Options Strategies

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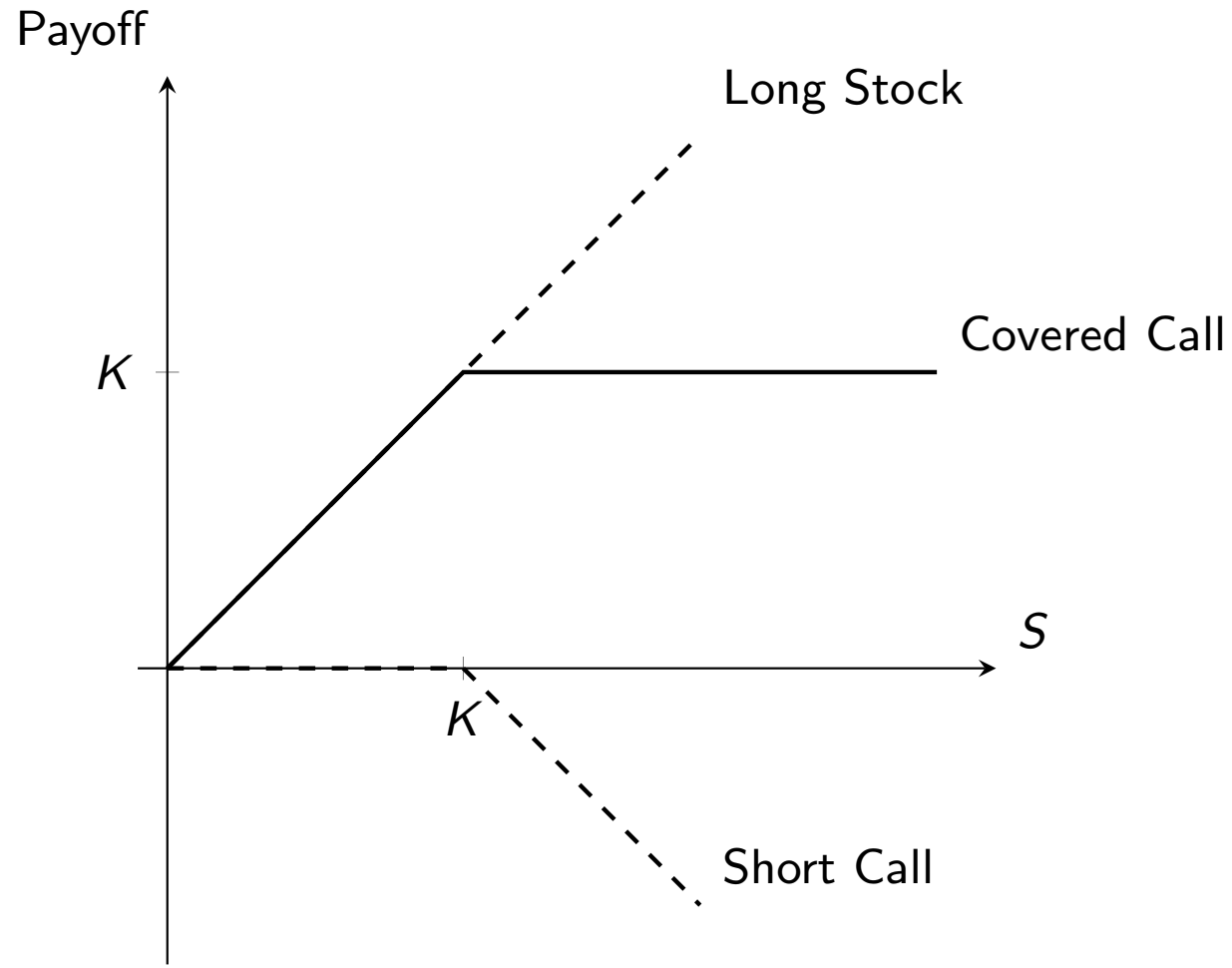
What Is an Option Strategy?

- An option strategy involves combining an option with other assets, such as stocks and bonds, and/or other options together.
- The analysis that follows applies to European type options written on non-dividend paying stocks.
- Even though all strategies could be implemented using American type options, the payoff diagrams we present below might be affected by early exercise.

Covered Call

- A covered call consists in a long position in the stock and a short position in a European call option with strike K and maturity T.



Example 1: Covered Call

- A non-dividend paying stock currently trades at \$50.
- A call option with strike \$60 and maturity 3 months sells for \$3.45.
- The cost of the covered call is:

$$50 - 3.45 = \$46.55$$

- The payoff and profit for different stock prices at maturity is:

Stock Price	40	60	80
Long Stock	40	60	80
Short Call	0	0	-20
Payoff	40	60	60
Profit	-6.55	13.45	13.45

