

Options: Basics and Strategies

Fundamental of Finance I.25

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Overview

- Option basics
 - Option valuation on expiration date
 - Option strategies
- Next two classes: Option valuation prior to expiration date
 - No-arbitrage bounds on option prices
 - Black-Scholes-Merton Formula

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Option Strategies

1. Using calls for leverage
2. Protective put
3. Covered calls
4. Straddle/Strangle
5. Collars

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DIY: 1. Call Options for Leverage

- Example
 - Microsoft share price is $S_0 = \$70$
 - A call option with $X = \$70$ and 6-month maturity costs $C_0 = \$10$
- What is the payoff investing \$7000 in
 - A. Buy 100 shares of Microsoft $100 * 65 = 6500$
 - B. Buy 700 call options with $X = \$70$ $700 * 5 = 3500$
 - C. Buy 100 call options and invest \$6000 at the risk-free rate (2% per half year).

S_T	60	65	70	75	80	85	90
Payoff A:	6000	6500	7000	7500	8000	8500	9000
Payoff B:	0	0	0	3500	7000	10500	14000
Payoff C:	6120	6120	6120	6620	7120	7620	8120

$$100 * 0 + 6000 * 1.02 = 6120$$

$$100 * 15 + 6000 * 1.02 = 7620$$

DIY: 1. Call Options for Leverage

$$\text{Return} = \text{Profit} / 7000$$

S_T	60	65	70	75	80	85	90
Return A:	-15.4%	-7.1%	0%	7.1%	14.3%	21.4%	28.6%
Return B:	-100%	-100%	-100%	-50%	0%	50%	100%
Return C:	-12.6%	-12.6%	-12.6%	-5.4%	1.7%	8.9%	16%

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Call Option for Leverage: Conclusion

- Holding call options for leverage (portfolio B): when price falls below zero, you lose everything, but when price increases only modestly, e.g. an increase from 85 to 90 (only 6% increase), your return doubles from 50 to 100%! This is called leverage. This is the speculative feature of options.

S_T	60	65	70	75	80	85	90
Return A:	-15.4%	-7.1%	0%	7.1%	14.3%	21.4%	28.6%
Return B:	-100%	-100%	-100%	-50%	0%	50%	100%

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Call Option for insurance: Conclusion

- **Holding call options for insurance (portfolio C):** when prices fall the option just expires worthless, your minimum return is -12%. With holding the stock you can get returns of -15% and worse if the stock falls further below 60. If price goes up you earn the same as portfolio A minus 880.
- **This is the insurance feature of options.**

S_T	60	65	70	75	80	85	90
Return A:	-15.4%	-7.1%	0%	7.1%	14.3%	21.4%	28.6%
Return C:	-12.6%	-12.6%	-12.6%	-5.4%	1.7%	8.9%	16%

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2. Protective Put

- You own a share of Microsoft with current price $S_0 = \$70$. You are afraid that the stock price will drop. How do you limit your possible losses by trading options?

S_T	40	50	60	70	80	90	100
Payoff Stock:							

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S_T	40	50	60	70	80	90	100
Payoff Stock:	40	50	60	70	80	90	100



The loss is unlimited.

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S_T	40	50	60	70	80	90	100
Payoff Stock:	40	50	60	70	80	90	100
Payoff Put, $X=70$:							

- Lets purchase Put option with $X=70$

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S_T	40	50	60	70	80	90	100
Payoff Stock:	40	50	60	70	80	90	100
Payoff Put, $X=70$:	30	20	10	0	0	0	0

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S_T	40	50	60	70	80	90	100
Payoff Stock:	40	50	60	70	80	90	100
Payoff Put, $X=70$:	30	20	10	0	0	0	0
Payoff Total:	70	70	70	70	80	90	100

- What does the payoff of this strategy remind you of?

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Payoff Stock:	40	50	60	70	80	90	100
Payoff Put, $X=70$:	30	20	10	0	0	0	0
Payoff Total:	70	70	70	70	80	90	100

- This payoff is the same as that of a long call with $X=70$ + a bond with a face value of 70!
- Next week: put-call parity.*

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2. Protective Put

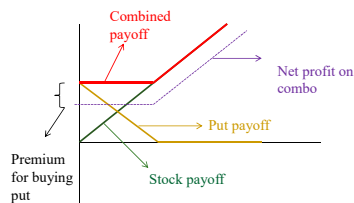
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S_T	40	50	60	70	80	90	100
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Payoff Put, $X=70$:	30	20	10	0	0	0	0
Payoff Total:	70	70	70	70	80	90	100

- Why don't you always protect yourself against down-side risk?
- Because it is costly: it eats in your profits*

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Protective Put



S_T	40	50	60	70	80	90	100
Payoff Stock:	40	50	60	70	80	90	100
Payoff Put, $X=70$:	30	20	10	0	0	0	0
Payoff Total:	70	70	70	70	80	90	100

3. Covered Call

- **Covered Call** - Writing a call on an asset together with buying the asset
- Your potential obligation to deliver the call (short call) is covered by your long position in stock.
- Writing an option without an offsetting stock position is called by contrast **naked option writing**.

