333-201 Business Finance

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Lecture 24:
Introduction to Derivative Securities III

Introduction to Options Contracts II

- Analyze some speculative strategies using options

- Analyze some hedging strategies using options

- Examine the factors affecting option prices

- Examine the put-call parity relationship and its implications

Some Option Trading Strategies

A trader expects the price of BHP shares to move considerably but is uncertain about the direction

Strategy: Buy a call and put at the same (or similar) exercise price, X
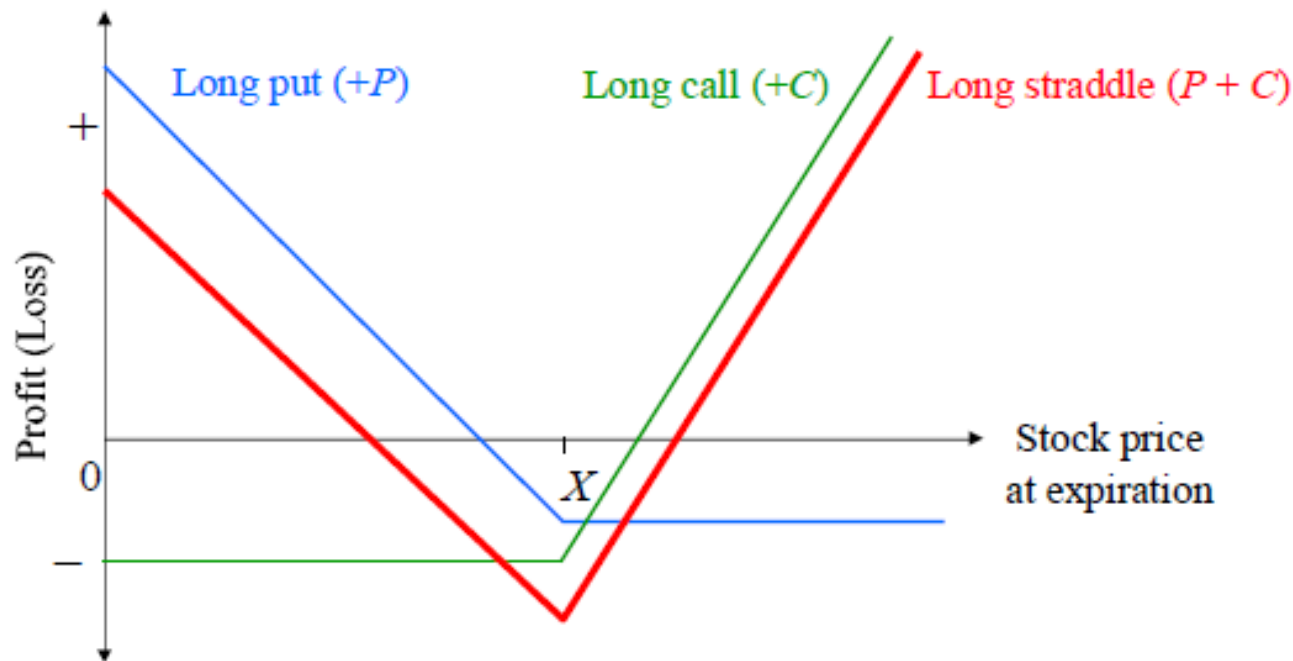
❖ When would a trader sell a call and sell a put at the same exercise rate?
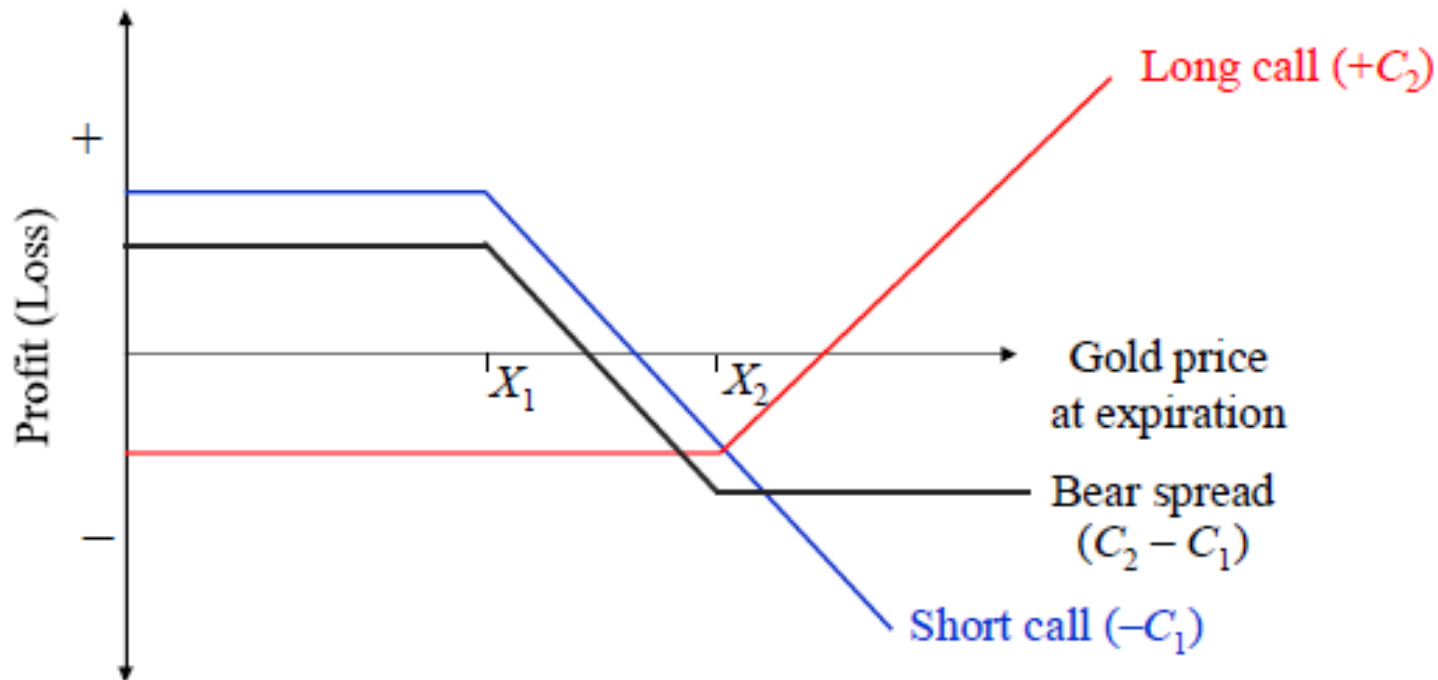
Some Option Trading Strategies