Covered Call

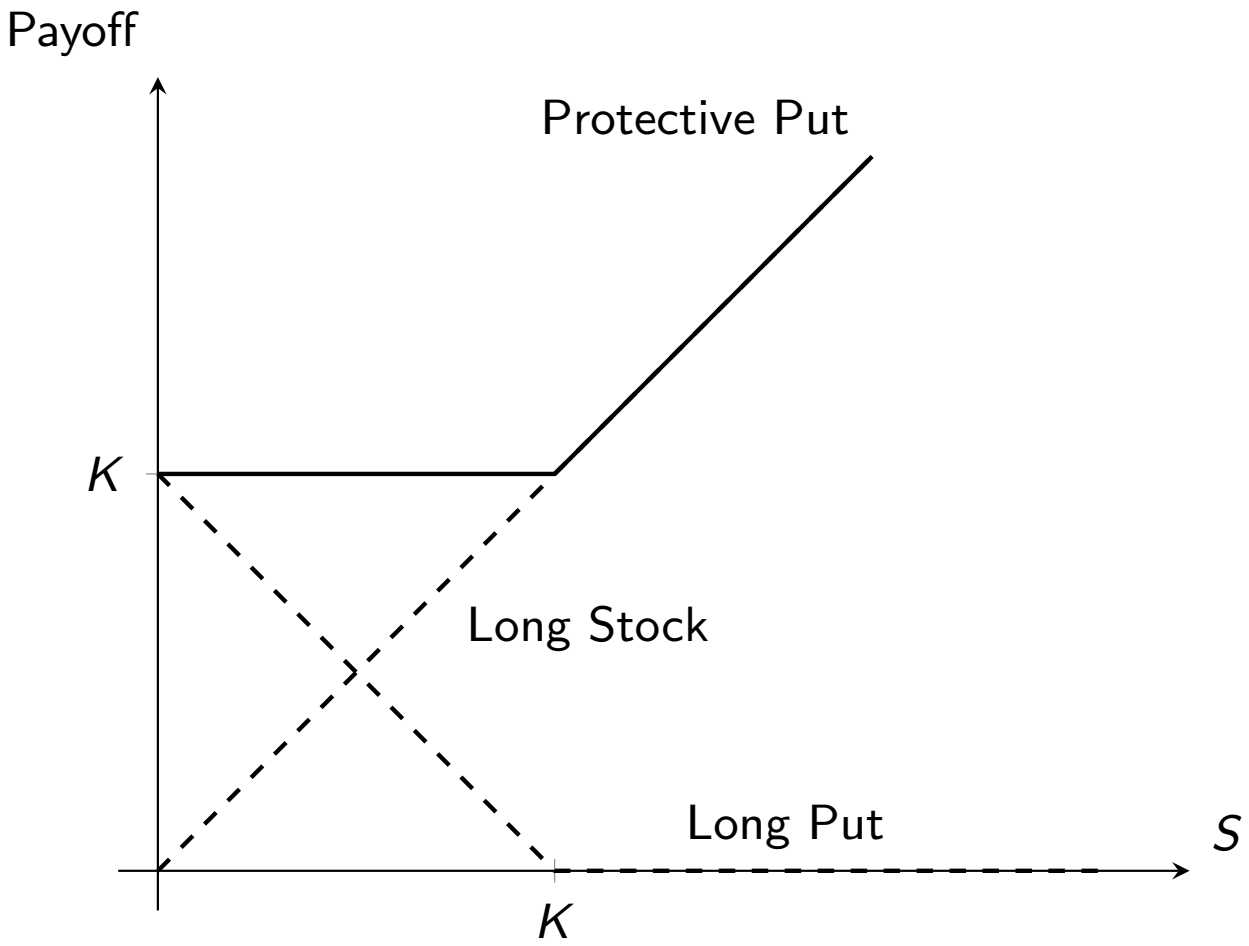
- The payoff of a covered call on a non-dividend paying stock can then be described as follows:

	$S \leq K$	$S > K$
Long Stock	S	S
Short Call	0	$-(S-K)$
Covered Call	S	K

- Therefore, the covered call pays like the stock if $S \leq K$ and caps the payoff at K otherwise.
- This might be an interesting strategy if you think that the stock should go up in the near future but not that much.

Protective Put

- A protective put consists in a long position in the stock and a long position in a European put option with strike K and maturity T.



Example 2: Protective Put

- A non-dividend paying stock currently trades at \$50.
- A put option with strike \$40 and maturity 3 months sells for \$1.28.
- The cost of the protective put is:

$$50 + 1.28 = \$51.28$$

- The payoff and profit for different stock prices at maturity is:

Stock Price	30	50	70
Long Stock	30	50	70
Long Put	10	0	0
Payoff	40	50	70
Profit	-11.28	-1.28	18.72