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3. Covered Call

- Suppose that you buy a share of Microsoft for $S_0 = \$70$. You think that at-the-money call options trading at \$10 seem excessively expensive, and you want to profit from this.

S_T	40	50	60	70	80	90	100
Payoff Stock:							

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S_T	40	50	60	70	80	90	100
Payoff Stock:	40	50	60	70	80	90	100
Payoff Short Call:							

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S_T	40	50	60	70	80	90	100
Payoff Stock:	40	50	60	70	80	90	100
Payoff Short Call:	0	0	0	0	-10	-20	-30
Payoff Total:							

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Payoff Stock:	40	50	60	70	80	90	100
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Payoff Total:	40	50	60	70	70	70	70
Profit Total:							

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Payoff Stock:	40	50	60	70	80	90	100
Payoff Short Call:	0	0	0	0	-10	-20	-30
Payoff Total:	40	50	60	70	70	70	70
Profit Total:	50	60	70	80	80	80	80

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3. Covered Call

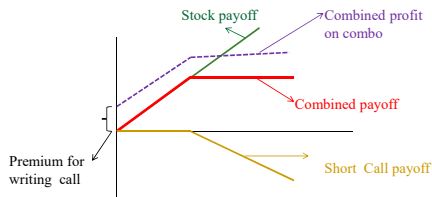
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Payoff Stock:	40	50	60	70	80	90	100
Payoff Short Call:	0	0	0	0	-10	-20	-30
Payoff Total:	40	50	60	70	70	70	70
Profit Total:	50	60	70	80	80	80	80

- You sold your upside.
- Compare: "naked option writing"

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Covered Call



S_T	40	50	60	70	80	90	100
Payoff Stock:	40	50	60	70	80	90	100
Payoff Short Call:	0	0	0	0	-10	-20	-30
Payoff Total:	40	50	60	70	70	70	70
Profit Total:	50	60	70	80	80	80	80

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3. Covered Call

- Why doing that?
- Institutional investors use this strategy a lot. They are getting extra revenue from the option premium. Of course they don't profit anymore if the stock goes above the strike price, but they set the strike price at a level at which they would want to sell anyways.
- The option generates some extra cash for them in the process.

4. Straddle and Strangle

- You have private information that a particular stock's price will change dramatically soon, but you do not know if it will go up or down. So you buy
 - Straddle: Put $(X=X_1)$ + Call $(X=X_2)$, $X_1=X_2$
 - Strangle: Put $(X=X_1)$ + Call $(X=X_2)$, $X_1 < X_2$

S_T	30	40	50	60	70	80	90
Payoff Call:							
Payoff Put:							
Payoff Total:							

- Illustrated a straddle with $X_1=X_2=60$:

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S_T	30	40	50	60	70	80	90
Payoff Call:	0						
Payoff Put:							
Payoff Total:							

- Illustrated a straddle with $X_1=X_2=60$:

30

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S_T	30	40	50	60	70	80	90
Payoff Call:	0	0	0	0			
Payoff Put:							
Payoff Total:							

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S_T	30	40	50	60	70	80	90
Payoff Call:	0	0	0	0	10	20	30
Payoff Put:							
Payoff Total:							

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S_T	30	40	50	60	70	80	90
Payoff Call:	0	0	0	0	10	20	30
Payoff Put:	30						
Payoff Total:							

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S_T	30	40	50	60	70	80	90
Payoff Call:	0	0	0	0	10	20	30
Payoff Put:	30	20	10	0	0	0	0
Payoff Total:							

- Illustrated a straddle with $X_1=X_2=60$:

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4. Straddle and Strangle

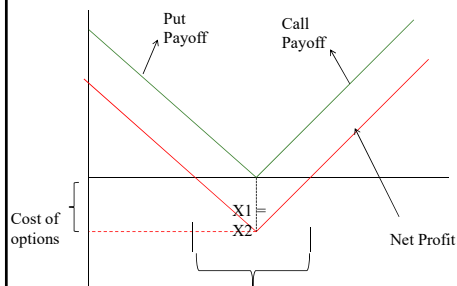
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 - Strangle: Put ($X=X_1$) + Call ($X=X_2$), $X_1 < X_2$

S_T	30	40	50	60	70	80	90
Payoff Call:	0	0	0	0	10	20	30
Payoff Put:	30	20	10	0	0	0	0
Payoff Total:	30	20	10	0	10	20	30

- Illustrated a straddle with $X_1=X_2=60$:

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Straddle

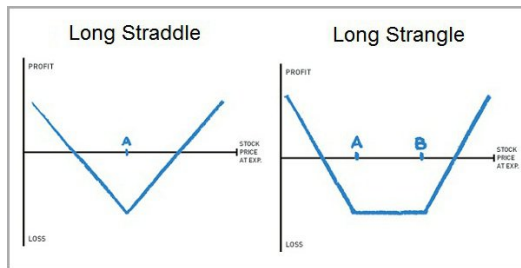


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4. Straddle and Strangle

- Straddle: Long a call and long a put with same exercise price.
- Gives you a V shaped combined payoff diagram and a V below that for profits.
- Is expensive because you have to pay two options.
- A cheaper way of doing a similar bet on volatility is by buying out of the money calls and puts. They are a lot cheaper (Strangle).