A trader is bullish on Telstra shares and expects its price to rise in the short run. The trader also wishes to limit the downside risk Strategy: Buy a call with a low exercise price X_1, sell a call with a higher exercise price X_2.
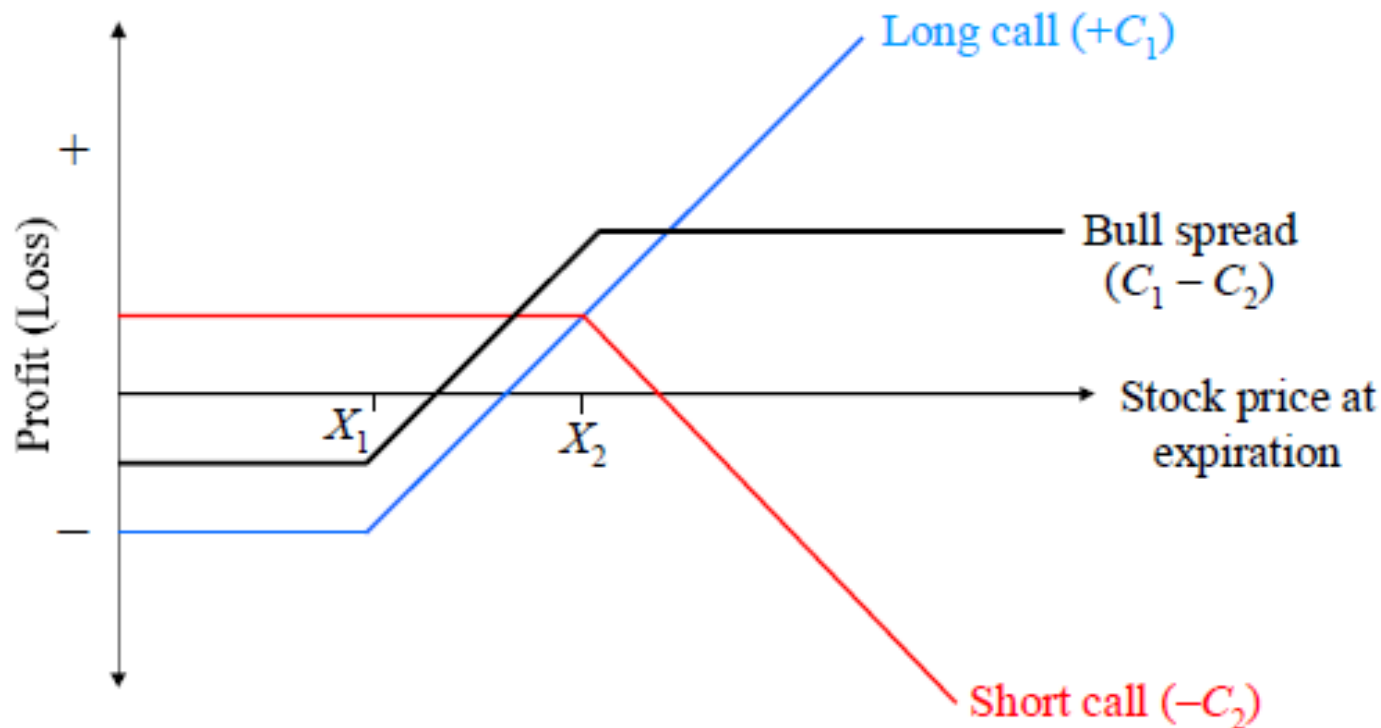
Some Option Trading Strategies

A trader is bearish on gold and expects the price of gold to fall soon
Strategy: Sell a call with a low exercise price X_1, buy a call with a higher exercise price X_2

Long call $(+C_2)$

Profit (Loss)

X_1 X_2

Gold price at expiration

Bear spread $(C_2 - C_1)$

Short call $(-C_1)$

Hedging with Call Options

Example: You sold short 1000 shares of ABD Ltd at $27.00 per share and are now concerned that the stock's price will rise soon. What is your underlying exposure and what option can you use to hedge this exposure?

