



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

QUANTITATIVE INVESTMENT MANAGEMENT

LECTURE 41

Option Trading Strategies – 2

J P Singh

Department of Management Studies



TRADING STRATEGIES WITH OPTIONS



COMPLEX OPTION TRADING STRATEGIES

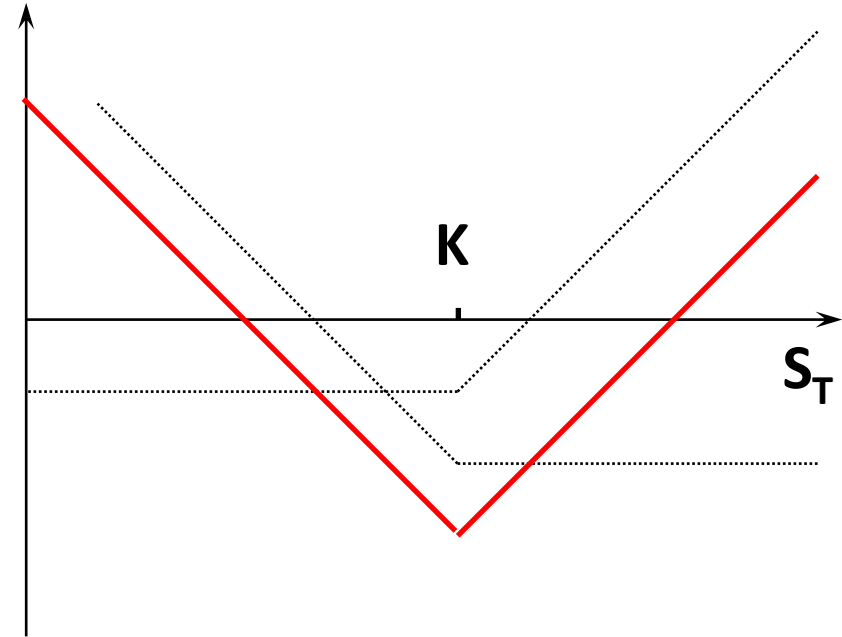
- The covered call strategy
- The protective put strategy
- Straddles & Strangles
- Strips & Straps
- Spread strategies



STRADDLE

Profit

- BUY CALL A (K, T, c)
- BUY PUT B (K, T, p)
- BOTH EUROPEAN
- SAME UNDERLYING
- SAME MATURITY
- SAME EXERCISE PRICE



STRADDLE STRATEGY

	$t=0$	$t=T$	
		$S_T < K$	$S_T > K$
LONG CALL	$-c$	0	$S_T - K$
LONG PUT	$-p$	$K - S_T$	0
TOTAL	$-(c+p)$	$K - S_T$	$S_T - K$

$$\pi_{\text{Straddle}} = \pi_{\text{Long Call A}} + \pi_{\text{Long Put B}}$$

$$= \begin{cases} (\mathbf{K} - \mathbf{S}_T) - (\mathbf{p} + \mathbf{c}) & \text{if } \mathbf{S}_T < \mathbf{K} \\ (\mathbf{S}_T - \mathbf{K}) - (\mathbf{p} + \mathbf{c}) & \text{if } \mathbf{K} < \mathbf{S}_T \end{cases}$$

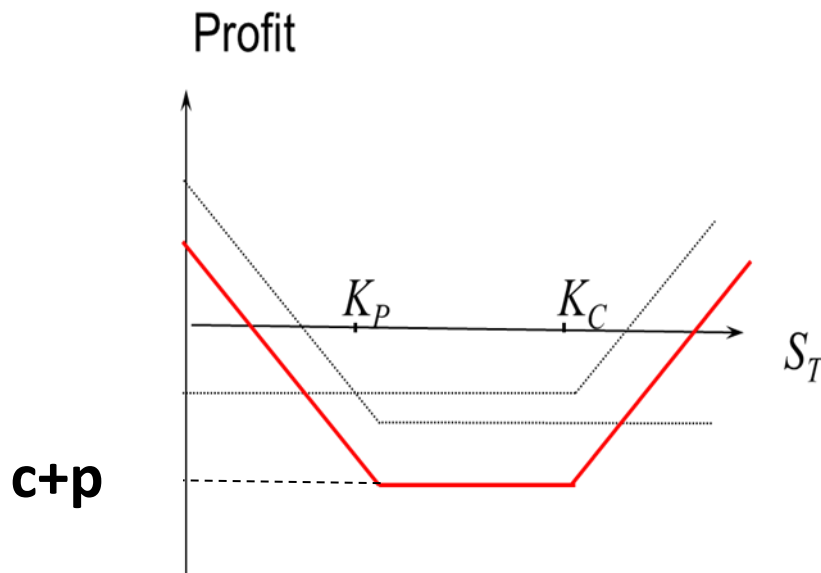
$$\pi_{\text{STRADDLE}}^{\text{MAX}} = \infty; \quad \pi_{\text{STRADDLE}}^{\text{MIN}} = -(\mathbf{p} + \mathbf{c})$$

$$\mathbf{S}_T^{\text{BEP}} = \mathbf{K} - (\mathbf{p} + \mathbf{c}), \quad \mathbf{K} + (\mathbf{p} + \mathbf{c})$$