Protective Put

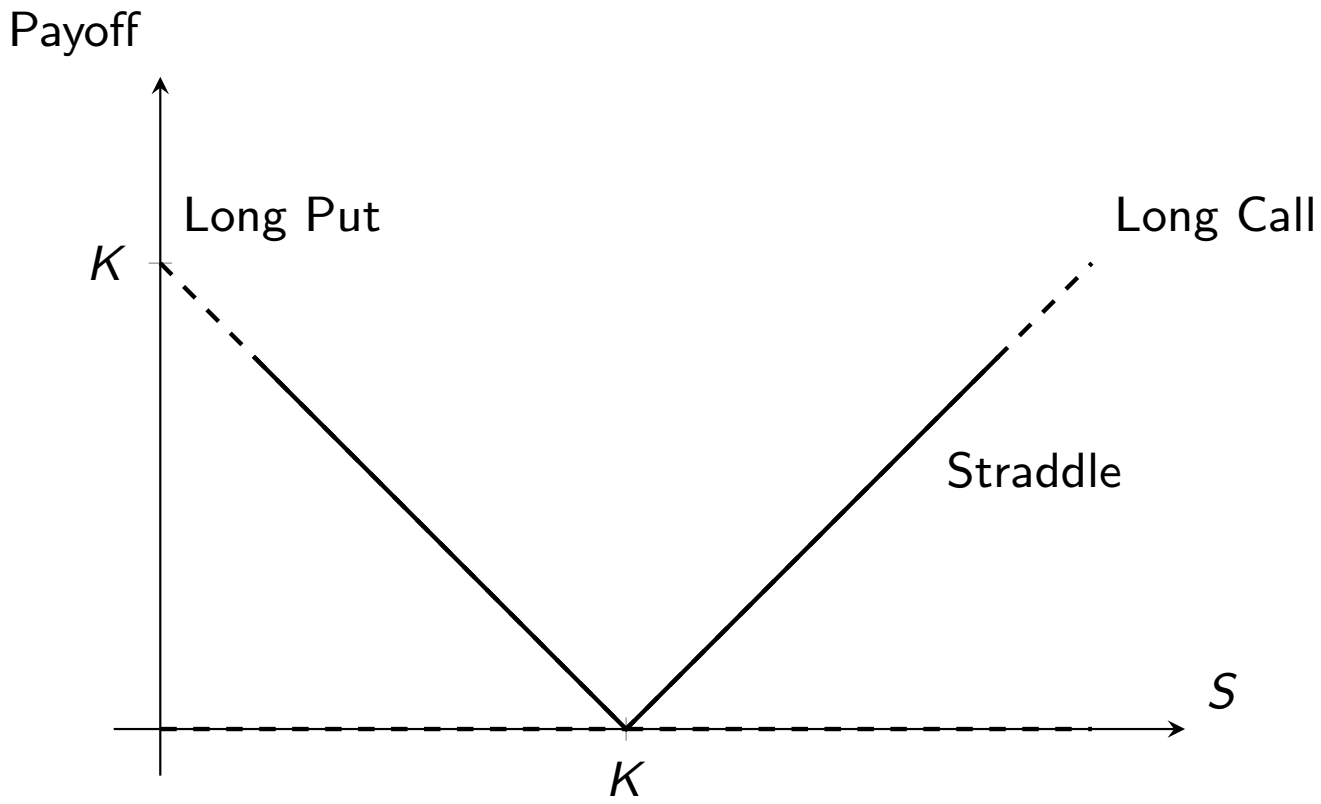
- The payoff of a protective put on a non-dividend paying stock can then be described as follows:

	$S \leq K$	$S > K$
Long Stock	S	S
Long Put	$K - S$	0
Protective Put	K	S

- Therefore, the protective put pays like the stock if $S > K$ and caps the payoff at K otherwise.
- This might be an interesting strategy if you want to hedge your portfolio from potential losses, although the hedge comes at a cost.

Straddle

- A straddle is a two-leg option strategy that consists in buying a call and a put with the same strike K.



Example 3: Straddle

- A non-dividend paying stock currently trades at \$50.
- A put and a call with strike $K = \$50$ cost \$4.68 and \$7.12, respectively.
- The cost of the straddle is:

$$4.68 + 7.12 = \$11.80$$

- The payoff and profit for different stock prices at maturity is:

Stock price	30	50	70
Long Put	20	0	0
Long Call	0	0	20
Payoff	20	0	20
Profit	8.20	-11.80	8.20

Straddle

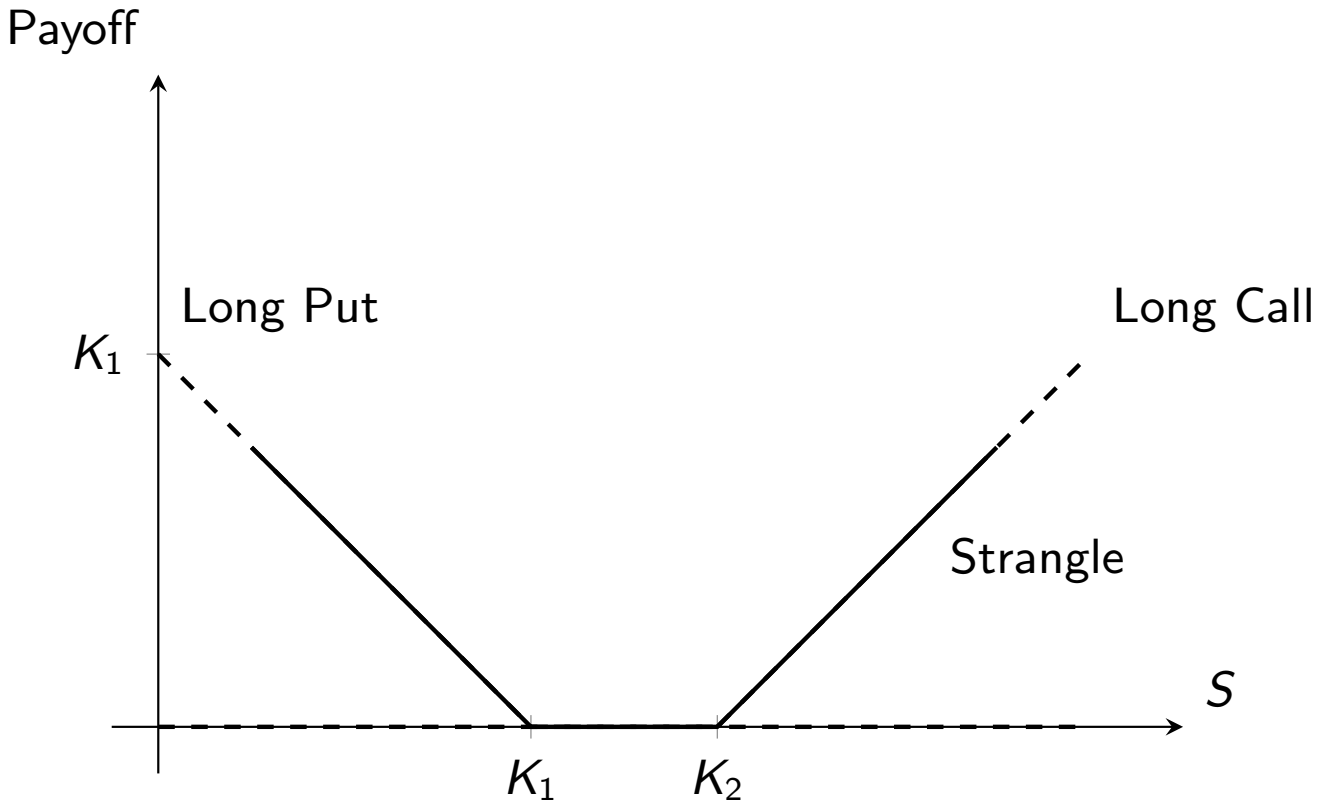
- The payoff of a straddle can then be described as follows:

	$S \leq K$	$K < S$
Long Put	$K - S$	0
Long Call	0	$S - K$
Straddle	$K - S$	$S - K$

- The straddle pays off when the stock price moves significantly from the middle strike.

Strangle

- A strangle is a two-leg option strategy that consists in a long call with strike K_2 and a long put with strike K_1 where $K_1 < K_2$.



Example 4: Strangle

- A non-dividend paying stock currently trades at \$50.
- A put with strike $K_1 = \$45$ trades for \$2.65 whereas a call with strike $K_2 = \$55$ costs \$5.01.
- The cost of the strangle is:

$$2.65 + 5.01 = \$7.66$$

- The payoff and profit for different stock prices at maturity is:

Stock Price	30	50	70
Long Put	15	0	0
Long Call	0	0	15
Payoff	15	0	15
Profit	7.34	-7.66	7.34

Strangle

- The payoff of a strangle can then be described as follows:

	$S \leq K_1$	$K_1 < S \leq K_2$	$K_2 < S$
Long Put	$K_1 - S$	0	0
Long Call	0	0	$S - K_2$
Strangle	$K_1 - S$	0	$S - K_2$

- Compared to the straddle, the strangle requires the stock price to move even more in order to make a profit.

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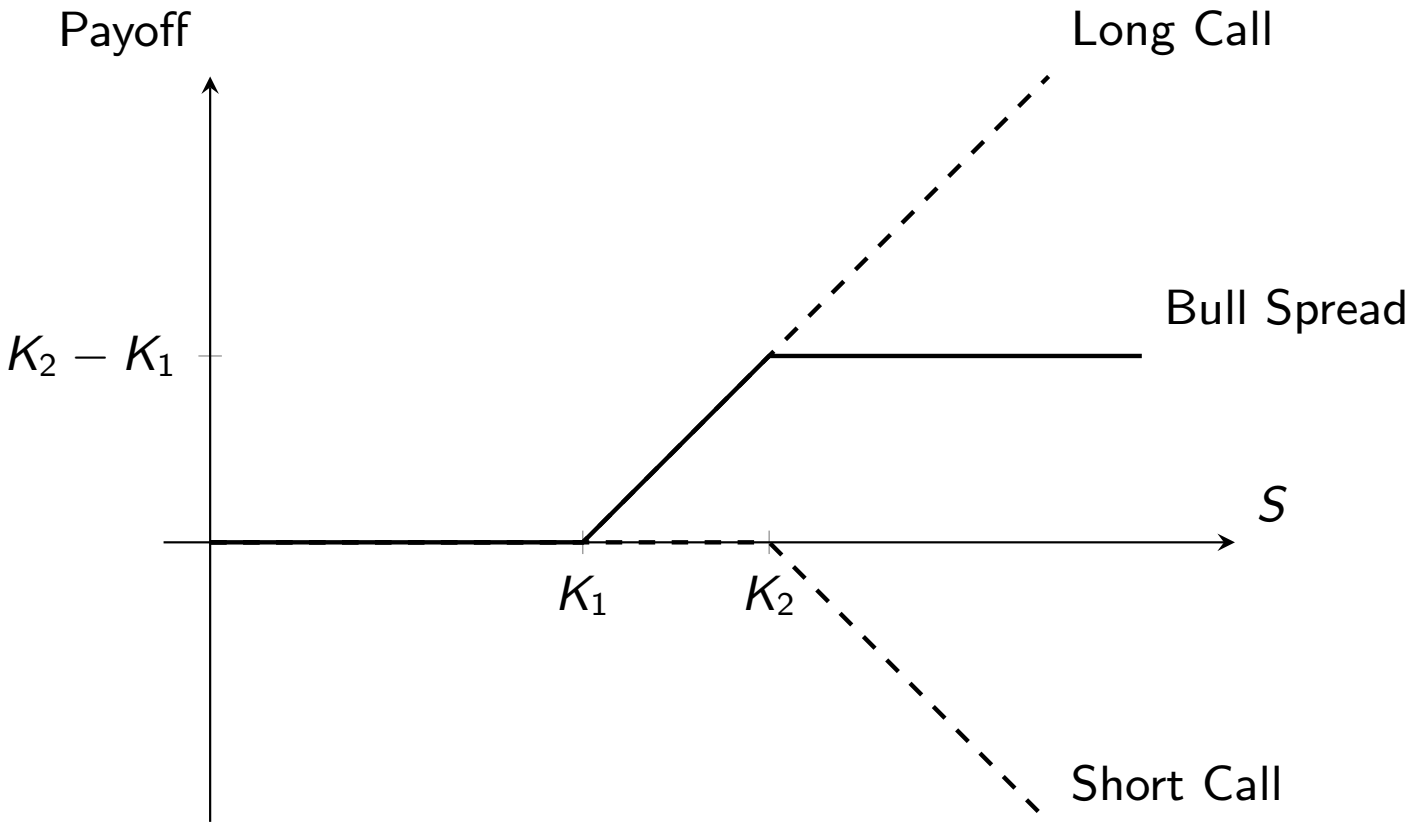
What Is an Option Spread?