You can purchase a call option to buy ABD Ltd at a prespecified exercise price

- Assume that you buy an at-the-money call option with an exercise price (X) of $27.00 and a premium of $0.50

Profit/Loss on long call option = $Max(S_T - 27.00, 0) - 0.50$
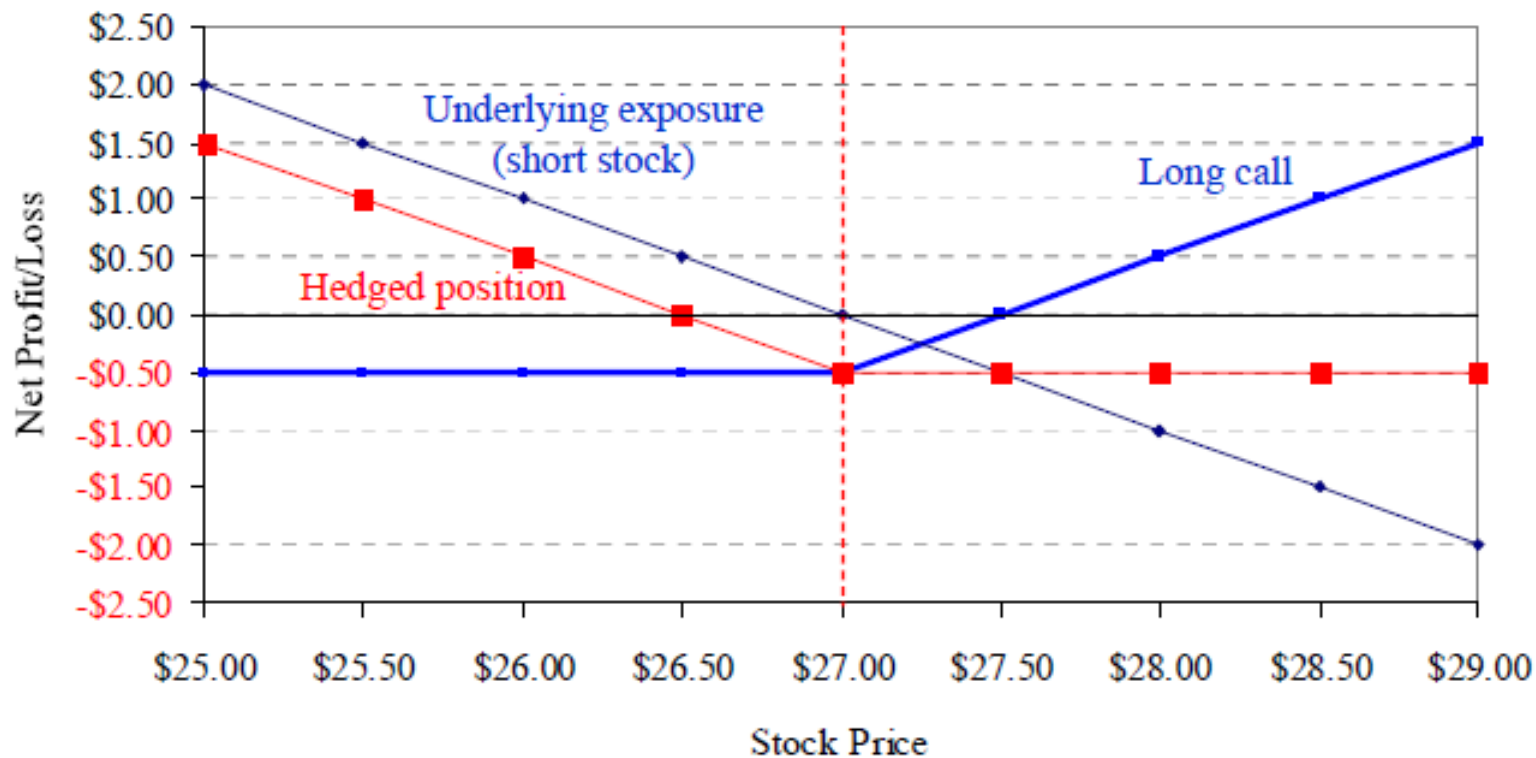
Profit/Loss on short shares = $27.00 - S_T$

Hedging with Call Options

Spot Price	Profit/Loss on Call Option	Profit/Loss on Short Stock	Hedged Position
$25.00	-$0.50	$2.00	$1.50
$25.50	-$0.50	$1.50	$1.00
$26.00	-$0.50	$1.00	$0.50
$26.50	-$0.50	$0.50	$0.00
$27.00	-$0.50	$0.00	-$0.50
$27.50	$0.00	-$0.50	-$0.50
$28.00	$0.50	-$1.00	-$0.50
$28.50	$1.00	-$1.50	-$0.50
$29.00	$1.50	-$2.00	-$0.50

Profit/Loss on long call option = $\text{Max}(S_T - 27.00, 0) - 0.50$

Profit/Loss on short shares = $27.00 - S_T$

Hedging with Call Options

Hedging with Put Options

Example: You have just purchased 1000 shares of BAD Ltd at $26.00 per share and are now concerned that the stock price will fall soon. What is your underlying exposure and what option can you use to hedge this exposure?