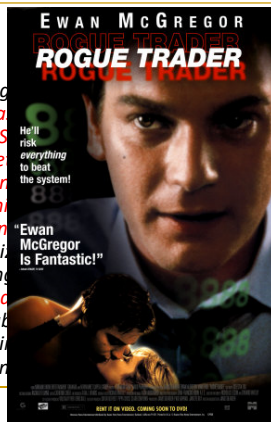
4. Straddle and Strangle



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The beginning when *Nicholas Leeson* in the Stock Exchange of Singapore, essentially bet that the market would not move significantly. On January 16, 1995, an earthquake hit Kobe, Japan, sending Asian markets into a tailspin. Realizing the situation, Leeson left a note reading "I have lost everything" on January 23. Losses eventually reached twice the bank's available bailout. The bailout attempt, Bari's merchant bank, failed on February 26.



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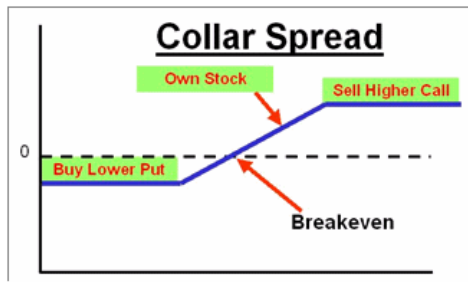
DIY: 5. Collar

- What should you do if
 - you want to buy shares of Microsoft for \$70 per share
 - you want to make sure that in 6 months the value of your position is at least \$60 per share
 - you think that the stock price will go up, but that it will at most reach (about) \$80

S_T	40	50	60	70	80	90	100
Payoff Stock:	40	50	60	70	80	90	100
Long Put : $X=60$	20	10	0	0	0	0	0
Short Call : $X=80$	0	0	0	0	0	-10	-20
Payoff Total:	60	60	60	70	80	80	80

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5. Collar

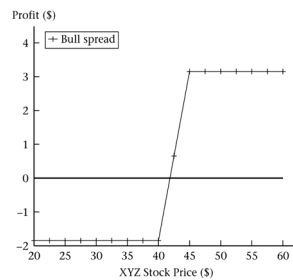


Overview of Option Strategies

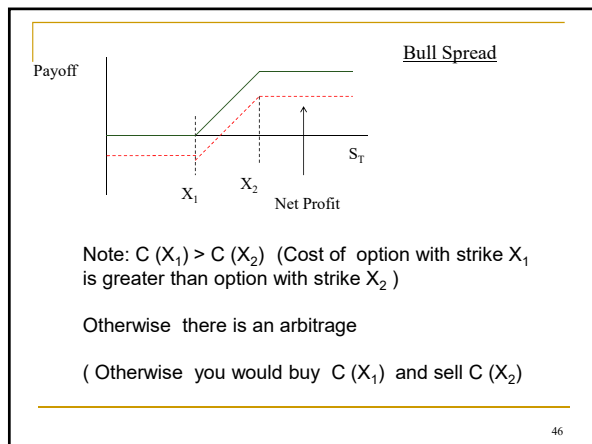
1. Calls get you leverage
2. Protective put = stock + put
3. Covered call = stock + short call
4. Straddle (Strangle) = ATM (OTM) put + call
5. Collar = stock + put + short call
6. *Bull spread*: long call X1 + short call X2, with $X1 < X2$
7. *Bear spread*: long call X2 + short call X1, with $X1 < X2$
8. *Butterfly spread*: long call X1 + 2*short call X2 + long call X3, $X1 < X2 < X3$

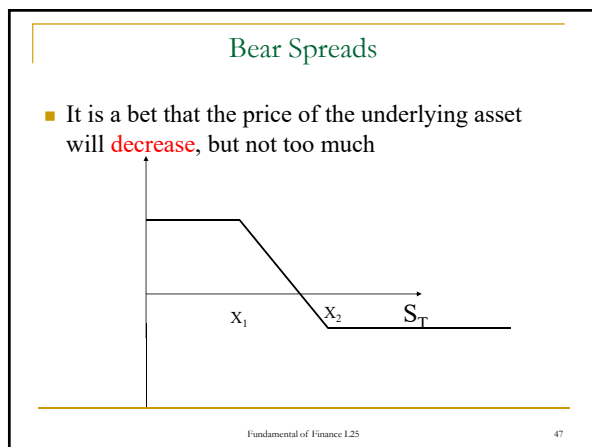
Bull Spreads

- A **bull spread** is a position with the following profit shape.



- It is a bet that the price of the underlying asset will **increase**, but not too much





- ### Concepts to Know
- Option basics
 - Call option
 - Put option
 - Draw payout profile
 - Option strategies
 - Which are common option strategies?
 - What are they used for?
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