- An option spread is an option strategy in which the payoff is limited.
- Option spreads can be directional, such as bull or bear spreads, or pay the spread if the stock price is within a certain range.

Bull Spread

- A bull spread is a two-leg option strategy that consists in a long position in a call with strike K_1 and a short position in a call with strike K_2, where $K_1 < K_2$.



Example 5: Bull Spread

- A non-dividend paying stock currently trades at \$50.
- Call options with strikes $K_1 = \$40$ and $K_2 = \$60$ trade for \$13.23 and \$3.45, respectively.
- The cost of the bull spread is:

$$13.23 - 3.45 = \$9.78$$

- The payoff and profit for different stock prices at maturity is:

Stock Price	30	50	70
Long Call	0	10	30
Short Call	0	0	-10
Payoff	0	10	20
Profit	-9.78	0.22	10.22

Bull Spread

- The payoff of a bull spread can then be described as follows:

	$S \leq K_1$	$K_1 < S \leq K_2$	$S > K_2$
Long Call	0	$S - K_1$	$S - K_1$
Short Call	0	0	$-(S - K_2)$
Bull Spread	0	$S - K_1$	$K_2 - K_1$

- If $K_2 - K_1$ is small, the bull spread is like an all-or-nothing bet on the stock going above K_2.

Call Premium and the Strike Price

- The previous analysis shows that the payoff of the bull spread is either zero or positive.
- Thus, no-arbitrage implies that the cost of a bull spread cannot be negative, that is,

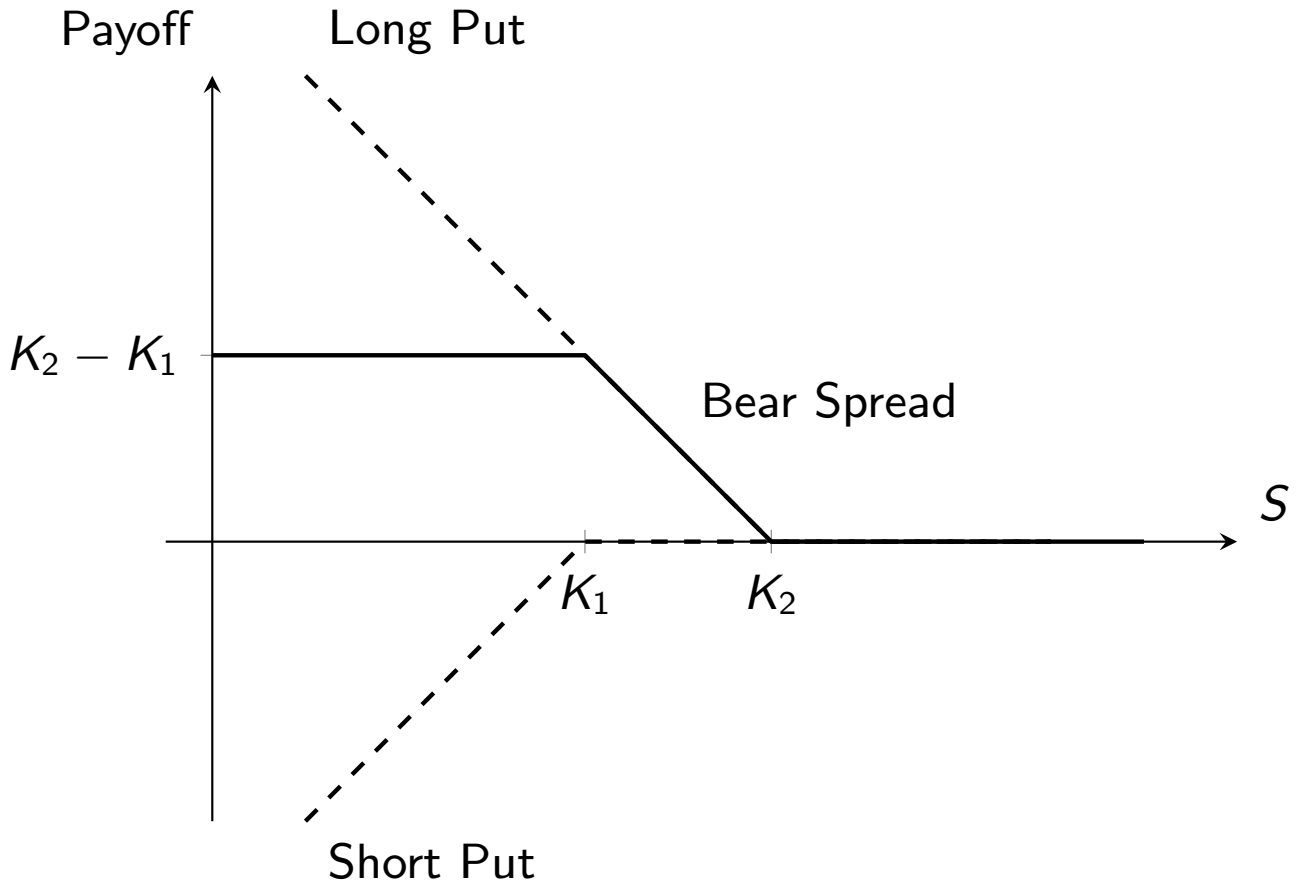
$$C_1 - C_2 \geq 0$$

- If not, you could build a bull spread with a negative cost!
- This implies that a call with a lower strike cannot cost less than an otherwise equivalent call with a higher strike price:

$$C_1 \geq C_2$$

Bear Spread

- A bear spread is a two-leg option strategy that consists in a long position in a put with strike K_2 and a short position in a put with strike K_1, where $K_1 < K_2$.