You can purchase a put option to sell BAD Ltd at a prespecified exercise price

Assume that you buy an at-the-money put option with an exercise price (X) of $26.00 and a premium of $0.50

Profit/Loss on long put option = Max($26.00 - S_T$, 0) - 0.50
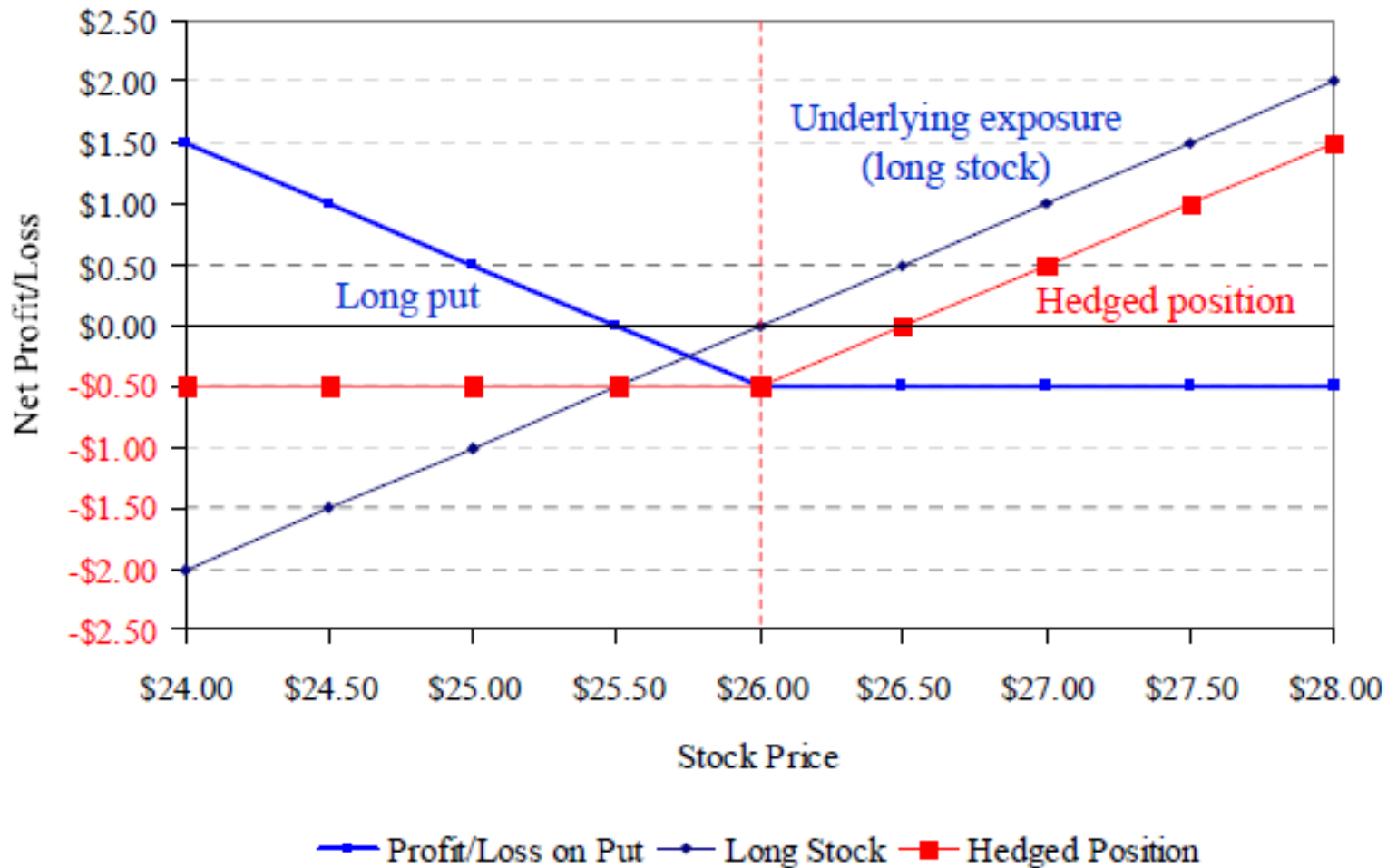Profit/Loss on long shares = $S_T - 26.00$

Hedging with Call Options

Spot Price	Profit/Loss on Long Put	Profit/Loss on Long Stock	Hedged Position
$24.00	$1.50	-$2.00	-$0.50
$24.50	$1.00	-$1.50	-$0.50
$25.00	$0.50	-$1.00	-$0.50
$25.50	$0.00	-$0.50	-$0.50
$26.00	-$0.50	$0.00	-$0.50
$26.50	-$0.50	$0.50	$0.00
$27.00	-$0.50	$1.00	$0.50
$27.50	-$0.50	$1.50	$1.00
$28.00	-$0.50	$2.00	$1.50

Profit/Loss on long put option $= \text{Max}(26.00 - S_T, 0) - 0.50$
Profit/Loss on long shares $= S_T - 26.00$

Hedging with Put Options

Hedging with Call and Put Options

Example: You have just purchased 1000 shares in DAB Ltd at a price of $26.00 per share. You decide to sell a call option with an exercise price of $27.00 and buy a put option with an exercise price of $25.00. What is your overall hedged position?

What have you accomplished with this hedging strategy?