STRANGLE ($K_C > K_P$)

- BUY CALL A (K_C, T, c)
- BUY PUT B (K_P, T, p)
- SAME TYPE (EUROPEAN)
- SAME UNDERLYING
- SAME MATURITY
- DIFFERENT STRIKE PRICE
- CASE 1: $K_C > K_P$
- CASE 2: $K_C < K_P$



STRANGLE..... ($K_C > K_P$)

- WE CAN DIVIDE THE ENTIRE SPECTRUM OF STOCK PRICE INTO THREE SEGMENTS VIZ.
- $S_T < K_P < K_C$: PUT WILL BE EXERCISED, CALL WILL LAPSE
- $K_P < S_T < K_C$: BOTH WILL LAPSE
- $K_P < K_C < S_T$: CALL WILL BE EXERCISED, PUT WILL LAPSE



STRANGLE STRATEGY ($K_C > K_P$)

	$t=0$	$t=T$		
		$S_T < K_P$	$K_P < S_T < K_C$	$K_C < S_T$
LONG CALL	$-c$	0	0	$S_T - K_C$
LONG PUT	$-p$	$K_P - S_T$	0	0
TOTAL	$-(c+p)$	$K_P - S_T$	0	$S_T - K_C$

$$\pi_{\text{STRANGLE}}^{\text{MAX}} = \infty;$$

$$\pi_{\text{STRANGLE}}^{\text{MIN}} = -(\mathbf{p} + \mathbf{c})$$

$$\mathbf{S}_{\text{T}}^{\text{BEP}} = \mathbf{K}_{\text{P}} - (\mathbf{p} + \mathbf{c}),$$

$$\mathbf{K}_{\text{C}} + (\mathbf{p} + \mathbf{c})$$

STRANGLE..... ($K_C < K_P$)

- WE CAN DIVIDE THE ENTIRE SPECTRUM OF STOCK PRICE INTO THREE SEGMENTS VIZ.
- $S_T < K_C < K_P$: PUT WILL BE EXERCISED, CALL WILL LAPSE
- $K_C < S_T < K_P$: BOTH WILL BE EXERCISED
- $K_C < K_P < S_T$: CALL WILL BE EXERCISED, PUT WILL LAPSE



$$\pi_{\text{Strangle}} = \pi_{\text{Long Call A}} + \pi_{\text{Long Put B}}$$

$$= \begin{cases} (\mathbf{K_P} - \mathbf{S_T}) - (\mathbf{p} + \mathbf{c}) & \text{if } \mathbf{S_T} < \mathbf{K_C} \\ \left[(\mathbf{K_P} - \mathbf{S_T}) + (\mathbf{S_T} - \mathbf{K_C}) - (\mathbf{p} + \mathbf{c}) \right] & \text{if } \mathbf{K_C} < \mathbf{S_T} < \mathbf{K_P} \\ (\mathbf{K_P} - \mathbf{K_C}) - (\mathbf{p} + \mathbf{c}) \\ (\mathbf{S_T} - \mathbf{K_C}) - (\mathbf{p} + \mathbf{c}) & \text{if } \mathbf{K_P} < \mathbf{S_T} \end{cases}$$

$$\pi_{\text{STRANGLE}}^{\text{MAX}} = \infty; \pi_{\text{STRANGLE}}^{\text{MIN}} = (\mathbf{K_P} - \mathbf{K_C}) - (\mathbf{p} + \mathbf{c})$$

$$\mathbf{S_T}^{\text{BEP}} = \mathbf{K_P} - (\mathbf{p} + \mathbf{c}), \mathbf{K_C} + (\mathbf{p} + \mathbf{c})$$



$$\pi_{\text{STRANGLE}}^{\text{MIN}} = (\mathbf{K}_P - \mathbf{K}_C) - (\mathbf{p} + \mathbf{c})$$