Example 6: Bear Spread

- A non-dividend paying stock currently trades at \$50.
- Put options with strikes $K_1 = \$40$ and $K_2 = \$60$ trade for \$1.28 and \$10.53, respectively.
- The cost of the bear spread is:

$$10.53 - 1.28 = \$9.25$$

- The payoff and profit for different stock prices at maturity is:

Stock Price	30	50	70
Long Put	30	10	0
Short Put	-10	0	0
Payoff	20	10	0
Profit	10.75	0.75	-9.25

Bear Spread

- The payoff of a bear spread can then be described as follows:

	$S \leq K_1$	$K_1 < S \leq K_2$	$S > K_2$
Long Put	$K_2 - S$	$K_2 - S$	0
Short Put	$-(K_1 - S)$	0	0
Bear Spread	$K_2 - K_1$	$K_2 - S$	0

- If $K_2 - K_1$ is small, the bear spread is like an all-or-nothing bet on the stock going below K_1.

Put Premium and the Strike Price

- The payoff diagram of the bear spread shows that the strategy can either pay nothing, or a positive amount.
- Thus, no-arbitrage implies that the cost of a bear spread cannot be negative, that is,

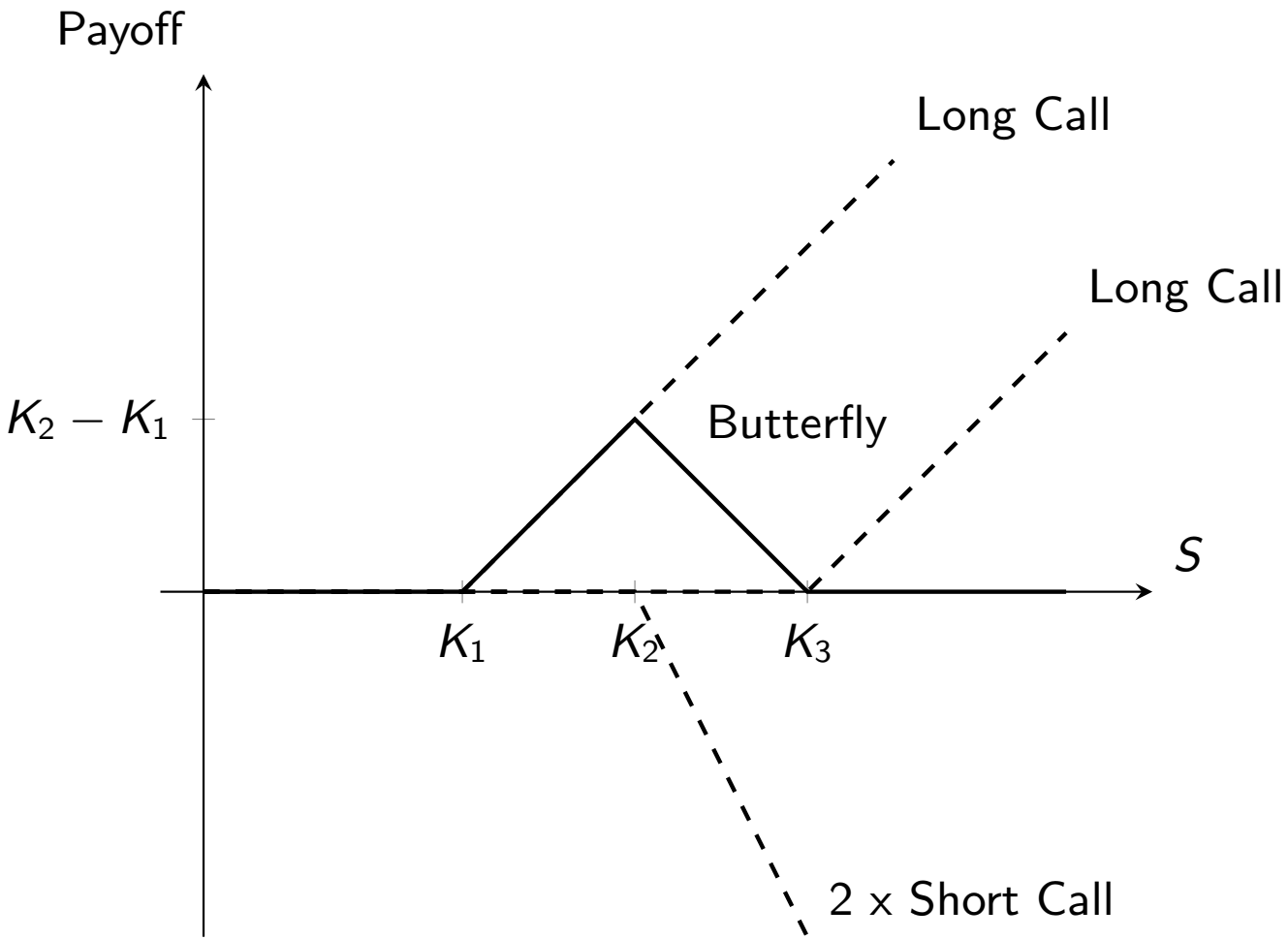
$$P_2 - P_1 \geq 0$$

- If not, you could build a bear spread with a negative cost!
- This implies that a put with a higher strike must cost more than an otherwise equivalent put with a lower strike price:

$$P_2 \geq P_1$$

Butterfly

- A butterfly is a three-leg option strategy that consists in a long call with strike K_1, short two calls with strike K_2 and a long call with strike K_3 where $K_1 < K_2 < K_3$ and $K_2 = (K_1 + K_3)/2$.