Profit/Loss on short call option = $-\text{Max}(S_T - 27.00, 0) + 0.50$
Profit/Loss on long put option = $\text{Max}(25.00 - S_T, 0) - 0.50$
Profit/Loss on long shares = $S_T - 26.00$

Hedging with Call and Put Options

Spot Price	Long Put	Short Call	Long Stock	Hedged Position
$22.00	$2.50	$0.50	-$4.00	-$1.00
$23.00	$1.50	$0.50	-$3.00	-$1.00
$24.00	$0.50	$0.50	-$2.00	-$1.00
$25.00	-$0.50	$0.50	-$1.00	-$1.00
$26.00	-$0.50	$0.50	$0.00	$0.00
$27.00	-$0.50	$0.50	$1.00	$1.00
$28.00	-$0.50	-$0.50	$2.00	$1.00
$29.00	-$0.50	-$1.50	$3.00	$1.00
$30.00	-$0.50	-$2.50	$4.00	$1.00

Profit/Loss on short call option $= -\text{Max}(S_T - 27.00, 0) + 0.50$
Profit/Loss on long put option $= \text{Max}(25.00 - S_T, 0) - 0.50$
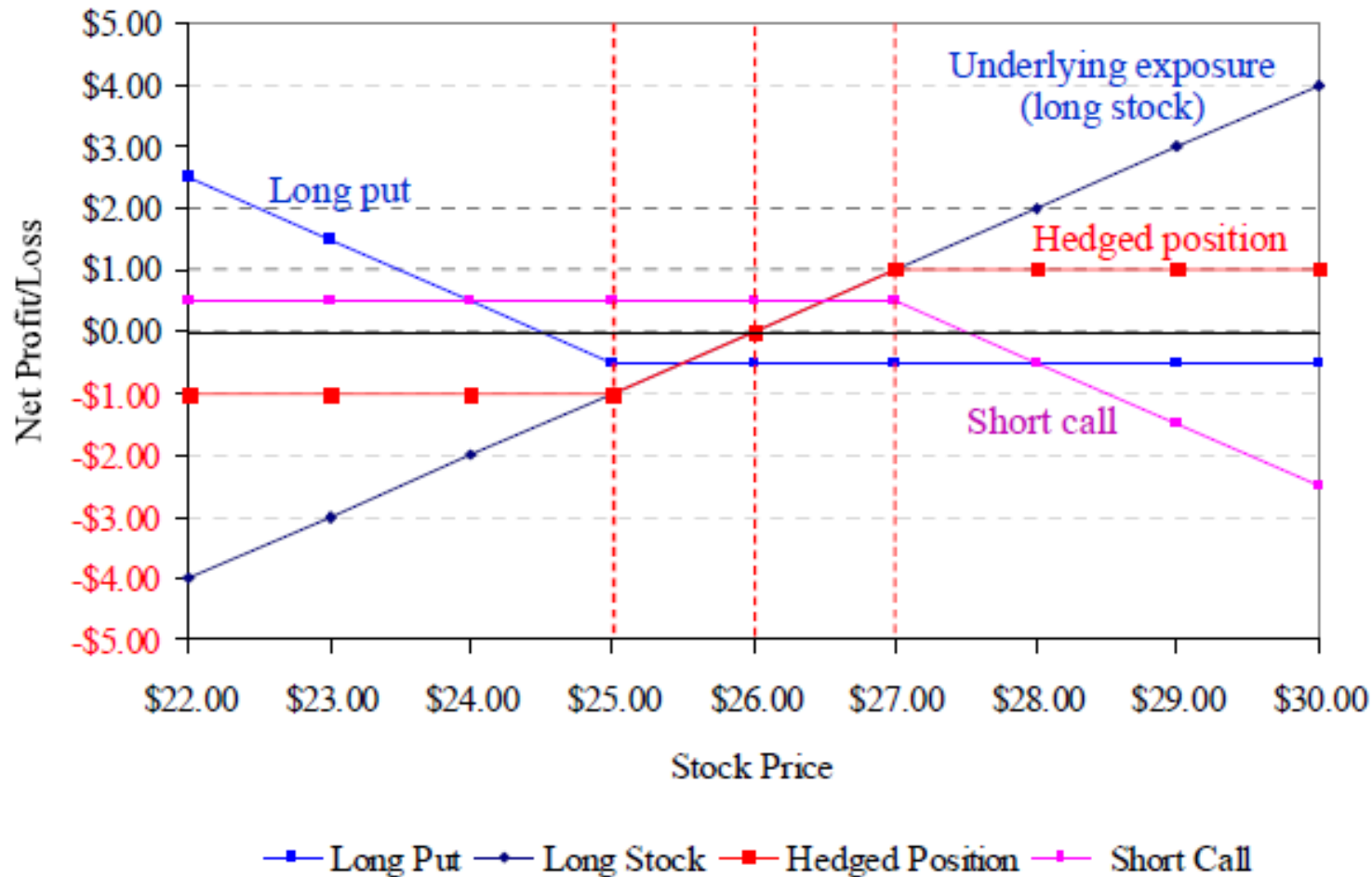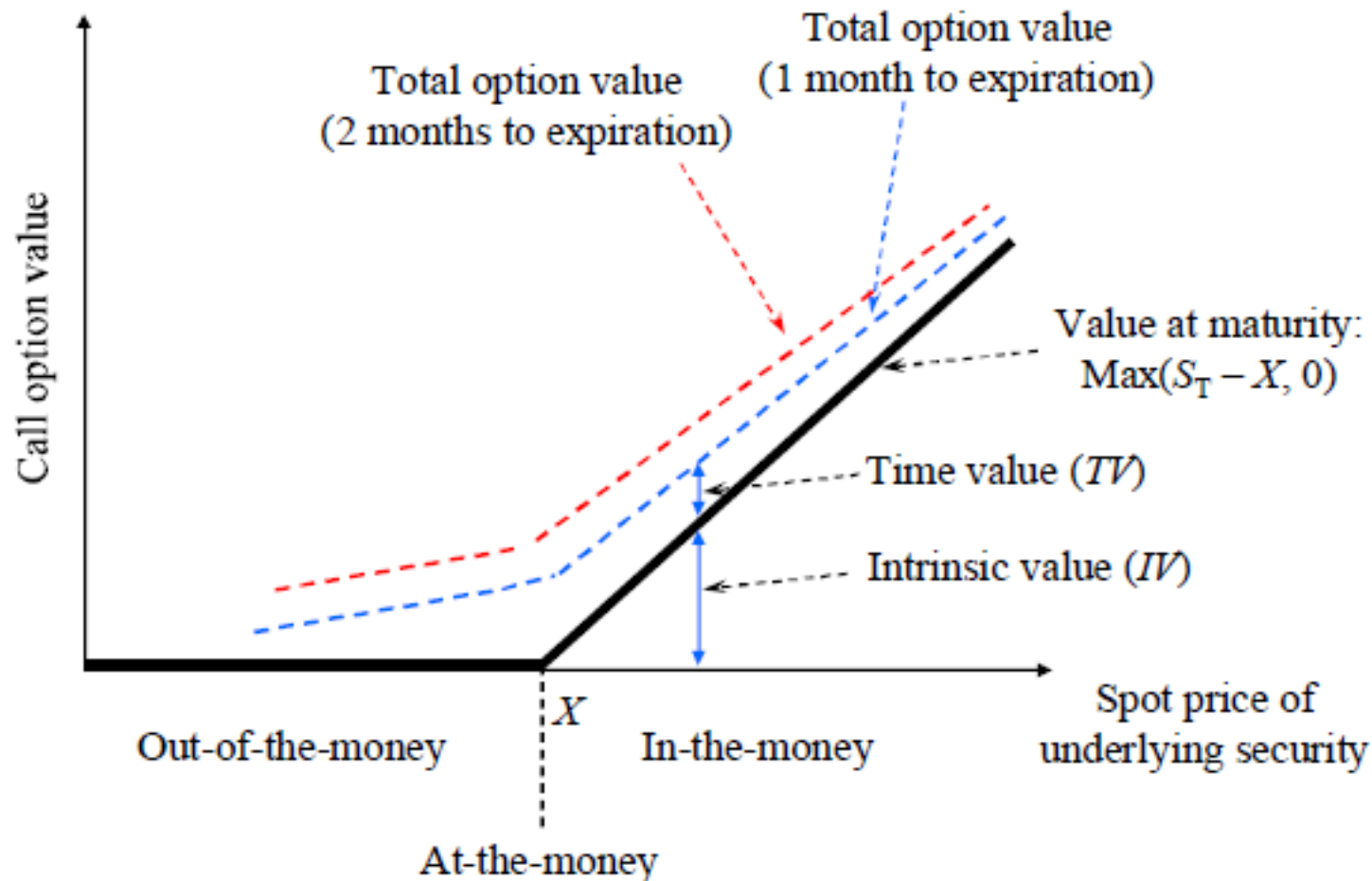Profit/Loss on long shares $= S_T - 26.00$

