrace{-30 + c_t(\text{Oct 2021}) + 5 - 8}_{=\text{profit}} \leq 117.$$

Combinations — Straddle and Strangle

Combinations = Constructed by mixing calls and puts

Straddle. Long call + long put, same K , same T . View: large move, direction uncertain.

Strangle. Long call at K_c + long put at K_p , $K_p < K_c$. Cheaper than straddle (both legs OTM), but needs a bigger move.



Both are **long volatility** positions. Pay premium today, profit if realized vol $\hat{\sigma}$ implied vol. Short straddle/strangle = the structure behind XIV.

Strangle Example — Where Is Profit Positive?

Q. European call $K_c = 80$ at \$6; European put $K_p = 50$ at \$5. Range of S_T where the long strangle is profitable?

S_T region	Long $K_p = 50$ put	Long $K_c = 80$ call	Profit
$S_T < 50$	$50 - S_T$	0	$50 - S_T - 11 = 39 - S_T$
$50 \leq S_T \leq 80$	0	0	-11
$S_T > 80$	0	$S_T - 80$	$S_T - 80 - 11 = S_T - 91$

Profit > 0 when $S_T < 39$ or $S_T > 91$. Total premium paid \$11.

Breakeven points: $S_T = 39$ and $S_T = 91$.

Strangle — Example

- An investor considers making a strangle using a European call and a European put. The call has the strike price of \$80 and currently sells for \$6. The put has the strike price of \$50 and currently sells for \$5. Both options have the expiration date T . Find the range of future stock price S_T where the profit is positive.

Strangle — Example

- The profit of the strangle is as follows:

Action	Payoff at T		
	$S_T \geq 80$	$80 > S_T \geq 50$	$50 > S_T$
long 80-call	$S_T - 80$	0	0
long 50-put	0	0	$50 - S_T$
net payoff	$S_T - 80$	0	$50 - S_T$
initial cash flow	-11	-11	-11
net profit	$S_T - 91$	-11	$39 - S_T$

Thus, the profit is positive when $S_T > 91$ or $S_T < 39$.

Summary

- Principle-protected note: a zero-coupon bond and a European call option; for risk-averse investors
- A single option + underlying stock
 - Writing a covered call involves buying the stock and selling a call option on the stock
 - Protective put involves buying a put option and buying the stock
- Spreads
 - A bull spread can be created by buying a call (put) with a low strike price and selling a call (put) with a high strike price.
 - A bear spread can be created by buying a put (call) with a high strike price and selling a put (call) with a low strike price.

Summary

- A butterfly spread involves buying calls (puts) with a low and high strike price and selling two calls (puts) with some intermediate strike price.
- A calendar spread involves selling a call (put) with a short time to expiration and buying a call (put) with a longer time to expiration.
- Combinations involve taking a position in both calls and puts on the same stock.
 - A straddle combination involves taking a long position in a call and a long position in a put with the same strike price and expiration date.
 - A strangle consists of a long position in a call and a put with different strike prices and the same expiration date.

Appendix: 0DTE

What is a 0DTE option?

- “Zero days to expiration” = an option expiring on the trading day it was bought (or held into).
- Possible because exchanges now list **daily expiries** on the major equity-index products:
 - SPX (S&P 500 index): all 5 weekdays since May 2022.
 - QQQ (Nasdaq 100 ETF): all 5 weekdays since 2023.
 - SPY (SPDR S&P 500): all 5 weekdays since 2022.
 - Single-stock: weeklies are common; some names also have daily expiries on heavy-volume days.
- Pre-2016, most index options were monthly. Weeklies were added 2010s. The shift to true *dailies* happened in 2022.
- European options \Rightarrow 0DTE means cash-settled at end-of-day; no overnight risk; no early exercise.

Who is trading 0DTE?

Three roughly equal cohorts (per JPM, CBOE, broker public reports):

- **Retail (35–40%)**: long calls/puts on direction; lottery-ticket OTM calls; reaction to FOMC days, jobs reports, earnings.
- **Asset managers & yield strategies (30–35%)**: short straddles/strangles, iron condors as systematic premium-collection programs. Sometimes called “0DTE income strategies.”
- **Hedge funds, prop, market-makers (25–30%)**: hedging dealer books; intraday vol arbitrage; gamma trading; some fundamental positioning.
- ETF wrappers exist: JEPI, JEPQ, SPYI, QQQI run option-overlay strategies (some use 0DTE) — combined AUM \$70B+ as of 2024.
- The growth of these wrapper ETFs is a major driver of *systematic short-vol* flows in 0DTE.

Long 0DTE calls — the retail favorite

- Cheap (premium $\sim 10\text{--}30$ cents per SPX point of OTM at moderate vol).
- Lottery-ticket payoff: 90%+ of these expire worthless; the few that pay off can return $10\text{--}50\times$.
- Heavily concentrated around macro events (FOMC days), product news (Apple announcements), and meme moves.
- Academic finding (Beason & Schaper 2024): **retail 0DTE call buyers earn negative expected returns**, consistent with paying up for the “lottery” feature.
- **P&L distribution:** median return -100% , mean return ~ -30 to -50% , occasional $20\times$ winners.

Functional analogue: buying a Powerball ticket every trading day. Same psychology, same expected return profile.

Short 0DTE strangles — the income side

- Sell 1 OTM call + 1 OTM put, both expiring today. Pocket the combined premium.
- Profit if SPX stays inside the strangle's breakevens by 4 PM ET.
- Typical premium received: 0.05–0.20% of notional per day. Annualized: ~15–50% *if no losses*.
- **Catch:** on a big-move day (e.g., Aug 5 2024 down –3%), losses can exceed weeks of cumulative profits in a single session.
- Distribution: **positive median, very negative left tail**. “Picking up nickels in front of a steamroller.”
- Several large 0DTE income funds exist; have been hit hard on tail days but also recovered.

0DTE iron condor — the structured income variant

- Buy 1 deep-OTM put (insurance) + sell 1 less-OTM put + sell 1 less-OTM call + buy 1 deep-OTM call.
- Same shape as a short strangle, but with the tail risk capped by the deep wings.
- Lower premium than naked short strangle, but bounded loss.
- Many 0DTE retail strategies are actually iron condors (the broker often mandates this for risk-mgmt reasons).