Example 7: Butterfly

- A non-dividend paying stock currently trades at \$50.
- Call options with strikes $K_1 = \$45$, $K_2 = \$50$ and $K_3 = \$55$ trade for \$9.85, \$7.12 and \$5.01, respectively.
- A butterfly with strikes K_1, K_2 and K_3 then costs

$$9.85 - 2(7.12) + 5.01 = \$0.62$$

- Below are some possible straddle payoffs and profits for different stock prices at maturity:

Stock Price	40	50	60
Payoff	0	5	0
Profit	-0.62	4.38	-0.62

Butterfly Payoff

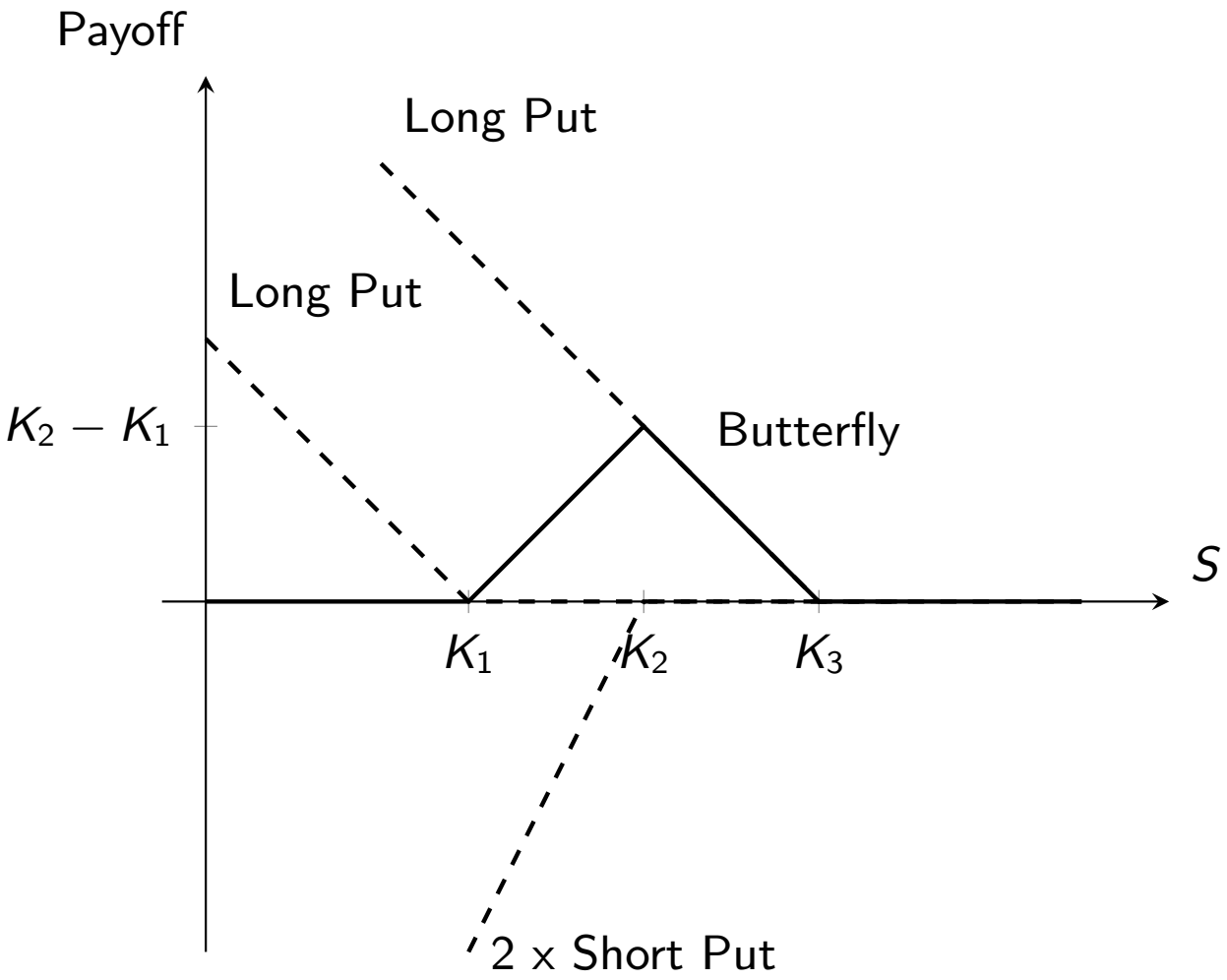
- The payoff of a butterfly can then be described as follows:

	$S \leq K_1$	$K_1 < S \leq K_2$	$K_2 < S \leq K_3$	$S > K_3$
Long Call	0	$S - K_1$	$S - K_1$	$S - K_1$
2 x Short Call	0	0	$2(K_2 - S)$	$2(K_2 - S)$
Long Call	0	0	0	$S - K_3$
Butterfly	0	$S - K_1$	$K_3 - S$	0

- The butterfly is a bull's eye bet on the stock price around K_2!

Building a Butterfly with Put Options

- The butterfly can also be obtained by buying puts with strikes K_1 and K_3, and shorting two puts with strikes $K_2 = (K_1 + K_3)/2$.



A Butterfly with Put Options

- We can check that the payoffs of a butterfly built with puts are the same as the butterfly built using calls.