Hedging with Call and Put Options

Factors Affecting Option Prices

• Option value (or price) = Intrinsic value + Time value

• The intrinsic value (IV) of an option is the amount by which it is in-the-money
- For a call option, $IV = S_T - X$
- For a put option, $IV = X - S_T$
- S_T = Spot price at expiration
- X = Exercise price

• The time value (TV) of an option is the option's value above its intrinsic value
- TV = Option premium $- IV$
- $TV > 0$ and increases with time remaining to expiration

Intrinsic and Time Value of Call Options

Total option value
(1 month to expiration)

Total option value
(2 months to expiration)

Call option value

Value at maturity:
$Max(S_T - X, 0)$

Time value (*TV*)

Intrinsic value (*IV*)

Out-of-the-money

X

In-the-money

Spot price of
underlying security

At-the-money

Factors Affecting Option Prices

- Price of the underlying security

- Exercise or strike price

- Time to maturity

- Volatility of underlying security

- Riskfree interest rate

- Expected dividends (in the case of equity options)

Factors Affecting Call Option Prices

- Selected call options traded on CSL Ltd
- Last sale price on CSL shares on October 15, 2008: $38.38

Series	Exercise price	Last sale	Volume (1000s)	Open interest
Oct 08	$39.00	$0.92	1	169
Oct 08	$40.00	$0.69	5	180
Nov 08	$39.00	$2.17	18	65
Nov 08	$40.00	$1.51	14	64
Dec 08	$39.00	$2.38	1	70
Dec 08	$40.00	$2.67	10	148