From put - call parity ($\mathbf{K}_C < \mathbf{K}_P$)

$$\mathbf{c} + \mathbf{K}_C \mathbf{e}^{-rT} = \mathbf{p}_c + \mathbf{S}_0$$

$$\mathbf{c}_p + \mathbf{K}_P \mathbf{e}^{-rT} = \mathbf{p} + \mathbf{S}_0$$

$$(\mathbf{c} - \mathbf{c}_p) - (\mathbf{K}_P - \mathbf{K}_C) \mathbf{e}^{-rT} = \mathbf{p}_c - \mathbf{p}$$

$$(\mathbf{K}_P - \mathbf{K}_C) \mathbf{e}^{-rT} - (\mathbf{p} + \mathbf{c}) = -(\mathbf{c}_p + \mathbf{p}_c) < \mathbf{0}$$

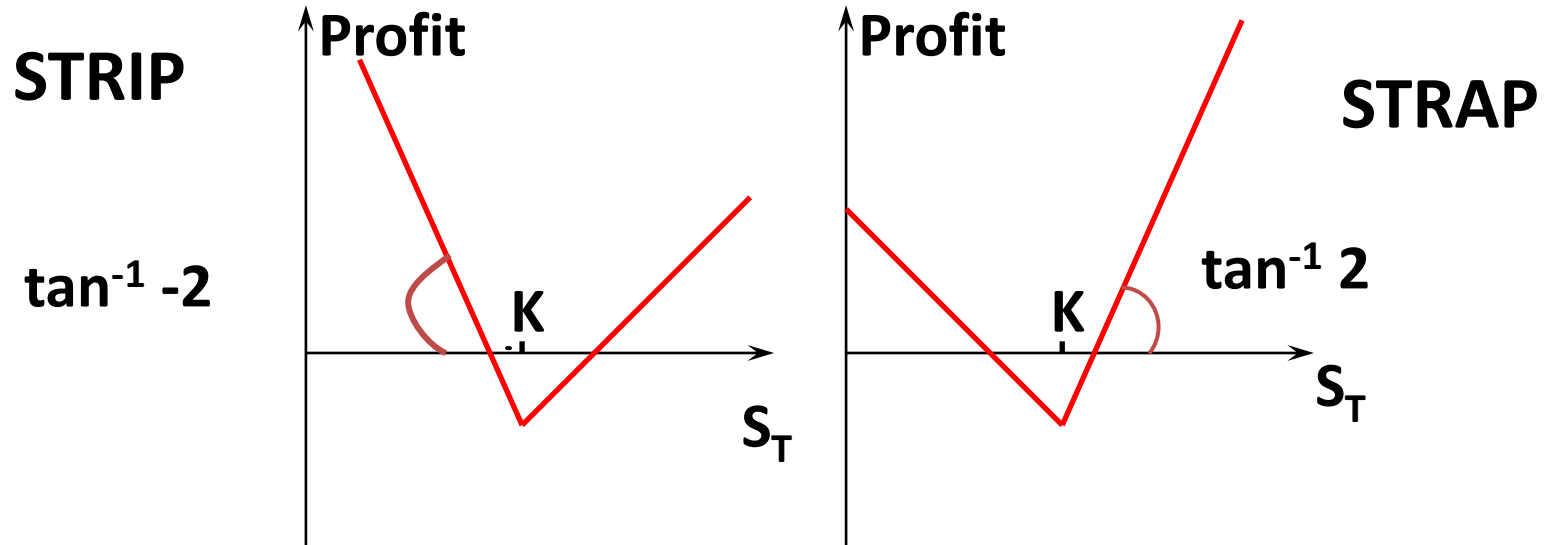


STRIPS & STRAPS

- A *strip* consists of a long position in one call and two puts with the same strike price and expiration date.
- A *strap* consists of a long position in two calls and one put with the same strike price and expiration date.
- In a strip the investor is betting that there will be a big stock price move and considers a decrease in the stock price to be more likely than an increase.



STRIP & STRAP: PROFIT DIAGRAMS



$$\pi_{Strip} = \pi_{Long \text{ Call } A} + 2\pi_{Long \text{ Put } B}$$

$$= \begin{cases} 2(K - S_T) - (2p + c) & \text{if } S_T < K \\ (S_T - K) - (2p + c) & \text{if } K < S_T \end{cases}$$

$$\pi_{STRIP}^{MAX} = \infty; \quad \pi_{STRIP}^{MIN} = -(2p + c)$$

$$S_T^{BEP} = K - \left(p + \frac{1}{2}c \right), K + (2p + c)$$

SPREAD STRATEGIES

- **SPREAD STRATEGIES INVOLVE:**
- **COMBINATION OF LONG & SHORT POSITIONS IN OPTIONS OF THE SAME TYPE**
- **VERTICAL SPREADS**
- **HORIZONTAL SPREADS**
- **DIAGONAL SPREADS**



COMMON TYPES OF SPREADS

- **Vertical Spreads:** Long & Short positions in options of **same type with same maturity but different exercise prices.**
- **Horizontal Spreads:** Long & Short positions in options of same type with same exercise prices but different maturities.
- **Diagonal Spreads:** Different exercise prices & different maturities.