	$S \leq K_1$	$K_1 < S \leq K_2$	$K_2 < S \leq K_3$	$S > K_3$
Long Put	$K_1 - S$	0	0	0
2 x Short Put	$2(S - K_2)$	$2(S - K_2)$	0	0
Long Put	$K_3 - S$	$K_3 - S$	$K_3 - S$	0
Butterfly	0	$S - K_1$	$K_3 - S$	0

Option Premium Convexity with Respect the Strike Price

- No-arbitrage implies that the price of a butterfly cannot be negative, that is,

$$P_1 - 2P_2 + P_3 = C_1 - 2C_2 + C_3 \geq 0,$$

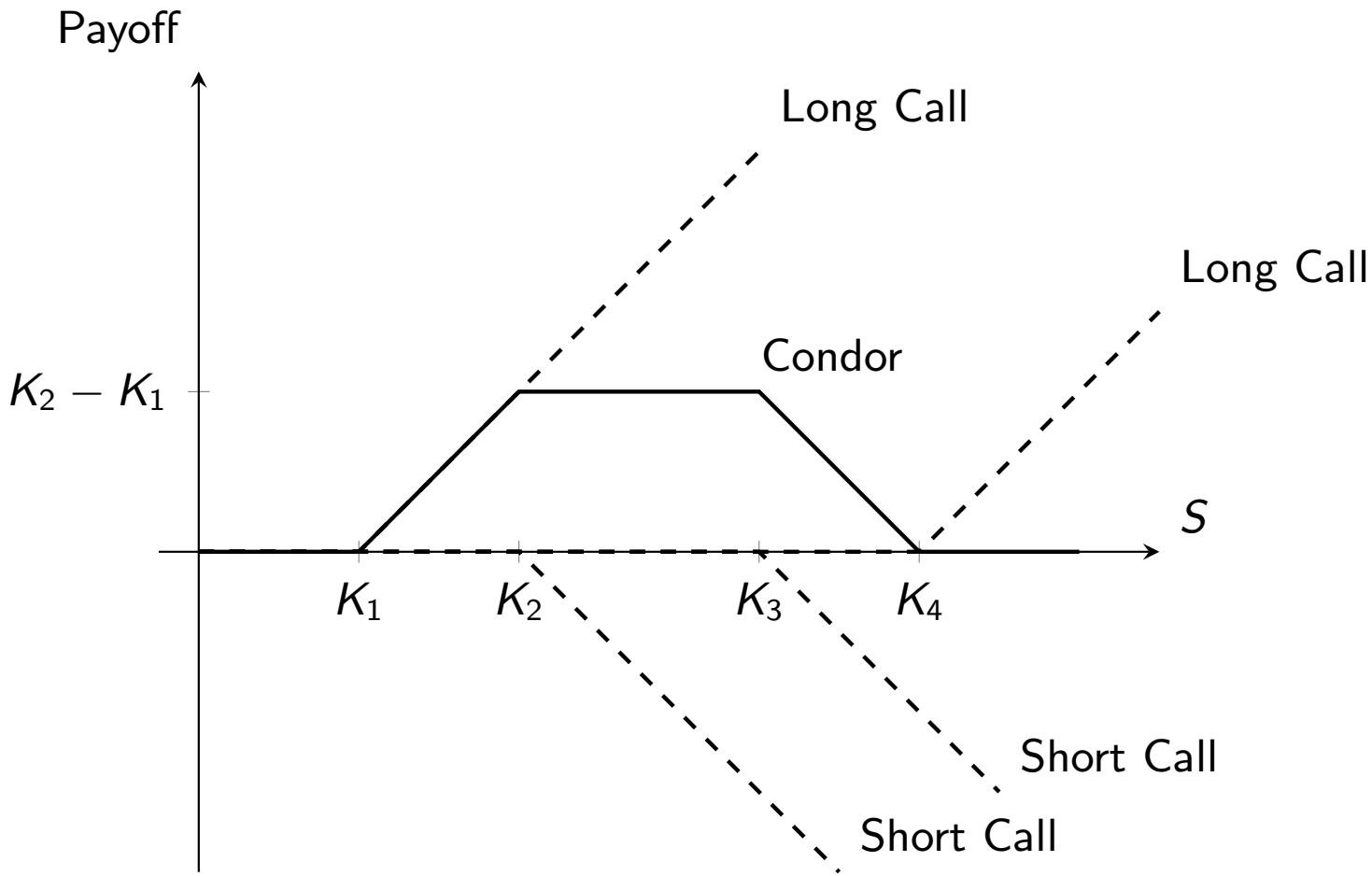
  which in turn implies that

$$P_2 \leq \frac{P_1 + P_3}{2} \quad \text{and} \quad C_2 \leq \frac{C_1 + C_3}{2}.$$

- If this was not the case, you could make a butterfly out of calls or puts with a negative price!

Condor

- A condor consists in a long call with strike K_1, a short call with strike K_2, a short call with strike K_3 and a long call with strike K_4 where $K_1 < K_2 < K_3 < K_4$ and $K_2 - K_1 = K_4 - K_3$.



Example 8: Condor

- A non-dividend paying stock currently trades at \$50.
- Call options with strikes $K_1 = \$40$, $K_2 = \$45$, $K_3 = \$55$ and $K_4 = \$60$ trade for \$13.23, \$9.85, \$5.01 and \$3.45, respectively.
- A condor with strikes K_1, K_2, K_3 and K_4 then costs

$$13.23 - 9.85 - 5.01 + 3.45 = \$1.82$$

- Below are some possible straddle payoffs and profits for different stock prices at maturity:

Stock Price	40	50	60
Payoff	0	5	0
Profit	-1.82	3.18	-1.82