Source: Adapted from the *Australian Financial Review*, October 16, 2008

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Factors Affecting Put Option Prices

- Selected put options traded on CSL Ltd
- Last sale price on CSL shares on October 15, 2008: $38.38

Series	Exercise price	Last sale	Volume (1000s)	Open interest
Oct 08	$39.00	$1.63	12	37
Oct 08	$40.00	$2.40	1	73
Nov 08	$32.00	$0.45	2	113
Nov 08	$44.00	$5.95	10	--
Feb 09	$40.00	$4.35	1	8

Source: Adapted from the *Australian Financial Review*, October 16, 2008

Factors Affecting Option Prices

$$C = f(S, X, T, \sigma, r, D) \text{ and } P = f(S, X, T, \sigma, r, D)$$

	Results in the value of a...	
An increase in...	*Call option*	*Put option*
1. Spot rate (S)	+	−
2. Exercise price (X)	−	+
3. Time to expiration (T)	+	+
4. Price volatility (σ)	+	+
5. Riskfree interest rate (r)	+	−
6. Expected dividends (D)	−	+

❖ *Interest rate:* The buyer of a call option can defer paying for the shares. The higher the interest rate the more valuable this right to defer.

❖ *Dividends:* What happens on ex-dividend dates?

Put-Call Parity and Synthetic Positions

Example: You buy a call option and sell a put option on ANZ Bank shares expiring in three months' time. The exercise price of the options are $27 per share. What is the payoff on each option and the combined position if the price of ANZ's shares in three months is $25, $26, $27, $28 and $29?
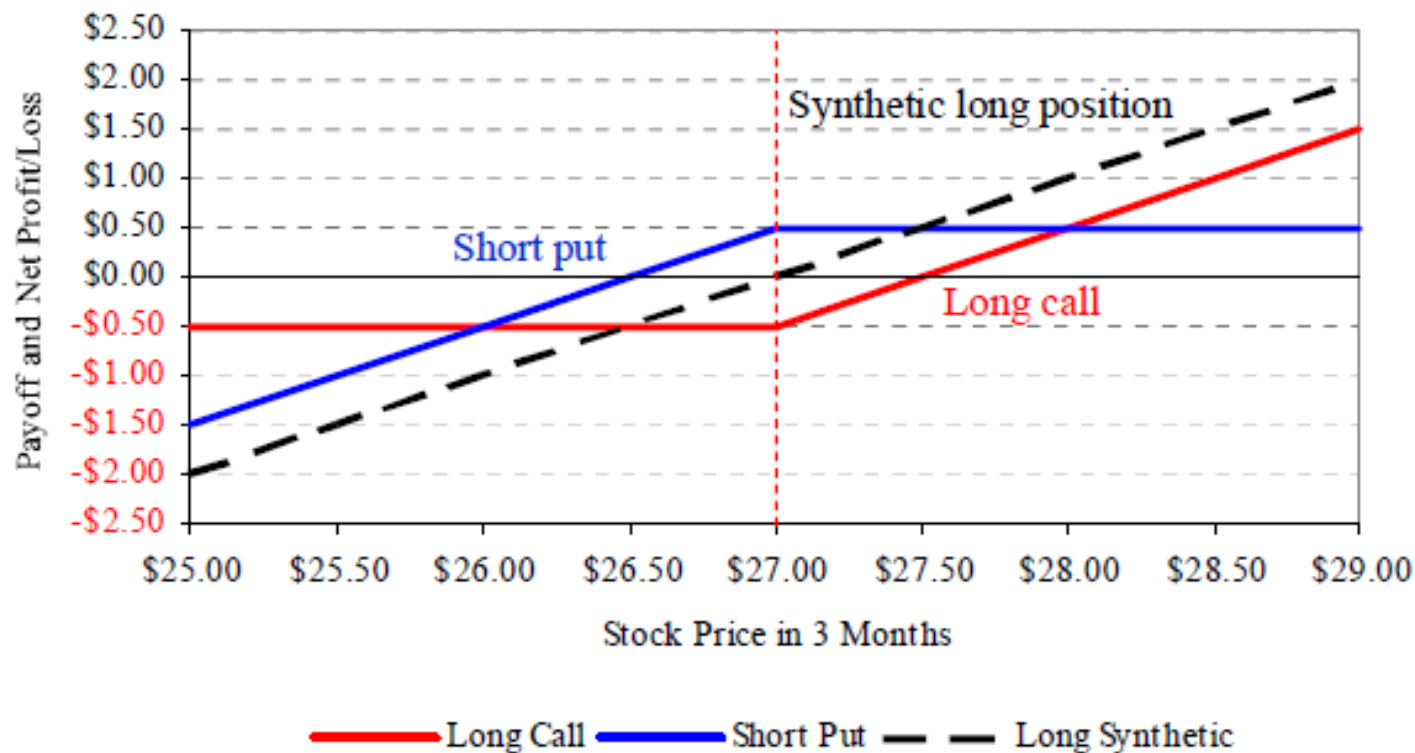
Payoff on long call option = Max(S_T – X, 0)
Payoff on short put option = –Max(X – S_T, 0)

Spot Price in 3 Months	Long Call	Short Put	Combined
$25	$0.00	-$2.00	-$2.00
$26	$0.00	-$1.00	-$1.00
$27	$0.00	$0.00	$0.00
$28	$1.00	$0.00	$1.00
$29	$2.00	$0.00	$2.00

Put-Call Parity and Synthetic Positions

A position in a long call and a short put with the same underlying terms and conditions is equivalent to a (synthetic) long position in the underlying security.