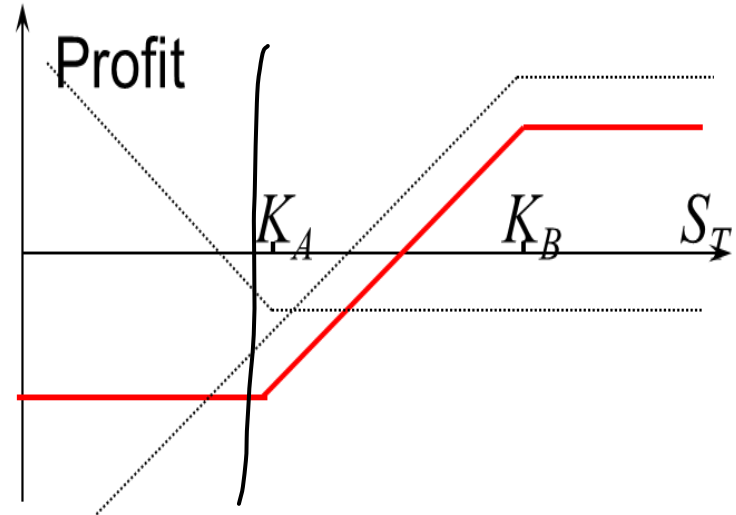
COMMON VERTICAL SPREADS

- BULLISH VERTICAL SPREADS USING CALLS
- BEARISH VERTICAL SPREADS USING CALLS
- BULLISH VERTICAL SPREADS USING PUTS
- BEARISH VERTICAL SPREADS USING PUTS
- BUTTERFLY SPREADS WITH CALLS
- BUTTERFLY SPREADS WITH PUTS
- BOX SPREAD



BULLISH, VERTICAL CALL SPREADS

- BUY CALL A (K_A, T, c_A)
- SELL CALL B (K_B, T, c_B)
- $K_A < K_B$;
- $c_A > c_B$



BULLISH VERTICAL CALL SPREAD

- We can divide the entire spectrum of stock price into three segments viz.
- $S_T < K_A < K_B$: BOTH CALLS WILL LAPSE
- $K_A < S_T < K_B$: CALL A WILL BE EXERCISED, B WILL LAPSE
- $K_A < K_B < S_T$: BOTH CALLS WILL BE EXERCISED



BULLISH CALL SPREAD

	$t=0$	$t=T$		
		$S_T < K_A$	$K_A < S_T < K_B$	$K_B < S_T$
LONG CALL A	$-c_A$	0	$S_T - K_A$	$S_T - K_A$
SHORT CALL B	c_B	0	0	$-(S_T - K_B)$
TOTAL	$(c_B - c_A) < 0$	0	$S_T - K_A$	$K_B - K_A > 0$

$$\pi_{\text{BULLISH SPREAD WITH CALLS}} = \pi_{\text{LONG CALL A}} + \pi_{\text{SHORT CALL B}}$$

$$= \begin{cases} c_B - c_A & \text{if } S_T < K_A < K_B \\ (S_T - K_A) + (c_B - c_A) & \text{if } K_A < S_T < K_B \\ (S_T - K_A) + (K_B - S_T) + (c_B - c_A) & \text{if } K_A < K_B < S_T \end{cases}$$

$$= \begin{cases} c_B - c_A (< 0 \text{ ALWAYS}) & \text{if } S_T < K_A < K_B \\ (S_T - K_A) + (c_B - c_A) & \text{if } K_A < S_T < K_B \\ (K_B - K_A) + (c_B - c_A) (> 0 \text{ ALWAYS}) & \text{if } K_A < K_B < S_T \end{cases}$$



$$K_B - K_A + (c_B - c_A) > 0$$

- This can be proved by using put call parity.
- Writing the put-call parity for the two options and subtracting we get $K_B e^{-rt} + c_B - K_A e^{-rt} - c_A = p_B - p_A$
- But right hand must be either positive or zero because $K_B > K_A$.



BULLISH CALL SPREADS

- Why bull spread as against long call???