Put-Call Parity and Synthetic Positions

Example: You sell a call option and buy a put option on ANZ Bank shares expiring in three months' time. The exercise price of the options are $27 per share. What is the payoff on each option and the combined position if the price of ANZ's shares in three months is $25, $26, $27, $28 and $29?

Payoff on short call option = $-Max(S_T - X, 0)$
Payoff on long put option = $Max(X - S_T, 0)$

Spot Price in 3 Months	Short Call	Long Put	Combined
$25	$0.00	$2.00	$2.00
$26	$0.00	$1.00	$1.00
$27	$0.00	$0.00	$0.00
$28	-$1.00	$0.00	-$1.00
$29	-$2.00	$0.00	-$2.00

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Put-Call Parity and Synthetic Positions

A position in a short call and a long put with the same underlying terms and conditions is equivalent to a (synthetic) short position in the underlying security
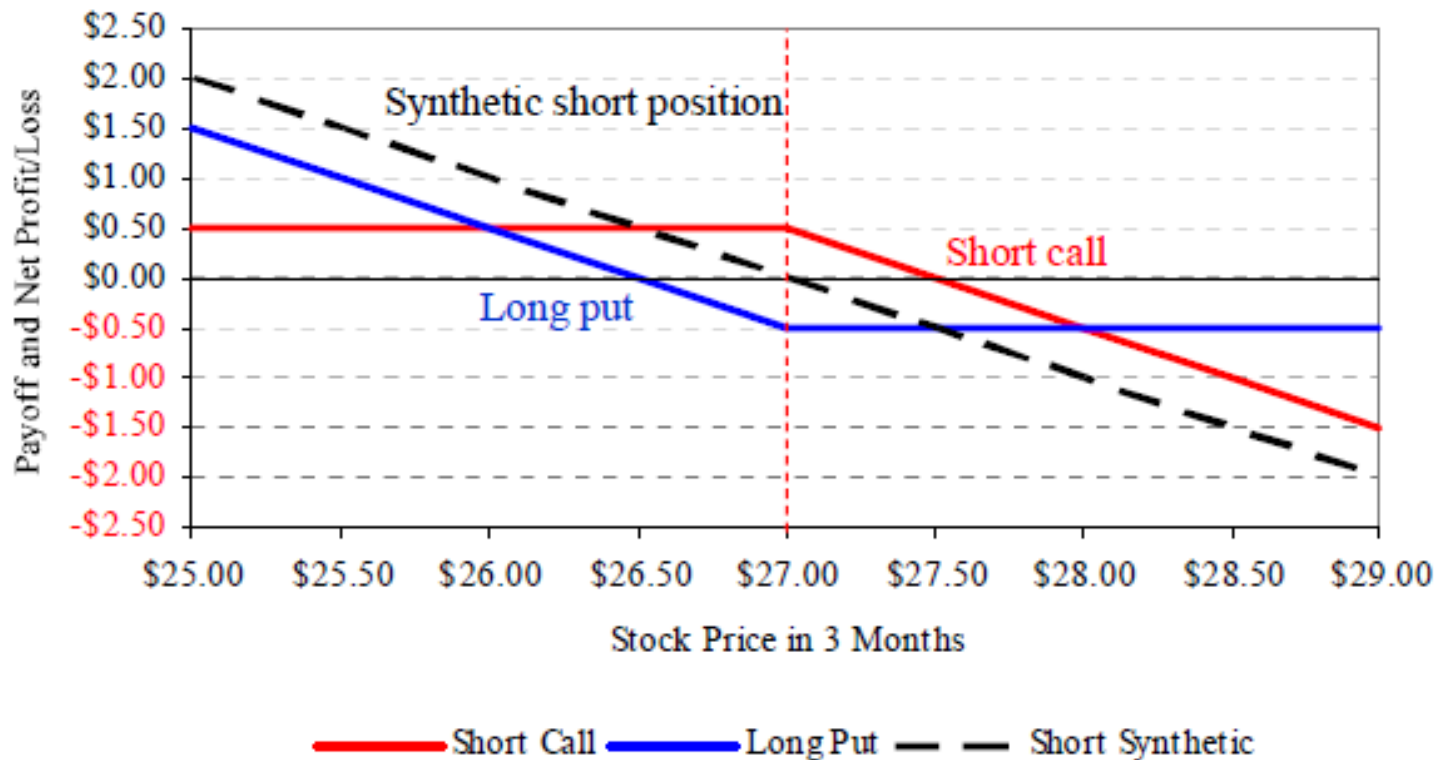
Key Concepts

• There are a large number of speculative and hedging strategies that can be implemented using option contracts

• An option's price equals its intrinsic value and time value

• The intrinsic value of an option is the amount by which it is in-the-money

• The six factors that affect the price of option contracts are the price of the underlying security, the exercise price, time to maturity, volatility of the underlying security, riskfree interest rate and expected dividends (in the case of equity options)